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GDE PREPARATORY PAST PAPERS 2014 TO 2020

REDWOOD ACADEMY

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REDWOOD ONLINE

GRADE 12

MATHEMATICS PAPER 2

BY NAEEM MOHAMED

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GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION

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MATHEMATICS
(Second Paper)

TIME: 3 hours

MARKS: 150

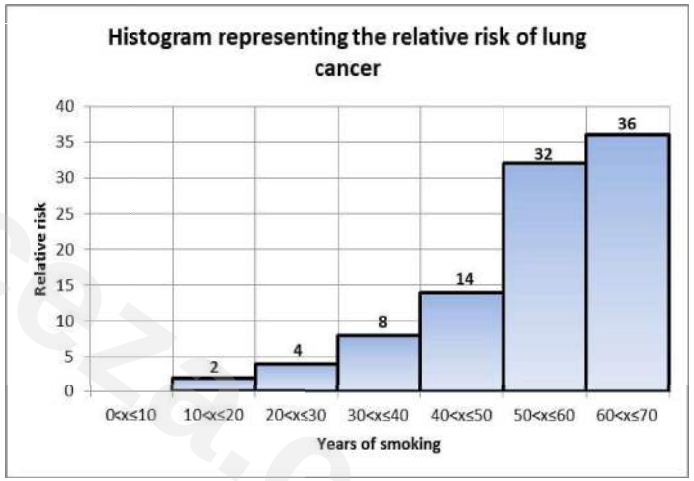
INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 12 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.
4. Answers only will not necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Six DIAGRAM SHEETS for QUESTIONS 1.2, 2.1, 2.4, 7.1, 9.2, 10, 11.1, 11.2, 12.2 and 12.3 and the INFORMATION SHEET are attached at the end of this question paper.
9. Write your name in the space provided on the DIAGRAM SHEETS and hand them in with your ANSWER BOOK.
10. Number the answers correctly according to the numbering system used in this question paper.
11. It is in your own interest to write legibly and to present the work neatly.

QUESTION 1

Globally, cigarette smoking is killing people by the millions every single year.
The histogram below represents the total number of years as a smoker (25 or more cigarettes per day) against the relative risk to contract lung cancer.
The risk of contracting lung cancer increases with both duration and intensity of smoking.



1.1 State whether the distribution of the data is normal, positively skewed or negatively skewed . (1)

1.2 On **DIAGRAM SHEET 1**, draw the ogive (cumulative frequency polygon) of the above data. (4)

1.3 Indicate clearly on the sketch drawn on **DIAGRAM SHEET 1,** where the median can be read off. (1)
[6]

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QUESTION 2

During the month of June patients visited a number of medical facilities for treatment. The table shows the number of patients treated on certain dates during the month of June.

Dates in the month of June	3	5	8	12	15	19	22	26
Number of patients treated	270	275	376	420	602	684	800	820

2.1 On **DIAGRAM SHEET 2**, draw a scatter plot of the given data. (3)

2.2 Determine the equation of the least squares regression line of patients treated (y) against date (x). (3)

2.3 Estimate how many patients have been treated on the 24th of June. (2)

2.4 Draw the least squares regression line on the grid on DIAGRAM SHEET 2. (3)

2.5 Calculate the correlation coefficient of the data. Comment on the strength of the relationship between the variables. (3)

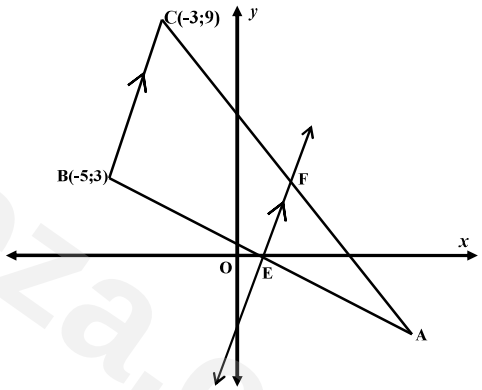
2.6 The statistics gathered for Youth Day, the 16th of June was (16 ; 102). Comment on this point and justify your answer. (2)
[16]

QUESTION 3

3.1 The points Q (1 ; 3) and R (7 ; 0) lie on the line l_1. The length of QR is $a\sqrt{5}$. Determine the value of a. (3)

3.2 Three straight lines AB, RS and $x = -3$ intersect each other. The equation of AB is $3x + ty = -2$ with $t \neq 0$, and the equation of RS is $y = -\frac{2}{3}x + 2$.
Calculate t. (4)

3.3 In the diagram below, EF || BC and the vertices of ΔABC are A, B (– 5 ; 3) and C (– 3 ; 9). The x-intercept at point E of line AB is (1 ; 0).



3.3.1 Calculate θ, the angle of inclination of line EB. (3)

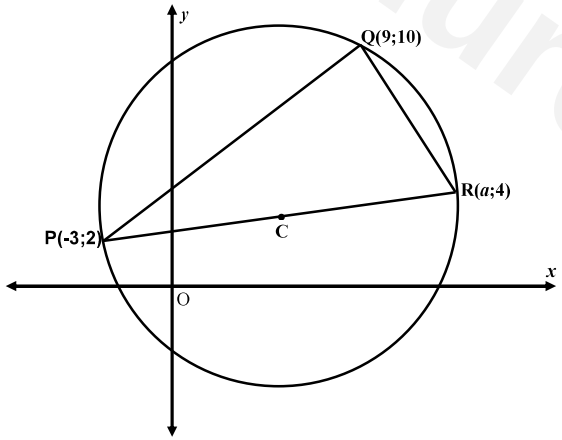
3.3.2 Determine the equation of line EF, which is parallel to BC and passes through point E. (4)

3.3.3 Calculate the size of $E\hat{B}C$. (3)
[17]

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QUESTION 4

4.1 The points P(−3 ; 2), Q(9 ; 10) and R(a ; 4) lie on the circumference of the circle, as shown in the figure below. PR is a diameter of the circle with centre C.



4.1.1 Show that $a = 13$. (3)

4.1.2 Determine the equation of the circle in the form: (4)

$$(x-a)^2+(y-b)^2=r^2$$

4.2 Two circles with centres A and B are given below.

Circle A: $(x-2)^2+(y-3)^2=9$

Circle B: $(x-1)^2+(y+1)^2=16$

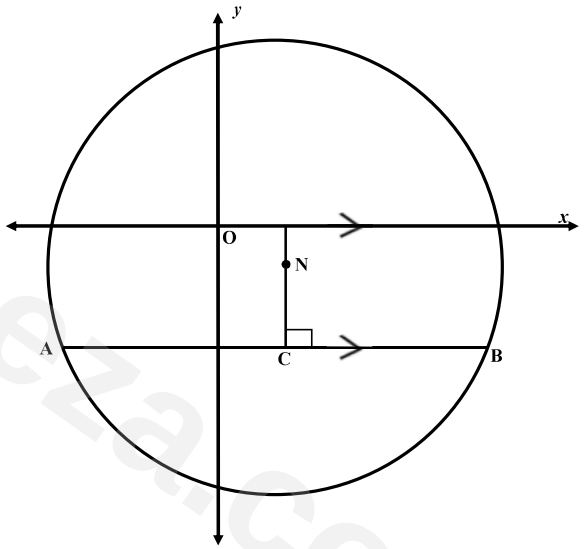
Without solving for x and y, determine if the circles

- intersect each other at 2 points.
- touch each other.
- do not intersect each other.

Show all your calculations. (6)

4.3 The figure below shows a sketch of the circle with centre N and equation $x^2-4x+y^2+2y=\frac{149}{4}$.

Chord AB of circle N is parallel to the x-axis and lies below the x-axis. The length of AB is 12 units.



4.3.1 Determine the coordinates of N. (3)

4.3.2 Determine the radius of the circle. (1)

4.3.3 Calculate the coordinates of A and B. (5)

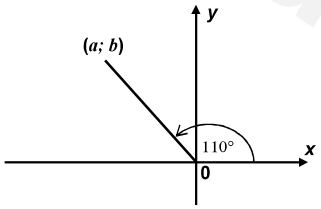
[22]

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QUESTION 5

5.1 In the Cartesian plane below, the point $(a\,;\,b)$ and the angle of $110°$ are shown.



5.1.1 Complete the following: $\frac{b}{a} = \ldots 110°$. (1)

5.1.2 Determine, rounded off to two decimal places the value of:

$$\frac{b}{\sqrt{a^2+b^2}}$$ (2)

5.2 Given: $\sin 56° = q$

Determine **without using a calculator**, the value of the following in terms of q:

5.2.1 $\cos 146°$ (2)

5.2.2 $\sin 112°$ (3)

[8]

QUESTION 6

6.1 Express $\cos(P+Q)$ in terms of trigonometric ratios of P and Q. (1)

6.2 Hence, derive a formula, which expresses $\cos 2P$ in terms of $\cos P$. (3)

6.3 Given: $\frac{\sin 2x - \cos 2x + 1}{\sin 2x + \cos 2x + 1}$

6.3.1 Prove that: $\frac{\sin 2x - \cos 2x + 1}{\sin 2x + \cos 2x + 1} = \tan x$ (5)

6.3.2 Hence, evaluate $\tan 22{,}5°$. (Leave your answer in SURD form). (3)

6.4 Given the expression: $\sin 2x.\cos 2x$

6.4.1 Calculate the maximum value of the above expression. (3)

6.4.2 Calculate the first negative value of x for which the expression has this maximum value. (4)

[19]

QUESTION 7

7.1 Use the system of axes on **DIAGRAM SHEET 3** to sketch the graphs of:

$$f(x) = -\frac{1}{2}\sin(x+30°) \text{ and } g(x) = \cos 2x \text{ if } -180° \le x \le 180°$$ (6)

7.2 Write down the period of g. (1)

7.3 Graph h is obtained when the y-axis for f is moved $120°$ to the left. Give the equation of h in the form $h(x) = \ldots\ldots$ (2)

7.4 Determine the general solution of:

$$\cos 2x = 1$$ (2)

[11]

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QUESTION 8

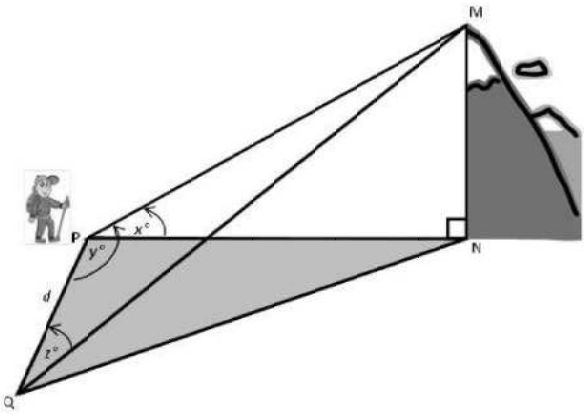
A mountain climber wants to determine the height, MN, of a mountain.

He uses a theodolite (instrument used to measure angles). The mountain climber is standing on flat ground. P is in the same horizontal plane as the foot of the mountain N.

He measures the following angles from P:

- The angle of elevation of the top of the mountain M, is $x°$
- $M\hat{P}Q$ is $y°$

He then walks d metres to point Q, which is also in the same horizontal plane as P and N, and measures $P\hat{Q}M$ which is $z°$.



8.1 Show that: $MN = \dfrac{d \sin x \sin z}{\sin(y+z)}$ (4)

8.2 Calculate MN, **without using a calculator** if $d = 1\,000$ m, $x = 90° - y$ and $y = z$. (3)

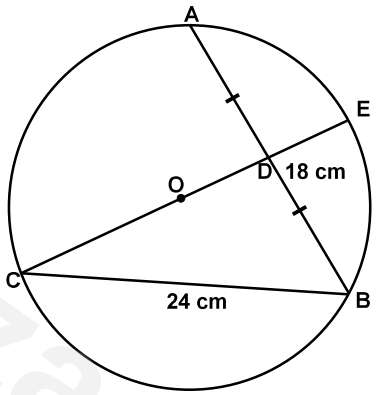
[7]

QUESTION 9

9.1 Complete the following so that the Euclidian Geometry statement is true: (1)

A line drawn from the centre of a circle to the midpoint of the chord is .....to the chord

9.2 In the circle with centre O, chord AB = 18cm and AD = DB.
Chord CB = 24 cm.



9.2.1 Calculate the length of CD. Leave the answer in simplest surd form. (4)

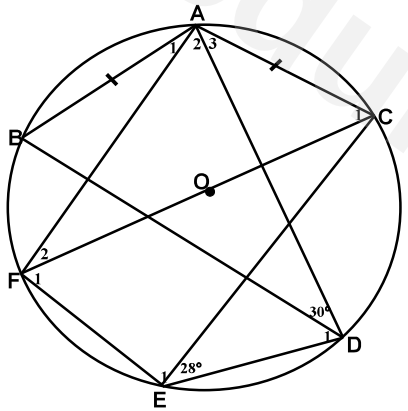
9.2.2 If $\dfrac{CD}{DE} = 3$, calculate the length of DE. (2)

[7]

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QUESTION 10

In the diagram, O is the centre of the circle. Chords AB = AC. $C\hat{E}D = 28°$ and $A\hat{D}B = 30°$



Calculate, with reasons, the sizes of the following angles:

10.1 $\hat{E}_1$ (2)

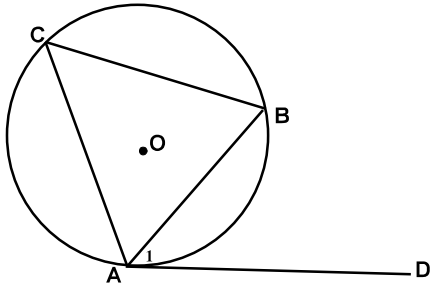
10.2 $\hat{A}_2$ (3)

10.3 $\hat{F}_2$ (2)

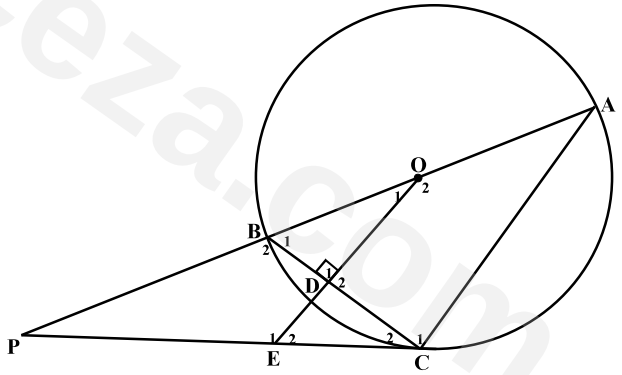
[7]

QUESTION 11

11.1 Use the diagram on **DIAGRAM SHEET 5**, to prove the theorem that states that $\hat{A}_1 = \hat{C}$ (5)



11.2 In the diagram, AB is a diameter of circle, centre O. AB is produced to P. PC is a tangent to the circle at C. OE ⊥ BC at D.



11.2.1 Prove, with reasons, that EO || CA. (4)

11.2.2 If $\hat{C}_2 = x$, name with reasons, two other angles each equal to x. (3)

11.2.3 Calculate the size of $\hat{P}$ in terms of x. (2)

[14]

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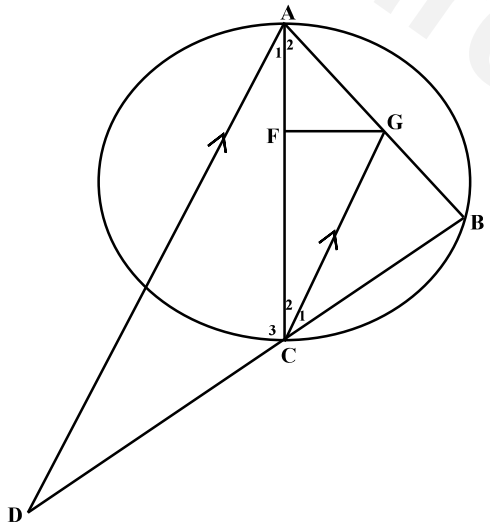
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QUESTION 12

12.1 Complete the following so that the Euclidian Geometry statement is true:

A line drawn parallel to one side of a triangle divides the other two sides ……. (1)

12.2 In the diagram below, CG bisects $A\hat{C}B$. AD || GC.

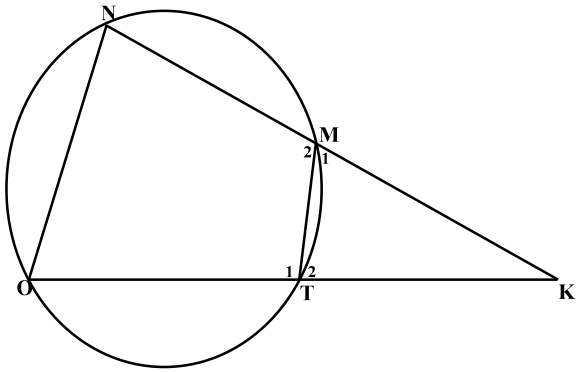


Prove, with reasons, that:

12.2.1 AC = DC (4)

12.2.2 $\frac{BC}{AC} = \frac{BG}{AG}$ (3)

12.3 In the diagram, KMN and KTO are two secants of a circle.



12.3.1 Prove that $\Delta MTK \;|||\; \Delta ONK$. (3)

12.3.2 Hence, prove that KM.KN = KT.KO (1)

12.3.3 Calculate KT if OT = 6 units, MN = 3 units and MK = 5 units. (4)
[16]

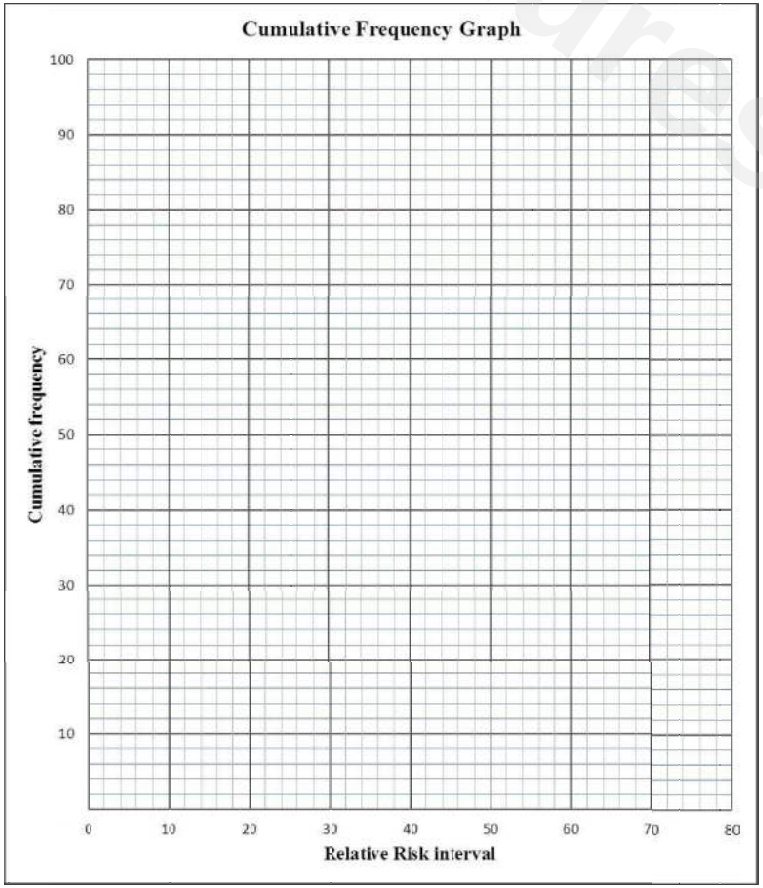
TOTAL: 150

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NAME:

DIAGRAM SHEET 1

QUESTION 1.2

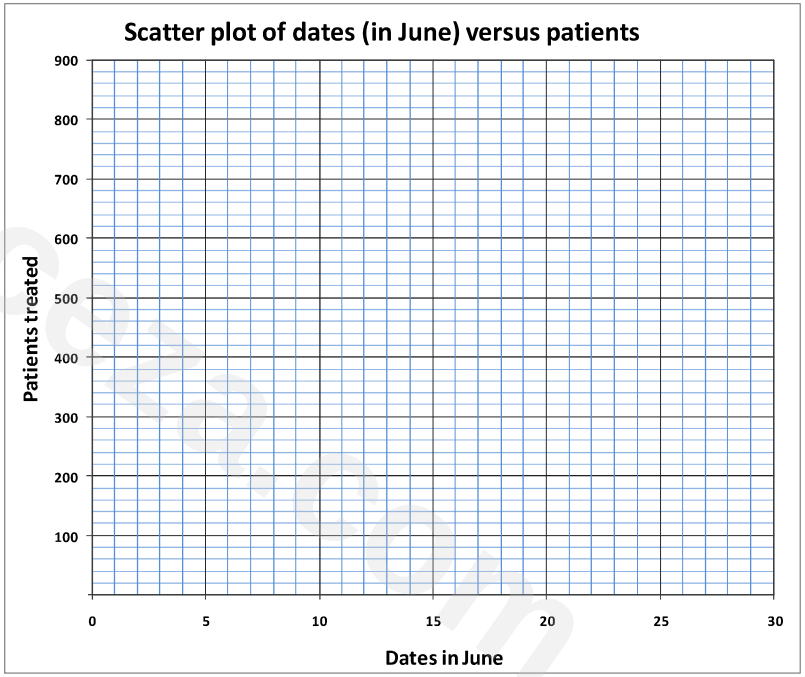


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NAME:

DIAGRAM SHEET 2

QUESTIONS 2.1 AND 2.4



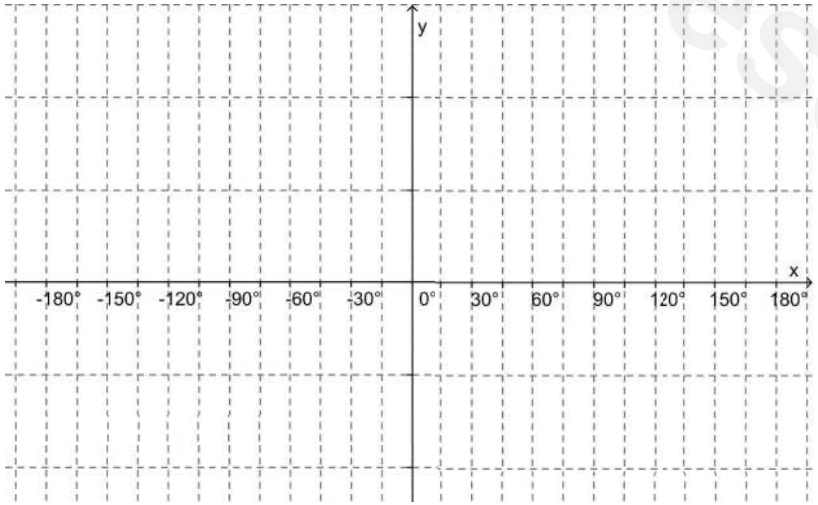
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MATHEMATICS (Second Paper)	10612/14	18

NAME:

DIAGRAM SHEET 3

QUESTION 7.1



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GAUTENG DEPARTMENT OF EDUCATION
PREPARATORY EXAMINATION
2015

10612

MATHEMATICS

SECOND PAPER

MARKS: 150
TIME: 3 hours

14 pages, 5 diagram sheets
and 1 information sheet.

MATHEMATICS: Paper 2
1061E
10612E

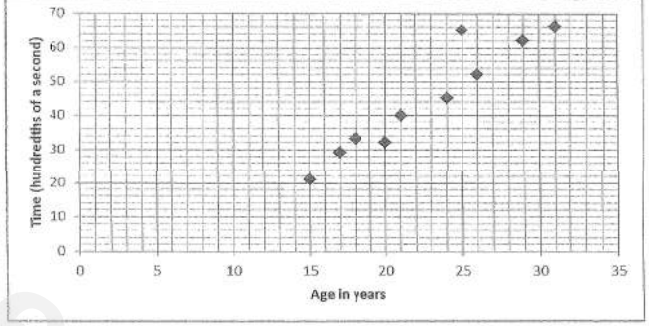
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3

QUESTION 1

A hospital carries out a survey to compare the reaction time of patients of different ages, to a specific medication taken.
The results are shown in the table and scatter plot below.

Age in years	15	17	18	20	21	24	25	26	29	31
Time (hundredths of a second)	21	29	33	32	40	45	65	52	62	66



1.1 Draw the line of best fit on the scatter plot on DIAGRAM SHEET 1. (2)

1.2 ONE of the patient's reaction time is an outlier.

1.2.1 How old is this patient? (1)

1.2.2 Explain why this patient is an outlier. (1)

1.3 Calculate the equation of the least squares regression line (line of best fit) for the data. (3)

1.4 Calculate the correlation coefficient of the data. Comment on the strength of the relationship between the variables. (2)

1.5 Hospital records for this reaction time test give the following information.

	15 year olds Time (hundredths of a second)	30 year olds Time (hundredths of a second)
Lower quartile	20	61
Median	22	65
Upper quartile	25	76

Comment on the reaction time of the different age groups on this test. Motivate your answer by referring to the values given. (2)
[11]

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QUESTION 2

The ages of 500 people attending a concert are given in the table below.

Age in years	Number of people	Cumulative frequency
$0 \leq A < 10$	20	
$10 \leq A < 20$	130	
$20 \leq A < 30$	152	
$30 \leq A < 40$	92	
$40 \leq A < 60$	86	
$50 \leq A < 80$	18	
$80 \leq A < 100$	2	

2.1 Complete the cumulative frequency column on DIAGRAM SHEET 2. (1)

2.2 Draw an ogive (cumulative frequency graph) of the above data on DIAGRAM SHEET 2. (3)

2.3 Use your cumulative frequency graph to estimate

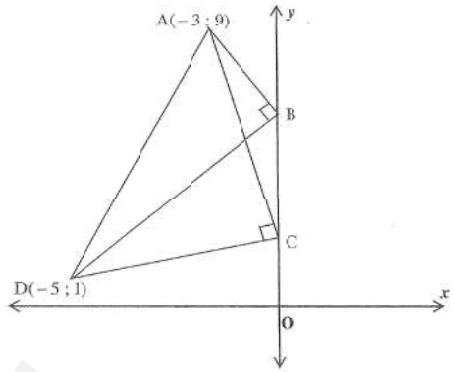
2.3.1 the median age. (1)

2.3.2 the percentage of people at the concert who are 16 years and older. (3)
[8]

QUESTION 3

In the diagram, A(−3 ; 9) and D(−5 ; 1) are points on ΔABD and ΔACD.

B and C are points on the y-axis such that $A\hat{B}D = A\hat{C}D = 90°$



3.1 Calculate the coordinates of M, the midpoint of AD. (2)

3.2 Calculate the length of the radius of the circle passing through A, B and D. (2)

3.3 Will point C lie on circle ABD? Give a reason for your answer. (2)

3.4 Calculate the coordinates of B. (5)

3.5 Determine the equation of the straight line passing through D and which is parallel to AB. (3)

3.6 Calculate the size of $B\hat{D}A$. Round off the answer to the nearest degree. (6)
[20]

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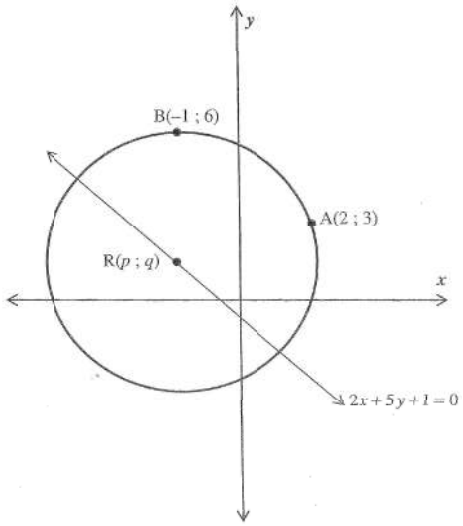
QUESTION 4

4.1 Given: $x^2 + y^2 - 2x + 6y = 0$.

4.1.1 Determine the coordinates of the centre of the circle and the length of the of the circle. (4)

4.1.2 Determine the equation of the tangent to the circle at $(-2 ; -4)$. (4)

4.2 Points A(2 ; 3) and B(–1 ; 6) lie on the circumference of the given circle. R(p ; q) is the centre of the circle and lies on the line $2x + 5y + 1 = 0$.



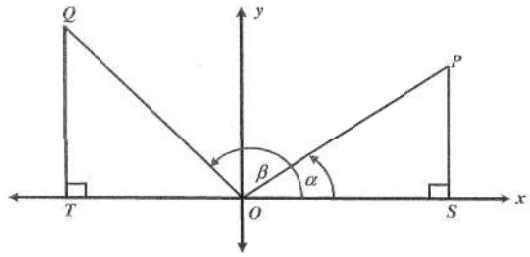
4.2.1 Show that $p - q = -4$. (4)

4.2.2 Hence, determine the equation of the circle. (7)
[19]

QUESTION 5

This question is to be done without the use of a calculator.

In the diagram below the equation of OP is given by $3y - 2x = 0$. S is a point on the x-axis such that PS $\perp$ x-axis. $S\hat{O}P = \alpha$. The line segment OQ is drawn such that $S\hat{O}Q = \beta$. T is a point on the x-axis such that QT $\perp$ x-axis.



5.1 Show that $\tan\alpha = \frac{2}{3}$. (2)

5.2 Calculate the value of $\sin\alpha$. (2)

5.3 Write down $Q\hat{O}P$ in terms of α and β. (1)

5.4 If it is given that $\sin\beta = \frac{3}{5}$, find the value of $\sin Q\hat{O}P$. (4)
[9]

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QUESTION 6

6.1 Simplify fully WITHOUT the use of a calculator:

$$\frac{\cos(40°-x)\cdot\cos x-\sin(40°-x)\cdot\sin x}{\sin 205°.\cos 25°} \quad (5)$$

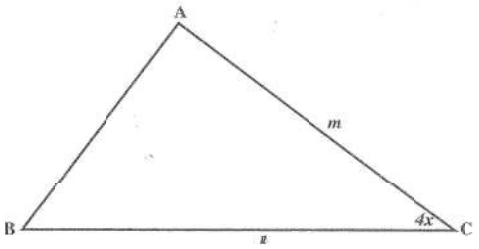
6.2 Given: $\frac{\cos 2x}{\cos x+\sin x}$

6.2.1 Show that: $\frac{\cos 2x}{\cos x+\sin x}=\cos x-\sin x$. (2)

6.2.2 Show that $\cos x\left(\frac{\cos 2x}{\cos x+\sin x}\right)=\frac{1}{2}$ can be simplified to $\cos 2x=\sin 2x$. (4)

6.2.3 Hence, determine the general solution of $\cos x\left(\frac{\cos 2x}{\cos x+\sin x}\right)=\frac{1}{2}$. (3)

6.3 In ΔABC, $AC=m$, $BC=n$ and $\hat{C}=4x$.



6.3.1 Write down an expression for the area of ΔABC. (1)

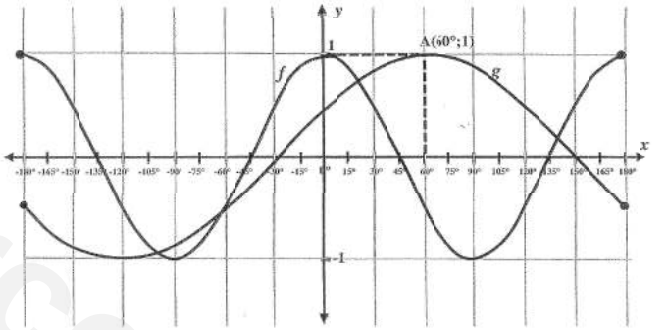
6.3.2 Calculate the value of x for which the area of the triangle will be a maximum. (2)

6.3.2 What conclusion can you make about the type of triangle formed when the area of the triangle is a maximum? (1)

[18]

QUESTION 7

The sketch below shows the graphs of $f(x)=\cos 2x$ and $g(x)=\sin(x-\theta)$ for $x\in[-180°;180°]$. A$(60°;1)$ is a point on the graph of g. Use the graph to answer the questions that follow.



7.1 Write down the value of θ. (1)

7.2 Determine the period of f. (1)

7.3 If $h(x)=f(x)-1$, write down the range of h. (1)

7.4 Determine the values of x, where $x\in[0°;180°]$ for which

7.4.1 $f(x).g(x)<0$ (3)

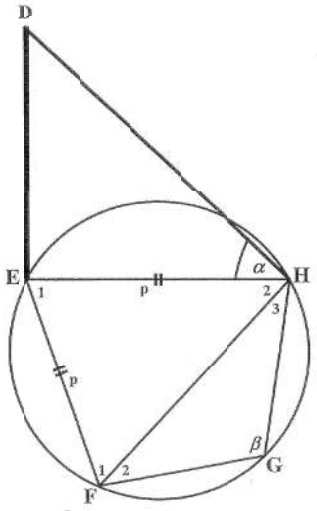
7.4.2 $f'(x).g(x)>0$ (2)

[8]

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QUESTION 8

In the diagram below, DE represents a vertical cell phone tower positioned on one corner of a field. The field is shaped as a cyclic quadrilateral EFGH and E, F, G and H are all on the same horizontal plane.. From H, the angle of elevation to D, the top of the cell phone tower, is α. EH = EF = p units. $\hat{G} = \beta$.



8.1 Write down DE in terms of α. (1)

8.2 Show that:

8.2.1 $\hat{H}_2 = \frac{1}{2}\beta$ (Give reasons for your answers). (3)

8.2.2 $p = \dfrac{FH}{2\cos\frac{1}{2}\beta}$ (3)

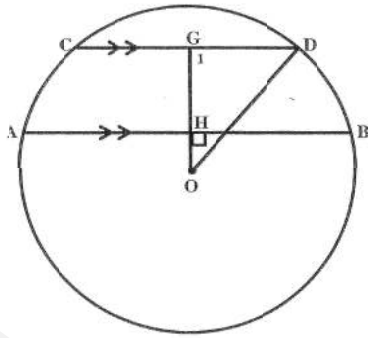
8.2.3 $FH = p\sqrt{2(1+\cos\beta)}$ (3)

[10]

GIVE REASONS FOR YOUR STATEMENTS IN QUESTIONS 9, 10, AND 11.

QUESTION 9

9.1 In the diagram, O is the centre of the circle with AB ∥ CD and OH ⊥ AB, AB = 24 cm, CD = 10 cm and OD = 13 cm.



9.1.1 Give reasons for the statements below.

(a) $\hat{G}_1 = 90°$

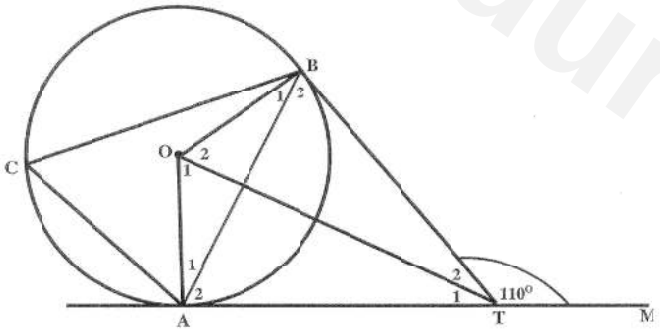
(b) AH = 12

(c) OB = 13 (3)

9.1.2 Calculate the length of GH. (5)

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9.2 In the diagram, O is the centre of the circle ACB. TA and TB are tangents to the circle at A and B respectively. O and T are joined. $B\hat{T}M = 110°$.



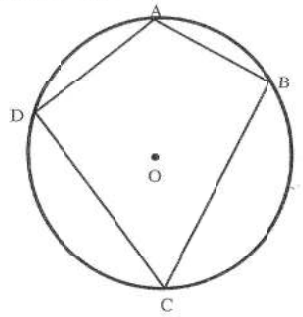
9.2.1 Prove that AOBT is a cyclic quadrilateral. (3)

9.2.2 Give a reason why $\hat{T}_1 = \hat{T}_2$ (2)

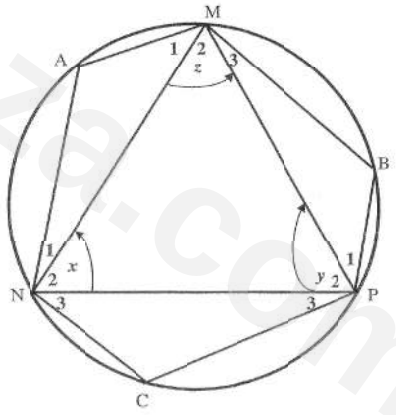
9.2.3 Calculate $\hat{C}$. (4)
[17]

QUESTION 10

10.1 In the diagram, O is the centre of the circle. A, B, C and D are points on the circumference of the circle. Use Euclidean Geometry methods to prove the theorem which states that $\hat{A} + \hat{C} = 180°$. (5)



10.2 In the diagram, the circle passes through A, M, B, P, C and N.



Let $\hat{N}_2 = x$, $\hat{P}_2 = y$ and $\hat{M}_2 = z$.

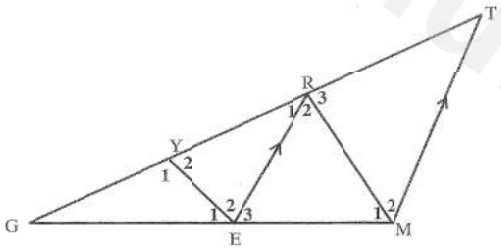
10.2.1 Write down the sizes of $\hat{A}$, $\hat{B}$ and $\hat{C}$ in terms of x, y and z. (2)

10.2.2 Hence, calculate the value of $\hat{A} + \hat{B} + \hat{C}$. (4)
[11]

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QUESTION 11

In $\triangle RGM$, $\hat{E}_1 = \hat{R}_1 = \hat{R}_2$. T lies on RG produced so that TM ∥ RE.



11.1 Give with reasons, TWO other angles which are equal to $\hat{R}_1$. (4)

11.2 Prove that $\frac{EM}{EG} = \frac{RM}{RG}$. (4)

11.3 Prove that $\Delta GYE \;|||\; \Delta GER$. (4)

11.4 Hence, prove that $\frac{EG}{EY} = \frac{RG}{RE}$. (1)

11.5 If it is further given that $G\hat{R}M = 90°$, RM = 6 and GM = 10.
Calculate the lengths of:

11.5.1 RG (2)

11.5.2 GE (4)
[19]

TOTAL: 150

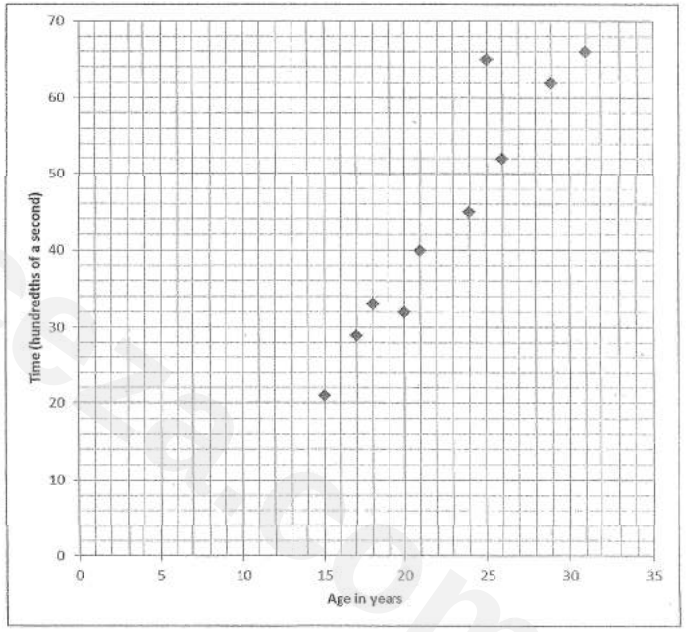
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NAME:

DIAGRAM SHEET 1

QUESTION 1.1



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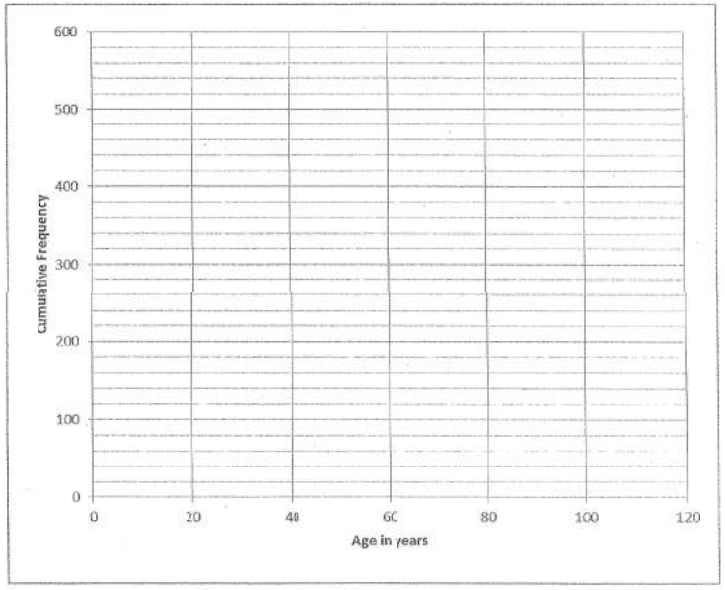
NAME:

DIAGRAM SHEET 2

QUESTION 2.1

Age in years	Number of people	Cumulative frequency
$0 \leq A < 10$	20	
$10 \leq A < 20$	130	
$20 \leq A < 30$	152	
$30 \leq A < 40$	92	
$40 \leq A < 60$	86	
$60 \leq A < 80$	18	
$80 \leq A < 100$	2	

QUESTION 2.2 AND 2.3



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GAUTENG DEPARTMENT OF EDUCATION
PREPARATORY EXAMINATION
2016

10612

MATHEMATICS

SECOND PAPER

TIME: 3 hours

MARKS: 150

3 pages + 1 information sheet

MATHEMATICS: Paper 2
1061E
10612E

X1Ø

QUESTION 1

1.1 The table below shows the recorded monthly rainfall (in mm) measured at Silver Lakes, a residential area in Pretoria, for the months of December. The statistics was taken for the period 2004 to 2015.

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Rainfall for December (in mm)	286	68	150	147	176	132	255	174	172	197	172	39

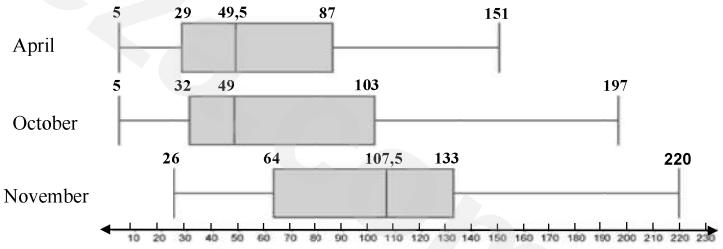
Source: Prof. Francois Swanepoel from Silver Lakes

1.1.1 Which year's rainfall will decrease the average December rainfall the most? (1)

1.1.2 Calculate the standard deviation for the rainfall in December. (2)

1.1.3 Determine the percentage of the data points for the rainfall in December, which lie within one standard deviation of the mean. (3)

1.2 The diagram below shows a comparison of the recorded monthly rainfall statistics for the months of April, October and November, for the years 2004 to 2015.



1.2.1 Determine the range of the rainfall for the November months. (1)

1.2.2 Comment on the skewness of the data for the October months. (1)

1.2.3 If the maximum rainfall for October was incorrectly recorded and is now increased, what effect will this have on

(a) the mean and

(b) the median. (2)

1.2.4 For how many years was November's rainfall less than 64 mm? (2)

[12]

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QUESTION 2

A company called Math πrates sent out a number of advertising pamphlets. The table below shows the number of pamphlets sent out to a certain place. The table also shows the orders that were received after the distribution of the pamphlets.

Number of Pamphlets	Number of Orders
600	350
1000	550
500	300
700	300
600	330
100	200
500	350
800	450
300	250
900	500

2.1 Represent the above information in a scatter plot on the grid provided in the ANSWER BOOK. (2)

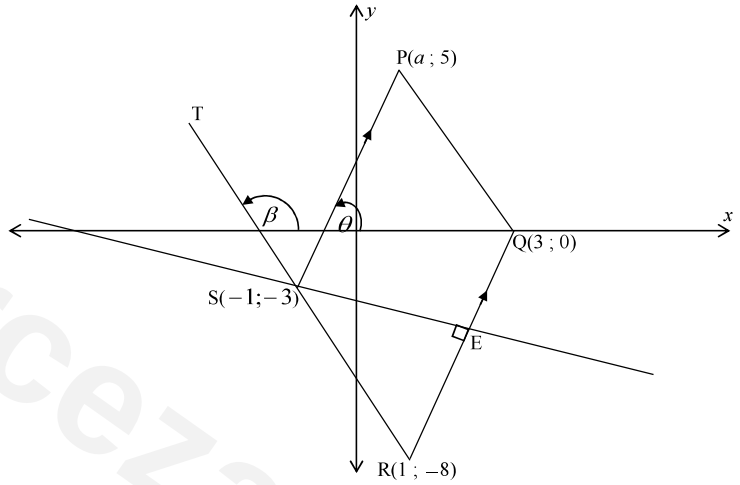
2.2 Determine, using your calculator, the equation of the least squares regression line. (2)

2.3 Draw the least squares regression line on the scatter plot drawn for QUESTION 2.1. (2)

2.4 Calculate the possible number of orders if 200 pamphlets were sent out. (2)
[8]

QUESTION 3

In the diagram below, PQRS is a trapezium with SP || QR and vertices P(a ; 5), Q(3 ; 0), R(1 ; -8) and S($-1;-3$). SE $\perp$ QR.



3.1 Determine the length of QR. (2)

3.2 Determine the gradient of QR. (2)

3.3 Calculate the value of y if E$\left(\frac{35}{17};y\right)$ lies on the line QR. (2)

3.4 Determine the equation of SE. (3)

3.5 Calculate the value of a. (3)

3.6 Calculate the value of:

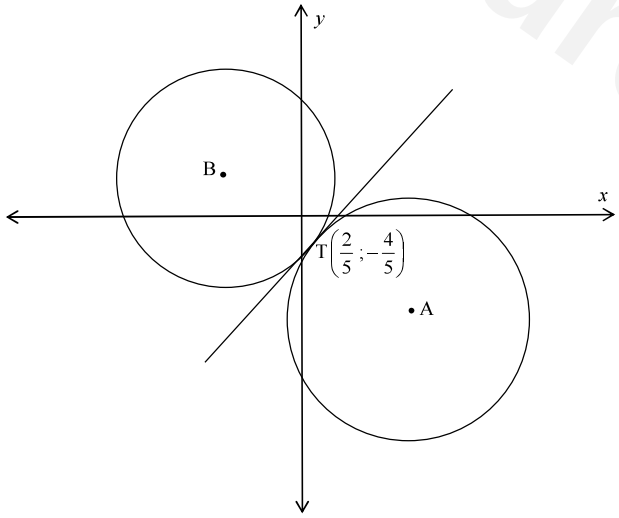
3.6.1 θ (2)

3.6.2 $S\hat{R}Q$ (5)

3.7 Determine the length of the radius of circle ESR. (3)
[22]

QUESTION 4

The diagram below shows circle centre A with equation $(x-2)^2+(y+2)^2=4$ and a circle centre B with equation, $x^2+y^2+4x-2y+p=0$. The two circles touch externally at $T\left(\frac{2}{5};-\frac{4}{5}\right)$.



4.1 Write down the coordinates of the centre of circle A. (1)

4.2 Calculate:

4.2.1 The coordinates of the centre of circle B (2)

4.2.2 The radius of circle B (in terms of p) (2)

4.2.3 The length of AB (2)

4.2.4 The value of p (3)

4.3 If the two circles touch at the point $T\left(\frac{2}{5};-\frac{4}{5}\right)$, determine the equation of the tangent in the form $y = mx + c$. (5)

[15]

QUESTION 5

5.1 If $5\tan\theta+2\sqrt{6}=0$ and $0°<\theta<270°$, determine with the aid of a sketch and without the use of a calculator, the value of:

5.1.1 $\sin\theta$ (2)

5.1.2 $\cos\theta$ (1)

5.1.3 $\dfrac{14\cos\theta+7\sqrt{6}\sin\theta}{\cos(-240°).\tan 225°}$ (4)

5.2 Prove the identity:

$$\frac{\cos\theta-\cos 2\theta+2}{3\sin\theta-\sin 2\theta}=\frac{1+\cos\theta}{\sin\theta}$$ (5)

5.3 Determine the general solution of $\sin\theta\sin\frac{3\theta}{2}+\cos\frac{3\theta}{2}\cos\theta=-\frac{\sqrt{3}}{2}$. (4)

5.4 Given: $\sin\theta.\cos\beta=-1$

5.4.1 Write down the maximum and minimum value of $\cos\beta$. (1)

5.4.2 Solve for $\theta\in[0°;270°]$ and $\beta\in[-180°;90°]$. (4)

[21]

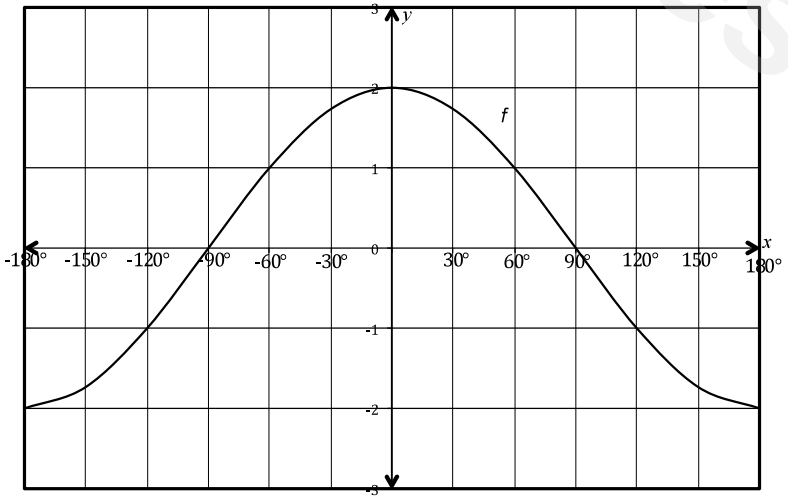
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QUESTION 6

6.1 Show that the equation $2\cos x = \sin(x+30^\circ)$ is equivalent to $\sqrt{3}\sin x = 3\cos x$. (3)

6.2 Hence or otherwise, calculate the value of x for $x \in [-180^\circ; 180^\circ]$ if $2\cos x = \sin(x+30^\circ)$. (4)

6.3 In the diagram below, the graph of $f(x) = 2\cos x$ is drawn for $x \in [-180^\circ; 180^\circ]$



6.3.1 Write down the range of f. (1)

6.3.2 Draw the graph of g, where $g(x) = \sin(x+30^\circ)$ for $x \in [-180^\circ; 180^\circ]$. Use the grid provided in your ANSWER BOOK. (3)

6.3.3 Write down the period of g. (1)

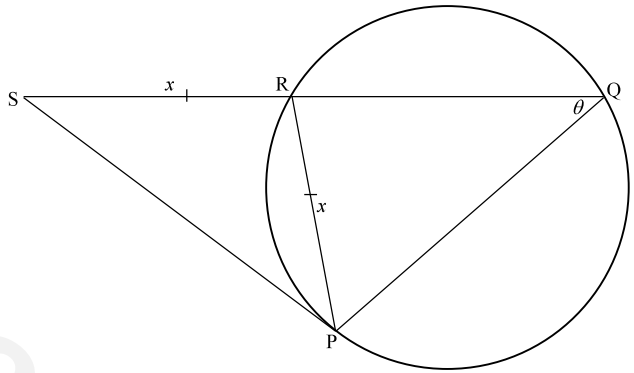
6.3.4 For which values of x is g strictly increasing as x increases, for $x \in [-180^\circ; 180^\circ]$? (2)

6.3.5 For which values of x will $f(x).g(x) > 0$ for $x \in [-90^\circ; 90^\circ]$? (2)

[16]

QUESTION 7

In the diagram below, PS is a tangent to the circle through P, Q and R. QRS is a straight line. PR = RS = x and $P\hat{Q}R = \theta$.



Prove that $PS = 2x\cos\theta$. (6)

[6]

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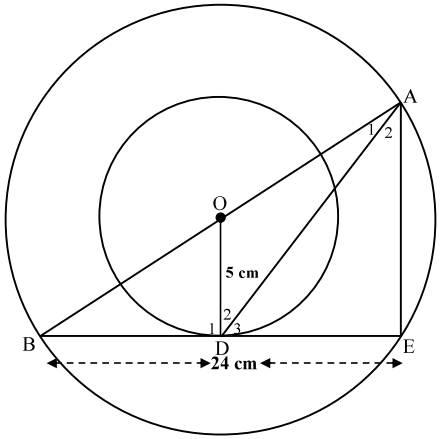
Give reasons for ALL statements in QUESTIONS 8, 9, 10 and 11.

QUESTION 8

8.1 Complete the following statement.

The line drawn from the centre of a circle, perpendicular to a chord, ... the chord. (1)

8.2 In the diagram below, two concentric circles with centre O are drawn. Chord BDE of the larger circle has a length of 24 cm and is a tangent to the smaller circle at D. The radius of the smaller circle is 5 cm. AB is the diameter of the larger circle.



8.2.1 Calculate the length of OB. (4)

8.2.2 Write down the reason why $\hat{E} = 90°$. (1)

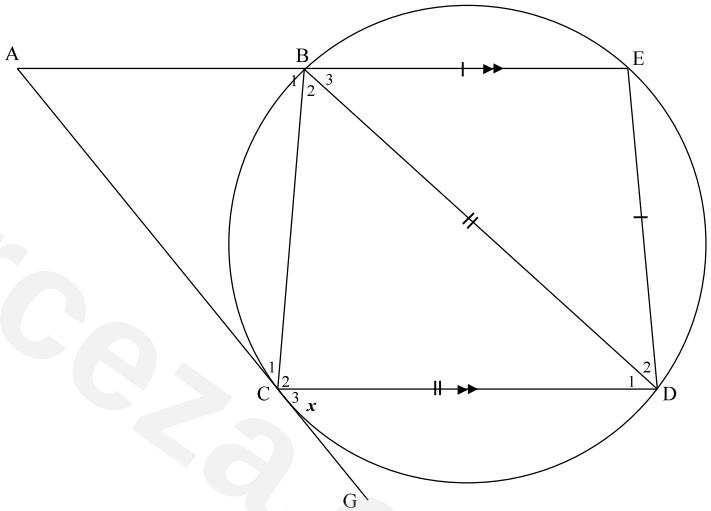
8.2.3 Calculate the length of AE. (3)

8.2.4 Calculate the length of AD. (2)

[11]

QUESTION 9

In the diagram below, BCDE is a cyclic quadrilateral with $BE = ED$, $BD = CD$ and $AE \parallel CD$. ACG is a tangent at C and meets EB produced at A.



9.1 If $\hat{C}_3 = x$, determine, with reasons, FIVE other angles each equal to x. (7)

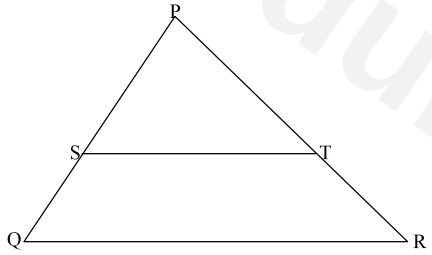
9.2 Prove that $BC = ED$. (2)

[9]

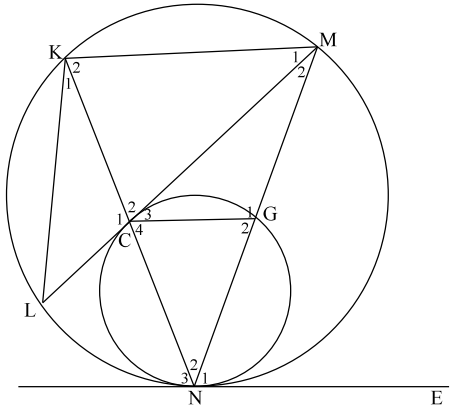
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QUESTION 10

10.1 Use the diagram given in the ANSWER BOOK, to prove the theorem which states that if ST ∥ QR , then $\frac{PS}{SQ} = \frac{PT}{TR}$. Show all construction lines. (5)



10.2 In the diagram below NE is a common tangent to the two circles. NCK and NGM are double chords. Chord LM of the larger circle is a tangent to the smaller circle at point C. KL, KM and CG are drawn.



Prove that:

10.2.1 $\frac{KC}{KN} = \frac{MG}{MN}$ (4)

10.2.2 KMGC is a cyclic quadrilateral if CN = NG. (3)

10.2.3 $\Delta MCG \;|||\; \Delta MNC$ (3)

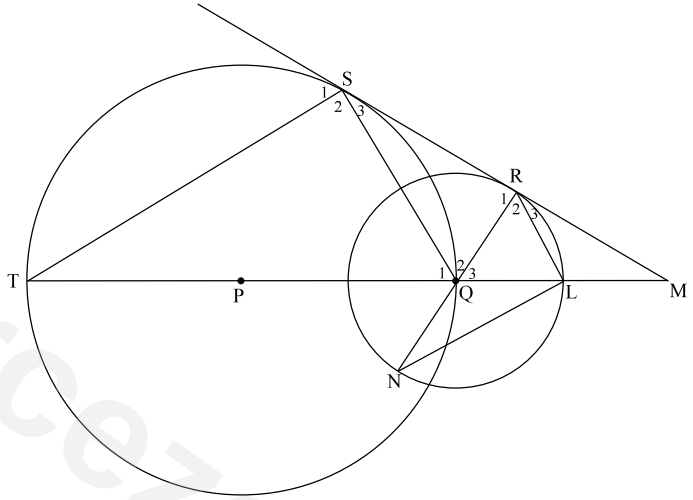
10.2.4 $\frac{MC^2}{MN^2} = \frac{KC}{KN}$ (4)

[19]

P.T.O.

QUESTION 11

In the diagram below, the length of the radius of the larger circle, with centre P, is twice the length of the radius of the smaller circle, with centre Q. SRM is a tangent to both circles.



11.1 Calculate the size of $\hat{R}_3$ if $\hat{Q}_3 = 60°$. (4)

11.2 If the length of the radius of the smaller circle is r and $\Delta TSQ \;|||\; \Delta SRQ$, show that the length of SQ is equal to $2r$. (3)

11.3 Calculate the size of $T\hat{S}R$. (4)

[11]

TOTAL: 150

END

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GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION

2017

10612

MATHEMATICS

SECOND PAPER

TIME: 3 hours

MARKS: 150

7 pages and 1 information sheet

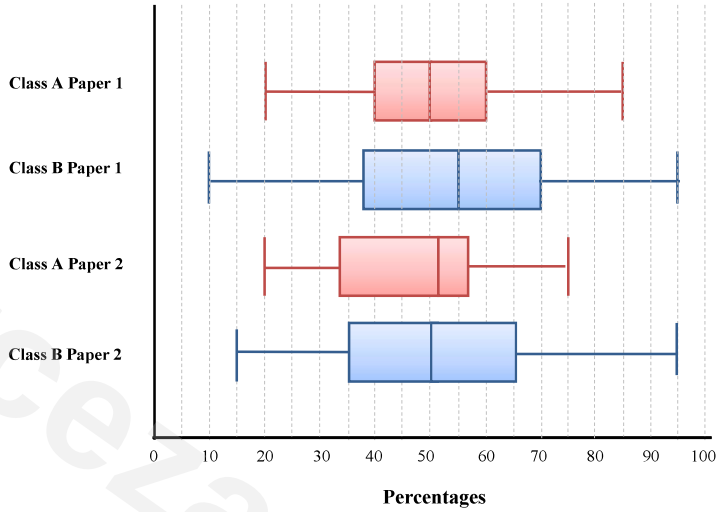
MATHEMATICS: Paper 2
1061E
10612E

X10

3

QUESTION 1

1.1 The box and whisker plot below summarises the results obtained in Paper 1 and Paper 2 by Class A and Class B in a certain school in the 2016 Preparatory Examination.



1.1.1 Write down the median mark for **Class B Paper 1**. (1)

1.1.2 Write down the interquartile range for **Class A Paper 1**. (2)

1.1.3 Write down the range of percentages that were achieved by 75% of the learners in **Class B Paper 2**. (1)

1.1.4 Comment on the skewness of the data for **Class A Paper 2**. (1)

1.2 The table below represents **cumulative frequencies** of exam percentages. The marks are for a group of 30 learners.

Class interval	Cumulative Frequency
$10 \leq x \leq 19$	1
$20 \leq x \leq 29$	2
$30 \leq x \leq 39$	4
$40 \leq x \leq 49$	6
$50 \leq x \leq 59$	14
$60 \leq x \leq 69$	19
$70 \leq x \leq 79$	23
$80 \leq x \leq 89$	26
$90 \leq x \leq 100$	30

1.2.1 Sketch the ogive (cumulative frequency graph) from the table given above. (3)

1.2.2 What percentage of learners achieved lower than 70%? (1)

1.2.3 How many learners achieved marks from 80 – 89%? (1)

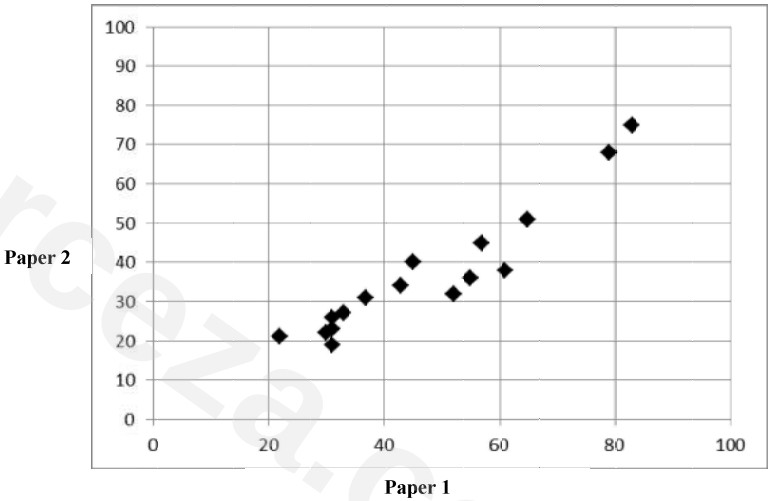
1.2.4 Write down a possible mark for a learner who achieved the third lowest mark. (1)

1.2.5 Use the graph to write down the SMALLEST possible range of marks achieved by the learners. (1)
[12]

QUESTION 2

The marks obtained as a percentage by 17 learners in Paper 1 and Paper 2 in the 2016 Preparatory Examination is given in the table below. The same information is represented in the scatter plot.

Paper 1	22	83	55	52	65	31	61	31	31	57	30	33	45	31	43	37	79
Paper 2	21	75	36	32	51	19	38	23	26	45	22	27	40	23	34	31	68



2.1 Calculate the equation of the least squares regression line for the data. (3)

2.2 Calculate the correlation coefficient of the data. (1)

2.3 Sketch the least squares regression line on the scatter plot provided in the ANSWER BOOK. (2)

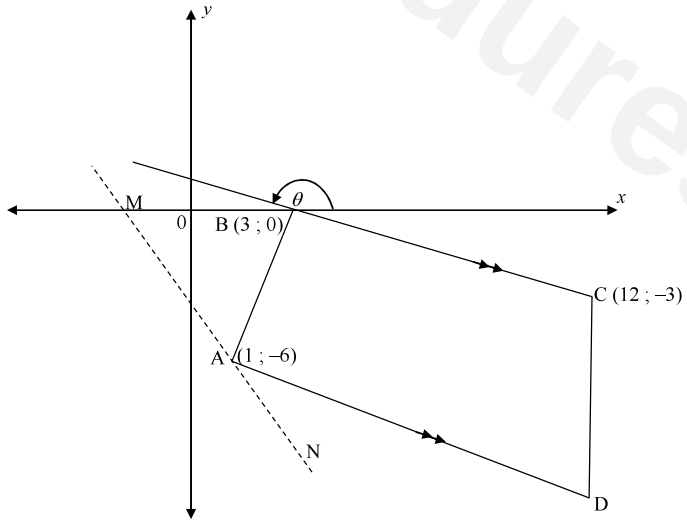
2.4 A learner achieved 98 % in Paper 1 and 79.4% in Paper 2.
Are these marks valid and reliable? Substantiate your answer. (2)
[8]

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QUESTION 3

3.1 In the diagram below, A (1 ; – 6), B (3 ; 0), C (12 ; – 3) and D are the vertices of a trapezium having AD || BC. The inclination of line BC is θ.

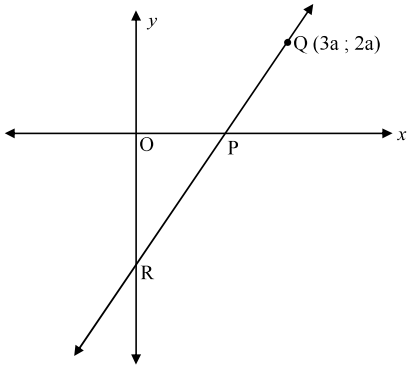


3.1.1 Calculate the size of θ. (4)

3.1.2 Prove that AD ⊥ AB. (3)

3.1.3 A straight line, MAN, only passes through vertex A of trapezium ABCD. An angle of 45° is formed between line MAN and line AD. Determine the equation of line MAN. (4)

3.2 A straight line with a gradient of 2, cuts the x-axis at P, the y-axis at R and passes through Q (3a ; 2a)



3.2.1 Write down the equation of QR, in terms of a. (2)

3.2.2 Hence, determine the area of ΔPOR in terms of a. (4)

3.2.3 Calculate the value of a, if the points D (–3 ; –14), Q and E (3 ; –2) are collinear. (3)

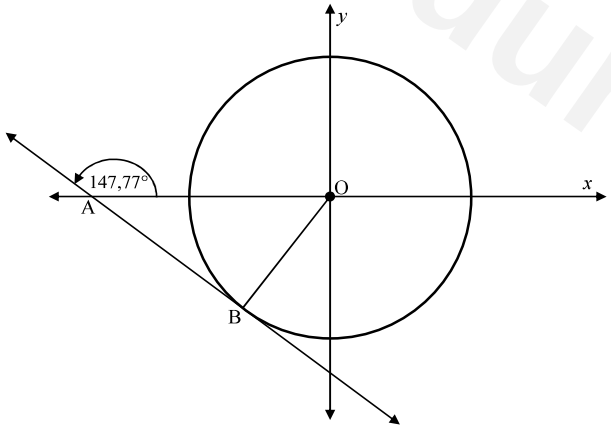
[20]

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QUESTION 4

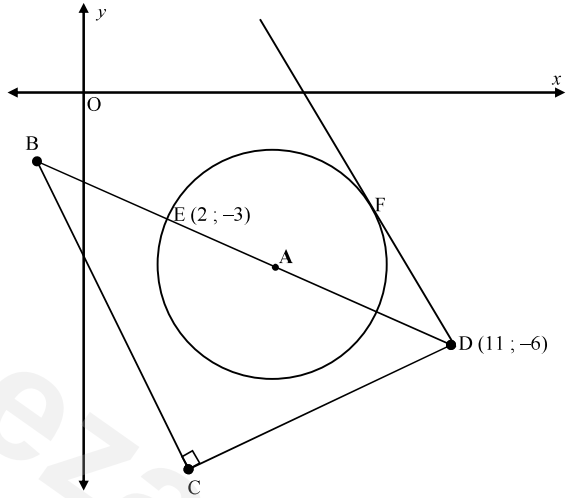
4.1 The figure below shows circle O with a radius of 8 units. Tangent AB touches the circle at B and cuts the negative *x*-axis at A such that the inclination of the tangent is 147,77°.



4.1.1 Write down the equation of the circle. (1)

4.1.2 Calculate the coordinates of A. (4)

4.2 A is the centre of a circle having equation $x^2 - 10x + y^2 + 8y + 31 = 0$.
E (2 ; –3), a point on the circle, is also the midpoint of AB.
BEA is produced to D (11 ; –6). C is a point such that BC ⊥ DC.



4.2.1 Write the equation of the circle in the form $(x-a)^2 + (y-b)^2 = r^2$. (3)

4.2.2 Write down the coordinates of A, the centre of the circle. (1)

4.2.3 Write down the length of the radius of the circle in surd form. (1)

4.2.4 Calculate the coordinates of B. (3)

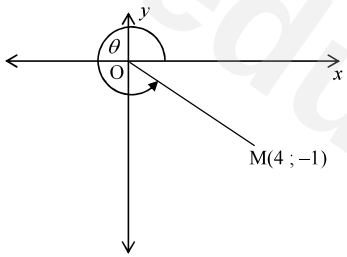
4.2.5 If $x = k$ is a tangent to circle A, determine the value(s) of k.
(Leave your answer in surd form.) (3)

4.2.6 DF is a tangent to the circle at F. Calculate the length of DF in surd form. (4)
[20]

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QUESTION 5

In the diagram below, M (4 ; –1) is given and $X\hat{O}M = \theta$.



5.1 Calculate the size of θ. (3)

5.2 Simplify, the following expression to a single trigonometric function, **without the use of a calculator**:

$$\frac{2\cos(90°-x)}{\sin(180°-2x)} \times \frac{\cos(60°-x)\cos x - \sin(60°-x)\sin x}{\tan(-x)}$$ (7)

5.3 If $\cos 18° = k$, express the following in terms of k, **without the use of a calculator.**

5.3.1 $\sin 108°$ (2)

5.3.2 $\cos(-36°)$ (3)

5.4 Solve for x if:

$2\sin x\cos x + 2\sin x + \cos^2 x + \cos x = 0$ for $x \in [-180;180°]$ (6)

5.5 Given that $\tan\theta = p$ in any right-angled triangle:

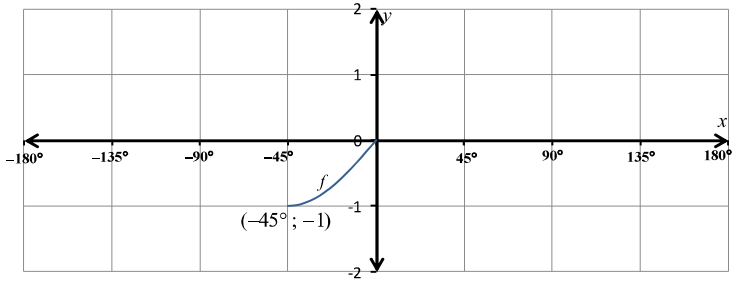
5.5.1 Show that $\sin 2\theta = \frac{2p}{p^2+1}$. (2)

5.5.2 Hence, or otherwise, calculate the maximum value of $\frac{(p+1)^2}{p^2+1}$. (3)

[26]

QUESTION 6

The sketch below shows a part of the graph of f where $f(x) = a\sin bx$. A turning point of f is at $(-45° ; -1)$.



6.1 Write down the values of a and b. (3)

6.2 Use the grid provided in your ANSWER BOOK to complete the graph of f for $x \in [-180°; 180°]$. (3)

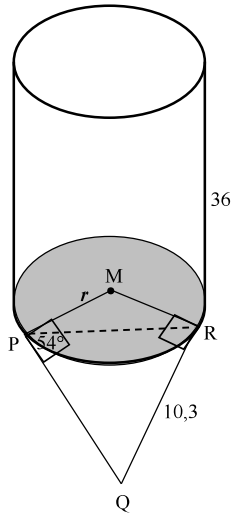
6.3 Hence, determine the values of x for which $f'(x) < 0$ in the interval $x \in [0°; 180°]$. (2)

[8]

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QUESTION 7

The diagram below represents a right cylindrical silo. M is the centre of the circular base.
PQ and RQ are tangents to the base at P and R. M, P, Q and R lie in the same horizontal plane.
The vertical height of the cylinder is 36 metres.
QR = 10,3 m and $R\hat{P}Q = 54^{\circ}$.



7.1 Determine the size of $\hat{Q}$. (2)

7.2 Calculate the length of PR. (2)

7.3 Calculate the volume of the cylindrical section of the silo. (5)
[9]

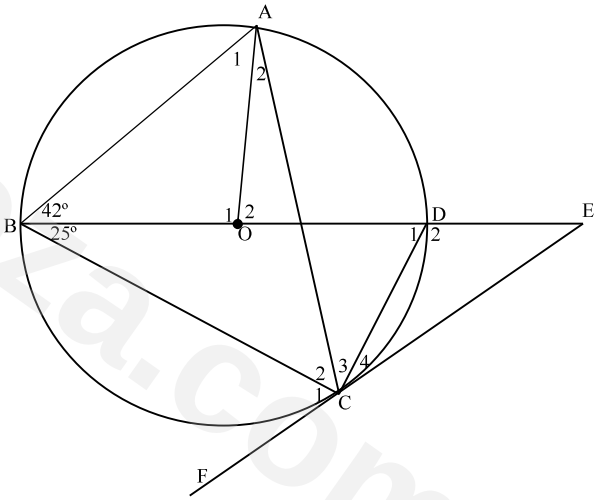
GIVE REASONS FOR ALL STATEMENTS AND CALCULATIONS IN QUESTIONS 8, 9, 10 AND 11.

QUESTION 8

8.1 Complete the statement so that it is TRUE.

The angle which an arc of a circle subtends at the … of a circle is twice the angle it subtends at the circumference of the circle. (1)

8.2 In the diagram below, the circle with centre O passes through A, B, C and D such that BOD is a diameter. BD is extended to E such that FCE is a tangent to the circle at C.
$A\hat{B}E = 42^{0}$ and $D\hat{B}C = 25^{0}$.



Calculate:

8.2.1 $B\hat{C}D$ (2)

8.2.2 $\hat{A}_1$ (2)

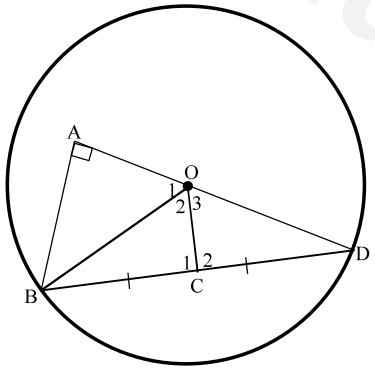
8.2.3 $\hat{O}_2$ (2)

8.2.4 $\hat{C}_4$ (2)
[9]

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QUESTION 9

In the diagram below, O is the centre of the circle. C is the midpoint of chord BD. Point A lies within the circle such that $BA \perp AOD$.

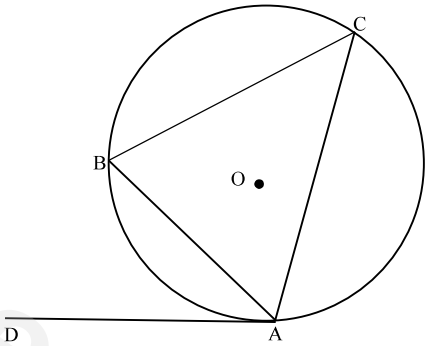


9.1 Show that $DA.OD = OD^2 + OD.OA$ (1)

9.2 Prove that $2DC^2 = OD^2 + OD.OA$ (7)
[8]

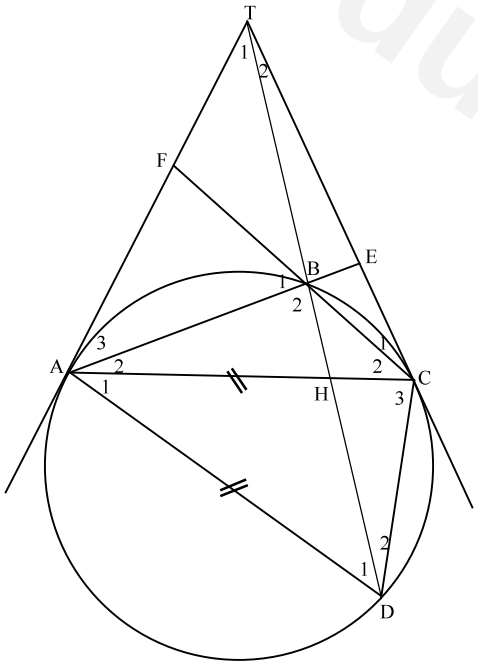
QUESTION 10

10.1 Use the given diagram to prove the theorem which states that if DA is a tangent to the circle centre O, then $D\hat{A}B = B\hat{C}A$. (5)



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10.2 In the diagram below, ABCD is a cyclic quadrilateral with AC = AD. Tangents AT and CT touch the circle at A and C respectively. FBC, ABE, AHC and DBT are straight lines.



Prove:

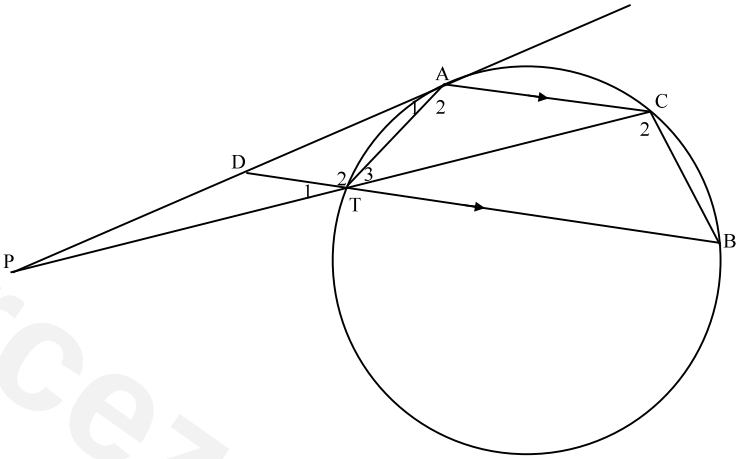
10.2.1 $\hat{B}_1 = \hat{B}_2$. (5)

10.2.2 BECH is a cyclic quadrilateral. (4)

10.2.3 CA is a tangent to the circle passing through points A, B and T. (5)
[19]

QUESTION 11

In the diagram below, ACBT is a cyclic quadrilateral having AC || TB. CT is produced to P such that tangent PA meets the circle at A. BT produced meets PA at D.



11.1 Prove that $\Delta PAT \;|||\; \Delta PCA$ (3)

11.2 If PA = 6, TC = 5 and PT = x,

11.2.1 show that PT = 4. (4)

11.2.2 calculate the length of PD. (4)
[11]

TOTAL: 150

END

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GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION

2018

10612

MATHEMATICS
PAPER 2

TIME: 3 hours

MARKS: 150

15 pages, 1 information sheet and a 21 page answer book

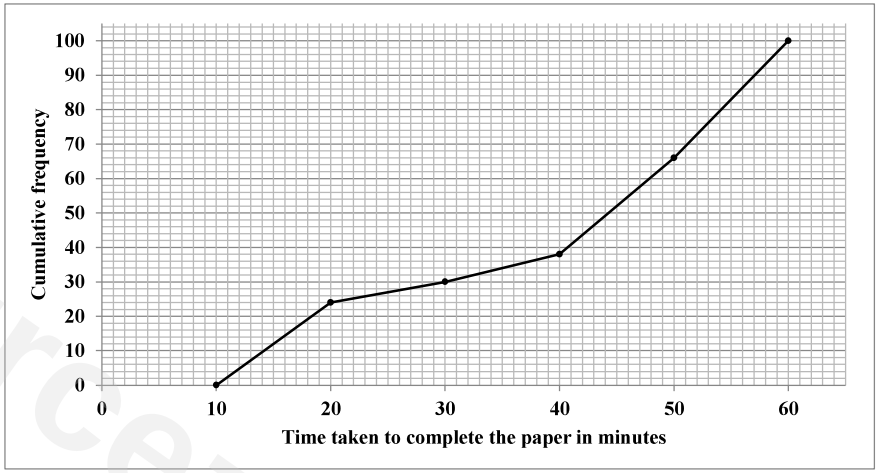
MATHEMATICS: Paper 2
1061E
10612E

X05

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QUESTION 1

In a Mathematics competition learners were expected to answer a multiple choice question paper. The time taken by the learners to the nearest minute to complete the paper, was recorded and data was obtained. The cumulative frequency graph representing the time taken to complete the paper is given below.



An incomplete frequency table for the data is given below.

Time taken to complete the paper in minutes	$10 \le x < 20$	$20 \le x < 30$	$30 \le x < 40$	$40 \le x < 50$	$50 \le x < 60$
Frequency	a	6	8	28	34

1.1 Determine the value of a in the frequency table. (2)

1.2 How many learners wrote the paper? (1)

1.3 Identify the modal class of the data. (1)

1.4 Calculate:

1.4.1 The estimated mean time, in minutes, taken to complete the paper (3)

1.4.2 The number of learners that took longer than 35 minutes to complete the paper (2)

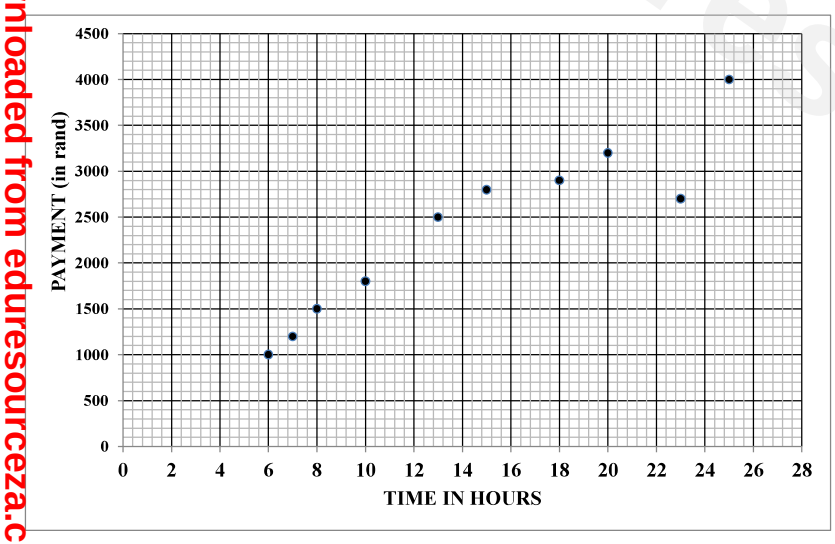
[9]

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QUESTION 2

A group of students did some part-time work for a company. The number of hours that the students worked and the payment (in rand) received for the work done is shown in the table below. The scatter plot is drawn for the data.

Number of hours worked	6	7	8	10	13	15	18	20	23	25
Payment (in rand)	1000	1200	1500	1800	2500	2800	2900	3200	2700	4000



2.1 Calculate the standard deviation of the number of hours worked. (1)

2.2 Determine the number of hours that a student needed to work in order to receive a payment that was more than one standard deviation above the mean. (3)

2.3 Determine the equation of the least squares regression line of the data. (3)

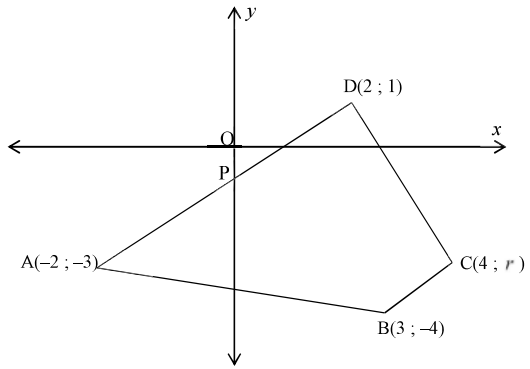
2.4 Mapula who worked for 11,5 hours was omitted from the original data. Calculate the possible amount that the company has to pay Mapula. (2)

2.5 Use the scatter plot to identify an outlier and give a possible reason for this point to be an outlier. (2)

[11]

QUESTION 3

3.1 In the diagram below, points A(–2 ; –3), B(3 ; –4), C(4 ; r) and D(2 ; 1) are the vertices of quadrilateral ABCD. P is the midpoint of line AD.



3.1.1 Calculate the value of r if AD ∥ BC. (4)

3.1.2 What type of quadrilateral is ABCD? (1)

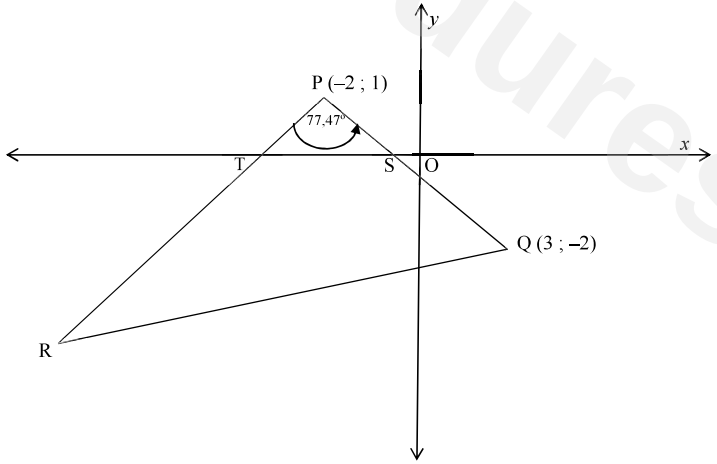
3.1.3 Determine the coordinates of P. (2)

3.1.4 Prove that BP ⊥ AD. (2)

3.1.5 Determine the equation of the circle passing through PBA in the form $(x-a)^2+(y-b)^2=r^2$. (5)

3.1.6 Calculate the maximum radius of the circle having equation $x^2+y^2-2x\cos\theta-4y\cos\theta=-2$ for any value of θ. (5)

3.2 In the diagram below, points P(–2 ; 1) and Q(3 ; –2) are given and R is a point in the third quadrant. PQ and PR cut the x-axis at S and T respectively.
$\hat{QPR} = 77{,}47°$.

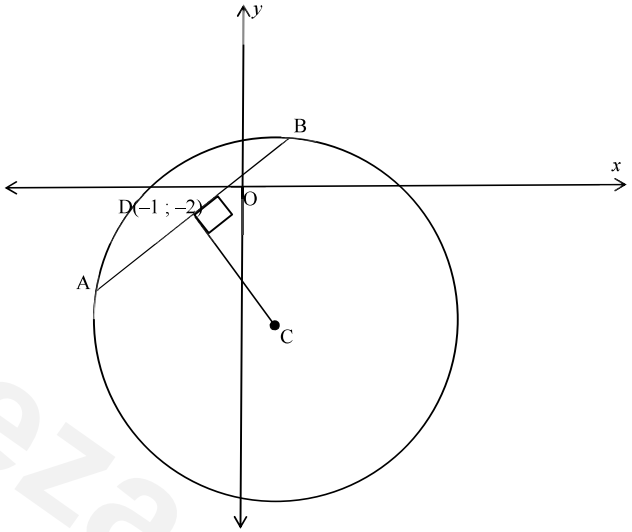


3.2.1 Determine the equation of line PQ in the form $ax + by + c = 0$ (3)

3.2.2 Determine the equation of PR in the form $y = mx + c$. (6)
[28]

QUESTION 4

In the diagram below, AB is a chord of the circle with centre C. D(–1 ; –2) is the midpoint of AB. DC ⊥ AB. The equation of the circle is $x^2 + y^2 + 6y = 4x + 12$.



4.1 Determine the coordinates of C. (3)

4.2 Determine the radius of the circle. (1)

4.3 Calculate the length of AB. (5)

4.4 Calculate the area of ΔABC. (3)
[12]

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QUESTION 5

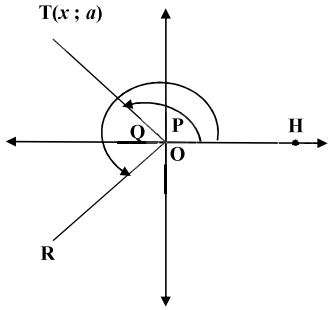
5.1 Simplify the following expression to a single trigonometric function.

$$\frac{\sin x.\sin(90°+y)-\cos x.\sin(180°+y)}{\cos x.\cos(y-360°)+\sin(-x)\sin y} \quad (6)$$

5.2 Given: $\cos(A-B)=\cos A\cos B+\sin A\sin B$

5.2.1 Prove that $\cos(A+B)=\cos A\cos B-\sin A\sin B$ (2)

5.2.2 In the diagram, T is a point such that $H\hat{O}T = P$ and $\sin P = a$. T is reflected about the x-axis to R such that $H\hat{O}R = Q$



(a) Determine the coordinates of T in terms of a. (2)
(b) Write down the coordinates of R in terms of a. (2)
(c) Calculate $\cos(P+Q)$. (2)
(d) Hence, show that P + Q = 360°. (1)

5.3 Given: $\cos\theta = d$

5.3.1 Write down the values of d such that $\cos\theta$ is defined. (2)

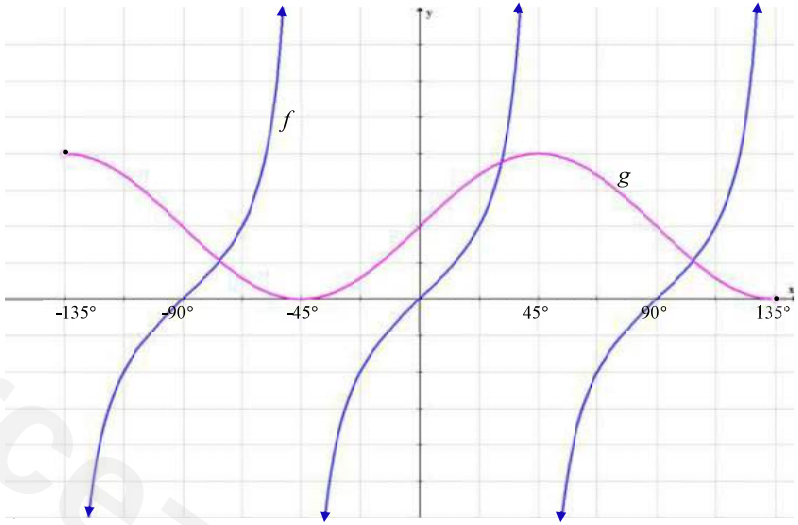
5.3.2 Determine the general solution for θ if :

$$\cos\theta = \frac{1}{\cos\theta} + \frac{5}{6} \quad (6)$$

[23]

QUESTION 6

The functions $f(x)=\tan 2x$ and $g(x)=1+\sin 2x$ are sketched for $x\in[-135°;135°]$.



6.1 Write down the equation of the asymptote in the interval $x\in[-135°;0°]$. (1)

6.2 If $h(x)=\frac{\sin x-2\sin^3 x}{2\sin^2 x.\cos x}$, determine h in terms of f. (4)

6.3 Determine the equation of p in its simplest form, if graph g is translated by moving the y-axis 45° to the right. (3)

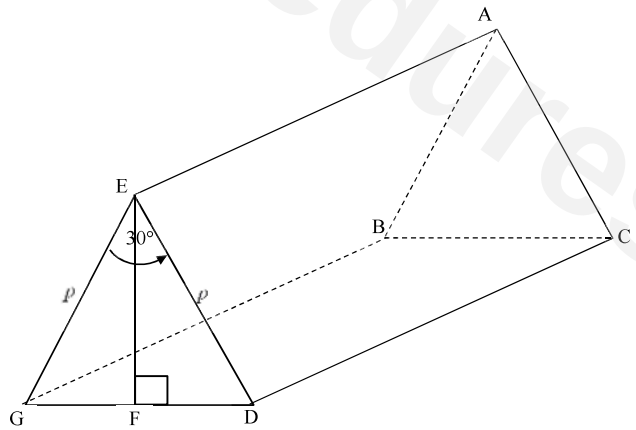
6.4 Determine the values of x for which $(\tan 2x)(-1-\sin 2x)\le 0$ for $x\in[-135°;0°)$. (3)

[11]

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QUESTION 7

The given figure represents a roof in the form of a triangular prism. The beams EG and ED have length p metres. $EF \perp GD$ and $G\hat{E}D = 30°$.



Without using a calculator:

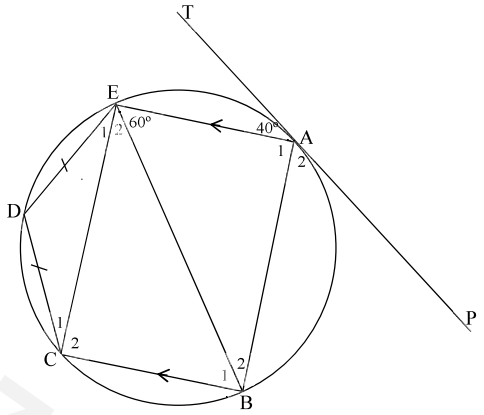
7.1 Prove that $GD^2 = p^2(2-\sqrt{3})$. (3)

7.2 Hence, determine the value of CD in terms of p, if $C\hat{G}D = 60°$. (3)
[6]

GIVE REASONS FOR ALL STATEMENTS AND CALCULATIONS IN QUESTIONS 8, 9, 10 AND 11.

QUESTION 8

In the diagram below, TAP is a tangent to circle ABCDE at A. AE || BC and DC = DE. $T\hat{A}E = 40°$ and $A\hat{E}B = 60°$.



8.1 Identify TWO cyclic quadrilaterals. (2)

8.2 Determine, with reasons, the size of the following angles:

8.2.1 $\hat{B}_2$ (2)

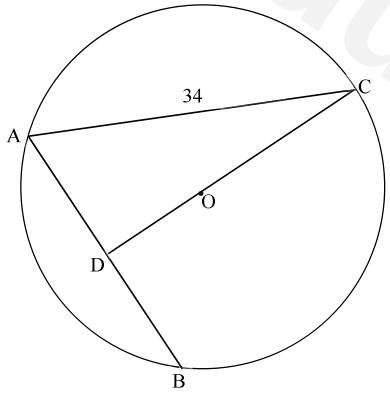
8.2.2 $\hat{B}_1$ (2)

8.2.3 $\hat{D}$ (2)

8.2.4 $\hat{E}_1$ (3)

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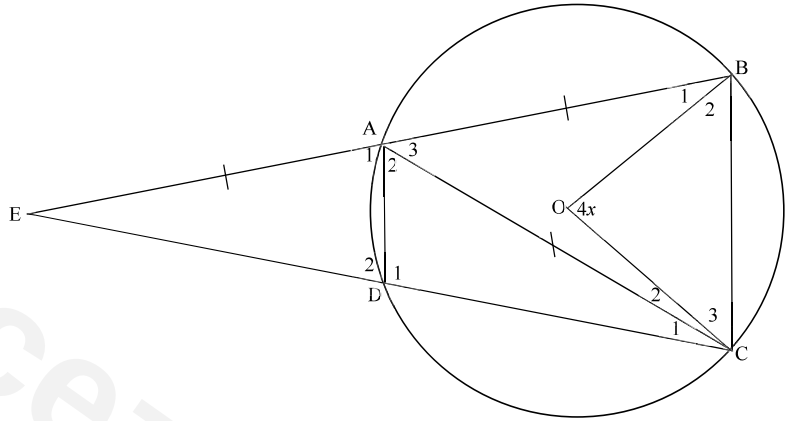
8.3 In the diagram below, radius CO is produced to bisect chord AB at D.
$CA = 34\,mm$ and $AB = 40\,mm$



Calculate the size of $\hat{C}$. (4)
[15]

QUESTION 9

In the diagram below, O is the centre of the circle. ABCD is a cyclic quadrilateral. BA and CD are produced to intersect at E such that AB = AE = AC.



Determine in terms of x:

9.1 $\hat{B}_2$ (2)

9.2 $\hat{E}$ (5)

9.3 $\hat{C}_2$ (3)

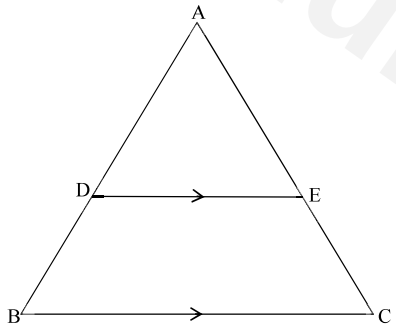
9.4 If $\hat{E} = \hat{C}_2 = x$, prove that ED is a diameter of circle AED. (4)
[14]

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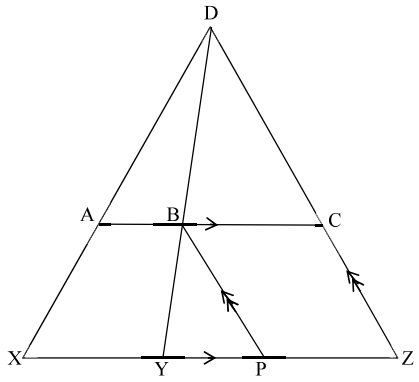
QUESTION 10

10.1 In ΔABC below, D and E are points on AB and AC respectively such that DE || BC.

Prove the theorem that states that $\frac{AD}{DB} = \frac{AE}{EC}$. (6)



10.2 In ΔDXZ below, AC || XZ and BP || DZ. DY is drawn to intersect AC at B.

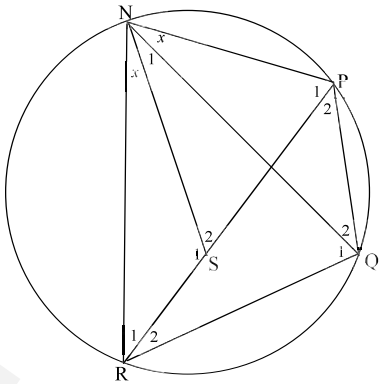


Prove that: $\frac{BC}{YZ} = \frac{DA}{DX}$ (5)

[11]

QUESTION 11

In the diagram below, NPQR is a cyclic quadrilateral with S a point on chord PR. N and S are joined and $R\hat{N}S = P\hat{N}Q = x$.



Prove that:

11.1 $\Delta NSR ||| \Delta NPQ$ (3)

11.2 $\Delta NQR ||| \Delta NPS$ (3)

11.3 $NR.PQ + NP.QR = NQ.PR$ (4)

[10]

TOTAL: 150

END

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GAUTENG DEPARTMENT OF EDUCATION
PREPARATORY EXAMINATION
2019

10612

MATHEMATICS

PAPER 2

TIME: 3 hours

MARKS: 150

16 pages, 1 information sheet and a 25 page answer book

MATHEMATICS: Paper 2

10612E

X10

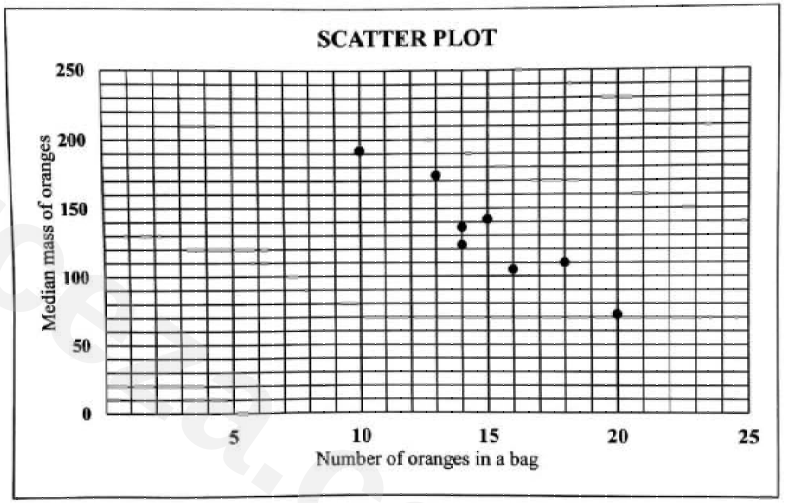
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QUESTION 1

A student is investigating the number of oranges in a bag in relation to the median mass of the oranges filled in the same bag. The findings are recorded in the table below.

Number of oranges in a bag	18	16	20	15	14	13	14	10
Median mass of oranges in the same bag (to the nearest gram)	110	105	72	142	123	174	136	192



1.1 Determine the equation of the least squares regression line for the data. (3)

1.2 Write down the correlation coefficient of the data. (1)

1.3 Draw the least squares regression line on the scatter plot given in your ANSWER BOOK. (2)

1.4 Comment on the strength of the relationship between the number of oranges in the bag and the median mass of the oranges. (1)

1.5 Determine the possible median mass of oranges in a bag, if there are 12 oranges in that bag. (2)
[9]

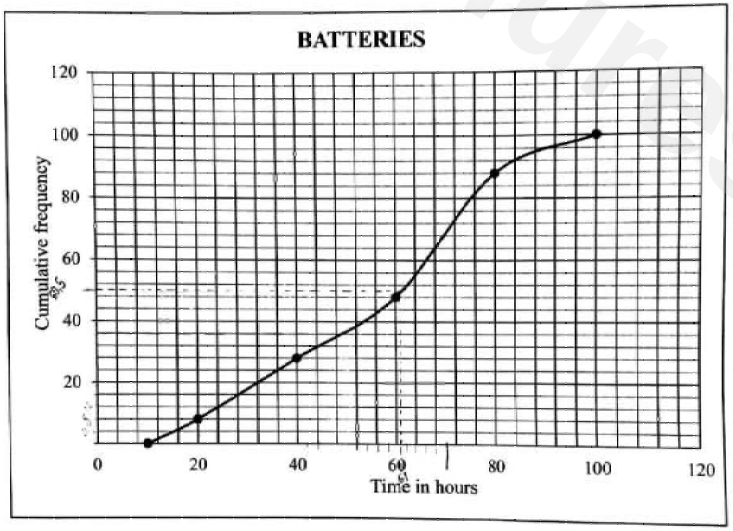
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QUESTION 2

2.1 Batteries are used in everyday life. The Grade 12 Physical Sciences learners investigated the life span of batteries under constant test conditions.

The ogive (cumulative frequency graph) below shows the lifespan (in hours) of the batteries.



2.1.1 How many batteries were tested for this investigation? (1)

2.1.2 Use the graph to estimate the median time for the life span (in hours) of the batteries. (2)

2.1.3 The minimum lifespan of batteries is 10 hours and the maximum lifespan is 100 hours. Use the cumulative frequency graph to draw a box and whisker diagram in your ANSWER BOOK. (3)

2.1.4 Comment on the skewness of the distribution of the lifespan of the batteries. (1)

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2.2 The table below represents values in a data set written in increasing order. None of the values in the data set are repeated.

5	a	19	b	c	d	35

Determine the values of a, b, c, and d if:

- The median is 20.
- The semi interquartile range is 8.
- The upper quartile is twice the lower quartile.
- The mean is 22. (4)

[11]

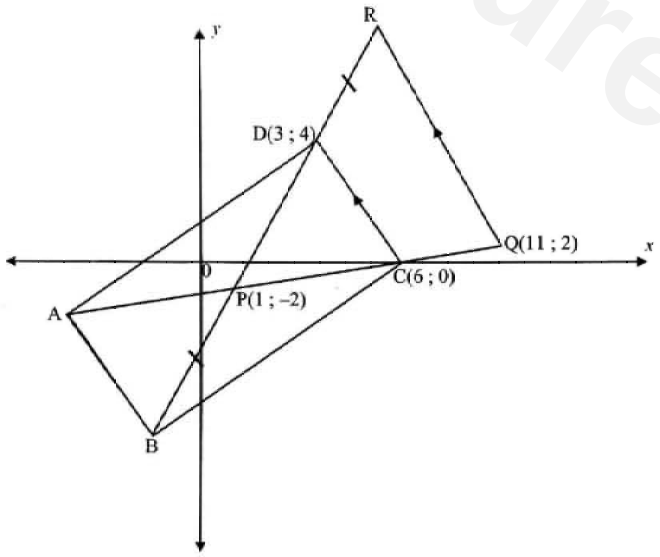
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QUESTION 3

3.1 In the diagram below, A, B, C (6 ; 0) and D (3 ; 4) are the vertices of rectangle ABCD. Diagonals AC and BD bisect each other at P(1 ; –2). AC is produced to Q(11 ; 2) and BD is produced to R such that BP = DR and CD ∥ QR.



3.1.1 Calculate the coordinates of B. (3)

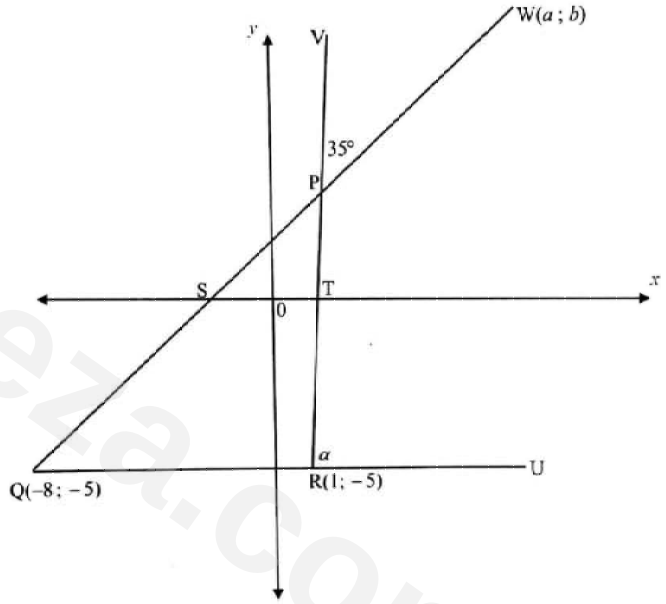
3.1.2 Determine the gradient of CD. (2)

3.1.3 Show that the equation of QR is $y=-\frac{4}{3}x+\frac{50}{3}$. (2)

3.1.4 If K(4 ; y) is a point in the 4th quadrant such that PK = RQ, calculate the value of y. (6)

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3.2 In the diagram below, P, Q(–8 ; –5) and R(1 ; –5) are the vertices of ΔPQR. RP is produced to V and QP is produced to W(a ; b) such that $V\hat{P}W = 35°$. The equation of QW is $y=x+\frac{2}{3}$. QR is produced to U and $U\hat{R}V = \alpha$. QW and RV intersect the x-axis at S and T respectively.



3.2.1 Calculate the size of α. (5)

3.2.2 It is further given that QU ⊥ WU and R is the midpoint of QU. Calculate the area of ΔQWU. (6) **[24]**

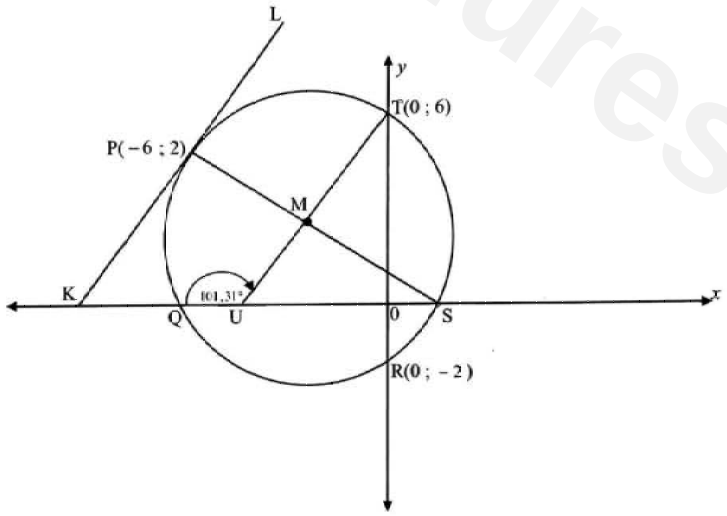
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QUESTION 4

In the diagram below, a circle with centre M, cuts the x-axis at Q and S and the y-axis at T(0 ; 6) and R(0 ; −2). The equation of diameter SMP is $y=\frac{-1}{5}x+\frac{4}{5}$.

KPL is a tangent to the circle at P(−6 ; 2). TM produced cuts the x-axis at U. $Q\hat{U}T = 101{,}31°$.



4.1 Determine the equation of TU. (3)

4.2 Calculate the coordinates of M. (3)

4.3 If the coordinates of M are (−1 ; 1), determine the equation of the circle in the form $(x-a)^2+(y-b)^2=r^2$. (3)

4.4 Prove that KL is parallel to TU. (3)

4.5 Is the point $V\left(-\frac{1}{2};7\right)$ inside the circle? Support your answer with calculations. (3)

[15]

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QUESTION 5

5.1 If $\sin 16° = \frac{1}{\sqrt{1+k^2}}$, express the following in terms of k, **without the use of a calculator.**

5.1.1 $\tan 16°$ (2)

5.1.2 $\cos 32°$ (3)

5.2 Simplify the following expression.

$$\frac{\cos(90°+x)\,\sin(x-180°)-\cos^2(180°-x)}{\cos(-2x)}$$ (6)

5.3 Calculate the value of the following, **without the use of a calculator.**

$\cos 75°.\cos 45° - \cos 15°.\cos 45°$ (4)

5.4 Given: $\tan\theta\left(\sin 2\theta+\frac{3\cos^2\theta}{\sin\theta}\right) = -2\cos^2\theta+3\cos\theta+2$

5.4.1 Prove the identity. (3)

5.4.2 Determine the general solution of:

$$\tan\theta\left(\sin 2\theta+\frac{3\cos^2\theta}{\sin\theta}\right)=0$$ (4)

5 Solve for a and b:

$\cos(a+b)=-\frac{\sqrt{2}}{2}$ if $a+b \in [0° ; 180°]$

$\cos(a-2b)=\frac{1}{2}$ if $a-2b \in [0° ; 180°]$ (4)

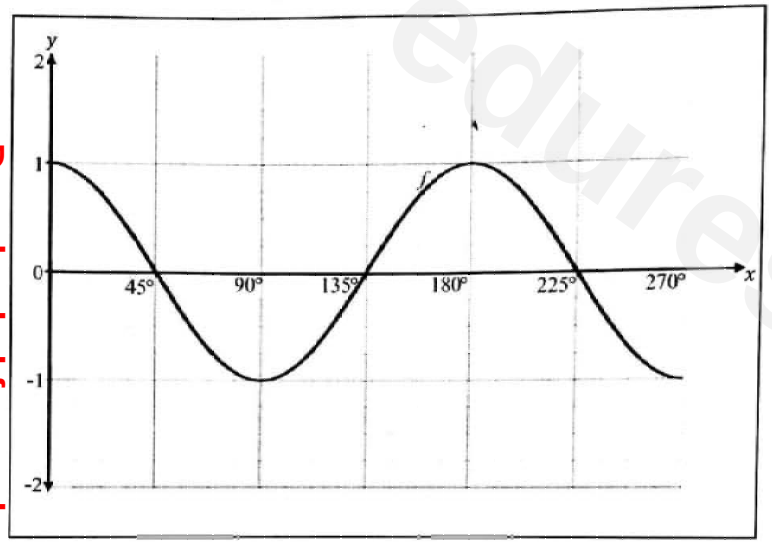
[26]

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QUESTION 6

In the diagram below, the graph of $f(x) = \cos 2x$ is drawn for the interval $x \in [0°; 270°]$.



6.1 Draw the graph of $g(x) = -\frac{1}{2}\tan x$ for the interval $x \in [0° ; 270°]$ on the grid provided in the ANSWER BOOK. Show all intercepts with the axes and asymptotes. (4)

6.2 Write down the range of $h(x) = 3 - f(x)$. (1)

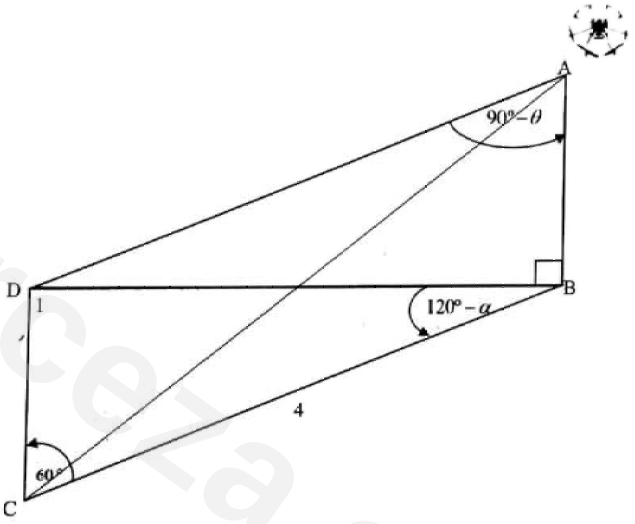
6.3 Use the graph to determine the value(s) of x in the interval $x \in [135° ; 270°]$ for which $\frac{f(x)}{g(x)} \geq 0$. (2)
[7]

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QUESTION 7

In the diagram below, B, C and D are in the same horizontal plane. A drone positioned at A, captures the images of two objects at B and C. B is directly below the drone and C is 4 units away from B.

$D\hat{C}B = 60°$; $D\hat{B}C = 120° - \alpha$ and $D\hat{A}B = 90° - \theta$.



7.1 Determine $\hat{D}_1$ in terms of α. (2)

7.2 **Without the use of a calculator**, determine BD in terms of α. (3)

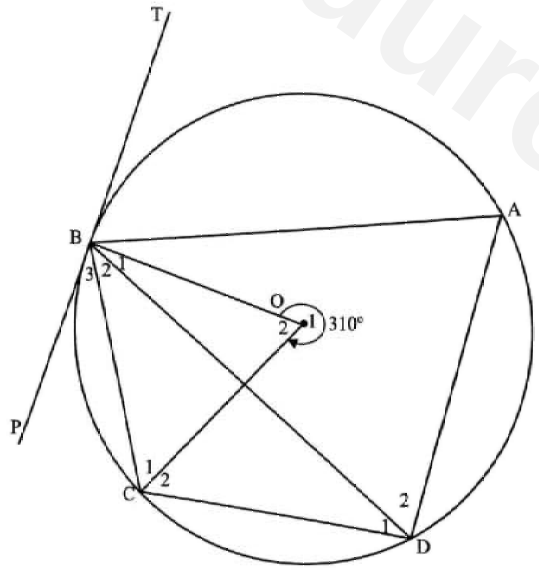
7.3 Show that $AB = \frac{2\sqrt{3}\tan\theta}{\sin\alpha}$. (3)
[8]

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QUESTION 8

In the diagram below, A, B, C and D are points on a circle having centre O.
PBT is a tangent to the circle at B.
Reflex $B\hat{O}C = \hat{O}_1 = 310°$ as shown in the diagram below.



Calculate, giving reasons, the size of:

8.1 $\hat{D}_1$ (3)

8.2 $\hat{B}_3$ (2)

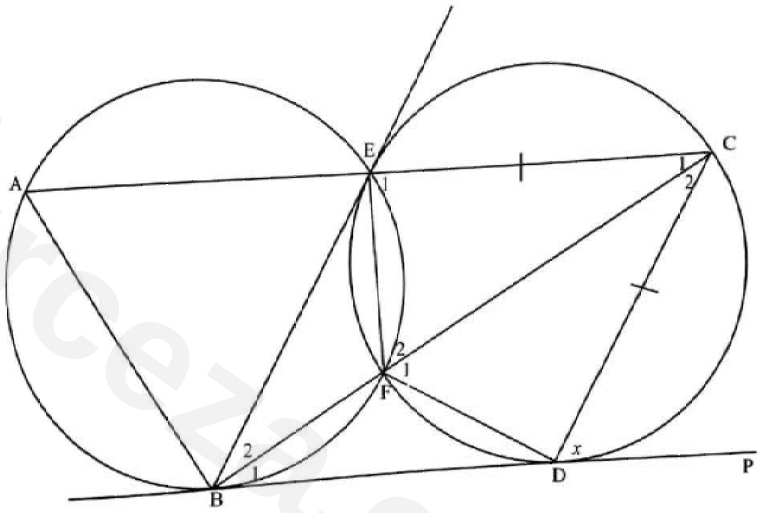
8.3 $\hat{B}_1$, if it is given that $\hat{A} = 60°$. (4)
[9]

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QUESTION 9

9.1 Complete the statement so that it is TRUE.
Angles subtended by a chord of a circle, on the same side of a chord, are … (1)

9.2 In the diagram below, ABFE and EFDC are cyclic quadrilaterals in two equal circles that intersect at E and F. BFC and AEC are straight lines. BD is a common tangent to the circles at B and D respectively. EC = CD.
Let $C\hat{D}P = x$



Prove, giving reasons, that:

9.2.1 $\hat{F}_1 = \hat{F}_2$. (3)

9.2.2 ABDC is a cyclic quadrilateral. (3)

9.2.3 BE || CD. (2)

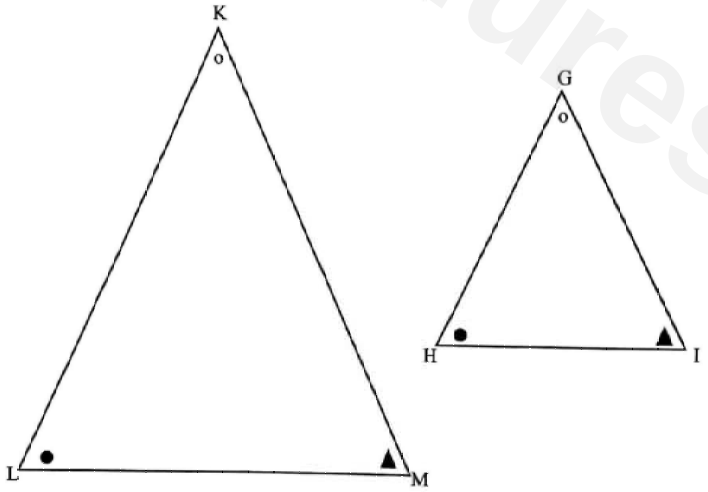
9.2.4 FC is a diameter of circle FDCE if it is given that EBDC is a rhombus. (5)
[14]

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QUESTION 10

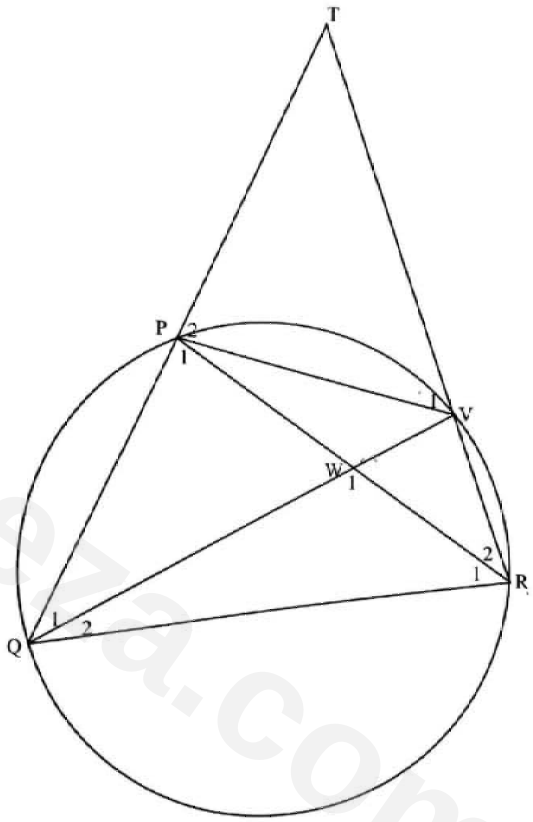
10.1 In the diagram below, ΔKLM and ΔGHI are drawn such that $\hat{K} = \hat{G}$, $\hat{L} = \hat{H}$ and $\hat{M} = \hat{I}$. Prove the theorem which states that if two triangles are equiangular, then the corresponding sides are in proportion, i.e. prove that $\frac{KL}{GH} = \frac{KM}{GI}$.



(5)

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10.2 In the diagram below, ΔPQR is an equilateral triangle inscribed in a circle. V is a point on the circle. QP produced meets RV produced at T. PR and QV intersect at W.



Prove, giving reasons, that:

10.2.1 $\hat{W}_1 = T\hat{R}Q$ (3)

10.2.2 $\Delta TQR \,|||\, \Delta QRW$ (3)

10.2.3 $\frac{PT}{QW} = \frac{PV}{WR}$ (6)

[17]

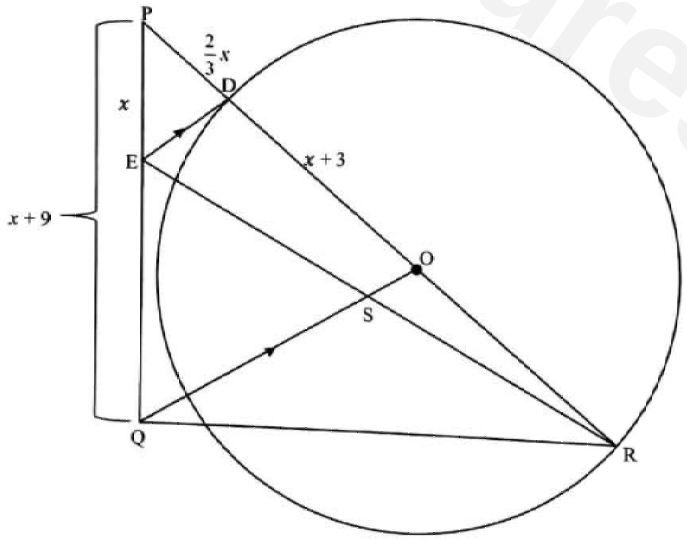
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QUESTION 11

In the diagram below, the circle with centre O is drawn. OQ is drawn parallel to a tangent to the circle at D. ER is drawn with S on OQ.
RD is produced to P and PQ is joined.

PE = x units, PQ = $x + 9$ units, PD = $\frac{2}{3}x$ units and DO = $x + 3$ units.



11.1 Calculate the length of RO. (4)

11.2 If OS = 1,4 units and S is the midpoint of ER, determine the length of DE. (2)

11.3 If the area of $\Delta PED = 2{,}7$ units^2, find the area of ΔPER. (4)
[10]

TOTAL: 150

END

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GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION
PREPARATORY EXAMINATION
2020

10612

MATHEMATICS

PAPER 2

TIME: 3 hours

MARKS: 150

14 pages + 1 information sheet

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 10 questions.
2. Answer ALL the questions in the ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs etc. that you have used to determine the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round-off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. An INFORMATION SHEET with formulae is included at the end of the question paper.
9. Write neatly and legibly.

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QUESTION 1

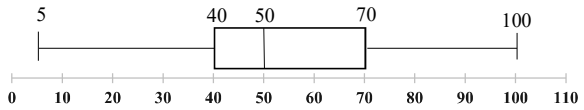
The A-Rithmetic High School decided to compare the results of 31 Grade 12 learners in Mathematics and Physical Sciences in the 2019 Preparatory Examination.

- The Mathematics results are recorded in the table below.
- The box and whisker plot below illustrates the results of Physical Sciences.
- Marks are recorded as percentages.

Mathematics Results

7	11	15	19	19	23	28	28	31	38	39
40	41	48	48	52	53	55	57	59	59	64
67	72	76	83	85	87	89	92	96	-	-

Physical Sciences Results



1.1 Calculate the mean mark of the Mathematics learners. (2)

1.2 Comment on the skewness of the Mathematics data. (1)

1.3 Determine which subject performed better in the 2019 Preparatory Examination. Give a reason for your conclusion. (2)

1.4 Write down a possible mark for a learner who achieved the tenth lowest mark in Physical Sciences. (2)

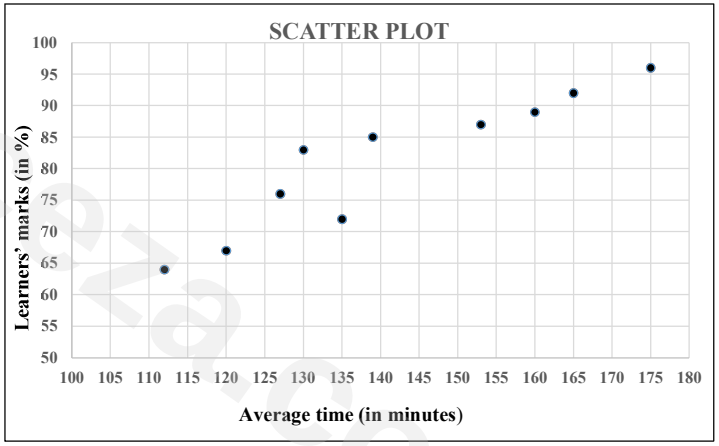
1.5 A learner scored the fourth highest in both subjects. The learner obtained the GREATEST possible difference between both subjects. Calculate the learner's mark in Physical Sciences. (2)
[9]

QUESTION 2

A question raised by many educators is whether the results that a learner achieves in an examination is dependent on the time that the learner takes to complete the examination.

The average time taken by each of the top 10 Mathematics learners was recorded. The data is represented in the table and scatter plot below.

Average time (in minutes)	175	165	160	153	139	130	127	135	120	112
Learners' marks (in %)	96	92	89	87	85	83	76	72	67	64



2.1 Calculate the equation of the least squares regression line for the data. (3)

2.2 A learner completed the exam in 2,5 hours. Predict the mark that the learner achieved. (2)

2.3 Explain within the context why the regression line is not reliable. (1)

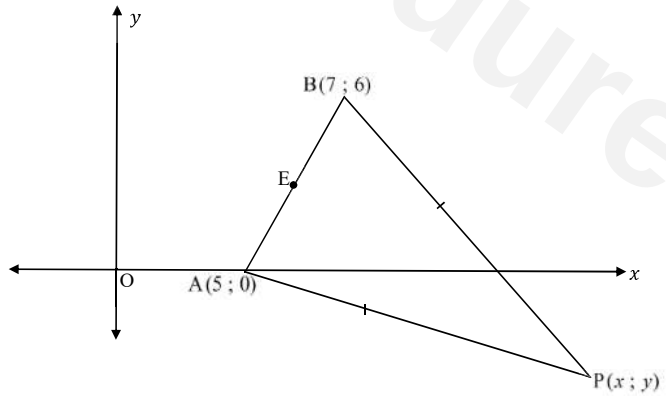
2.4 Calculate the standard deviation of the top 10 Mathematics learners. (2)

2.5 It is further given that $(p\ ;\ 103{,}59)$ is the interval of 15 random learners' marks within ONE standard deviation of the mean. If $\bar{x} = 63{,}96$, calculate the value of p. (3)
[11]

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QUESTION 3

In the diagram below, points $A(5\,;\,0)$, $B(7\,;\,6)$ and $P(x\,;\,y)$ form a triangle.
BP = AP and E is the midpoint of AB.



3.1 Determine the coordinates of E. (2)

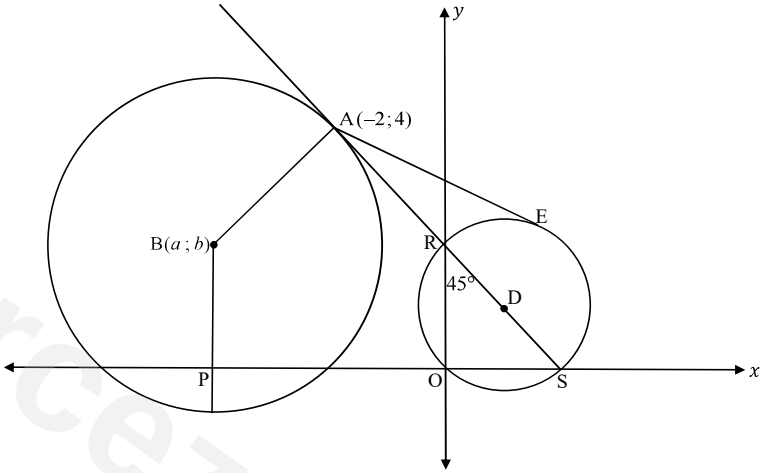
3.2 Determine the equation of line BA. (3)

3.3 Line BA is parallel to the straight line with equation $rx - 3y + 5 = 0$.
Calculate the value of r. (3)

3.4 If the area of $\Delta AOP = 10$ units^2 and $y < 0$, calculate the coordinates of P. (7)
[15]

QUESTION 4

The diagram below shows a circle with centre $B(a\,;\,b)$. BP is parallel to the y-axis with P on the x-axis. AS is a tangent to circle B at $A(-2\,;\,4)$ and intersects the x-axis at S and the y-axis at R.
AE is a tangent to the smaller circle with centre D and touches the circle at E. $O\hat{R}S = 45°$.



4.1 Determine the equation of tangent AS. (4)

4.2 If OP = 4 units, determine the values of a and b, the centre of the larger circle. (4)

4.3 Determine the equation of the circle with centre B. (3)

4.4 The equation of the smaller circle with centre D is $x^2 - 2x + y^2 - 2y = 0$.
Write this equation in the form $(x - a)^2 + (y - b)^2 = r^2$. (3)

4.5 Write down the coordinates of D, the centre of the smaller circle. (1)

4.6 Calculate the length of AE, the tangent to circle D at E. (6)
[21]

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QUESTION 5

5.1 Calculate the value of $1 - 4\sin^2 15°$ without the use of a calculator. (5)

5.2 Simplify without the use of a calculator:

$$\frac{\sqrt{3}\sin x.\sin^2 72° + \sin^2 198°.\sqrt{3}\cos(x - 90°)}{\tan 120°.\sin x}$$ (6)

5.3 Determine the general solution of the following:

$$6\sin x.\cos x + 3\cos x - 4\sin^2 x - 2\sin x = 0$$ (7)

5.4 Prove that:

$$(1 - \tan A)\left(\frac{\cos A}{\cos 2A}\right) = \frac{1}{\cos A + \sin A}$$ (4)

5.5 If $\sin 2\theta = k$ and $0° < 2\theta < 90°$, determine in terms of k:

5.5.1 $\cos 2\theta$ (2)

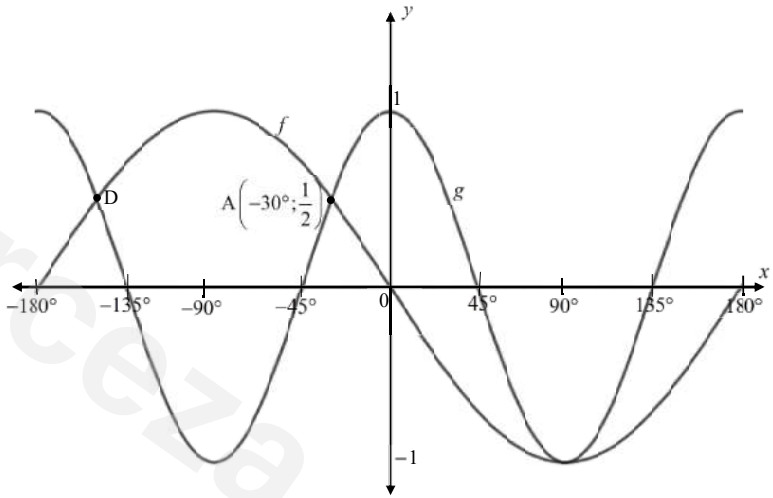
5.5.2 $\frac{\sin 2\theta}{\tan \theta}$ (5)

[29]

QUESTION 6

The sketch below shows the graphs of $f(x) = a\sin x$ and $g(x) = \cos dx$ for $x \in [-180° ; 180°]$.

$A\left(-30° ; \frac{1}{2}\right)$ is a point of intersection of f and g.



6.1 Write down the values of a and d. (2)

6.2 Determine the coordinates of D. (1)

6.3 For which value(s) of x is:

6.3.1 f decreasing for $x \in [-180° ; 180°]$? (2)

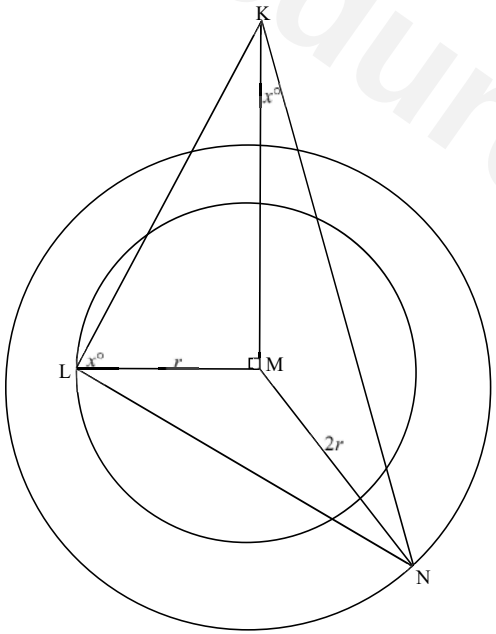
6.3.2 $f(x) \cdot g(x) < 0$ for $x \in [-180° ; 0°]$? (2)

[7]

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QUESTION 7

In the figure below, KM is a vertical flag post set in the centre of two circles which lie on the same horizontal plane. $M\hat{K}N = M\hat{L}K = x°$. The radius of the inner circle ML = r units and the radius of the outer circle MN = $2r$ units.



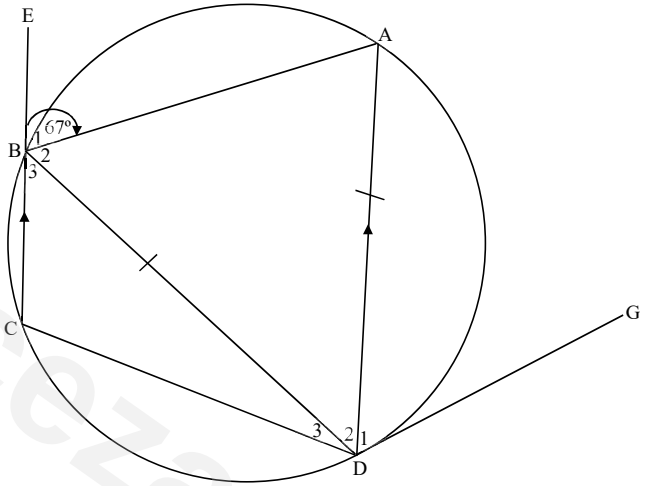
7.1 Calculate the value of x. (6)

7.2 If $r = 5m$ and $L\hat{M}N = 110°$, calculate the length of LN. (2)

[8]

QUESTION 8

In the diagram below, points A, B, C and D lie on the circumference of a circle with AD || EC. CB is produced to E. GD is a tangent to the circle at D and DB = AD.
$E\hat{B}A = 67°$.



8.1 Calculate, with reasons, the size of the following angles:

8.1.1 $A\hat{D}C$ (2)

8.1.2 $\hat{C}$ (1)

8.1.3 $\hat{A}$ (1)

8.1.4 $\hat{D}_2$ (3)

8.1.5 $B\hat{D}G$ (2)

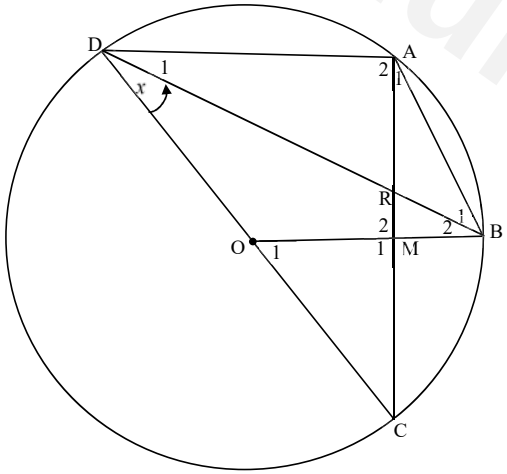
8.2 Prove that AB = CD. (2)

[11]

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QUESTION 9

9.1 In the diagram below, A, B, C and D are points on a circle with centre O. OB intersects AC at M, the midpoint of chord AC.
Let $B\hat{D}C = x$.



9.1.1 Determine, with reasons, in terms of x:

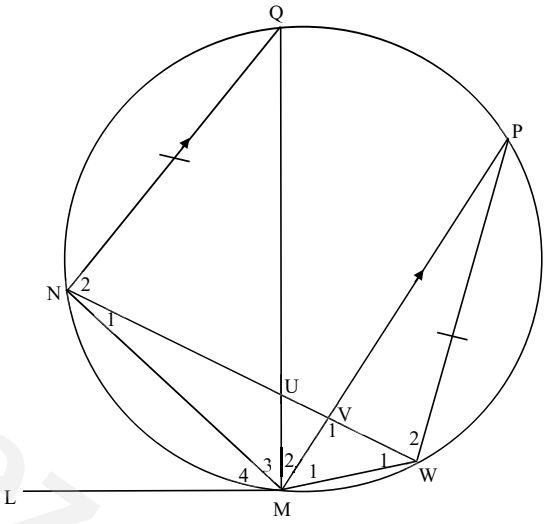
(a) $\hat{O}_1$ (1)

(b) $A\hat{B}O$ (4)

9.1.2 Prove that AB is a tangent to the circle that passes through points A, D and R. (6)

9.1.3 Prove that $AD^2 = 4DO^2 - 4AB^2 + 4MB^2$. (4)

9.2 In the diagram below, LM is a tangent to circle QNMWP at M. NW cuts QM and PM at U and V respectively.
NQ = WP and NQ || MP.



9.2.1 State, with reasons, THREE angles equal to $\hat{M}_2$. (3)

9.2.2 Prove that $\Delta WMV \| \Delta QMN$. (3)

9.2.3 Prove that $\frac{MV}{WV} = \frac{MN}{PW}$. (3)

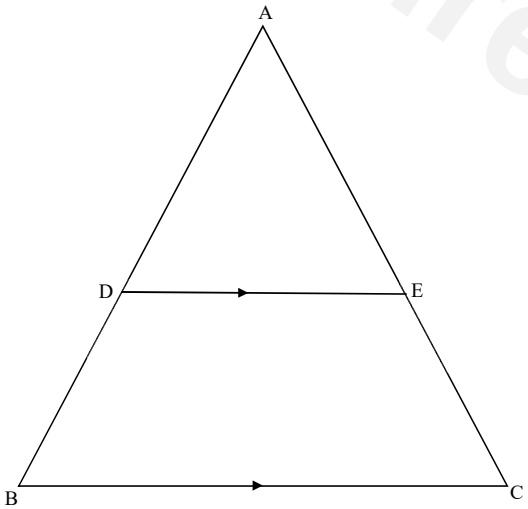
[24]

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QUESTION 10

10.1 In ΔABC below, D and E are points on sides AB and AC respectively such that DE ∥ BC.

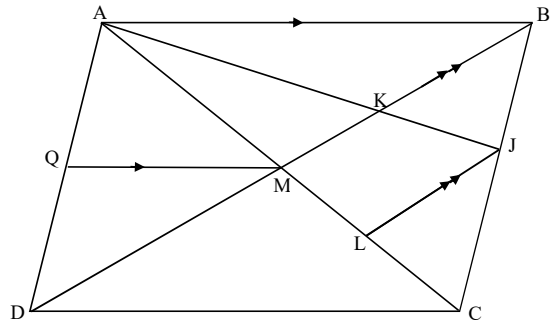
Prove the theorem which states that $\frac{AD}{DB} = \frac{AE}{EC}$.



(6)

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10.2 ABCD is a parallelogram with diagonals that intersect at M. J is a point on BC. BJ : JC is 2 : 3. AJ meets BD at K. BD ∥ JL and JL meets AC at L. Q is a point on AD such that AB ∥ QM.



10.2.1 Determine, with reasons, the following ratios:

(a) $\frac{ML}{LC}$ (2)

(b) $\frac{AK}{KJ}$ (3)

10.2.2 If $AB = \sqrt{10}$ units and $BC = \frac{2}{3}AB$.

Calculate the length of AQ. (4)

[15]

TOTAL: 150

END

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INFORMATION SHEET

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$A = P(1+ni)$ $\quad A = P(1-ni)$ $\quad A = P(1-i)^n$ $\quad A = P(1+i)^n$

$T_n = a + (n-1)d$ $\quad S_n = \frac{n}{2}[2a + (n-1)d]$

$T_n = ar^{n-1}$ $\quad S_n = \frac{a(r^n - 1)}{r-1}$; $r \neq 1$ $\quad S_\infty = \frac{a}{1-r}$; $-1 < r < 1$

$F = \frac{x[(1+i)^n - 1]}{i}$ $\quad P = \frac{x[1-(1+i)^{-n}]}{i}$

$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $\quad M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$

$y = mx + c$ $\quad y - y_1 = m(x - x_1)$ $\quad m = \frac{y_2 - y_1}{x_2 - x_1}$ $\quad m = \tan\theta$

$(x-a)^2 + (y-b)^2 = r^2$

In ΔABC: $\quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$a^2 = b^2 + c^2 - 2bc.\cos A$

$area\ \Delta ABC = \frac{1}{2}\ ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$ $\quad \sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta$ $\quad \cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$$

$\sin 2\alpha = 2\sin\alpha.\cos\alpha$

$\bar{x} = \frac{\sum x}{n}$ $\quad \sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $\quad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$

$\hat{y} = a + bx$ $\quad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$

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GAUTENG DEPARTMENT OF EDUCATION

PREPARATORY EXAMINATION

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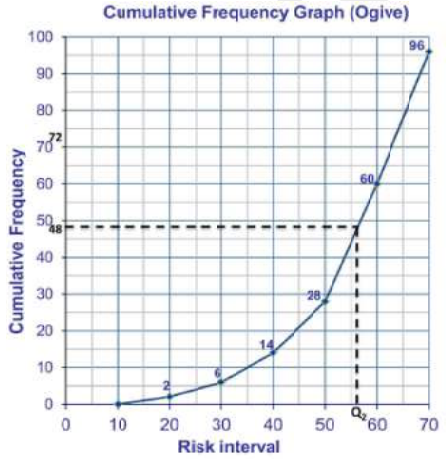
MATHEMATICS
(Second Paper)

MEMORANDUM

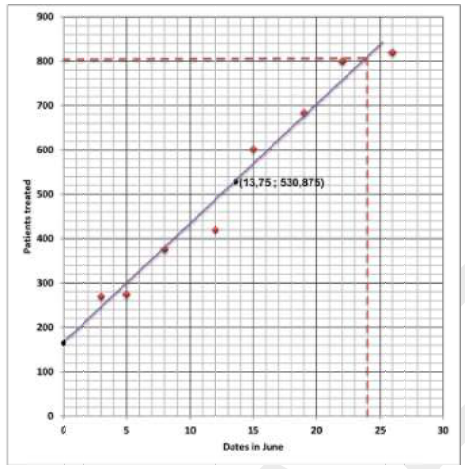
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NOTE:
- If a candidate answered a question TWICE, mark the FIRST attempt ONLY.
- Consistent accuracy applies in ALL aspects of the memorandum.
- S/R refers to STATEMENT as well as REASON

QUESTION 1

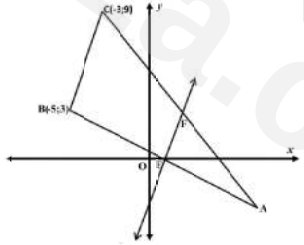
1.1	• Negatively skewed • *Negatief skeef*	✓negatively skewed / *negatief skeef* (1)
1.2		**1.2** ✓shape ✓grounding at 10 ✓✓accuracy of points Subtract a mark if grounded at (0; 0) and/or at the end (4) **1.3** ✓ Q_2 shown on the graph, linked to cumulative frequency (1) **[6]**

QUESTION 2

2.1		✓✓✓points plotted correctly -1 for every 2 mistakes -1 if points are joined (3)
2.2	$y = 26{,}88x + 161{,}24$	✓value of A = 161,24 ✓value of B = 26,88 ✓equation of the line (3)
2.3	$y = 26{,}88(24) + 161{,}24$ $y = 806{,}36$ 806 people treated on 24th of June CANNOT USE GRAPH – NO LINE OF BEST FIT DRAWN YET	✓substitute in formula ✓answer as Natural Number (2) **answer only (using calculator)** $\hat{y} = 806{,}42$ **full marks**
2.4	See grid	✓straight line ✓graph passes through $(\bar{x}\,;\,\bar{y})$ ✓graph passes through y-intercept from regression line formula (3)
2.5	$r = 0{,}98$ This is a very strong positive, linear correlation. As the days increase the number of patients increase *Hierdie is 'n baie sterk positiewe lineêre korrelasie.* *Soos wat die dae vermeerder, vermeerder die getal pasiënte*	✓✓correct answer ✓interpretation (3)
2.6	This point is clearly an outlier/*Die punt is 'n duidelike uitskieter* The 16th of June is a public holiday and people might have decided to wait for the next day or certain medical facilities might have been closed. *Die 16de Junie is 'n publieke vakansiedag en mense het dalk besluit om te wag tot die volgende dagof sekere mediese fasiliteite kon dalk gesluit gewees het.*	✓outlier/ *uitskieter* ✓justification (2) **[16]**

QUESTION 3

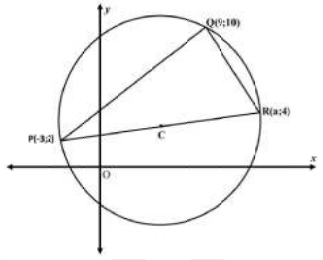
3.1	QR $= \sqrt{(x_Q - x_R)^2 + (y_Q - y_R)^2}$ $= \sqrt{(1-7)^2 + (3-0)^2}$ $= \sqrt{45}$ $= 3\sqrt{5}$ $\therefore\ a = 3$ **OR** QR $= \sqrt{(x_Q - x_R)^2 + (y_Q - y_R)^2}$ $a\sqrt{5} = \sqrt{(1-7)^2 + (3-0)^2}$ $a\sqrt{5} = \sqrt{45}$ $5a^2 = 45$ $a^2 = 9$ $a = 3 \ ; \ a > 0$ **OR** $QR^2 = (x_Q - x_R)^2 + (y_Q - y_R)^2$ $5a^2 = (1-7)^2 + (3-0)^2$ $5a^2 = 45$ $a^2 = 9$ $a = 3 \ ; \ a > 0$	✓substitution in correct formula ✓ answer for QR ✓ $a = 3$ (3) ✓substitution in correct formula ✓ $5a^2 = 45$ Squaring both side ✓ $a = 3 \ ; \ a > 0$ (3 ✓substitution in correct formula ✓ $5a^2 = 45$ Squaring both side ✓ $a = 3 \ ; \ a > 0$ (3

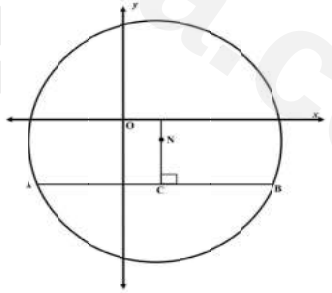
3.2	$3x + ty = -2$ $3(-3) + ty = -2$ $ty = 7 \ldots\ldots(1)$ $y = -\frac{2}{3}x + 2$ $y = -\frac{2}{3}(-3) + 2$ $y = 4 \ldots\ldots(2)$ $ty = 7$ $t(4) = 7$ $t = \frac{7}{4}$ **OR** $y = -\frac{2}{3}x + 2$ $3x + ty = -2$ $y = -\frac{3}{t}x - \frac{2}{t}$ $-\frac{3}{t}x - \frac{2}{t} = -\frac{2}{3}x + 2$ $-\frac{3(-3)}{t} - \frac{2}{t} = -\frac{2(-3)}{3} + 2$ $t = \frac{7}{4}$	✓ $3(-3) + ty = -2$ ✓ $ty = 7$ ✓ $y = 4$ ✓value of t (4) ✓ $y = -\frac{3}{t}x - \frac{2}{t}$ ✓equations equal ✓substitute $x = -3$ ✓value of t (4)
3.3.1	 $\tan\theta = m_{EB}$ $\tan\theta = \frac{3-0}{-5-1}$ $\tan\theta = -\frac{1}{2}$ **OR** $\theta = -26{,}565\ldots + 180°$ $\theta = 153{,}43°$ $\theta = 180° - 26{,}565$ $\theta = 153{,}43°$	✓ gradient of EB $= -\frac{1}{2}$ ✓ $\tan\theta = -\frac{1}{2}$ ✓ $\theta = 153{,}43°$ (3)

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3.3.2	Equation of EF: $y-y_1=m(x-x_1)$ $\quad m_{BC}=m_{EF}=3$ $y-0=3(x-1)$ $y=3x-3$	✓ $m_{BC}=\frac{9-3}{-3+5}=3$ ✓ $m_{BC}=m_{EF}=3$ ✓substitute point (1 ; 0) ✓equation of line (4)
3.3.3	$\tan F\hat{E}A=3$ (From line in 1.3.2) $F\hat{E}A=71,57°$ $B\hat{E}F=153,43°-71,57°$ $\angle's$ *on a straight line/ $\angle$'e op rt lyn* $B\hat{E}F=81,86°$ $E\hat{B}C=180°-81,86°$ $E\hat{B}C=98,14°$ (co-interior angles /*ko-binnehoeke*; EF // BC)	✓ $F\hat{E}A=71,57°$ ✓ $B\hat{E}F=81,86°$ ✓ $E\hat{B}C=98,14°$ (3) **[17]**

QUESTION 4

4.1.1	 $\hat{Q}=90°$ ($\angle$ in semi-circle/$\angle$ *in halfsirkel*) $m_{PQ}.m_{QR}=-1$ $\frac{10-4}{9-a}\times\frac{10-2}{9+3}=-1$ $\frac{6}{9-a}\times\frac{8}{12}=-1$ $\frac{4}{9-a}=-1$ $4=-9+a$ $a=13$	✓ $\hat{Q}=90°$ ✓subs into $m_{PQ}.m_{QR}=-1$ ✓simplification (3)

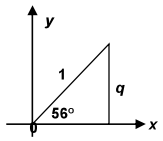
4.1.2	midpoint of PR $C\left(\frac{-3+13}{2};\frac{4+2}{2}\right)$ $C(5;3)$ $r=\sqrt{(13-5)^2+(4-3)^2}$ **or** $r^2=(13-5)^2+(4-3)^2$ $=\sqrt{65}$ $\quad r^2=65$ Eq of circle: $(x-a)^2+(y-b)^2=r^2$ $(x-5)^2+(y-3)^2=65$	✓ C $(5;3)$ ✓ substitute in distance formula ✓ $r=\sqrt{65}$ / $r^2=65$ ✓ $(x-5)^2+(y-3)^2=65$ (4)
4.2	$r_A=3$ and A(2 ; 3) $r_B=4$ and B(1 ; -1) $\therefore r_A+r_B=7$ Distance between A and B $AB=\sqrt{(x_B-x_A)^2+(y_B-y_A)^2}$ $AB=\sqrt{(1-2)^2+(-1-3)^2}$ $=\sqrt{1+16}$ $=\sqrt{17}$ $\therefore r_A+r_B>\sqrt{17}$ The circles intersect each other	✓radius and centre of circle A ✓radius and centre of circle B ✓sum of two radii ✓calculating distance between centres ✓AB $=\sqrt{17}$ ✓correct conclusion (6)
4.3	$x^2-4x+y^2+2y=\frac{149}{4}$  	
4.3.1	$(x-2)^2-4+(y+1)^2-1=\frac{149}{4}$ $(x-2)^2+(y+1)^2=\frac{169}{4}$ N(2;−1)	✓completing the square ✓standard form ✓ N(2;−1) (3)

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4.3.2	$r^2 = \frac{169}{4}$ $r = \frac{13}{2}$ OR $r = 6\frac{1}{2}$ OR $r = 6{,}5$	✓answer of radius (1)
4.3.3	NC ⊥ AB ∴ AC = CB = 6 (line from centre ⊥ chord/ *lyn van midpt van sirkel ⊥ op koord*) $x_A = 2 - 6 = -4$ Substitute $x = -4$ in $(-4)^2 - 4(-4) + y^2 + 2y = \frac{149}{4}$ $32 + y^2 + 2y = \frac{149}{4}$ $128 + 4y^2 + 8y = 149$ $4y^2 + 8y - 21 = 0$ $(2y - 3)(2y + 7) = 0$ $y = \frac{3}{2}$ *or* $y = -\frac{7}{2}$ invalid $y < 0$ $A\left(-4; -\frac{7}{2}\right)$ and $B\left(8; -\frac{7}{2}\right)$	✓ AC = CB = 6 ✓ $x_A = -4$ ✓substitute $x = -4$ ✓coordinates of A ✓coordinates of B (5) **[22]**

QUESTION 5

5.1.1	$\frac{b}{a} = \tan 110°$	✓ tan 110° (1)
5.1.2	$\frac{b}{\sqrt{a^2 + b^2}} = \sin 110°$ $= 0{,}94$	✓ sin 110° ✓answer (2)
5.2.1	$\cos 146° = \cos(90° + 56°)$ $= -\sin 56°$ $= -q$ **OR** $\cos(180° - 34°)$ $= -\cos 34°$ $= -\sin 56°$ $= -q$	✓ $-\sin 56°$ ✓ answer (2) ✓ $-\sin 56°$ ✓ answer (2)

5.2.2	 $x^2 = r^2 - y^2$ $= 1^2 - q^2$ $\therefore x = \sqrt{1 - q^2}$ $\sin 112°$ $= 2\sin 56° \cos 56°$ $= 2q\sqrt{1 - q^2}$ **OR** $\cos^2 56° + \sin^2 56° = 1$ $\cos 56° = \sqrt{1 - \sin^2 56°}$ $= \sqrt{1 - q^2}$ $\sin 112°$ $= 2\sin 56° \cos 56°$ $= 2q\sqrt{1 - q^2}$	✓ $x = \sqrt{1 - q^2}$ ✓ $2\sin 56° \cos 56°$ ✓answer (3) ✓ $\cos 56° = \sqrt{1 - q^2}$ ✓ $2\sin 56° \cos 56°$ ✓answer (3) **[8]**

QUESTION 6

6.1	$\cos(P + Q) = \cos P \cos Q - \sin P \sin Q$	✓ correct formula (1)
6.2	$\cos 2P = \cos P \cos P - \sin P \sin P$ $= \cos^2 P - \sin^2 P$ $= \cos^2 P - (1 - \cos^2 P)$ $= 2\cos^2 P - 1$	✓ $\cos P \cos P - \sin P \sin P$ ✓replacing $\sin^2 P$ with $1 - \cos^2 P$ ✓ $2\cos^2 P - 1$ (3)
6.3.1	$LHS = \frac{\sin 2x - \cos 2x + 1}{\sin 2x + \cos 2x + 1}$ $= \frac{2\sin x \cos - (1 - 2\sin^2 x) + 1}{2\sin x \cos + (2\cos^2 x - 1) + 1}$ $= \frac{2\sin^2 x + 2\sin x \cos x}{2\cos^2 x + 2\sin x \cos x}$ $= \frac{2\sin x(\sin x + \cos x)}{2\cos x(\cos x + \sin x)}$ $= \frac{\sin x}{\cos x}$ $= \tan x$ $= RHS$	✓ $2\sin x \cos x$ ✓ $1 - 2\sin^2 x$ ✓ $2\cos^2 x - 1$ ✓factors ✓ $\frac{\sin x}{\cos x}$ (5)

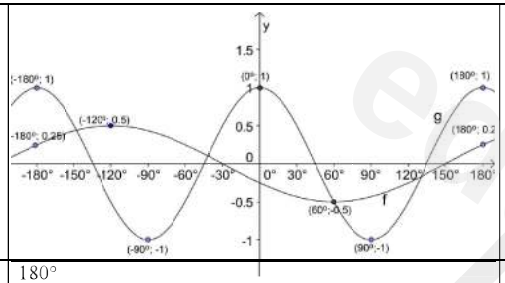
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	OR $LHS = \dfrac{\sin 2x - \cos 2x + 1}{\sin 2x + \cos 2x + 1}$ $= \dfrac{2\sin x\cos x - (\cos^2 x - \sin^2 x) + 1}{2\sin x\cos x + (\cos^2 x - \sin^2 x) + 1}$ $= \dfrac{2\sin x\cos x - \cos^2 x + \sin^2 x + 1}{2\sin x\cos x + \cos^2 x - \sin^2 x + 1}$ $= \dfrac{2\sin x\cos x + 2\sin^2 x}{2\sin x\cos x + 2\cos^2 x}$ $= \dfrac{2\sin x(\cos x + \sin x)}{2\cos x(\sin x + \cos x)}$ $= \dfrac{\sin x}{\cos x}$ $= \tan x$ $= RHS$	✓ $2\sin x\cos x$ ✓ $\cos^2 x - \sin^2 x$ ✓ simplification ✓ factors ✓ $\dfrac{\sin x}{\cos x}$ (5)
9.3.2	$\tan 22,5° = \dfrac{\sin 45° - \cos 45° + 1}{\sin 45° + \cos 45° + 1}$ $= \dfrac{\frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2} + 1}{\frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2} + 1}$ $= \dfrac{1}{\frac{2\sqrt{2}}{2} + 1}$ $= \dfrac{1}{\sqrt{2} + 1}$ $= \dfrac{1}{\sqrt{2}+1} \times \dfrac{\sqrt{2}-1}{\sqrt{2}-1}$ $= \sqrt{2} - 1$ **OR**	✓ $\tan 22,5° = \dfrac{\sin 45° - \cos 45° + 1}{\sin 45° + \cos 45° + 1}$ ✓ substitution of $\dfrac{\sqrt{2}}{2}$ ✓ answer (3)

	$\tan 22,5° = \dfrac{\sin 45° - \cos 45° + 1}{\sin 45° + \cos 45° + 1}$ $= \dfrac{\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}} + 1}{\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + 1}$ $= \dfrac{1}{\frac{1+1}{\sqrt{2}} + 1}$ $= \dfrac{1}{\frac{2}{\sqrt{2}} + 1}$ $= \dfrac{1}{\frac{2}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} + 1}$ $= \dfrac{1}{\sqrt{2}+1}$ $= \dfrac{1}{\sqrt{2}+1} \times \dfrac{\sqrt{2}-1}{\sqrt{2}-1}$ $= \sqrt{2} - 1$	✓ $\tan 22,5° = \dfrac{\sin 45° - \cos 45° + 1}{\sin 45° + \cos 45° + 1}$ ✓ substitution of $\dfrac{1}{\sqrt{2}}$ ✓ answer (3)
6.4.1	$\sin 2x.\cos 2x$ $= \frac{1}{2}.2\sin 2x.\cos 2x$ $= \frac{1}{2}\sin 4x$ $= \frac{1}{2}.1$ $= \frac{1}{2}$	✓ $\frac{1}{2}.2\sin 2x.\cos 2x$ ✓ max of $\sin 4x = 1$ ✓ $\frac{1}{2}$ (3)
6.4.2	$\sin 4x = 1$ $4x = 90° + k.360° \quad k \in Z$ $x = 22,5° + k.90° \quad k \in Z$ $x = -67,5°$	✓ $\sin 4x = 1$ ✓ $4x = 90° + k.360° \quad k \in Z$ ✓ $x = 22,5° + k.90°$ ✓ $x = -67,5°$ (4) **[19]**

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QUESTION 7

7.1		f: ✓shape ✓✓intercepts ✓✓ turning points g: ✓shape ✓✓intercepts ✓✓ turning points (6)
7.2	$180°$	✓ answer (1)
7.3	$h(x)=-\frac{1}{2}\sin(x-90°)$ **OR** $h(x)=-\frac{1}{2}\sin[-(90°-x)]$ $=-\frac{1}{2}[-\sin(90°-x)]$ $\therefore h(x)=\frac{1}{2}\cos x$	✓✓ correct equation (2) ✓$-\frac{1}{2}\sin[-(90°-x)]$ ✓$\frac{1}{2}\cos x$ (2)
7.4	$\cos 2x=1$ $2x=0°+k.360°,\ k\in Z$ $x=0°+k.180°,\ k\in Z$ **OR** $\cos 2x=1$ $2x=k.360°,\ k\in Z$ $x=k.180°,\ k\in Z$	✓$2x=0°+k.360°,\ k\in Z$ ✓$x=0°+k.180°$ (2) ✓$2x=k.360°,\ k\in Z$ ✓$x=k.180°$ (2) **[11]**

QUESTION 8

8.1	In ΔMPQ: $\frac{PM}{\sin z}=\frac{d}{\sin(180°-(y+z))}$ $\therefore PM=\frac{d\sin z}{\sin(y+z)}$ .....1 In ΔMPN: $\frac{MN}{PM}=\sin x$ $MN=PM\sin x$ .....2 $\therefore MN=\frac{d\sin z.\sin x}{\sin(y+z)}$	✓ correct substitution into sine rule ✓$PM=\frac{d\sin z}{\sin(y+z)}$ ✓$\frac{MN}{PM}=\sin x$ ✓substituting for PM into equation 2 and final answer (4)

8.2	$MN=\frac{1\,000\sin y\sin(90°-y)}{\sin 2y}$ $=\frac{1\,000\sin y\cos y}{2\sin y\cos y}$ $=500$ m	✓ correct replacement of angles ✓$2\sin y\cos y$ ✓Answer (3) **[7]**

QUESTION 9

9.1	…perpendicular / …*loodreg*	✓ perpendicular /*loodreg* (1)
9.2.1	$AB\perp CD$ (line from centre to midpoint of chord) / (*lyn van die midpt van sirkel na midpt van koord*) $DB=9$cm (AD = DB/ Given) In ΔDCB $(CD)^2=(24)^2-(9)^2$ (pythagoras) $CD^2=576-81$ $=495$ $CD=3\sqrt{55}$	✓S/R **[S/R Statement and reason]** ✓DB = 9 cm ✓using Theorem of Pythagoras(S/R) ✓ $CD=3\sqrt{55}$ (4)
9.2.2	$\frac{CD}{DE}=3$ $\frac{3\sqrt{55}}{DE}=3$ $DE=\sqrt{55}$	✓$\frac{3\sqrt{55}}{DE}=3$ ✓ $DE=\sqrt{55}$ (2) **[7]**

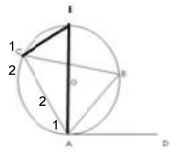
QUESTION 10

10.1	$\hat{E}_1=90°$ ($\angle$in a semi−circle /*∠in halwe sirkel*)	✓$\hat{E}_1=90°$ ✓ $\angle$in a semi−circle (2)
10.2	$\hat{E}_1=90°$ ($\angle$in a semi−circle /*∠in halwe sirkel*) $\hat{E}+\hat{A}_2=180°$ (opp $\angle$'s cyclic quad/*oorst ∠'e van kvh*) $\therefore \hat{A}_2=180°-(90°+28°)$ $=62°$ **OR**	✓$\hat{E}+\hat{A}_2=180°$ ✓ opp $\angle$'s cyclic quad ✓$\hat{A}_2=62°$ (3)

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	$F\hat{A}C = 90°$ ($\angle$ in a semi – circle / *$\angle$ in halwe sirkel*) $\hat{A}_3 = 28°$ ($\angle^s$ in the same segment subt by DC / *$\angle$e in dieselfde segment onderspdeur* DC) $\therefore \hat{A}_2 = 90° - 28°$ $= 62°$	✓ $F\hat{A}C = 90°$ S/R ✓ $\hat{A}_3 = 28°$ S/R ✓ $\hat{A}_2 = 62°$ (3)
10.3	$\hat{F}_2 = 30°$ (equal chords subtend equal $\angle$'s) / (*gelyke koorde onderspan gelyke hoeke*)	✓ $\hat{F}_2 = 30°$ ✓ equal chords subtend eq $\angle$'s (2) **[7]**

QUESTION 11

11.1	 Construction: Draw a diameter/ *middellyn* AOE and join CE Proof: $\hat{A}_1 + \hat{A}_2 = 90°$ (tan/rk lyn $\perp$ radius) $\hat{C}_1 + \hat{C}_2 = 90°$ ($\angle$ in a semi circle / *$\angle$ in halwe sirkel*) but $\hat{C}_1 = \hat{A}_2$ ($\angle^s$ in the same segment) $\therefore \hat{A}_1 = \hat{C}_2$	✓construction ✓ $\hat{A}_1 + \hat{A}_2 = 90°$ ✓ tang $\perp$ radius ✓ $\hat{C}_1 + \hat{C}_2 = 90°$ (S/R) ✓ $\hat{C}_1 = \hat{A}_2$ (S/R) (5)
11.2.1	$\hat{C}_1 = 90°$ ($\angle$ in a semi circle / *$\angle$ in halwe sirkel*) $\hat{D}_1 = 90°$ (OE $\perp$ BC) $\hat{C}_1 = \hat{D}_1$ $\therefore$ OE $\|$ AC (corr $\angle^s$ are equal / ooreenk $\angle^e$ is gelyk) **OR** $\hat{C}_1 = 90°$ ($\angle$ in a semi circle / *$\angle$ in halwe sirkel*) $\hat{D}_2 = 90°$ (OE $\perp$ BC) $\hat{C}_1 + \hat{D}_2 = 180°$ $\therefore$ OE $\|$ AC (co interior $\angle^s$ are equal / *ko – binne $\angle^e$* is gelyk)	✓ $\hat{C}_1 = 90°$ (S/R) ✓ $\hat{D}_1 = 90°$ (S/R) ✓ $\hat{C}_1 = \hat{D}_1$ (S) ✓ corr $\angle^s$ are equal (4) ✓ $\hat{C}_1 = 90°$ (S/R) ✓ $\hat{D}_{21} = 90°$ (S/R) ✓ $\hat{C}_1 + \hat{D}_2 = 180°$ (S) ✓ co interior $\angle^s$ are equal (4)

11.2.2	$\hat{A} = x$ (tan chord / rk lyn koord) $\hat{O}_1 = x$ (corr $\angle^s$/ooreenk $\angle^e$ OE $\|$ AC)	✓ $\hat{A} = x$ ✓ tan chord ✓ $\hat{O}_1 = x$ S/R (3)
11.2.3	In ΔPAC $\hat{P} = 180° - x - 90° - x$ (sum of $\angle^s$ of a triangle / som van $\angle^e$ van driehoeke) $= 90° - 2x$	✓ $\hat{P} = 90° - 2x$ ✓ sum of $\angle^s$ of a triangle (2) **[14]**

QUESTION 12

12.1	proportionally	✓ proportionally (1)
12.2.1	$\hat{C}_1 = \hat{C}_2$ (given) $\hat{C}_1 = \hat{D}$ (corr $\angle^s$ /ooreenk $\angle^e$ AD $\|$ CG) $\hat{C}_2 = \hat{A}_1$ (alt $\angle^s$/verwisselende $\angle^e$ AD $\|$ CG) $\therefore \hat{A}_1 = \hat{D}$ $\therefore$ CA = CD (sides opp equal $\angle^s$ / *sye teenoor gelyke $\angle^e$*)	✓ $\hat{C}_1 = \hat{D}$ (S/R) ✓ $\hat{C}_2 = \hat{A}_1$ (S/R) ✓ $\hat{A}_1 = \hat{D}$ ✓ CA = CD (S/R) (4)
12.2.2	$\frac{BC}{CD} = \frac{BG}{GA}$ (line $\|$ to one side of Δ / lyn $\|$ een sy van Δ) but CA = CD (proved) $\therefore \frac{BC}{AC} = \frac{BG}{AG}$	✓ $\frac{BC}{CD} = \frac{BG}{GA}$ ✓ ✓replace CD = CA (3)
12.3.1	In ΔKMT and ΔKON $\hat{M}_1 = \hat{O}$ (ext. $\angle$of a cyclic quad / buite $\angle$ *kvh*) $\hat{T}_2 = \hat{N}$ (ext. $\angle$of a cyclic quad/ buite $\angle$ *kvh*) $\hat{K} = \hat{K}$ (common/ gemeensk) $\therefore \Delta MTK \|\|\| \Delta ONK$ ($\angle\angle\angle$)	✓✓for any two of the three statements ✓equiangular / gelykhoekig / $\angle\angle\angle$ (3)
12.3.2	$\frac{MT}{ON} = \frac{TK}{NK} = \frac{MK}{OK}$ $\therefore$ KM.KN = KT.KO	✓ $\frac{MT}{ON} = \frac{TK}{NK} = \frac{MK}{OK}$ (1)

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12.3.2	$\frac{MK}{OK}=\frac{KT}{NK}$ $\frac{5}{6+KT}=\frac{KT}{8}$ $KT^2+6KT=40$ $KT^2+6KT-40=0$ $(KT+10)(KT-4)=0$ $KT=-10$ or $KT=4$ $\therefore KT=4$ units	✓ $\frac{5}{6+KT}=\frac{KT}{8}$ ✓ $KT^2+6KT-40=0$ ✓factors ✓answer (4) **[16]**

TOTAL: 150

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PREPARATORY EXAMINATION

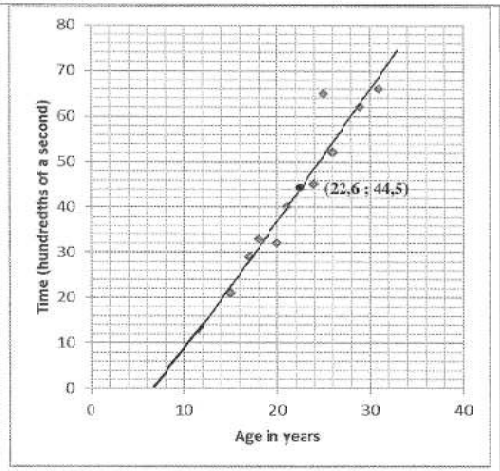
2015

MEMORANDUM

SUBJECT: MATHEMATICS P2/ WISKUNDE V2 (10612)

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QUESTION / VRAAG 1

1.1		✓ $(\bar{x};\bar{y})$ (22,6 ; 44,5) ✓ line of best fit *beste paslyn/lyn van beste passing* (2)
1.2.1	25 years /*25 jaar*	✓ answer / *antwoord* (1)
1.2.2	The reaction time according to the line of best fit for age 25 should be 51,46. The reaction time of this patient is ± 65. *Die reaksietyd volgens die lyn van beste passing vir die ouderdom van 25 moet 51,46 wees. Die reaksietyd vir hierdie pasiënt is ± 65.*	✓ answer / *antwoord* (1) **Any other valid explanation.** ***Enige ander geldige verduideliking***
1.3	A = –21,03 B = 2,90 $y = 2{,}90x - 21{,}03$	✓ A = –21,03 ✓ B = 2,90 ✓ $y = 2{,}90x - 21{,}03$ (3)
1.4	r = 0,95 very strong correlation / *baie sterk korrelasie*	✓ r = 0,95 ✓ very strong / strong *baie sterk / sterk* (2)
1.5	The 30 year olds have a higher reaction time on average. The interquartile range of this group is bigger (IQR = 15)than that of the 15 year olds(IQR=5). The reaction time of the 30 year olds varies more. *Die 30-jariges het gemiddeld 'n hoër reaksietyd. Die interkwartielvariasiewydte van hierdie groep is groter(IQR=15). as dié van die 15-jariges(IQR=5). Die reaksietyd van die 30-jariges varieer meer.*	✓IQR ✓ for comments / *vir kommentaar* (2) **[11]**

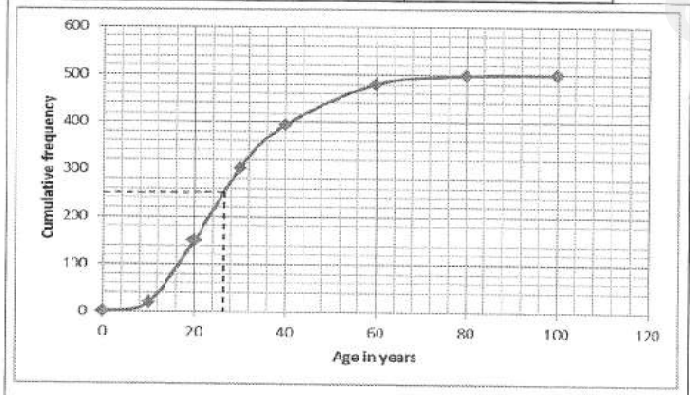
QUESTION / VRAAG 2

2.1

Age in years *Ouderdom in jare*	Number of people *Aantal mense*	Cumulative frecuency *Kumulatieve frekwensie*
$0 \le A < 10$	20	20
$10 \le A < 20$	130	150
$20 \le A < 30$	152	302
$30 \le A < 40$	92	394
$40 \le A < 60$	86	480
$60 \le A < 80$	18	498
$80 \le A < 100$	2	500

✓all answers/ *alle antwoorde* (1)

2.2

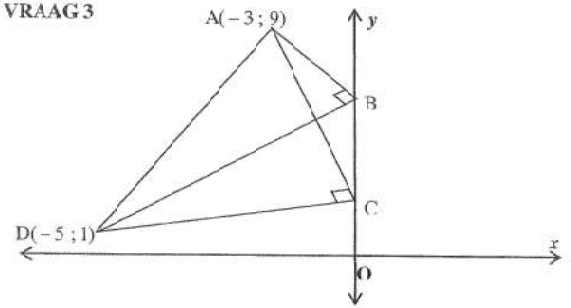


✓plotting of points *plot van punte*
✓ joining of points *verbind van punte*
✓grounding point at (0 ; 0) *grond punt by (0 ; 0)* (3)

2.3.1 26 years old (accept 25 – 27)
26 jaar oud (aanvaar 25-27)
✓answer *antwoord* (1)

2.3.2 $\frac{90}{500} \times 100$
$= 18\%$ The percentage of people 16 and above 18 is 82%
Die persentasie mense 16 jaar en ouer is 82%
✓90
✓18%
✓82% (3)
[8]

QUESTION / VRAAG 3



3.1

$M\left(\frac{-3-5}{2}; \frac{9+1}{2}\right)$
$M(-4\ ;\ 5)$
✓$x = -4$
✓$y = 5$ (2)

3.2

$AM^2 = (-4+3)^2 + (5-9)^2$ **OR/OF** $DM^2 = (-5+4)^2 + (1-5)^2$
$= 1 + 16$ $= 1 + 16$
$= 17$ $= 17$
$\therefore r = \sqrt{17}$

OR/OF

$AD^2 = (-5-3)^2 + (1-9)^2$
$= 4 + 64$
$= 68$
$\therefore AD = \sqrt{68}$
$\therefore$ radius $= \frac{\sqrt{68}}{2}$
$= \sqrt{17}$

✓correct substitution into distance formula *korrekte vervanging in afstandformule*
✓ $r = \sqrt{17}$

✓correct substitution into distance formula *korrekte vervanging in afstandformule*
✓ $r = \sqrt{17}$ (2)

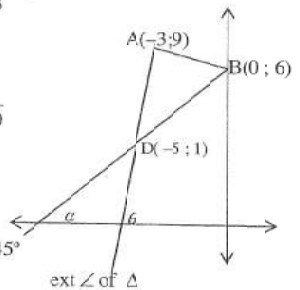
3.3

Yes, the circle will pass through point C
Ja, die sirkel gaan deur punt C
$\hat{B} = \hat{C} = 90°$, AD is the diameter line subtends equal $\angle$'s.
$\hat{B} = \hat{C} = 90°$, AD die middellyn *lynstuk onderspan gelyke* $\angle^e$

✓yes / *ja*
✓reason / *rede* (2)

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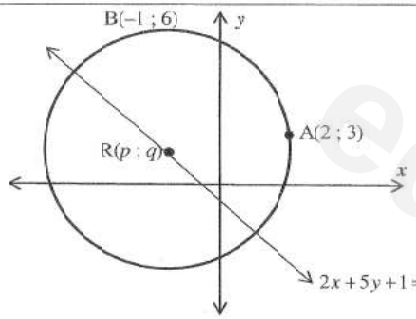
3.4	3(0 ; y) $m_{AB} \times m_{BD} = -1$ $\left(\frac{9-y}{-3-0}\right)\left(\frac{1-y}{-5-0}\right) = -1$ $(9-y)(1-y) = -15$ $9-10y+y^2 = -15$ $y^2-10y+24 = 0$ $(y-6)(y-4) = 0$ $\therefore y = 6$ or $y = 4$ $\quad \therefore B(0;6)$ **OR/OF** $AB^2+BD^2 = AD^2$ $(9-y)^2+(-3-0)^2+(-5-0)^2+(1-y)^2 = (-5+3)^2+(1-9)^2$ $81-18y+y^2-9+25+1-2y+y^2 = 4+64$ $2y^2-20y+48 = 0$ $y^2-10y+24 = 0$ $(y-6)(y-4) = 0$ $y = 6$ or $y = 4$ $\therefore B(0;6)$	✓ $m_{AB} \times m_{BD} = -1$ ✓ $\left(\frac{9-y}{-3-0}\right)$ / $\left(\frac{1-y}{-5-0}\right)$ ✓ standard form *standaardvorm* ✓ factors / faktore ✓ B(0 ; 6) (5) ✓ $(9-y)^2+(-3-0)^2+$ $(-5-0)^2+(1-y)^2$ ✓ $(-5+3)^2+(1-9)^2$ ✓ standard form/ *Standaardvorm* ✓ factors / faktore ✓ B(0 ; 6) (5)
3	$m_{AB} = \frac{9-6}{-3-0}$ $= -1$ $m_{\perp} = -1$ $y - y_1 = m(x-x_1)$ **OR/OF** $y = -x+c$ $y-1 = -1(x+5)$ $\quad -5 = -1+c$ $y-1 = -x-5$ $\quad c = -4$ $y = -x-4$ $\quad y = -x-4$	✓ $m_{\perp} = -1$ ✓ substitution of (–1 ; 5) *vervanging van* (–1 ; 5) ✓ $y = -x-4$ (3)

3.6	$m_{AD} = \frac{1-9}{-5+3} = 4$ $\tan\theta = 4$ $\theta = 75°$ $m_{DB} = \frac{1-6}{-5-0}$ $= 1$ $\tan\alpha = 1$ $= 45°$ $B\hat{D}A = 75° - 45°$ $= 31°$ ext ∠ of Δ **OR/OF** $AB^2 = (-3-0)^2+(9-6)^2$ $AB = \sqrt{18}$ $BD^2 = (-5-0)^2+(1-6)^2$ $BD = \sqrt{50}$ $\tan B\hat{D}A = \frac{\sqrt{18}}{\sqrt{50}} = 0{,}6$ $B\hat{D}A = 31°$  	✓ $m_{AD} = \frac{1-9}{-5+3} = 4$ ✓ $\tan\theta = 4$ ✓ 75° ✓ $\tan\alpha = 1$ ✓ 45° ✓ 31° (–1 if NOT rounded) 31° (–1 as NIE afgerond) ✓ $(-3-0)^2+(9-6)^2$ ✓ AB $= \sqrt{18}$ ✓ $(-5-0)^2+(1-6)^2$ ✓ BD $= \sqrt{50}$ ✓ using a correct trig ratio *gebruik korrekte trig verh* ✓ 31° (–1 if NOT rounded) 31° (–1 as NIE afgerond) (5) **[20]**

QUESTION / VRAAG 4

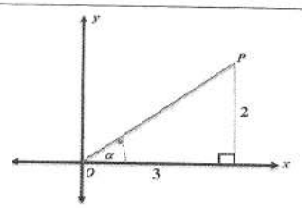
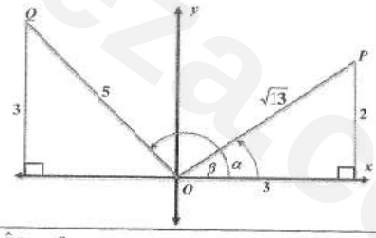
4.1.1	$x^2+y^2-2x+6y = 0$ $(x-1)^2-1+(y+3)^2-9 = 0$ $(x-1)^2+(y+3)^2 = 1+9$ $(x-1)^2+(y+3)^2 = 10$ $\therefore$ centre : (1 ; –3) $\therefore$ radius : $\sqrt{10}$	✓ $(x-1)^2-1$ ✓ $(y+3)^2-9$ ✓ (1 ; –3) ✓ $\sqrt{10}$ (4)
4.1.2	$m_{radius} = \frac{-3+4}{1+2}$ $= \frac{1}{3}$ $\therefore m_1 \times m_t = -1$ $\therefore m_t = -3$ equation of tangent / vergelyking van raaklyn $y+4 = -3(x+2)$ OR $y = -3x+c$ $y+4 = -3x-6$ $\quad -4 = -3(-2)+c$ $y = -3x-10$ $\quad \therefore c = -10$ $y = -3x-10$	✓ $m_r = \frac{1}{3}$ ✓ $m_t = -3$ ✓ substitution of (–2; –4) *vervanging van* (–2; –4) ✓ $y = -3x-10$ (4)

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4.1.1	RA = RB $RA^2 = RB^2$ $(p-2)^2+(q-3)^2=(p+1)^2+(q-6)^2$ $p^2-4p+4+q^2-6q+9=p^2+2p+1+q^2-12q+36$ $-6p+6q=24$ $\therefore p-q=-4$	✓ $RA^2 = RB^2$ ✓ $(p-2)^2+(q-3)^2$ ✓ $(p+1)^2+(q-6)^2$ ✓ $-6p+6q=24$ (4)
4.1.2	$R(p;q)$ lies on the line / lê op die lyn $2x+5y+1=0$ $2p+5q=-1$ .....(1) $p-q=-4$ $p=q-4$.....(2) OR sub (1) into (2) / vervang (1) in (2) $2p-2q=-8$....(2) $2p-2q=-8$....(2) $2(q-4)+5q=-1$ $2p-5q=-1$.....(1) $2q-8+5q=-1$ (2)−(1) $7q=7$ $7q=7$ $q=1$ $q=1$ sub q into equation (2) / vervang q in vgl (2) $p=1-4$ $p=-3$ R(−3;1) radius=RA OR/OF radius=RB $RA^2=(-3-2)^2+(1-3)^2$ $RB^2=(-3+1)^2+(1-5)^2$ $=25-4$ $=4+25$ $RA=\sqrt{29}$ $RB=\sqrt{29}$ $(x+3)^2+(y-1)^2=29$	✓ $2p+5q=-1$ ✓ $2(q-4)+5q=-1$ / $2p-2q=-8$ ✓ $q=1$ ✓ $p=-3$ ✓ RA^2 / RB^2 ✓ RA / $RB=\sqrt{29}$ ✓ $(x+3)^2+(y-1)^2=29$ (7) [19]

QUESTION / VRAAG 5

5.1.1	$3y-2x=0$ $3y=2x$ $y=\frac{2}{3}x$ $\tan\alpha=m$ $\tan\alpha=\frac{2}{3}$	✓ $y=\frac{2}{3}x$ ✓ $\tan\alpha=m$ (2)
5.1.2	 $OP^2=2^2+3^2$ *Pyth* $OP=\sqrt{13}$ $\sin\alpha=\frac{2}{\sqrt{13}}$ *or of* $\frac{2\sqrt{13}}{13}$ (with rational denominator) (met rasionale noemer)	✓ $OP=\sqrt{13}$ ✓ $\sin\alpha=\frac{2}{\sqrt{13}}$ (2)
5.2.1	 $Q\hat{O}P=\beta-\alpha$	✓ $\beta-\alpha$ (1)
5.2.2	$\sin Q\hat{O}P=\sin(\beta-\alpha)$ $=\sin\beta\cos\alpha-\cos\beta\sin\alpha$ $=\left(\frac{3}{5}\times\frac{3}{\sqrt{13}}\right)-\left(\frac{-4}{5}\times\frac{2}{\sqrt{13}}\right)$ $=\frac{17}{5\sqrt{13}}$	✓ $\sin(\beta-\alpha)$ $=\sin\beta\cos\alpha-\cos\beta\sin\alpha$ ✓ $\frac{3}{5}\times\frac{3}{\sqrt{13}}$ ✓ $\frac{-4}{5}\times\frac{2}{\sqrt{13}}$ ✓ $\frac{17}{5\sqrt{13}}$ (4) [9]

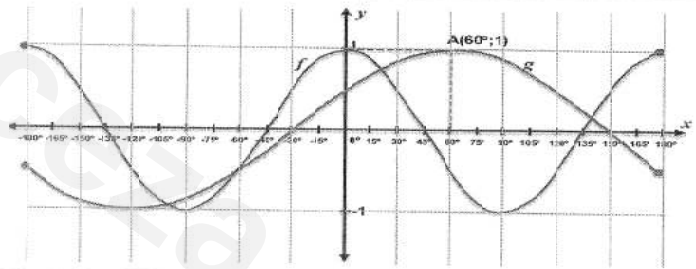
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QUESTION / VRAAG 6

6.1	$\frac{\cos(40°-x).\cos x-\sin(40°-x).\sin x}{\sin 205°.\cos 25°}$ $=\frac{\cos(40°-x+x)}{-\sin 25°.\cos 25°}$ $=\frac{\cos(40°-x+x)}{-\frac{1}{2}(2\sin 25°.\cos 25°)}$ $=\frac{\cos 40°}{-\frac{1}{2}\sin 50°}$ $=\frac{\cos 40°}{-\frac{1}{2}\cos 40°}$ **OR/OF** $\frac{\sin 50°}{-\frac{1}{2}\sin 50°}$ $=-2$	✓ $\cos(40°-x+x)$ ✓ $-\sin 25°$ ✓ $-\frac{1}{2}\sin 50°$ ✓ $\sin 50°=\cos 40°$ *or/of* $\cos 40°=\sin 50°$ *in numerator / in noemer* ✓ -2 (5)
6.2.1	LHS / LK $=\frac{\cos^2 x-\sin^2 x}{\cos x+\sin x}$ $=\frac{(\cos x-\sin x)(\cos x+\sin x)}{\cos x+\sin x}$ $=\cos x-\sin x$ $=$ RHS / RK	✓ $\cos 2x=\cos^2 x-\sin^2 x$ ✓ factorising / *faktorisering* (2)
6.2.2	$\cos x\left(\frac{\cos 2x}{\cos x+\sin x}\right)=\frac{1}{2}$ $\cos x\,(\cos x-\sin x)=\frac{1}{2}$ $\cos^2 x-\cos x\sin x=\frac{1}{2}$ $2\cos^2 x-2\cos x\sin x=1$ $2\cos^2 x-1=2\cos x\sin x$ $\cos 2x=\sin 2x$	✓ $\cos x-\sin x$ ✓ $\cos^2 x-\cos x\sin x=\frac{1}{2}$ ✓ $2\cos^2 x-1=\cos 2x$ ✓ $2\cos x\sin x=\sin 2x$ (4)
6.2.3	$\cos x\left(\frac{\cos 2x}{\cos x+\sin x}\right)=\frac{1}{2}$ $\cos 2x=\sin 2x$ $\tan 2x=1$ $2x=45°+k.180°$; $k\in Z$ $x=22,5°+k.90°$; $k\in Z$ **OR/OF**	✓ $\tan 2x=1$ ✓ $2x=45°+k.180°$ ✓ $x=22,5°+k.90°$; $k\in Z$ (3)

	$\cos 2x=\sin 2x$ $\cos 2x=\cos(90°-2x)$ $2x=90°-2x+k.360°$ or $2x=2x-90°+k.360°$; $k\in Z$ $4x=90°+k.360°$; $k\in Z$ $x=22,5°+k.90°$; $k\in Z$	✓ $\cos 2x=\cos(90°-2x)$ ✓ $4x=90°+k.360°$ ✓ $x=22,5°+k.90°$ (3)
6.3.1	Area $\Delta ABC=\frac{1}{2}mn\sin 4x$	✓ Area $\Delta ABC=\frac{1}{2}mn\sin 4x$ (2)
6.3.2	Max area *if* $\sin 4x=1$ $4x=90°$ $x=22,5°$	✓ $\sin 4x=1$ ✓ $x=22,5°$ (2)
6.3.3	Right-angled triangle/*Reghoekige driehoek*	✓ answer
		[18]

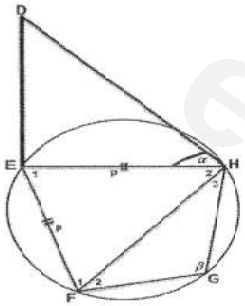
QUESTION / VRAAG 7



7.1	$\sin(60°-\theta)=1$ $60°-\theta=90°$ $\theta=-30°$	✓ $\theta=-30°$ (1)
7.2	period / periode $=\frac{360°}{2}$ $=180°$	✓ 180° (1)
7.3	$-2\le y\le 0$ of / or $[-2;0]$	✓ $-2\le y\le 0$ (1)
7.4	$45°<x<135°$ or/or $150°<x\le 180°$	✓ 45° and 135° ✓ 150° and 180° ✓ ALL inequalities correct *ALLE ongelykhede korrek* ***Subtract 1 mark for extra intervals*** ***Trek 1 punt af vir ekstra intervalle*** (3)
7.5	$90°<x<150°$	✓ 90° and/en 150° ✓ inequalities / *ongelykhede* (2) **[8]**

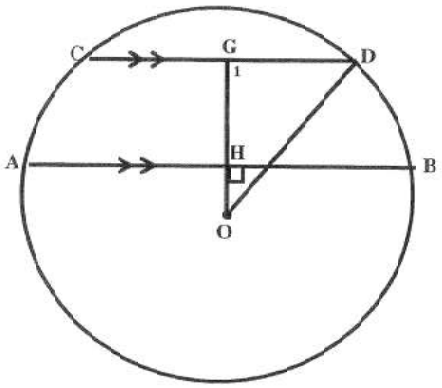
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QUESTION / VRAAG 8



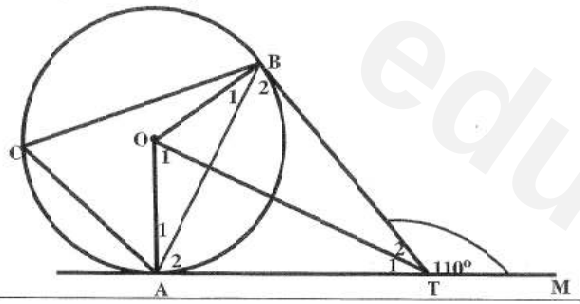
8.1	$\frac{DE}{p}=\tan\alpha$ $DE=p\tan\alpha$	✓ $p\tan\alpha$ (1)
8.2.1	$\hat{E}_1=180°-\beta$ (opp $\angle^s$ of cyclic quad *teenoorst. $\angle^e$ van kvh*) $\hat{F}_1=\hat{H}_2$ ($\angle^s$ opp equal sides; EH = EF *$\angle^e$ teenoor gelyke sye*) $\hat{F}_1+\hat{H}_2=180°-(180°-\beta)$ ($\angle^s$ of Δ/*$\angle^e$ van Δ*) $=\beta$ $\hat{F}_1=\hat{H}_2=\frac{1}{2}\beta$	✓ $\hat{E}_1=180°-\beta$ with reason/met rede ✓ $\hat{F}_1=\hat{H}_2$ with reason/met rede ✓ $\hat{F}_1-\hat{H}_2=\beta$ (3)
8.2.2	In ΔEFH $\frac{p}{\sin\frac{1}{2}\beta}=\frac{FH}{\sin(180°-\beta)}$ $p=\frac{FH.\sin\frac{1}{2}\beta}{\sin\beta}$ $=\frac{FH.\sin\frac{1}{2}\beta}{2\sin\frac{1}{2}\beta.\cos\frac{1}{2}\beta}$ $=\frac{FH}{2\cos\frac{1}{2}\beta}$	✓substitution in sine rule *vervanging in sinus formule* ✓ $p=\frac{FH.\sin\frac{1}{2}\beta}{\sin\beta}$ ✓ $\sin\beta=2\sin\frac{1}{2}\beta.\cos\frac{1}{2}\beta$ (3)
8.2.3	$FH^2=p^2+p^2-2p^2\cos(180°-\beta)$ $=2p^2+2p^2\cos\beta$ $=2p^2(1+\cos\beta)$ $FH=p\sqrt{2(1+\cos\beta)}$	✓substitution in cosine rule *vervanging in kosinus reël* ✓ $2p^2+2p^2\cos\beta$ ✓ $2p^2(1+\cos\beta)$ (3) **[10]**

QUESTION / VRAAG 9

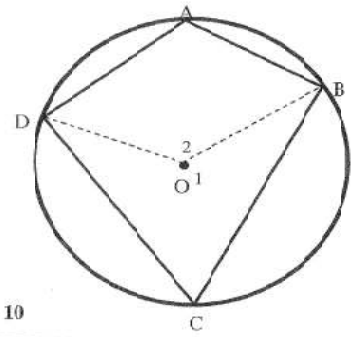


S/R	Statement and reason *S/R Bewering en rede*	
9.1.1	(a) AB ∥ CD corr. $\angle^s$ equal / *ooreenk. $\angle^e$ gelyk*	✓reason / *rede*
	(b) line from centre ⊥ to chord /*Midpt. Θ ; Midpt. koord*	✓reason / *rede*
	(c) Radius	✓reason / *rede* (3)
9.1.2	Join OB / *Verbind OB* HB = 12 and/*en* GD = 5 (line from centre ⊥ to chord / *Midpt. Θ ; Midpt. koord)*	✓ S/R
	In Δ OHB $(OH)^2=(OB)^2-(BH)^2$ $\hat{H}=90°$(Pyth) $=(13)^2-(12)^2$ $=25$	✓ Pythagoras
	$OH=5$	✓OH = 5
	In Δ OGD $(OG)^2=(OD)^2-(GD)^2$ $=(13)^2-(5)^2$ $=144$	
	$OG=12$	✓OG = 12
	$GH=CG-OH$ $=12-5$ $=7$	✓ GH = 7 (5)

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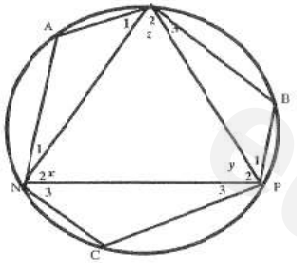
9.2.1	Tangents from same point / Tans from common pt *Raaklyne vanuit dies. punt*  	✓ reason /*rede* (1)
9.2.2	$\hat{E}_1 + \hat{E}_2 = 90°$ (tan ⊥ *rad* / *raaklyn* ⊥ radius) $\hat{A}_1 + \hat{A}_2 = 90°$ (tan ⊥ *rad* / *raaklyn* ⊥ radius) ∴ AOBT is a cyclic quadrilateral/*is 'n koordevierhoek* (*opposite* ∠'s supplementary/*oorstaande* ∠'e suppl)	✓ S/R ✓ S/R ✓R (3)
9.2.3	CA = OB (radii) $\hat{T}_1 = \hat{T}_1$ (equal chords subtend equal angels/ *gelyke hoeke onderspan deur gelyke koorde*	✓ CA = OB (radii) ✓ R (2)
9.2.4	$\hat{A}_2 + \hat{B}_2 = 110°$ (ext ∠ of Δ / buite ∠ van Δ) Eut $\hat{A}_2 = \hat{B}_2$ (∠'s opp equal sides / ∠'e teenoor gelyke sye) $\hat{A}_2 = 55°$ or $\hat{B}_2 = 55°$ $\hat{A}_2 = \hat{B}_2 = \hat{C} = 55°$ (tan chord / ∠ *tussen raaklyn en koord* **OR/OF** $\hat{C}_1 - \hat{O}_2 = 110°$ (ext ∠ of cycl quad/buite ∠ van *kvh*) $\hat{C}_1 - \hat{O}_2 = 2\hat{C}$ (∠ at centre = 2x∠at circ /midpts∠ = 2xomtreks∠) $\hat{C} = 55°$	✓S/R ✓ S/R ✓ $\hat{C} = 55°$ ✓ S/R (4) ✓ S/R ✓S ✓R ✓ $\hat{C} = 55°$ (4) [17]

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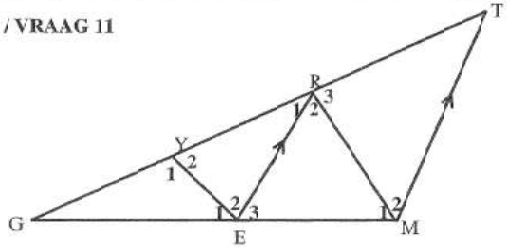
QUESTION / VRAAG 10

10.1	Construction: Join OD and OB *Konstruksie: Verbind* OD *en* OB $\hat{O}_1 = 2\hat{A}$ (∠ at centre = 2x ∠ at circumference / Midpts∠ = 2 x Omtreks∠) $\hat{O}_2 = 2\hat{C}$ (∠ at centre = 2x ∠ at circumference / Midpts∠ = 2 x Omtreks∠) $\hat{O}_1 + \hat{O}_2 = 360°$ (∠'s round a pt OR ∠'e in a rev ∠'e om 'n punt OF omwenteling $2\hat{A} + 2\hat{C} = 360°$ $2(\hat{A} + \hat{C}) = 360°$ $\hat{A} + \hat{C} = 180°$ M	✓Construction / Konstruksie ✓ S/R ✓ S/R ✓ S/R ✓ $2\hat{A} + 2\hat{C} = 360°$ (5)



10.2.1	$\hat{A}=180°-y$ $\hat{B}=180°-x$ (opp $\angle^e$ of cyclic quad / teenoorst. $\angle^e$ van koordevh) $\hat{C}=180°-z$	✓ all 3 statements *al 3 bewerings* ✓ reason *rede* (2)
10.2.2	$(180°-y)+(180°-x)+(180°-z)$ $=540°-(x+y+z)$ $=540°-180°$ (sum of $\angle$s of $\Delta=180°$) $=360°$	✓ substitution of angles *vervanging van hoeke* ✓ simplification *vereenvoudiging* ✓ 180° ✓ answer / *antw* (4) **[11]**

QUESTION / VRAAG 11



11.1	$\hat{R}_2=\hat{M}_2$ (alt$\angle$s RE$\parallel$TM / verw. $\angle^e$; RE$\parallel$TM) $\hat{R}_1=\hat{T}$ (corr $\angle$'s RE$\parallel$TM / ooreenk. $\angle^e$ RE$\parallel$TM)	✓ (S) ✓ (R) ✓ (S) ✓ (R) (4)
11.2	$\frac{EM}{EG}=\frac{RT}{RG}$ (line $\parallel$ one side of Δ OR prop theorem; RE$\parallel$TM (lyn $\parallel$ een sy van Δ) But / Maar RT = RM ($\angle^e$ opp equal sides ; $\hat{M}_2=\hat{T}$ / $\angle^e$ teenoor gelyke sye ; $\hat{M}_2=\hat{T}$) $\frac{EM}{EG}=\frac{RM}{RG}$	✓ (S) ✓ (R) ✓ (S) ✓ (R) (4)

11.3	In ΔGYE en ΔGER $\hat{G}=\hat{G}$ (common / gemeenskaplik) $\hat{E}_1=\hat{R}_1$ (given / gegee) $\hat{Y}_1=\hat{E}_1+\hat{E}_2$ (3rd $\angle$ of Δ / 3e $\angle$ van Δ) $\Delta GYE \|\|\| \Delta GER$ ($\angle,\angle,\angle$)	✓ $\hat{G}=\hat{G}$ (S/R) ✓ $\hat{E}_1=\hat{R}_1$ (S/R) ✓ $\hat{Y}_1=\hat{E}_1+\hat{E}_2$ (S/R) ✓ equiangular $\triangle$ / *gelykhoekige* $\triangle$ or/of $\angle,\angle,\angle$ (R) (4)
11.4	$\frac{EG}{EY}=\frac{RG}{RE}=\frac{YG}{EG}$ (equiang Δ's / $\Delta GYE \|\|\| \Delta GER$) $\therefore \frac{EG}{EY}=\frac{RG}{RE}$	✓ (R) equiang Δ's / $\Delta GYE \|\|\| \Delta GER$ gelykh Δ^e $\Delta GYE \|\|\| \Delta GER$ (1)
11.5.1	$(RG)^2=(GM)^2-(RM)^2$ $G\hat{R}M=90°$ Pythag. $=(10)^2-(6)^2$ $=64$ $\therefore RG=8$	✓ substitute into Pyth *vervang in Pyth* ✓ RG = 8 (2)
11.5.2	$\frac{GE}{GM}=\frac{GR}{GT}$ (line $\parallel$ one side of Δ OR prop theorem; RE$\parallel$TM (lyn $\parallel$ *een sy van* Δ) $\frac{GE}{10}=\frac{8}{14}$ $GE=5\frac{5}{7}$ or/of $\frac{40}{7}$ or/of 5,71 units/eenhede	✓ $\frac{GE}{GM}=\frac{GR}{GT}$ /reason / rede ✓ GT = 14 ✓ substitution of values *vervanging van waardes* ✓ answer /*antwoord* (4) **[19]**

TOTAL/TOTAAL: 150

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2016
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MATHEMATICS (SECOND PAPER) /
***WISKUNDE (TWEEDE VRAESTEL)* (10612)**

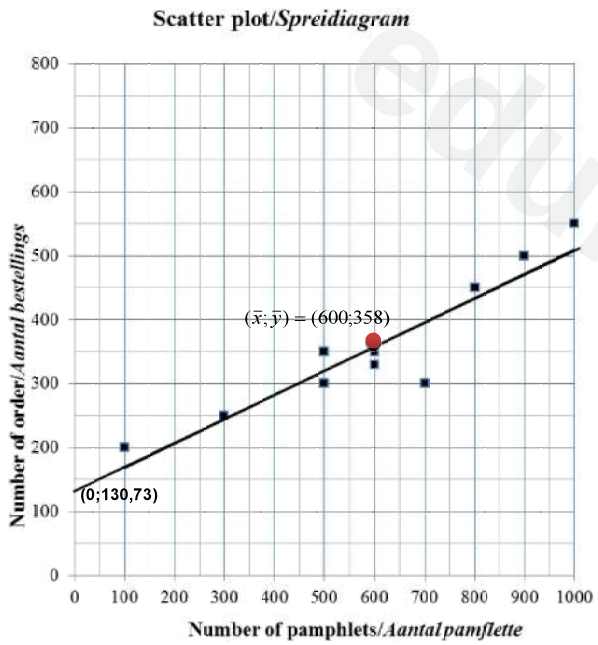
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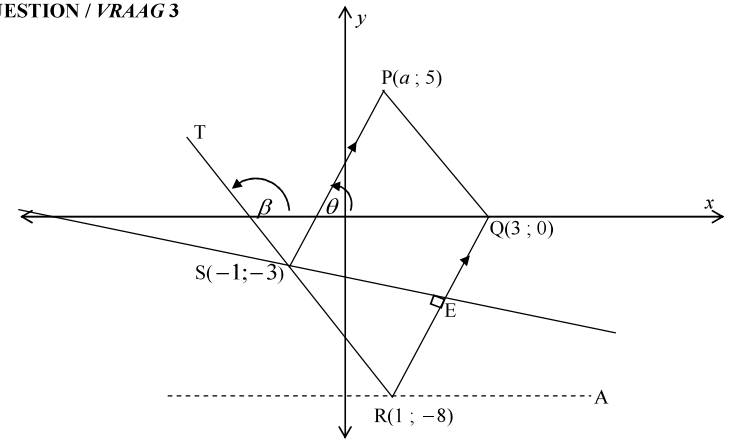
QUESTION / *VRAAG* 1

1.1.1	2015	✓2015 (1)
1.1.2	standard deviation/*standaardafwyking* = 65,18	✓65,18 (2)
1.1.3	$\bar{x} = 164$ (164 – 65,18 ; 164+65,18) =(98,82 ; 229,18) $\frac{8}{12} \times 100 = 66{,}67\%$	✓ $\bar{x} = 164$ ✓(98,82 ; 229,18) ✓66,67% (3)
1.2.1	220 – 26 =194	✓194 (1)
1.2.2	skewed to the right /*skeef na regs* **OR / *OF*** positively skewed / *positief skeef*	✓positively/skewed to the right *positief skeef/ skeef na regs* (1)
1.2.3	(a) the mean will increase / *die gemiddeld sal verhoog* (b) the median will stay the same / *die mediaan sal dieselfde bly*	✓mean increases ✓median the same (2)
1.2.4	$Q_1 = 64$ which means 25% of the data lies to the left of Q_1 / 25% *van die data lê links van* Q_1 25%×12 years = 3 for 3 years /*vir 3 jaar*	✓25% ✓3 years (2) **[12]**

QUESTION / *VRAAG* 2

2.1		no marks: 0 – 3 points correctly ✓plotting 4 – 6 points correctly ✓✓plotting 7 – 9 points correctly *geen punte: 0 – 3 punte korrek* ✓ *stip 4 – 6 pte korrek* ✓✓*stip 7 –9 pte korrek* (2)
2.2	$y = 0{,}38x + 130{,}73$	✓0,38 ✓130,73 (2)
2.3	*y*-intercept at/ *y-afsnit by* (0 ; 130,73) point $(\bar{x};\bar{y}) = (600;358)$ refer to answer book / *verwys na antwoordboek*	✓(0;130,73) ✓(600;358) (2)
2.4	$\hat{y} = 130{,}73+0{,}38(200)$ **OR / *OF*** Calculator usage / *sakrekenaar gebruik* $= 206{,}73 \approx 206$ orders/*bestellings* $\hat{y} = 206{,}48$ $= 206$ orders/*bestellings*	✓substitution ✓206 correct rounding (accept 207) (2)
		[8]

QUESTION / *VRAAG* 3



3.1	$QR = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ $= \sqrt{(3-1)^2+(0+8)^2}$ **OR /** $\sqrt{(1-3)^2+(-8-0)^2}$ $= \sqrt{4+64}$ ***OF*** $= \sqrt{68}$ $= 2\sqrt{17}$ $= 8{,}25$	✓ correct sub into distance formula / *korrekte verv. in afstandsformule* ✓ $2\sqrt{17}$ or 8,25 (2)
3.2	$m_{QR} = \frac{0-(-8)}{3-1}$ **OR / *OF*** $\frac{-8-(0)}{1-3}$ $= \frac{8}{2}$ $= \frac{-8}{-2}$ $= 4$ $= 4$	✓ subst into formula *verv. in formule* ✓4 (2)
3.3	$E\left(\frac{35}{17};y\right)$ $m_{QR} = 4$ $\frac{y-0}{\frac{35}{17}-3} = 4$ **OR / *OF*** $\frac{y-(-8)}{\frac{35}{17}-1} = 4$ $y = -\frac{64}{17}$ **OR / *OF***	✓ $\frac{y-0}{\frac{35}{17}-3} = 4$ ✓ or $\frac{y-(-8)}{\frac{35}{17}-1} = 4$ $y = -\frac{64}{17}$ (2) **OR / *OF***

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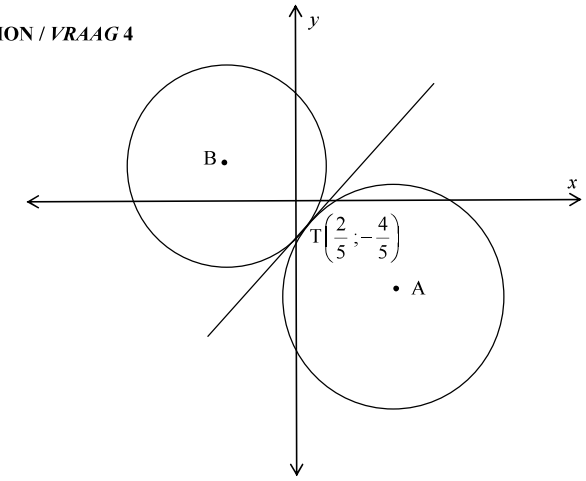
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	Equation RQ: $y-0=4(x-3)$ **OR / *OF*** $y+8=4(x-1)$ $y=4x-12$ $y=4x-12$ $=4\left(\frac{35}{17}\right)-12$ $=-\frac{64}{17}$	✓ $y=4x-12$ ✓ $y=-\frac{64}{17}$ (2)
3.4	SE ⊥ QR $m_{SE}=-\frac{1}{4}$ **OR / *OF*** $y=-\frac{1}{4}x+c$ $y-y_1=m(x-x_1)$ $-3=-\frac{1}{4}(-1)+c$ $y-(-3)=-\frac{1}{4}(x-(-1))$ $c=-\frac{13}{4}$ $y=-\frac{1}{4}x-\frac{13}{4}$ $y=-\frac{1}{4}x-\frac{13}{4}$ **OR / *OF*** $m_{SE}=-\frac{1}{4}$ **OR / *OF*** $y=-\frac{1}{4}x+c$ $y-y_1=m(x-x_1)$ $-\frac{64}{17}=-\frac{1}{4}\left(\frac{35}{17}\right)+c$ $y-\left(-\frac{64}{17}\right)=-\frac{1}{4}\left(x-\frac{35}{17}\right)$ $c=-\frac{13}{4}$ $y=-\frac{1}{4}x-\frac{13}{4}$ $y=-\frac{1}{4}x-\frac{13}{4}$ This answer could also be left as $4y=-x-13$ **OR / *OF*** $4y+x+13=0$	✓ $m_{SE}=-\frac{1}{4}$ ✓subst / *verv.* (−1 ;−3) ✓answer / *antw.* **OR / *OF*** ✓ $m_{SE}=-\frac{1}{4}$ (3) ✓subst / *verv.* $\left(\frac{35}{17};-\frac{64}{17}\right)$ ✓answer / *antw.* (3)
3.5	For parallel lines: / *Vir parallellyne:* $m_{PS}=m_{QR}$ $\frac{5-(-3)}{a-(-1)}=4$ $8=4(a+1)$ $8=4a+4$ $4a=4$ $a=1$ Answer only: FULL marks. Translation can be used to get the answer.	✓ $\frac{5-(-3)}{a-(-1)}$ ✓ 4 ✓ $a=1$ (3)
3.6.1	$m_{PS}=4$ $\tan\theta=4$ $\theta=75{,}96°$	✓ $\tan\theta=4$ ✓ 75,96° (2)

3.6.2	$m_{SR}=\frac{-8-(-3)}{1-(-1)}$ $=-\frac{5}{2}$ $\tan\beta=-\frac{5}{2}$ $=180°-68{,}20°$ $=111{,}80°$ $T\hat{S}P=111{,}80°-75{,}96°$ ext. angle of a triangle / *buite hoek van 'n driehoek* $=35{,}84°$ $\hat{R}=35{,}84°$ corresponding angles / *ooreenstemmende hoeke* PS // RQ **OR / *OF*** Draw a line RA parallel to *x*-axis through R / *Trek 'n lyn RA parallel aan die x-as deur R* $m_{QR}=m_{PS}=4$ $\tan Q\hat{R}A=4$ $Q\hat{R}A=75{,}96°$ $m_{SR}=\frac{-8-(-3)}{1-(-1)}$ $=-\frac{5}{2}$ $\tan S\hat{R}A=180°-68{,}20°$ $=111{,}80°$ $S\hat{R}Q=111{,}80°-75{,}96°$ $=35{,}84°$	✓ $-\frac{5}{2}$ ✓ $\tan\beta=-\frac{5}{2}$ ✓ 111,80° ✓ 35,84° ✓ $\hat{R}=35{,}84°$ (5) **OR / *OF*** ✓ 4 ✓ 75,96° ✓ $-\frac{5}{2}$ ✓ 111,80° ✓ 35,84° (5)
3.7	SR will be the diameter of the circle (line subt 90° angle) / $SR=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$ $=\sqrt{(-1-1)^2+(-3+8)^2}$ $=\sqrt{4+25}$ $=\sqrt{29}$ *radius of circle / radius van sirkel* $=\frac{\sqrt{29}}{2}$ or 2,69 **OR / *OF***	✓subst in distance formula / *verv. in afstandsformule* ✓ $\sqrt{29}$ ✓ $\frac{\sqrt{29}}{2}$ or 2,69 (3) **OR / *OF***

	SR will be the diameter of the circle (line subt 90° angle) Midpoint of SR: / *Middelpunt van SR:* $\left(\frac{1-1}{2};\frac{-8-3}{2}\right)$ $=\left(0;-\frac{11}{2}\right)$ Radius of the circle SRE / *Radius van die sirkel SRE*: $\sqrt{(1-0)^2+\left(-8+\frac{11}{2}\right)^2}$ **OR / *OF*** $\sqrt{(-1-0)^2+\left(-3+\frac{11}{2}\right)^2}$ *RE:* $=\sqrt{1+\frac{25}{4}}$ $=\frac{\sqrt{29}}{2}$ **OR / *OF*** 2,69 **[22]**	✓$\left(0;-\frac{11}{2}\right)$ ✓subst in distance formula / *verv. in afstandsform* ✓$\frac{\sqrt{29}}{2}$ or 2,69 (3)

QUESTION / *VRAAG* 4



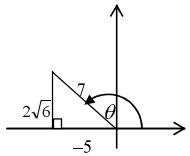
4.1	A(2 ; –2)	✓ (2 : –2) (1)
4.2.1	$x^2+y^2+4x-2y+p=0$ $x^2+4x+(2)^2+y^2-2y+(-1)^2=(2)^2+(-1)^2-p$ $(x+2)^2+(y-1)^2=5-p$ B(–2 ; 1)	✓–2 ✓1 (2)
4.2.2	$r^2=5-p$ $r=\sqrt{5-p}$	✓5 – p ✓ $r=\sqrt{5-p}$ (2)
4.2.3	AB $=\sqrt{(-2-2)^2+(1+2)^2}$ **OR / *OF*** AB $=\sqrt{(2+2)^2+(-2-1)^2}$ $=\sqrt{16+9}$ $=\sqrt{25}$ $=5$	✓subst. / *verv.* (2 ; –2) & (–2 ; 1) into distance formula / *afstandsformule* ✓ 5 (2)
4.2.4	AB = R + r $5=2+\sqrt{5-p}$ $3=\sqrt{5-p}$ $9=5-p$ $p=-4$	✓ R + r = $2+\sqrt{5-p}$ ✓ $5=2+\sqrt{5-p}$ ✓ $p=-4$ (3)

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4.3	$m_{AT}=\dfrac{-2+\frac{4}{5}}{2-\frac{2}{5}}$ $=\dfrac{-\frac{6}{5}}{\frac{8}{5}}$ $=-\dfrac{3}{4}$ **OR / *OF*** $m_{BT}=\dfrac{1+\frac{4}{5}}{-2-\frac{2}{5}}$ $=\dfrac{\frac{9}{5}}{-\frac{12}{5}}$ $=-\dfrac{3}{4}$	✓ sub (2 ; –2) and $\left(\frac{2}{5};-\frac{4}{5}\right)$ **OR / *OF*** sub / *verv.* (–2;1) and $\left(\frac{2}{5};-\frac{4}{5}\right)$ into gradient / formula / *in gradiënt formula* ✓ $-\frac{3}{4}$
	$m_{AB}\times m_{tangent}=-1$ $m_{tang}=\frac{4}{3}$ $y+\frac{4}{5}=\frac{4}{3}\left(x-\frac{2}{5}\right)$ $y+\frac{4}{5}=\frac{4}{3}x-\frac{8}{15}$ $y=\frac{4}{3}x-\frac{4}{3}$	✓ $m_{tang}=\frac{4}{3}$ ✓ sub $\left(\frac{2}{5};-\frac{4}{5}\right)$ ✓ $y=\frac{4}{3}x-\frac{4}{3}$ (5)
	OR / *OF* A : $x^2-4x+4+y^2+4y+4=4$ $x^2-4x+y^2+4y=-4$ B : $x^2+4x+y^2-2y=4$ A – B : $-8x+6y=-8$ $y=\frac{4}{3}x-\frac{4}{3}$	**OR / *OF*** ✓ $x^2-4x+4+y^2+4y+4=4$ ✓ $x^2-4x+y^2+4y=-4$ ✓ $-8x+6y=-8$ ✓✓ $y=\frac{4}{3}x-\frac{4}{3}$ (5) **[15]**

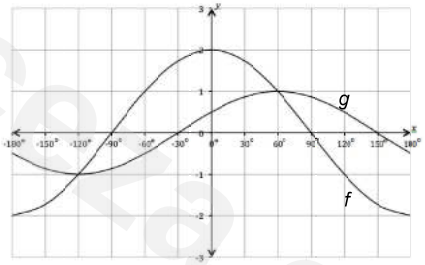
QUESTION / *VRAAG* 5

5.1.1	$\tan\theta=-\dfrac{2\sqrt{6}}{5}$  $r^2=(2\sqrt{6})^2+(-5)^2$ Pyth $=49$ $\therefore r=7$ $\sin\theta=\dfrac{2\sqrt{6}}{7}$	✓ r = 7 ✓ $\sin\theta=\frac{2\sqrt{6}}{7}$ (2)
5.1.2	$\cos\theta=-\dfrac{5}{7}$	✓ $\cos\theta=-\frac{5}{7}$ (1)
5.1.3	$\dfrac{14\cos\theta+7\sqrt{6}\sin\theta}{\cos(-240^\circ).\tan225^\circ}$ $=\dfrac{14\left(-\frac{5}{7}\right)+7\sqrt{6}\left(\frac{2\sqrt{6}}{7}\right)}{(\cos240^\circ)(\tan225^\circ)}$ $=\dfrac{-10+12}{(-\cos60^\circ)(\tan45^\circ)}$ $=\dfrac{2}{\left(-\frac{1}{2}\right)(1)}$ $=-4$	✓ –cos60° ✓ tan45° ✓ $-\frac{1}{2}$ and 1 ✓ –4 (4)
5.2	$\dfrac{\cos\theta-\cos2\theta+2}{3\sin\theta-\sin2\theta}$ $=\dfrac{\cos\theta-\left(2\cos^2\theta-1\right)+2}{3\sin\theta-2\sin\theta\cos\theta}$ $=\dfrac{\cos\theta-2\cos^2\theta+1+2}{\sin\theta(3-2\cos\theta)}$ $=\dfrac{3+\cos\theta-2\cos^2\theta}{\sin\theta(3-2\cos\theta)}$ $=\dfrac{(3-2\cos\theta)(1+\cos\theta)}{\sin\theta(3-2\cos\theta)}$ $=\dfrac{1+\cos\theta}{\sin\theta}$ = RHS	✓ $2\cos^2\theta-1$ ✓ $2\sin\theta.\cos\theta$ ✓ $3+\cos\theta-2\cos^2\theta$ ✓ $(3-2\cos\theta)(1+\cos\theta)$ ✓ $\frac{1+\cos\theta}{\sin\theta}$ (5)

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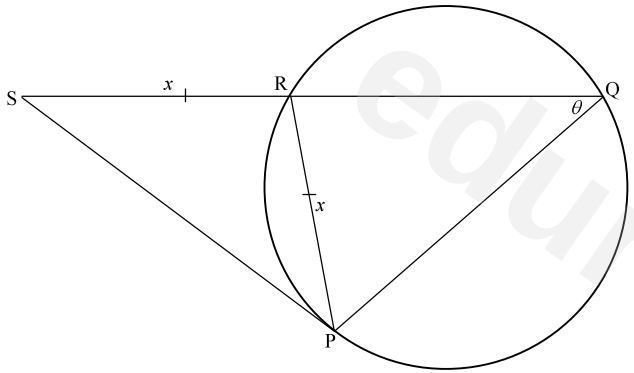
5.3	$\sin\theta\sin\frac{3\theta}{2}+\cos\frac{3\theta}{2}\cos\theta=-\frac{\sqrt{3}}{2}$ $\cos\frac{3\theta}{2}\cos\theta+\sin\frac{3\theta}{2}\sin\theta=-\frac{\sqrt{3}}{2}$ $\cos\left(\frac{3\theta}{2}-\theta\right)=-\frac{\sqrt{3}}{2}$ $\cos\left(\frac{\theta}{2}\right)=-\frac{\sqrt{3}}{2}$ $\frac{\theta}{2}=150°+k.360°\ k\in Z$ or/ *of* $\frac{\theta}{2}=-150°+k.360°\ k\in Z$ $\theta=300°+k.720°\ k\in Z$ $\theta=-300°+k.720°\ k\in Z$ **OR / *OF*** *ref* $\angle=30°$ $\frac{\theta}{2}=180°-30°+k.360°$ or / *of* $\frac{\theta}{2}=180°+30°+k.360°;k\in Z$ $\theta=300°+k.720°$ or / *of* $\theta=420°+k.720°$	✓ $\cos\left(\frac{3\theta}{2}-\theta\right)$ ✓ $\frac{\theta}{2}=\pm150°+k.360°$ ✓ $\theta=300°+k.720°$ ✓ $\theta=-300°+k.720°$ (4) **OR / *OF*** ✓ $\frac{\theta}{2}=180°\pm30°+k.360°$ ✓ 300°+k.720° ✓ 420°+k.720° (4)
5.4.1	Maximum value is 1 and minimum value is –1 / *Maksimum waarde is 1 en mimimum waarde –1*	✓answer /*antw.* (1)
5.4.2	Range of both graphs is $-1\le y\le 1$ $\sin\theta\cdot\cos\beta=-1$ $\sin\theta=1$ and / *en* $\cos\beta=-1$ or/ *of* $\sin\theta=-1$ and / *en* $\cos\beta=1$ $\theta=90°$ and / *en* $\beta=-180°$ $\theta=270°$ and / *en* $\beta=0°$	✓ $\theta=90°$ ✓ $\beta=-180°$ ✓ $\theta=270°$ ✓ $\beta=0°$ (4) **[21]**

QUESTION / *VRAAG* 6

6.1	$2\cos x=\sin(x+30°)$ $2\cos x=\sin x\cos 30°+\cos x\sin 30°$ $2\cos x=\sin x\left(\frac{\sqrt{3}}{2}\right)+\cos x\left(\frac{1}{2}\right)$ $4\cos x=\sqrt{3}\sin x+\cos x$ $3\cos x=\sqrt{3}\sin x$	✓ $\sin x\cos 30°+\cos x\sin 30°$ ✓ $\frac{\sqrt{3}}{2}$ and / *en* $\frac{1}{2}$ ✓ $4\cos x=\sqrt{3}\sin x+\cos x$ (3)
6.2	$\frac{3\cos x}{\cos x}=\frac{\sqrt{3}\sin x}{\cos x}$ $\tan x=\sqrt{3}$ ref $\angle=60°$ $x=60°+k360°$ **OR / *OF*** $x=240°+k.360°;k\in Z$ $\therefore x=\{-120°;60°\}$	✓ $\tan x=\sqrt{3}$ ✓ref angle / *verw. hoek* ✓–120° ✓60° (4)
6.3.1	$y\in[-2;2]$ **OR / *OF*** $-2\le y\le 2$	✓ $y\in[-2;2]$ (1)
6.3.2		✓ *x*-intercepts ✓ *y*-intercept ✓shape (3)
6.3.3	$360°$	✓ 360° (1)
6.3.4	$-120°<x<60°$ **OR / *OF*** $x\in(-120°;60°)$	✓ $-120°<x$ ✓ $x<60°$ (2)
6.3.5	$-30°<x<90°$ **OR / *OF*** $x\in(-30°;90°)$ **Brackets/ Inequality signs have to be correct.**	✓ $-30°<x$ ✓ $x<90°$ (2) **[16]**

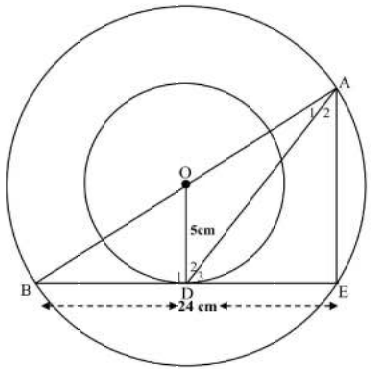
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QUESTION / *VRAAG* 7



	$S\hat{P}R = \theta$ [tan-chord / *raaklyn-koord*] $\hat{R} = 180° - 2\theta$ [sum $\angle^s$ of Δ / *som* $\angle^e$ *van* Δ] $PS^2 = x^2 + x^2 - 2x^2\cos(180° - 2\theta)$ $= 2x^2 + 2x^2\cos 2\theta$ $= 2x^2(1 + \cos 2\theta)$ $= 2x^2(1 + 2\cos^2\theta - 1)$ $= 2x^2(2\cos^2\theta)$ $= 4x^2\cos^2\theta$ $PS = 2x\cos\theta$ **OR / *OF*** $PS^2 = x^2 + x^2 - 2x^2\cos(180° - 2\theta)$ $= 2x^2 + 2x^2\cos 2\theta$ $= 2x^2(1 + \cos 2\theta)$ $= 2x^2(1 + 1 - 2\sin^2\theta)$ $= 2x^2(2 - 2\sin^2\theta)$ $= 4x^2(1 - \sin^2\theta)$ $= 4x^2\cos^2\theta$ $PS = 2x\cos\theta$	✓ $S\hat{P}R = \theta$ ✓ $\hat{R} = 180° - 2\theta$ ✓ $x^2 + x^2 - 2x^2\cos(180° - 2\theta)$ ✓ $+ 2x^2\cos 2\theta$ ✓ $2\cos^2\theta - 1$ ✓ $4x^2\cos^2\theta$ (6) **OR / *OF*** ✓ $x^2 + x^2 - 2x^2\cos(180° - 2\theta)$ ✓ $+ 2x^2\cos 2\theta$ ✓ $1 - 2\sin^2\theta$ ✓ $4x^2\cos^2\theta$ (6) **[6]**

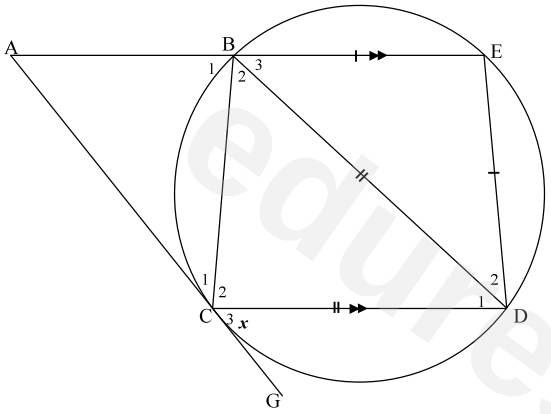
QUESTION / *VRAAG* 8



8.1	bisects / *halveer*		✓ answ/*antw*. (1)
8.2.1	OD⊥ BE $(\hat{D}_1 = \hat{D}_2 + \hat{D}_3 = 90°)$ $\therefore$ BD = DE = 12cm $OB^2 = 12^2 + 5^2$ $= 169$ OB = 13cm	[tan ⊥ radius / raaklyn ⊥ radius] [line from centre ⊥ to chord / *Loodlyn uit midpt.* ⊙ *na koord*] [Pyth; $\hat{D}_1 = 90°$]	✓ S/R ✓ S/R ✓ $OB^2 = 12^2 + 5$ ✓ OB = 13 (4)
8.2.2	$\hat{E} = 90°$	[∠ in semi ⊙/*∠ in halwe* ⊙] OR [corresp ∠s; DO ‖ AE / *ooreenk. ∠; DO || AE*]	✓R (1)
8.2.3	OD‖ AE and/ *en* BD = DE AE = 2OD = 10 **OR / *OF*** OB = OA AB = 26 In ΔABE $AE^2 = 26^2 - 24^2$ $= 100$ AE = 10	[Midpt Theorem / *Midpt.-stelling*] [radii] [Pyth; $\hat{E} = 90°$]	✓S/R ✓ AE = 2OD ✓AE = 10 (3) **OR / *OF*** ✓ AB = 26 ✓ S/R ✓AE = 10 (3)
8.2.4	In ΔADE $AD^2 = 10^2 + 12^2$ $= 244$ $AD = \sqrt{244}$ **OR / *OF*** $2\sqrt{61}$ **OR / *OF*** 15,62	[Pyth; $\hat{E} = 90°$]	✓S/R ✓ $AD = \sqrt{244}$ **OR / *OF*** $2\sqrt{61}$ **OR / *OF*** 15,62 (2) **[11]**

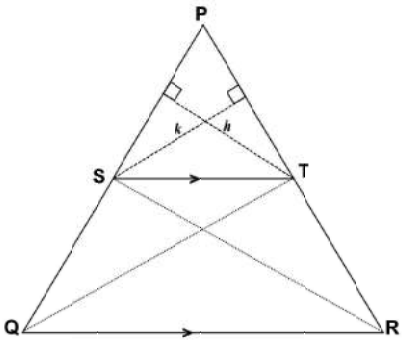
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QUESTION / *VRAAG* 9



9.1	$x = \hat{C}_3$	[given / *gegee*]	
	$= \hat{B}_2$	[tan chord theorem / *∠tussen raaklyn en koord*]	✓ S ✓R
	$= \hat{C}_2$	[∠s opp equal sides / *∠e teenoor gelyke sye*	✓S/R
	$= \hat{B}_1$	[alt ∠s; BE ∥ CD/*verw.∠e; BE ∥ CD*]	✓S/R
	$= \hat{D}_1 + \hat{D}_2$	[ext ∠ of cyclic quad /*buite ∠van kvh]*	✓S ✓R
	$\hat{C}_3 = \hat{A} = x$	[corresp ∠s; BE ∥ CD / *ooreenk. ∠; BE ∥ CD*]	✓S/R (7)
9.2	$\hat{B}_3 = \hat{D}_1$	[alt ∠s; BE ∥ CD /*verw.∠e; BE ∥ CD*]	✓S/R
	ED = BC	[equal ∠s ; equal chords *gelyke omtr ∠e; gelyke koorde*]	✓S/R (2)
	OR / *OF*		**OR / *OF***
	In Δ BCD and/*en* Δ EDC		
	CD = CD	[common / *gemeenskaplik*]	
	$\hat{C}_2 = E\hat{D}C = x$	[proven in 9.1 / *bewys in* 9.1]	✓S/R for all three angles/ *vir al drie hoeke*
	$\hat{B}_2 = C\hat{E}D$	[∠s in the same seg /*∠e in dies. ⊙ segm.*	
	Δ BCD ≡ Δ EDC	[AAS OR ∠∠S / *HHS OF ∠∠S*]	
	ED = BC	[from ≡ / *uit* ≡]	✓ S/R (2) **[9]**

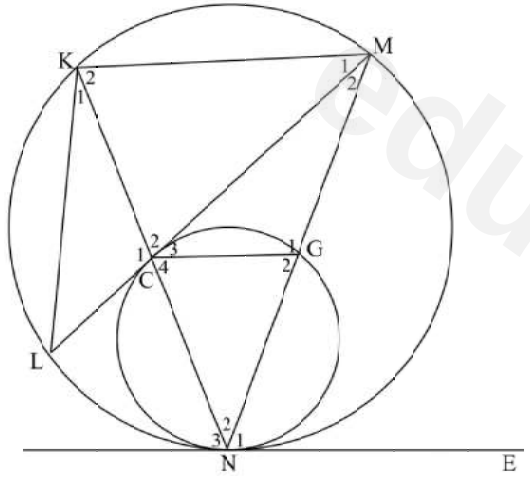
QUESTION / *VRAAG* 10



10.1	***Construction***: In ΔPQR, draw height h relative to base PS and the height k relative to base PT. Join QT and RS to form ΔSQT and Δ TRS.		✓ Construction **on sketch**/ *Konstruksie* **op skets**
	$\frac{\text{Area of } \Delta PST}{\text{Area of } \Delta SQT} = \frac{\frac{1}{2} \times PS \times h}{\frac{1}{2} \times SQ \times h} = \frac{PS}{SQ}$		✓S
	$\frac{\text{Area of } \Delta PTS}{\text{Area of } \Delta TRS} = \frac{\frac{1}{2} \times PT \times k}{\frac{1}{2} \times TR \times k} = \frac{PT}{TR}$	[same base, equal height **OR** same base, ST ∥QR /*dies. basis ; gelyke hoogte* **OF** *dies. basis,* ST ∥QR]	✓S/R
	But Area ΔSQT = Area ΔTRS		✓S
	$\frac{\text{Area of } \Delta PST}{\text{Area of } \Delta SQT} = \frac{\text{Area of } \Delta PTS}{\text{Area of } \Delta TRS}$		
	$\frac{PS}{SQ} = \frac{PT}{TR}$		(5)

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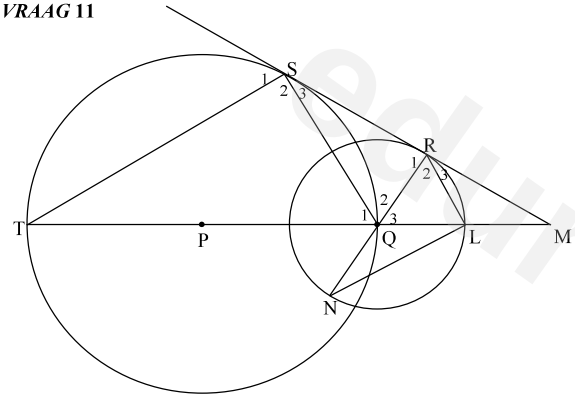


10.2.1	$\hat{N}_1 = \hat{C}_4$	[tan chord theorem / *∠tussen raaklyn en koord*]	✓S /R
	$\hat{N}_1 = \hat{K}_2$	[tan chord theorem / *∠tussen raaklyn en koord*]	✓S/R
	$\therefore \hat{C}_4 = \hat{K}_2$		
	CG ∥ KM	[corresp ∠s = /*ooreenk.∠e gelyk*]	✓S/R
	$\frac{KC}{KN} = \frac{MG}{MN}$	[line ∥ one side of Δ **OR** prop theorem; CG ∥ KM / *lyn ∥ een sy van Δ*]	✓R (4)
10.2.2	$\hat{C}_4 = \hat{K}_2$	proved	
	$\hat{C}_4 = \hat{G}_2$	[∠s opp equal sides / *∠e teenoor gelyke sye*]	✓$\hat{C}_4 = \hat{G}_2$ ✓R
	$\therefore \hat{G}_2 = \hat{K}_2$		
	∴ KMGC is a cyclic quad	[ext ∠ = int opp ∠ / *buite hoek = oorst binne∠*]	✓R (3)
10.2.3	In Δ MCG and/*en* Δ MNC		
	$\hat{M}_2 = \hat{M}_2$	[common / *gemeenskaplik*]	✓S
	$\hat{C}_3 = \hat{N}_2$	[tan chord theorem / *∠tussen raaklyn en koord*]	✓S/R
	$\hat{G}_1 = \hat{C}_3 + \hat{C}_4$	[∠ sum in Δ/*∠ som van Δ*]	
	ΔMCG ||| ΔMNC	[∠∠∠]	✓R (3)

10.2.4	$\frac{MC}{MG} = \frac{MN}{MC}$	[Δ^s ||| / Δ^e |||]	✓S/R
	$MC^2 = MG.MN$		
	$\frac{MC^2}{MN^2} = \frac{MG.MN}{MN^2}$		✓S
	$= \frac{MG}{MN}$		✓S
	$\frac{KC}{KN} = \frac{MG}{MN}$	[proved / *bewys*]	✓S
	$\frac{MC^2}{MN^2} = \frac{KC}{KN}$		(4) **[19]**

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QUESTION / *VRAAG* 11



11.1	$\hat{Q}_3 = 2\hat{N}$ $\hat{N} = 30°$ $\hat{N} = \hat{R}_3$ $\hat{R}_3 = 30°$	[∠ at centre = 2× ∠ at circ / *middelpts ∠ = 2× omtrek ∠*] [tan chord theorem / *∠tussen raaklyn en koord*]	✓ Reason ✓ $\hat{N} = 30°$ ✓Reason ✓ $\hat{R}_3 = 30°$ (4)
11.2	$\Delta TSQ \Vert\Vert\Vert \Delta SRQ$ $\frac{TS}{SR} = \frac{SQ}{RQ} = \frac{TQ}{SQ}$ $SQ^2 = TQ.RQ$ $= 4r.r$ $= 4r^2$ $SQ = 2r$ **OR / *OF*** $PQ = 2r$ $\therefore TQ = 4r$ $\frac{SQ}{RQ} = \frac{TQ}{SQ}$ $SQ^2 = TQ.RQ$ $= 4r^2$ $SQ = 2r$	[$\Delta^s \Vert\Vert\Vert$ / $\Delta^e \Vert\Vert\Vert$]	✓ $\frac{SQ}{RQ} = \frac{TQ}{SQ}$ ✓ $TQ = 4r$ ✓ $SQ^2 = 4r^2$ (3) **OR / *OF*** ✓ $TQ = 4r$ ✓ $\frac{SQ}{RQ} = \frac{TQ}{SQ}$ ✓ $SQ^2 = 4r^2$ (3)

11.3	$\hat{Q}_1 = \hat{Q}_2$ $\hat{Q}_1 = 60°$ $\hat{S}_2 = 90°$ $\hat{T} = 30°$ $\hat{S}_3 = 30°$ $T\hat{S}R = 120°$ **OR / *OF*** $\sin \hat{S}_3 = \frac{RQ}{SQ}$ $= \frac{r}{2r}$ $= \frac{1}{2}$ $\hat{S}_3 = 30°$ $\hat{S}_2 = 90°$ $T\hat{S}R = \hat{S}_3 + \hat{S}_2$ $= 120°$	[$\Delta^s \Vert\Vert\Vert$ / $\Delta^e \Vert\Vert\Vert$] [$\angle^s$ on str line / $\angle^e$ *op rt.lyn*] [∠ in semi-circle /*∠ in semi-sirkel*] [sum $\angle^s$ of Δ /*som* $\angle^e$ *van* Δ] [tan chord theorem / *∠tussen raaklyn en koord*] [∠ in semi-circle /*∠ in semi-sirkel*]	✓ $\hat{Q}_1 = 60°$ ✓ $\hat{S}_2 = 90°$ ✓ $\hat{T} = 30°$ ✓S/R ✓ $T\hat{S}R = 120°$ (4) **OR / *OF*** ✓ $\sin \hat{S}_3 = \frac{1}{2}$ ✓ $\hat{S}_3 = 30°$ ✓ S/R ✓ $T\hat{S}R = 120°$ (4) **[11]**

TOTAL / *TOTAAL*: 150

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PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN

2017

MEMORANDUM /

NASIEN RIGLYNE

MATHEMATICS (SECOND PAPER) (10612)
WISKUNDE (TWEEDE VRAESTEL) (10612)

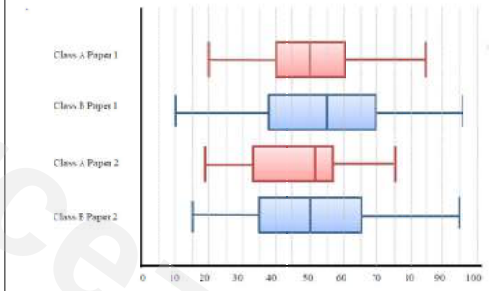
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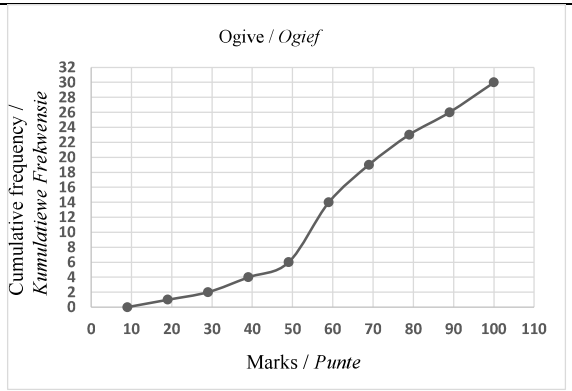
MATHEMATICS / *WISKUNDE*
(Second Paper / Tweede *Vraestel*)

MEMORANDUM

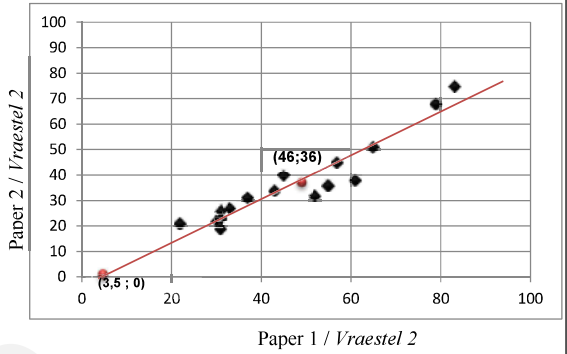
QUESTION/*VRAAG* 1

1.1		
1.1.1	median / *mediaan* = 55	✓ 55 (1)
1.1.2	IQR/*IKV* = 60 – 40 = 20	✓60 – 40 ✓20 (2)
1.1.3	15% – 65%	✓15% – 65% (1)
1.1.4	Skewed to the left / *Skeef na links* OR Negatively skewed / *Negatief skeef*	✓answer/*antwoord* (1)

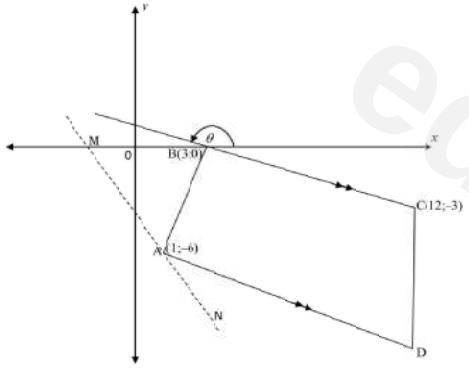
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1.2	<table><tr><th>Class interval / *Klasinterval*</th><th>Cumulative Frequency / *Kumulatiewe Frekwensie*</th></tr><tr><td>$10 \leq x \leq 19$</td><td>1</td></tr><tr><td>$20 \leq x \leq 29$</td><td>2</td></tr><tr><td>$30 \leq x \leq 39$</td><td>4</td></tr><tr><td>$40 \leq x \leq 49$</td><td>6</td></tr><tr><td>$50 \leq x \leq 59$</td><td>14</td></tr><tr><td>$60 \leq x \leq 69$</td><td>19</td></tr><tr><td>$70 \leq x \leq 79$</td><td>23</td></tr><tr><td>$80 \leq x \leq 89$</td><td>26</td></tr><tr><td>$90 \leq x \leq 100$</td><td>30</td></tr></table>	
2.1		✓ top points of interval / *hoogte punt van interval* ✓shape / *vorm* ✓grounding point / *laagste punt* (3)
2.2	$\frac{19}{30} \times 100$ $= 63\%$	✓ 63% (accuracy / akkuraatheid) (1)
2.3	$26 - 23$ = 3 learners/*leerders*	✓ 3 (1)
1.2.4	Mark between 30 – 39/*Enige punt tussen 30 – 39*	✓30 – 39 (1)
1.2.5	$90 - 19$ $= 71$	✓71 (1)
		[12]

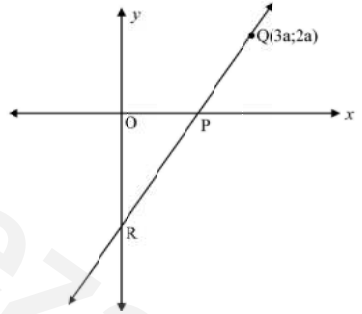
QUESTION/*VRAAG* 2

2.1	$\hat{y} = 0{,}84x - 2{,}92$	✓$a = 0{,}84x$ ✓$b = -2{,}92$ ✓ equation / *vergelyking* (3)
2.2	$r = 0{,}95$	✓$r = 0{,}95$ (1)
2.3		line through the point: / *lyn deur die punte:* ✓(46;36) average point / *gemiddelde punt* ✓ (3,5 ; 0) x-intercept / x-*afsnit* (2)
2.4	$y = 0{,}84(98) - 2{,}92$ $y = 79{,}4$ **OR / OF** calculator / *optel masjien* Yes / agree The correlation suggests a positive association between variables, therefore predictions using the least squares regression line is valid, reliable and usually accurate. *Ja / stem saam* *Die korrelasie dui op 'n positiewe assosiasie tussen veranderlikes, daarom is voorspellings met behulp van die kleinste kwadrate regressielyn geldig, betroubaar en gewoonlik akkuraat.*	✓ yes / *ja* ✓ reason / *rede* (2)
		[8]

QUESTION/*VRAAG* 3

3.1		
3.1.1	$m_{BC} = \frac{-3-0}{12-3}$ $= -\frac{1}{3}$ $\tan\theta = m_{BC}$ $= -\frac{1}{3}$ $\theta = 180° - 18{,}43°$ $= 161{,}57°$	✓ $m_{BC} = -\frac{1}{3}$ ✓ $\tan\theta = -\frac{1}{3}$ ✓ $18{,}43°$ ✓ $\theta = 161{,}57°$ (4)
3.1.2	$m_{AD} = m_{BC}$ AD parallel BC $= -\frac{1}{3}$ $m_{AB} = \frac{-6-0}{1-3}$ $= 3$ $m_{AB}.m_{AD} = 3.\left(-\frac{1}{3}\right)$ $= -1$ $\therefore$ AB $\perp$ AD	✓ $m_{AD} = -\frac{1}{3}$ ✓ $m_{AB} = 3$ ✓ $m_{AB}.m_{AD} = 3.\left(-\frac{1}{3}\right)$ (3)

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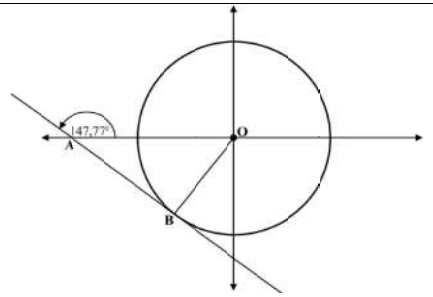
3.1.3	Inclination of the line / *Inklinasie van die lyn* $\alpha = 161{,}6° - 45°$ $= 116{,}6°$ $\tan\alpha = m_{line}$ $\tan 116{,}6° = -2$ $y - y_1 = m(x - x_1)$ **OR/*OF*** $y = mx + q$ $y + 6 = -2(x - 1)$ $-6 = -2(1) + q$ $y + 6 = -2x + 2$ $q = -4$ $y = -2x - 4$	✓ $\alpha = 116{,}6°$ ✓ $m = -2$ ✓substitute / *vervang* A(1;–6) ✓ $y = -2x - 4$ (4)
3.2		
3.2.1	$y - y_1 = m(x - x_1)$ $y - 2a = 2(x - 3a)$ $y = 2x - 6a + 2a$ $y = 2x - 4a$	✓substitute / *vervang* (3a;2a) and / *en* $m = 2$ ✓ $y = 2x - 4a$ (2)
3.2.2	P(2a;0) Q(0;–4a) Area / *Oppervlakte* $\Delta POQ = \frac{1}{2}$b.h $= \frac{1}{2}(2a)(4a)$ $= 4a^2$	✓ P(2a;0) ✓ Q(0;–4a) ✓correct substitution / *korrekte vervanging* ✓ $4a^2$ (4)

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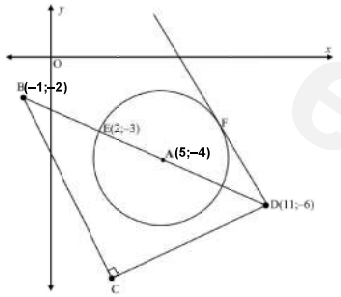
3.2.3	$m_{DE} = m_{EQ}$ $\frac{-2+14}{3+3} = \frac{2a+2}{3a-3}$ $2(3a-3) = 2a+2$ $6a-6 = 2a+2$ $4a = 8$ $a = 2$ **OR / *OF*** $m_{DQ} = m_{DE}$ $\frac{2a+14}{3a+3} = \frac{-2+14}{3+3}$ $2(3a+3) = 2a+14$ $6a+6 = 2a+14$ $4a = 8$ $a = 2$ $m_{DQ} = m_{EQ}$ $\frac{2a+14}{3a+3} = \frac{2a+2}{3a-3}$ $(2a+14)(3a-3) = (2a+2)(3a+3)$ $6a^2 + 36a - 42 = 4a^2 + 12a + 6$ $2a^2 + 24a - 48 = 0$ $a^2 + 12a - 24 = 0$ $(a+12)(a-2) = 0$ $a = -12$ or / of $a = 2$ invalid / *ongeldig*	If learner assumed that D and E lie on the straight line QPR do not award any marks. / *Indien leerder aanvaar het dat D en E op die reguit lyn QPR lê, moet daar geen punte toegeken word nie.* **OR/*OF***	✓ $\frac{-2+14}{3+3} = \frac{2a+2}{3a-3}$ ✓simplification / *vereenvoudiging* ✓ $a = 2$ (3) ✓ $\frac{2a+14}{3a+3} = \frac{-2+14}{3+3}$ ✓ simplification / *vereenvoudiging* ✓ $a = 2$ (3) ✓ $\frac{2a+14}{3a+3} = \frac{2a+2}{3a-3}$ ✓ simplification / *vereenvoudiging* ✓ $a = 2$ chosen / *gekies* (3)

[20]

QUESTION/*VRAAG* 4

4.1		
4.1.1	$x^2 + y^2 = 64$ **OR / *OF*** $x^2 + y^2 = 8^2$	✓ $x^2 + y^2 = 64$ **OR / *OF*** $x^2 + y^2 = 8^2$ (1)
4.1.2	$O\hat{A}B = 32{,}23°$ ($\angle$s on a str line / $\angle^e$ *op reguit lyn*) $O\hat{B}A = 90°$ (tan ⊥ radius **OR** tan ⊥ diameter / *raaklyn ⊥ radius*) $\sin 32{,}23° = \frac{OB}{OA}$ $\sin 32{,}23° = \frac{8}{OA}$ $OA = \frac{8}{\sin 32{,}23°}$ $= 15$ $\therefore A(-15;0)$	✓ $O\hat{A}B = 32{,}23°$ ✓ $\sin 32{,}23° = \frac{8}{OA}$ ✓ $OA = 15$ ✓ $A(-15;0)$ (4)

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4.2		
4.2.1	$x^2-10x+y^2+8y+31=0$ $(x-5)^2+(y+4)^2=-31+25+16$ $(x-5)^2+(y+4)^2=-31+25+16$ $(x-5)^2+(y+4)^2=10$	✓ $(x-5)^2+(y+4)^2$ ✓ $-31+25+16$ ✓ $(x-5)^2+(y+4)^2=10$ (3)
4.2.2	A(5;–4)	✓ A(5;–4) (1)
4.2.3	$r^2=10$ $r=\sqrt{10}$	✓ $r=\sqrt{10}$ (1)
4.2.4	$\frac{x_B+5}{2}=2$ and/*en* $\frac{y_B-4}{2}=-3$ $x_B=-1$ $y_B=-2$ $\therefore$ B(–1;–2)	✓ $\frac{x_B+5}{2}=2$ ✓ $\frac{y_B-4}{2}=-3$ ✓ B(–1;–2) (3)
4.2.5	$k=5-\sqrt{10}$ or / *of* $k=5+\sqrt{10}$ Any one of the two can be written first and then be allocated the two marks. / *Enigeen van die twee kan eerste geskryf word en dan die twee punte toegeken word.*	✓✓ $k=5+\sqrt{10}$ ✓ $k=5-\sqrt{10}$ (3)
4.2.6	$r^2=AF^2=10$ $AD=\sqrt{(11-5)^2+(-6+4)^2}$ $=\sqrt{36+4}$ $=\sqrt{40}$ $=2\sqrt{10}$ $A\hat{F}D=90°$ (radius ⊥ tangent / *raaklyn ⊥ radius*) $FD^2=AD^2-AF^2$ Pythagoras $=\left(\sqrt{40}\right)^2-\left(\sqrt{10}\right)^2$ $=30$ $FD=\sqrt{30}$	✓ $AF^2=10$ ✓ substitute in distance formula / *vervanging in afstandsformule* ✓ $AD=\sqrt{40}$ or $2\sqrt{10}$ ✓ $FD=\sqrt{30}$ (4)
		[20]

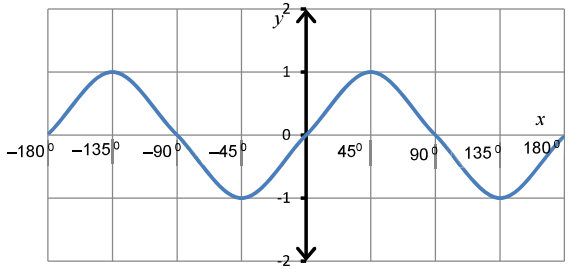
QUESTION/*VRAAG* 5

5.1	$\tan\theta=-\frac{1}{4}$ $\hat{O}_1=14{,}04°$ $\theta=360°-14{,}04°$ $=345{,}96°$	✓ $\tan\theta=-\frac{1}{4}$ ✓ $\hat{O}_1=14{,}04°$ ✓ 345,96° (3)
5.2	$\frac{2\cos(90°-x)}{\sin(180°-2x)}\times\frac{\cos(60°-x)\cos x-\sin(60°-x)\sin x}{\tan(-x)}$ $=\frac{2\sin x}{\sin 2x}\times\frac{\cos(60°-x+x)}{-\tan x}$ $=\frac{2\sin x}{2\sin x\cos x}\times\frac{\cos 60°}{-\frac{\sin x}{\cos x}}$ $=\frac{1}{\cos x}\times\frac{1}{2}\times-\frac{\cos x}{\sin x}$ $=-\frac{1}{2\sin x}$	✓ $2\sin x$ ✓ $\cos(60°-x+x)$ ✓ $\sin 2x$ ✓ $-\tan x$ ✓ $2\sin x\cos x$ ✓ $\frac{\sin x}{\cos x}$ ✓ $-\frac{1}{2\sin x}$ (7)
5.3.1	$\sin 108°=\sin(90°+18°)$ $=\cos 18°$ $=k$	✓ reduction/ *herleiding* ✓ k (2)
5.3.2	$\cos(-36)°=\cos 36°$ $=\cos 2(18°)$ $=2\cos^2 18°-1$ $=2k^2-1$	✓ $\cos 36°$ ✓ $2\cos^2 18°-1$ ✓ $2k^2-1$ (3)
5.4	$2\sin x\cos x+2\sin x+\cos^2 x+\cos x=0$ $2\sin x(\cos x+1)+\cos x(\cos x+1)=0$ $(\cos x+1)(2\sin x+\cos x)=0$ $\cos x=-1$ or / *of* $2\sin x=-\cos x$ $x=180°+k.360°$ or / *of* $2\tan x=-1$ $\tan x=-\frac{1}{2}$ $x=-26{,}57°+k.180°\quad k\in Z$ **OR / *OF*** ref$\angle=26{,}57°$ $x=153{,}43°+k.180°\quad k\in Z$ $x=\{-26{,}57°;153{,}43°;180°\}$	✓ common factor/ *gemeenskaplike faktor* ✓ $\cos x=-1$ ✓ $\tan x=-\frac{1}{2}$ ✓ 153,4° ✓ –26,57° ✓ 180° (6)

5.5.1	$\tan\theta = \frac{p}{1}$ $p^2 + y^2 = r^2$ $p^2 + 1 = r^2$ $r = \sqrt{p^2+1}$ $\sin 2\theta = 2\sin\theta\cos\theta$ $= 2\left(\frac{p}{\sqrt{p^2+1}}\right)\left(\frac{1}{\sqrt{p^2+1}}\right)$ $= \frac{2p}{p^2+1}$	✓ $r = \sqrt{p^2+1}$ ✓ $2\left(\frac{p}{\sqrt{p^2+1}}\right)\left(\frac{1}{\sqrt{p^2+1}}\right)$ (2)
5.5.2	$\frac{(p+1)^2}{p^2+1}$ $= \frac{p^2+2p+1}{p^2+1}$ $= \frac{2p}{p^2+1} + \frac{p^2+1}{p^2+1}$ $= \sin 2\theta + 1$ Maximum of / *Maksimum van* $\sin 2\theta$ is 1 Maximum of / *Maksimum van* $\frac{(p+1)^2}{p^2+1}$ will be 2	✓ $\frac{p^2+2p+1}{p^2+1}$ ✓ $\frac{2p}{p^2+1} + \frac{p^2+1}{p^2+1}$ **OR/*OF*** $\sin 2\theta + 1$ ✓ 2 (3) **[26]**

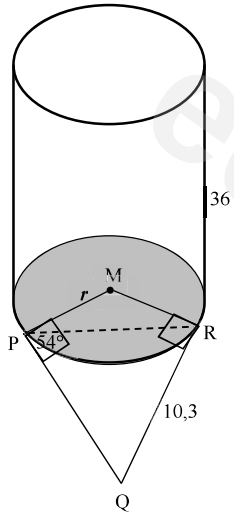
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QUESTION/*VRAAG* 6

6.1	$a = 1$ $b = 2$	✓ $a = 1$ ✓✓ $b = 2$ (3)
6.2		✓ *x*-intercepts/ *-afsnit* ✓ T/P ✓shape/*vorm* (3)
6.3	$x \in (45° ; 135°)$ **OR/*OF*** $45° < x < 135°$	✓ critical values / *kritiese waardes* ✓ correct interval / korrekte interval (2) **[8]**

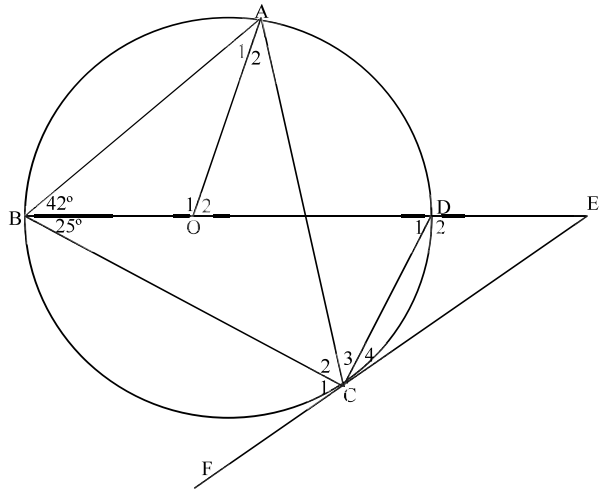
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QUESTION/*VRAAG* 7



7.1	PQ = PR (tangents from the same point / *raaklyne vanuit dies. punt*) $P\hat{R}Q = 54^\circ$ (∠'s opp. equal sides / ∠^{e} *teenoor gelyke sye*) $\hat{Q} = 180^\circ - (54^\circ + 54^\circ)$ (∠'s of a Δ / ∠^{e} *van Δ*) $= 72^\circ$	✓ $P\hat{R}Q = 54^\circ$ ✓ answer / *antwoord* (2)
7.2	$PR^2 = (10,3)^2 + (10,3)^2 - 2(10,3)(10,3)\cos 72^\circ$ $= 12,11$	✓substitution into correct cos rule / *vervanging na korrekte cos reël* ✓answer / *antwoord* (2)
7.3	MPQR is a cyclic quad. / *MPQR is 'n koordevierhoek* (opp. ∠'s sup) $\therefore \hat{M} = 108^\circ$ $(12,11)^2 = r^2 + r^2 - 2(r)(r)\cos 108^\circ$ $146,6521 = 2r^2 - 2r^2\cos 108^\circ$ $= 2r^2(1 - \cos 108^\circ)$ $r^2 = \frac{146,6521}{2(1-\cos 108^\circ)}$ $= 56,02$ Volume of/*van* silo = $\pi r^2 h$ $= \pi(56,02)(36)$ $= 6335,71 m^3$	✓ $\hat{M} = 108^\circ$ ✓ substitution into correct cos rule / *vervanging na korrekte cos reël* ✓answer / *antwoord* ✓substitution into correct volume formula/*vervanging na korrekte volume formule* ✓answer / *antwoord* (5) **[9]**

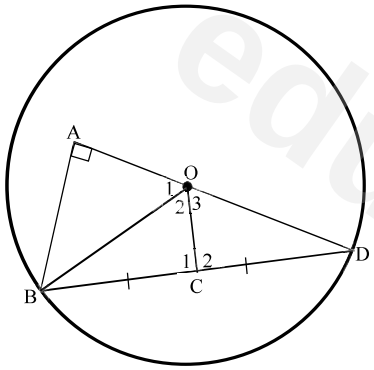
QUESTION/*VRAAG* 8



8.1	...centre / ...*middelpunt*		✓ answer / *antwoord* (1)
8.2.1	$B\hat{C}D = 90^\circ$	[∠ in semi ⊙ **OR** diameter subtends right angle **OR** ∠ *in semi ⊙* ***OF*** *deursnee onderspan rete hoek* ***OF*** ∠ in $\frac{1}{2}$⊙ / ∠ *in halwe ⊙* ***OF*** ∠ in $\frac{1}{2}$⊙]	✓ $B\hat{C}D = 90^\circ$ ✓R (2)
8.2.2	$\hat{A}_1 = 42^\circ$	[∠'s opposite equal radii / ∠^{e} teenoor gelyke radii]	✓ $\hat{A}_1 = 42^\circ$ ✓R (2)
8.2.3	$\hat{O}_2 = 84^\circ$	[∠ at centre = 2× ∠ at circumference / *Midpts∠ = 2 × Omtrek∠*]	✓ $\hat{O}_2 = 84^\circ$ ✓R (2)
8.2.4	$\hat{C}_4 = 25^\circ$	[tan chord theorem / *∠ tussen raaklyn en koord]*	✓ $\hat{C}_4 = 25^\circ$ ✓R (2) **[9]**

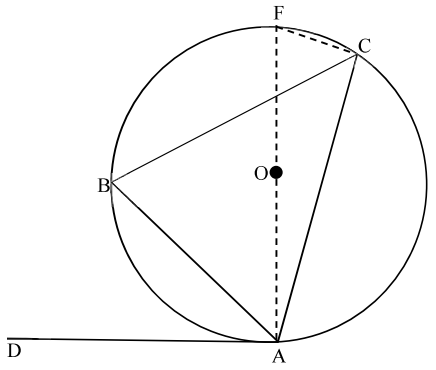
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QUESTION/*VRAAG* 9



9.1	$DA.OD = OD(OD + OA)$ $= OD^2 + OD.OA$		✓ $OD(OD + OA)$ (1)
9.2	In ΔDA and ΔDCO $\hat{D} = \hat{D}$ $\hat{C}_2 = 90^o$ $\hat{C}_2 = \hat{A}$ $\hat{B} = \hat{O}_3$ $\therefore \Delta DAB \|\|\| \Delta DCO$ [$\angle\angle\angle$] $\therefore \frac{DA}{DC} = \frac{AB}{CO} = \frac{DB}{DO}$ $DA.DO = DC.DB$ $OD^2 + OD.OA = DC.2DC$ $\therefore OD^2 + OD.OA = 2DC^2$	[common / *gemeenskaplik*] [line from centre to midpt of chord / *Midpt. O ; Midpt. koord*] / *lyn van middel tot midpunt van koord* [3rd $\angle^s$ of Δ / *3e $\angle^e$ van Δ*]	✓ S $\hat{D} = \hat{D}$ ✓ S $\hat{C}_2 = 90^o$ ✓R ✓ S $\hat{C}_2 = \hat{A}$ ✓ S $\hat{B} = \hat{O}_3$ ✓ $\frac{DA}{DC} = \frac{AB}{CO} = \frac{DB}{DO}$ ✓ $OD^2 + OD.OA = DC.2DC$ (7) **[8]**

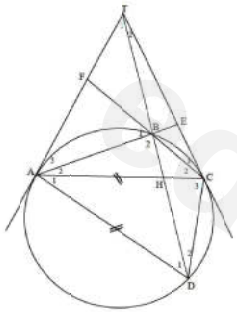
QUESTION/*VRAAG* 10



NB No construction: Breakdown 0/5

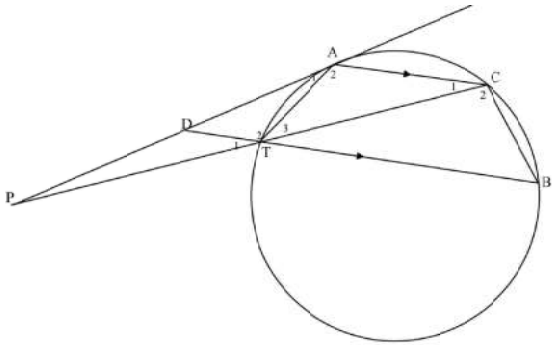
10. 1	***Construction***: Draw diameter AOF and join FC ***Konstruksie:*** *Teken middellyn AOF en verbind FC*		✓ Construction **on sketch**/ *Konstruksie* ***op skets*** ✓ S ✓ R
	$D\hat{A}F = 90^o$	[tan $\perp$ radius / tan $\perp$ diameter *raaklyn $\perp$ radius*]	✓ R
	$F\hat{C}A = 90^o$	[$\angle$ in semi *O* **OR** diameter subtends right angle **OR** $\angle$ in $\frac{1}{2}$ *O* / *$\angle$ in halwe O* ***OF*** $\angle$ in $\frac{1}{2}$ *O*]	✓ R
	$F\hat{A}B = F\hat{C}B$ $D\hat{A}B = B\hat{C}A$	[$\angle$s in the same seg / $\angle^e$ *in dies. O segm.*]	(5)

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10.2.1	$\hat{D} = \hat{C}_3$	[∠s opp equal sides / $\angle^e$ *teenoor gelyke sye*]	✓ S/R
	$\hat{D} = \hat{B}_1$	[exterior angle of a cyclic quad/ *buite ∠ van kvh*]	✓ S ✓ R
	$\hat{C}_3 = \hat{B}_2$	[∠s in the same segment / $\angle^e$ *in dies. O segm.*]	✓ S R
	$\hat{B}_1 = \hat{B}_2$		(5)
10.2.2	$\hat{C}_1 + \hat{C}_2 = \hat{D}$	[tan chord theorem /*∠tussen raaklyn en koord*]	✓ S/R
	but $\hat{D} = \hat{B}_2$	[proved]	✓ S
	$\therefore \hat{B}_2 = \hat{C}_1 + \hat{C}_2$		✓ S
	$\therefore$ BECH is a cyclic quad is 'n koordevierh	[exterior ∠ = int opp∠ **OR** converse of ext ∠ of cyclic quad / *buite ∠ van vierhoek = teenoorst. binne ∠*]	✓ R (4)
10.2.3	$\hat{B}_2 = \hat{A}_3 + \hat{T}_1$	[exterior ∠ of a triangle/ *buite ∠ van Δ*]	✓ S/R
	but $\hat{B}_2 = \hat{C}_1 + \hat{C}_2$ and AT = CT	[proved/ *bewys*] [tangents from the same point / *raaklyne vanuit dies. punt*]	✓ S/R ✓ S
	$\therefore \hat{C}_1 + \hat{C}_2 = \hat{A}_2 + \hat{A}_3$	[∠s opp equal sides / $\angle^e$ *teenoor gelyke sye*]	✓ S
	$\hat{A}_2 + \hat{A}_3 = \hat{A}_3 + \hat{T}_1$ $\therefore \hat{A}_2 = \hat{T}_1$	[∠ between line & chord **OR** converse of tan chord theorem / *∠ tussen lyn en koord = ∠ in teenoorst. O segm.*]	✓ R
	$\therefore$ CA is a tangent to circle ABT		(5) **[19]**

QUESTION/*VRAAG* 11



11.1	In ΔPAT and ΔPCA		
	$\hat{P} = \hat{P}$	[common / *gemeenskaplik*]	
	$\hat{A}_1 = \hat{C}_1$	[tan chord theorem / *∠ tussen raaklyn en koord*]	✓ S/R
	$\hat{T}_1 + \hat{T}_2 = \hat{A}_1 + \hat{A}_2$	[∠ sum in Δ **OR** sum of ∠s in Δ **OR** Int ∠s Δ / $\angle^e$ *van Δ*]	✓ S/R
	$\therefore$ ΔPAT ||| ΔPCA	[∠∠∠ **OR/** ***OF*** equiangular / *gelykhoeking* /∠∠∠]	✓ R (3)

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11.2.1	$\frac{PA}{PC} = \frac{AT}{CA} = \frac{PT}{PA}$ $PA^2 = PT.PC$ $6^2 = x(x+5)$ $36 = x^2 + 5x$ $x^2 + 5x - 36 = 0$ $(x+9)(x-4) = 0$ $\therefore x = -9$ or / *of* $x = 4$ $\therefore PT = 4$	$\Delta PAT \,|||\, \Delta PCA$	✓ S/R ✓ S ✓ substitution / *vervanging* ✓ factors / *faktore* (4)
11.2.2	In ΔAPC $\frac{PD}{PA} = \frac{PT}{PC}$ $\frac{PD}{6} = \frac{4}{9}$ $PD = \frac{(6)(4)}{9}$ $= \frac{8}{3} / 2{,}67$	[line ‖ one side of Δ **OR/*OF*** prop theorem; DT ‖ AC / *lyn ‖ een sy van* Δ]	✓ S ✓ R ✓ $\frac{PD}{6} = \frac{4}{9}$ ✓ answer /*antwoord* (4) **[11]**

TOTAL/*TOTAAL* [150]

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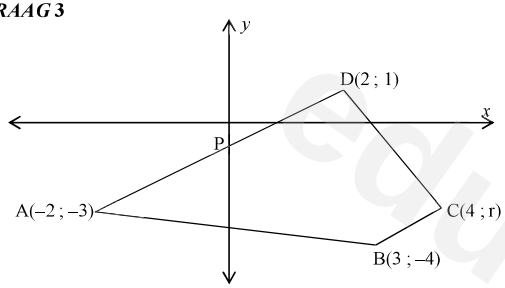
QUESTION / *VRAAG* 1

1.1	$a = 24$	✓✓ $a = 24$ (2)
1.2	100	✓ 100 (1)
1.3	$50 \le x < 60$	✓ answer (1)
1.4.1	$\bar{x} = \frac{24\times15+6\times25+8\times35+28\times45+34\times55}{100}$ $= 39{,}2$ Answer only 3/3	✓ numerator ✓✓ 39,2 (3)
1.4.2	$100 - 34$ $= 66$	✓ 34 ✓ 66 (2)
		[9]

QUESTION / *VRAAG* 2

2.1	$\sigma = 6{,}47$	✓ answer (1)
2.2	$\bar{x} = 14{,}5$ One standard deviation above the mean: $14{,}5 + 6{,}47$ $= 20{,}97$ Therefore a student needed to work for **21** hours	✓ $\bar{x} = 14{,}5$ ✓ 20,97 ✓ 21 hours (3)
2.3	$y = 454{,}38 + 131{,}42x$	✓ $a = 454{,}38$ ✓ $b = 131{,}42$ ✓ equation / *vergelyking* (3)
2.4	Payment when $x = 11{,}5$ / *Betaling wanneer* $x = 11{,}5$ $y = 454{,}38 + 131{,}42x$ **OR / OF** $= 454{,}38 + 131{,}42(11{,}5)$ by using the calculator $= \text{R}\,1965{,}71$ R 1 965,73 2 / 2 marks	✓ subst $x = 11{,}5$ / *vervang* $x = 11.5$ ✓ R1965,71 (2)
2.5	$(23\,;\,2700)$ The student could have done some of the work incorrectly and needed to redo work without any payment ***Any logical reason can be accepted***	✓ $(23\,;\,2700)$ ✓ reason (2)
		[11]

QUESTION / *VRAAG* 3

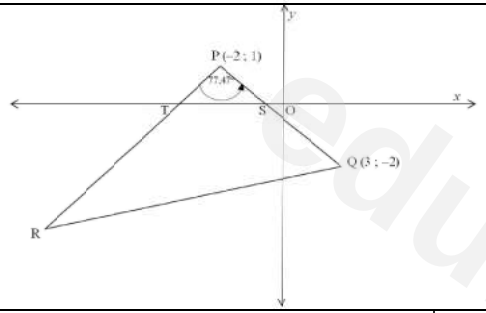


3.1.1	$m_{AD} = \frac{1-(-3)}{2-(-2)}$ $= 1$ $m_{AD} = m_{BC} = 1$ [AD ∥ BC] $1 = \frac{r-(-4)}{4-3}$ $1 = \frac{r+4}{1}$ $r + 4 = 1$ $r = -3$ **OR / OF** $m_{AD} = m_{BC}$ [AD ∥ BC] $\frac{1+3}{2+2} = \frac{r+4}{4-3}$ $r + 4 = 1$ $r = -3$	✓ $m_{AD} = 1$ ✓ $\frac{r-(-4)}{4-3}$ ✓ $r + 4 = 1$ ✓ value of r / *waarde van r* ✓ $m_{AD} = 1$ ✓ $\frac{r-(-4)}{4-3}$ ✓ $r + 4 = 1$ ✓ value of r / *waarde van r* (4)
3.1.2	Trapezium / *Trapesium*	✓ answer / *antwoord* (1)
3.1.3	$P\left(\frac{-2+2}{2}; \frac{-3+1}{2}\right)$ $= P(0 ; -1)$ **OR / OF** $y - 1 = 1(x - 2)$ $y = x - 1$ $P(0 ; -1)$	✓ $x = 0$ ✓ $y = -1$ (2)
3.1.4	$m_{PB} = \frac{-1-(-4)}{0-3}$ $= -1$ $m_{AD} \times m_{PB} = 1 \times -1$ $= -1$ $\therefore$ BP ⊥ AD	✓ $m_{PB} = -1$ ✓ product $= -1$ (2)

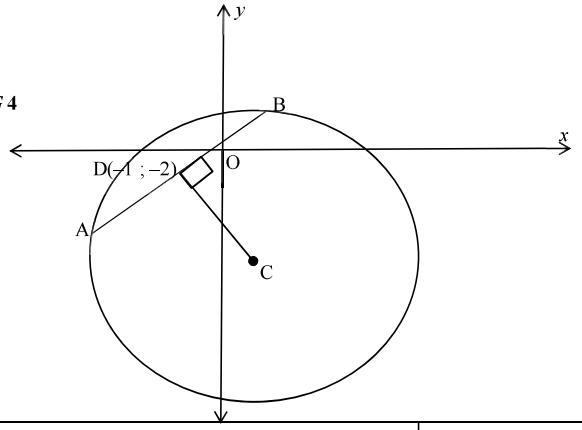
3.1.5	AB is a diameter / *middellyn* [$A\hat{P}B = 90°$] $AB = \sqrt{26}$ $r = \frac{\sqrt{26}}{2}$ $\therefore r^2 = \frac{26}{4}$ or $\frac{13}{2}$ midpoint of AB / *middelpunt van AB* $= \left(\frac{3-2}{2} ; \frac{-4-3}{2}\right)$ $= \left(\frac{1}{2} ; \frac{-7}{2}\right)$ $\therefore \left(x - \frac{1}{2}\right)^2 + \left(y + \frac{7}{2}\right)^2 = \frac{13}{2}$ **OR / *OF*** midpoint of AB / *middelpunt van AB* $= \left(\frac{3-2}{2} ; \frac{-4-3}{2}\right)$ $= \left(\frac{1}{2} ; \frac{-7}{2}\right)$ $r^2 = \left(\frac{1}{2} + 2\right)^2 + \left(-\frac{7}{2} + 3\right)^2$ or / *of* $r^2 = \left(0 - \frac{1}{2}\right)^2 + \left(-1 + \frac{7}{2}\right)^2$ $= \frac{25}{4} + \frac{1}{4}$ $= \frac{1}{4} + \frac{25}{4}$ $= \frac{13}{2}$ $= \frac{13}{2}$ $\therefore \left(x - \frac{1}{2}\right)^2 + \left(y + \frac{7}{2}\right)^2 = \frac{13}{2}$	✓ $r = \frac{\sqrt{26}}{2}$ ✓ $r^2 = \frac{13}{2}$ ✓ $\frac{1}{2}$ ✓ $-\frac{7}{2}$ ✓equation / *vergelyking* ✓ $\frac{1}{2}$ ✓ $-\frac{7}{2}$ ✓substitution into distance formula / *vervang in afstandformule* ✓ $r^2 = \frac{13}{2}$ ✓equation / *vergelyking* (5)
3.1.6	$x^2 + y^2 - 2x\cos\theta - 4y\cos\theta = -2$ $x^2 - 2x\cos\theta + y^2 - 4y\cos\theta = -2$ $(x - \cos\theta)^2 + (y - 2\cos\theta)^2 = -2 + \cos^2\theta + 4\cos^2\theta$ $r^2 = -2 + \cos^2\theta + 4\cos^2\theta$ $= -2 + 5\cos^2\theta$ For any value of θ the maximum of $\cos^2\theta = 1$ $r^2 = -2 + 5$ Maximum value of $r = \sqrt{3}$	✓ $(x-\cos\theta)^2 + (y-2\cos\theta)^2$ ✓ $-2 + \cos^2\theta + 4\cos^2\theta$ ✓ $r^2 = -2 + 5\cos^2\theta$ ✓ max of $\cos^2\theta = 1$ ✓ $r = \sqrt{3}$ (5)

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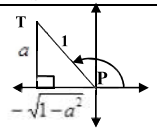
3.2		
3.2.1	$m_{PQ} = \frac{-2-1}{3+2}$ $= -\frac{3}{5}$ $y-1 = -\frac{3}{5}(x+2)$ or / *of* $-2 = -\frac{3}{5}(3)+c$ $5y-5 = -3x-6$ $-2 = -\frac{9}{5}+c$ $3x+5y+1=0$ $c = -\frac{1}{5}$ $y = -\frac{3}{5}x - \frac{1}{5}$ $3x+5y+1=0$	✓gradient of PQ / *gradiënt van PQ* ✓sub P, Q and / *en* m ✓equation / *vergelyking* (correct form) (3)
3.2.2	$\tan P\hat{S}O = m_{PQ}$ $= -\frac{3}{5}$ $P\hat{S}O = 180^\circ - 30,96^\circ$ $= 149,04^\circ$ $P\hat{T}S = 149,04^\circ - 77,47^\circ$ [ext ∠ of Δ]/ *[buite ∠ van Δ]* $= 71,57^\circ$ $m_{PR} = \tan 71,57^\circ$ $= 3$ $y-1 = 3(x+2)$ or/*of* $1 = 3(-2)+c$ $y = 3x+7$ $y = 3x+7$	✓ $\tan P\hat{S}O = -\frac{3}{5}$ ✓ $P\hat{S}O = 149,04^\circ$ ✓ $P\hat{T}S = 71,57^\circ$ ✓ $m_{PR} = 3$ ✓sub P(–2;1) and / *en* m ✓equation /*vergelyking* (correct form) (6) **[28]**

QUESTION / *VRAAG* 4



4.1	$x^2+y^2+6y-4x = 12$ $(x-2)^2+(y+3)^2 = 12+4+9$ $(x-2)^2+(y+3)^2 = 25$ C(2 ; –3) Answer only 3 / 3	✓ $(x-2)^2+(y+3)^2$ ✓✓ C(2 ; –3) (3)
4.2	$r = 5$	✓ $r = 5$ (1)
4.3	$DC^2 = (2+1)^2+(-3+2)^2$ $= 9+1$ $= 10$ $BC^2 = 25$ (radius) $DB^2 = BC^2 - DC^2$ (Pyth) $= 25-10$ $= 15$ $DB = \sqrt{15}$ $AB = 2\sqrt{15}$ or / *of* 7,75	✓sub into distance formula / *vervang in afstandformule* ✓ $DC^2 = 10$ ✓sub into / *in* Pythagoras ✓ $DB = \sqrt{15}$ ✓ $AB = 2\sqrt{15}$ or / *of* 7,75 (5)
4.4	$\text{Area} = \frac{1}{2}(AB)(DC)$ $= \frac{1}{2}\left(2\sqrt{15}\right)\left(\sqrt{10}\right)$ $= 5\sqrt{6}$ / 12,25	✓ area formula / *oppervlakte formule* ✓ substitution / *vervanging* (ca from / *van* 4.2) ✓ answer / *antwoord* (3) **[12]**

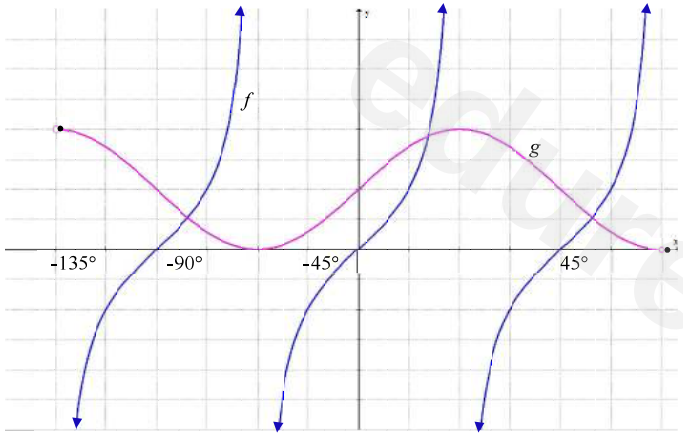
QUESTION / *VRAAG* 5

5.1	$\frac{\sin x.\sin(90°+y)-\cos x.\sin(180°+y)}{\cos x.\cos(y-360°)+\sin(-x)\sin y}$ $=\frac{\sin x.\cos y-\cos x.(-\sin y)}{\cos x.\cos y+(-\sin x).\sin y}$ $=\frac{\sin x.\cos y+\cos x.\sin y}{\cos x.\cos y-\sin x.\sin y}$ $=\frac{\sin(x+y)}{\cos(x+y)}$ $=\tan(x+y)$	✓ $\cos y$ ✓ $-\sin y$ ✓ $\cos y$ ✓ $-\sin x$ ✓ $\frac{\sin(x+y)}{\cos(x+y)}$ ✓ $\tan(x+y)$ (6)
5.2.1	$\cos(A+B)$ $=\cos(A-(-B))$ $=\cos A\cos(-B)+\sin(A)\sin(-B)$ $=\cos A\cos B-\sin A\sin B$ $=RHS$	✓ $\cos(A-(-B))$ ✓subst $B\rightarrow -B$ (2)
5.2.2 (a)	 $x^2+y^2=r^2$ $x^2=-\sqrt{1-a^2}$ $T\left(-\sqrt{1-a^2}\,;a\right)$	✓ Pythagoras ✓ $T\left(-\sqrt{1-a^2}\,;a\right)$ (2) Answer only 2/2
5.2.2 (b)	$R\left(-\sqrt{1-a^2}\,;-a\right)$	✓✓ $R\left(-\sqrt{1-a^2}\,;-a\right)$ (2)
5.2.2 (c)	$\cos(P+Q)=\cos P\cos Q-\sin P\sin Q$ $=\left(-\sqrt{1-a^2}\right)\left(-\sqrt{1-a^2}\right)-(a)(-a)$ $=1-a^2+a^2$ $=1$	✓$\left(-\sqrt{1-a^2}\right)\left(-\sqrt{1-a^2}\right)$ $-(a)(-a)$ ✓1 (2)
5.2.2 (d)	$\cos 360°=1$ $\hat{P}+\hat{Q}=360°\ ;\ \hat{P}>90^{\circ\circ}\ ;\ \hat{Q}>180^{\circ\circ}$	✓answer (1)

5.3.1	$-1\le d\le 1$ or / *of* $[-1\ ;\ 1]$	✓✓ answer / *antwoord* (2)
5.3.2	$\cos\theta=\frac{1}{\cos\theta}+\frac{5}{6}$ $6\cos^2\theta=6+5\cos\theta$ $6\cos^2\theta-5\cos\theta-6=0$ $(3\cos\theta+2)(2\cos\theta-3)=0$ $\cos\theta=-\frac{2}{3}$ or $\cos\theta=\frac{3}{2}$ no solution/geen oplossing $\theta=\pm 131{,}81°+k.360°\ ;\ k\in Z$ **OR / *OF*** $\theta=180°-48{,}19°+k.360°$ or $\theta=180°+48{,}19°+k.360°$ $=131{,}81°+k.360°\ ;\ k\in Z$ $=228{,}19°+k.360°;\ k\in Z$	✓ $6\cos^2\theta-5\cos\theta-6=0$ ✓factors / *faktore* ✓ both solutions ✓ choosing $\cos\theta=-\frac{2}{3}$ ✓ $\theta=131{,}81°+k.360°$ ✓ $\theta=-131{,}81°+k.360°$ **OR / *OF*** $228{,}19°+k.360°$ If $k\in Z$ is omitted then subtract one mark / *As $k\in Z$ weggelaat is, trek een punt af* (6)
		[23]

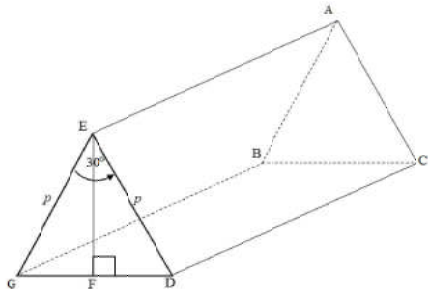
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QUESTION / *VRAAG* 6



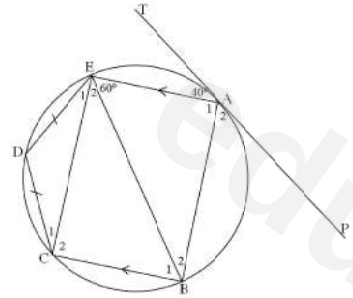
6.2	$x = -45°$	✓ $x = -45°$ (has to be an equation $x =$..) (1)
6.3	$h(x) = \dfrac{\sin x - 2\sin^3 x}{2\sin^2 x.\cos x}$ $= \dfrac{\sin x(1-2\sin^2 x)}{2\sin^2 x.\cos x}$ $= \dfrac{(1-2\sin^2 x)}{2\sin x.\cos x}$ $= \dfrac{\cos 2x}{\sin 2x}$ $= \dfrac{1}{\tan 2x}$ $= \dfrac{1}{f(x)}$	✓ $\sin x(1-2\sin^2 x)$ ✓ $\cos 2x$ ✓ $\sin 2x$ ✓ $\dfrac{1}{f(x)}$ (4)
6.3	$p(x) = 1+\sin 2(x+45°)$ $= 1+\sin(2x+90°)$ $= 1+\cos 2x$ Answer only 3/3	✓ $1+\sin 2(x+45°)$ ✓ $\sin(2x+90°)$ ✓ $1+\cos 2x$ (3)
6.4	$(\tan 2x).(-1-\sin 2x) \le 0$ $(\tan 2x).(1+\sin 2x) \ge 0$ $-90° \le x < -45°$ or $[-90° ; -45°)$	✓ $(\tan 2x).(1+\sin 2x) \ge 0$ ✓ $-90° \le x$ ✓ $x < -45°$ (3)
		[11]

QUESTION / *VRAAG* 7

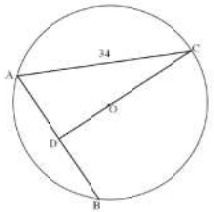
7.1	 $GD^2 = EG^2 + ED^2 - 2EG.ED\cos G\hat{E}D$ $= p^2 + p^2 - 2p.p\cos 30°$ $= 2p^2 - 2p^2\left(\dfrac{\sqrt{3}}{2}\right)$ $= 2p^2 - \sqrt{3}p^2$ $= p^2(2-\sqrt{3})$	✓ correct substitution in cos-rule / *korrekte vervanging in cos-reël* ✓ $\dfrac{\sqrt{3}}{2}$ ✓ simplification / *vereenvoudiging* $2p^2 - \sqrt{3}p^2$ (3)
7.2	In ΔCDG $\dfrac{CD}{GD} = \tan C\hat{G}D$ $CD = GD.\tan 60°$ $= \sqrt{p^2(2-\sqrt{3}).\sqrt{3}}$ $= \sqrt{p^2(2-\sqrt{3}).3}$ $= p\sqrt{6-3\sqrt{3}}$	✓ $\dfrac{CD}{GD} = \tan C\hat{G}D$ ✓ $\sqrt{p^2(2-\sqrt{3})}$ ✓ $\sqrt{3}$ (3)
		[6]

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QUESTION / *VRAAG* 8

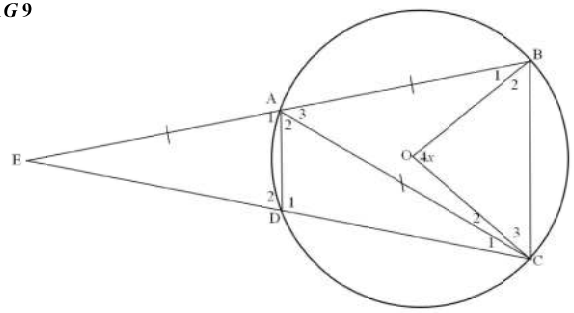


8.1	EABC EBCD	✓ EABC ✓ EBCD (2)
8.2.1	$\hat{B}_2 = 40°$ [tan chord theorem / *∠ tussen raaklyn en koord*]	✓S✓R (2)
8.2.2	$\hat{B}_1 = 60°$ [alt $\angle^s$; AE ∥ BC] / *verw. binne* $\angle^e$; AE ∥ BC	✓S ✓R (2)
8.2.3	$\hat{D} = 120°$ [opp $\angle^s$ of a cyclic quad / *teenoorst.* $\angle^e$ *van kvh*]	✓S✓R (2)
8.2.4	$\hat{E}_1 = \hat{C}_1$ [$\angle^s$ opp equal sides / $\angle^e$ *teenoor gelyke sye*] $\hat{E}_1 = 30°$ [sum of $\angle^s$ of a Δ / *som* $\angle^e$ *van Δ* / $\angle^e$ *van Δ*]	✓S ✓S ✓R (3)



8.3	AD = 20 $A\hat{D}C = 90°$ [line from centre to midpoint of chord / *midpt. ⊙; midpt. koord* ***OF*** *lyn van midpt ⊙ na midpt van koord*] $\sin\hat{C} = \frac{20}{34}$ $\sin\hat{C} = 0{,}588$ $\hat{C} = 36{,}03°$ **Accept 36°**	✓AD = 20 ✓ R ✓$\sin\hat{C} = \frac{20}{34}$ ✓$\hat{C} = 36°$ (4)
		[15]

QUESTION / *VRAAG* 9

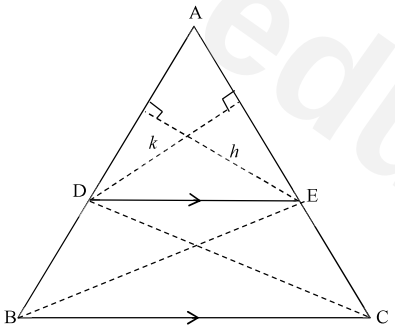


9.1	In ΔOBC $\hat{B}_2 = \hat{C}_3$ ($\angle$'s opposite equal radii / $\angle^e$ *teenoor gelyke radii*) $\hat{B}_2 = 90° - 2x$ (sum of $\angle$'s of a Δ // *som* $\angle^e$ *van Δ* / $\angle^e$ *van Δ*)	✓ S / R ✓ $\hat{B}_2 = 90° - 2x$ (2)
9.2	$\hat{A}_3 = 2x$ ($\angle$ at centre = 2 × $\angle$ at circumference *midpts* $\angle = 2 \times$ *omtreks* $\angle$) $\hat{A}_3 = \hat{C}_1 + \hat{E}$ (ext. $\angle$ of a Δ / *buite* $\angle$ *van* Δ) but/*maar* AB = AC = AE (given / *gegee*) $\hat{C}_1 = \hat{E}$ ($\angle$'s opp equal sides / $\angle^e$ *teenoor gelyke sye*) $\therefore \hat{E} = x$	✓ S✓R ✓ S ✓ S ✓ $\hat{E} = x$ (5)
9.3	$\hat{B}_1 + \hat{B}_2 = \hat{C}_2 + \hat{C}_3$ ($\angle$'s opp equal sides / $\angle^e$ *teenoor gelyke sye*) $\hat{B}_1 = \hat{C}_2 = 180° - (2x + 90° - 2x + 90° - 2x)$ (sum of $\angle$'s of a Δ / *som* $\angle^e$ *van Δ* / $\angle^e$ *van Δ*) $\therefore \hat{C}_2 = x$	✓ S ✓ S ✓ S (3)
9.4	$\hat{A}_1 = \hat{C}$ (ext. $\angle$ of a cyclic quadrilateral / *buite* $\angle$ *van koordevier hoek*) $= 90° - 2x + x + x$ $\hat{A}_1 = 90°$ ED is a diameter of circle AED (line subtends 90° $\angle$ / converse of $\angle$ in a semi circle) ED *is 'n middellyn van sirkel AED (lyn onderspan* 90° $\angle$ *of omgekeerde van* $\angle$ *in halwe sirkel*)	✓ S ✓ R ✓ $\hat{A}_1 = 90°$ ✓ R (4)

[14]

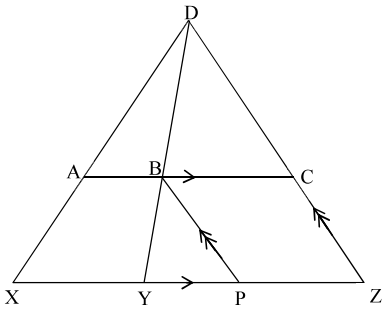
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QUESTION / *VRAAG* 10



10.1	Construction: In ΔADE, draw height h relative to base AD and height k relative to base AE. Join BE and DC to create ΔBDE and ΔCED. / *Konstruksie: In ΔADE, trek hoogte h relatief tot basis AD en die hoogte k relatief tot basis AE. Verbind BE en DC om ΔBDE en ΔCED te vorm.* Proof: / *Bewys:* $\frac{\text{Area } \Delta ADE}{\text{Area } \Delta BED} = \frac{\frac{1}{2}AD.h}{\frac{1}{2}BD.h} = \frac{AD}{DB}$ $\frac{\text{Area } \Delta ADE}{\text{Area } \Delta CED} = \frac{\frac{1}{2}AE.k}{\frac{1}{2}CE.k} = \frac{AE}{EC}$ but Area of ΔBED = Area of / *van* ΔCED [same base, same height / *dies. basis; dies. hoogte*] $\therefore \frac{\text{Area } \Delta ADE}{\text{Area } \Delta BED} = \frac{\text{Area } \Delta ADE}{\text{Area } \Delta CED}$ $\therefore \frac{AD}{DB} = \frac{AE}{EC}$	✓ construction / *konstruksie* ✓ S ✓ S ✓ S✓R ✓ S (6)

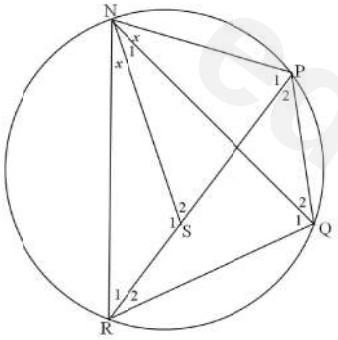
10.2



10.2	In ΔDXY: $\frac{DA}{DX} = \frac{DB}{DY}$	[line ‖ to one side of Δ *or* prop.theorem ; AB ‖ XY / *lyn ‖ een sy van Δ of ewer. stelling* ; AB ‖ XY]	✓ S✓R
	In DYZ: $\frac{ZP}{ZY} = \frac{DB}{DY}$	[line ‖ to one side of Δ *or* prop.theorem ; BC ‖ YZ / *lyn ‖ een sy van Δ of ewer. stelling* ; BC ‖ YZ]	✓ S
	$\frac{DA}{DX} = \frac{ZP}{ZY}$		✓ S
	ZP = BC	[opp. sides of a parm / *teenoorst sye van ‖^m*]	✓ S / R
	$\frac{BC}{YZ} = \frac{DA}{DX}$		(5) **[11]**

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QUESTION / *VRAAG* 11



11.1	In ΔNSR and ΔNPQ $R\hat{N}S = P\hat{N}Q$ [given /*gegee*] $\hat{R}_1 = \hat{Q}_2$ [$\angle^s$ in the same segment / *omtr* $\angle^e$ *in dies sirkel segm*] $\hat{S}_1 = N\hat{P}Q$ [sum of $\angle^s$ in a Δ / *som* $\angle^e$ *van* Δ / $\angle^e$ *van* Δ] $\therefore \Delta NRS \| \| \| \Delta NQP$ [$\angle,\angle,\angle$]	✓ S ✓S / R ✓ R (3)
11.2	In ΔNQR and ΔNPS $R\hat{N}Q = P\hat{N}S$ [$R\hat{N}S = P\hat{N}Q$] $\hat{Q}_1 = \hat{P}_1$ [$\angle^s$ in the same segment / *omtr* $\angle^e$ *in dies sirkel segm*] $\hat{R} = \hat{S}_2$ [sum of $\angle^s$ in a Δ / *som* $\angle^e$ *van* Δ / $\angle^e$ *van* Δ] $\therefore \Delta NQR \| \| \| \Delta NPS$ [$\angle,\angle,\angle$]	✓ S ✓ S ✓ R (3)
11.3	$\frac{QR}{PS} = \frac{NQ}{NP}$ [$\Delta NQR \| \| \| \Delta NPS$] $QR.NP = PS.NQ$ $\frac{NR}{NQ} = \frac{SR}{PQ}$ [$\Delta NRS \| \| \| \Delta NQP$] $NR.PQ = NQ.SR$ $NR.PQ + QR.NP = NQ.SR + PS.NQ$ $= NQ(SR + PS)$ $\therefore NR.PQ + NR.QR = NQ.PR$	✓ S / R ✓ S / R ✓ S ✓ S (4) **[10]**

TOTAL / *TOTAAL* **[150]**

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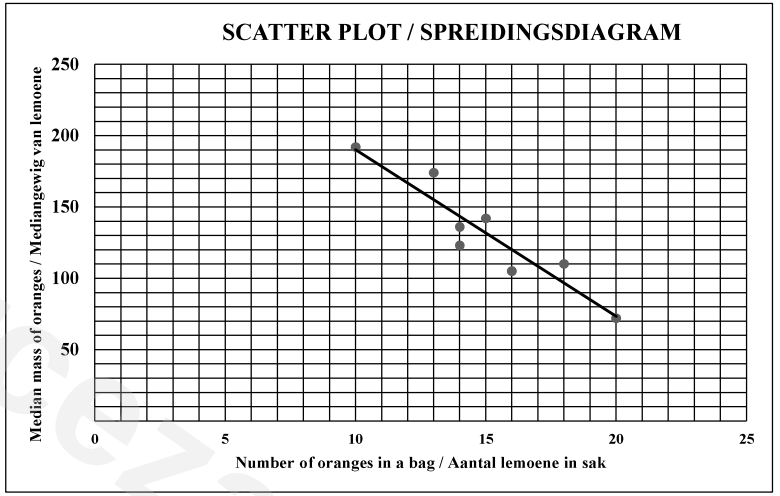
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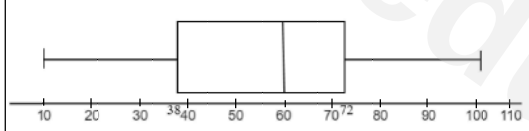
QUESTION / *VRAAG* 1

Number of oranges in the bag *Aantal lemoene in sak*	18	16	20	15	14	13	14	10
Median mass of oranges in the same bag (to the nearest gram) / *Mediaangewig van die lemoene in dieselfde sak (tot die naaste gram)*	110	105	72	142	123	174	136	192



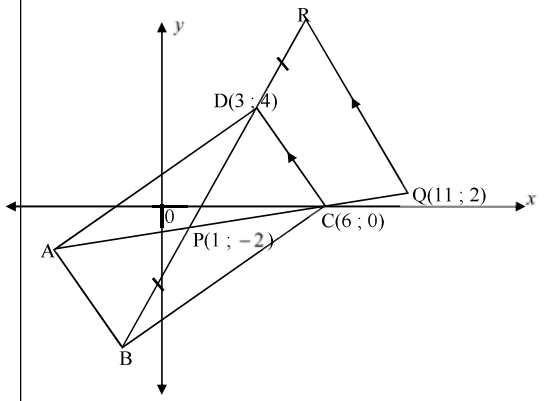
1.1	$a = 307{,}20$ $b = -11{,}70$ $\hat{y} = 307{,}20 - 11{,}7x$	✓ $a = 307{,}20$ ✓ $b = -11{,}70$ ✓ $\hat{y} = 307{,}20 - 11{,}7x$ (3)
1.2	$r = -0{,}93$	✓ $r = -0{,}93$ (1)
1.3	See scatter plot above/*sien spreidingsdiagram hierbo* (10 ; 190,2) (20 ; 73,2)	✓ (10 ; 190,2) ✓ (20 ; 73,2) (2)
1.4	Negative strong association / *Negatiewe sterk assosiasie*	✓answer / *antwoord* (1)
1.5	$\hat{y} = 307{,}20 - 11{,}7(12)$ $= 166{,}8$	✓substitution / *vervang* ✓answer / *antwoord* (2)
		[9]

QUESTION / *VRAAG* 2

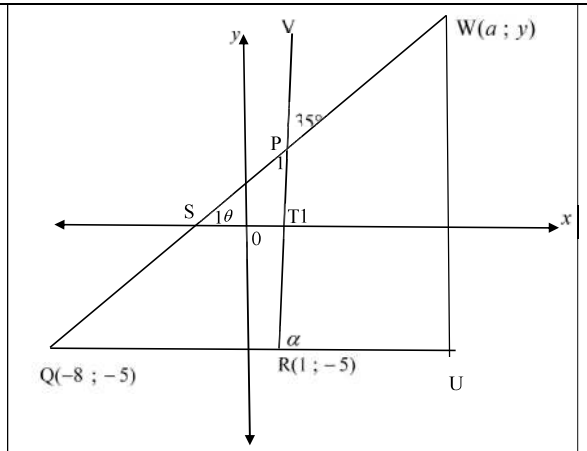
2.1.1	100	✓answer / *antwoord* (1)
2.1.2	Median / *Mediaan* = ±62	✓✓answer / *antwoord* (Accept / *Aanvaar* 61 / 62) (2)
2.1.3		✓ Q_1 = 37/38 ✓Q_3 = 72/73 ✓ Q_2 = 61/62 & min & max / *min & maks* (10 & 100) (3)
2.1.4	Skewed to the left / *Skeef na links*	✓ left / *links* (1)
2.2	$b = 20$ $\frac{d-a}{2} = 8$ $2a = d$ *sub* $\frac{2a-a}{2} = 8$ $a = 16$ $d = 32$ $5+16+19+20+c+32+35 = 7\times 22$ $\therefore c = 27$	✓$b = 20$ ✓$a = 16$ ✓$d = 32$ ✓$c = 27$ (4)
		[11]

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QUESTION / *VRAAG* 3

3.1		
3.1.1	$1 = \frac{3+x}{2}$ $\quad -2 = \frac{4+y}{2}$ $2 = 3+x$ $\quad -4 = 4+y$ $x = -1$ $\quad y = -8$ B(−1;−8)	✓$1 = \frac{3+x}{2}$ ✓$-2 = \frac{4+y}{2}$ ✓ B(−1;−8) (3)
3.1.2	$m_{CD} = \frac{0-4}{6-3}$ $= -\frac{4}{3}$	✓substitution into gradient formula / *vervang in gradient formule* ✓$m_{CD} = -\frac{4}{3}$ (2)
3.1.3	$y-2 = \frac{-4}{3}(x-11)$ $y = \frac{-4}{3}x + \frac{50}{3}$ **OR / *OF*** $y = \frac{-4}{3}x + c$ $2 = \frac{-4}{3}(11) + c$ $c = \frac{50}{3}$ $y = \frac{-4}{3}x + \frac{50}{3}$	✓substitute *m* /*vervang m* ✓substitute / *vervang* Q(11;2) (2)

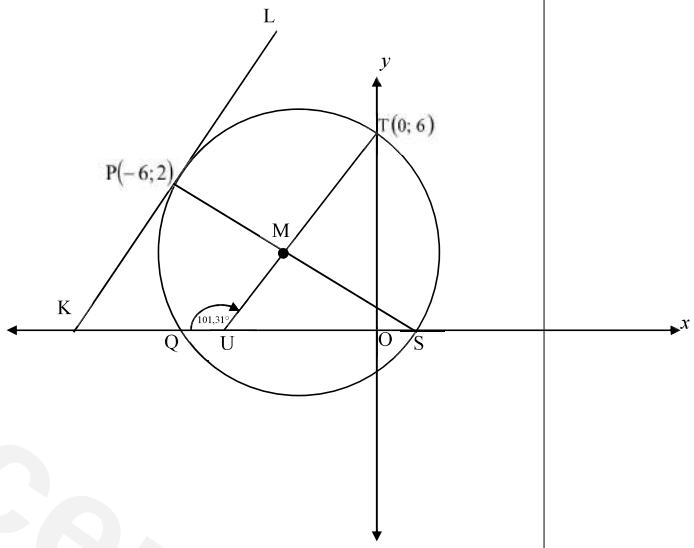
3.1.4	$CD = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$ **OR / *OF*** $R(5;10)$ midpoint / *middelpunt* $= \sqrt{(0-4)^2 + (6-3)^2}$ $RQ = \sqrt{(2-10)^2 + (11-5)^2}$ $= \sqrt{25}$ $RQ = 10$ $CD = 5$	✓CD = 5 **OR / *OF*** R(5 ; 10)
	D is the midpoint of PR / *D is die middelpunt van PR* C is the midpoint of PQ (line from midpoint of 1 side ‖ to 2nd side)/ *C is die middelpunt van PQ (lyn van middelpunt van 1 sy ‖ aan 2de sy)*	✓ statement / *bewering*
	$RQ = 2CD = 10$ (midpoint theorem/ *middelpuntstelling*)	✓RQ = 10
	$PK = RQ$ $\sqrt{(y+2)^2 + (4-1)^2} = 10$ $\sqrt{(y+2)^2 + (4-1)^2} = 10$ $(y+2)^2 + (4-1)^2 = 10^2$ $y^2 + 4y + 4 + 9 = 100$ $(y+2)^2 = 91$ **or / *of*** $y^2 + 4y - 87 = 0$ $y+2 = \pm\sqrt{91}$ $y = \frac{-4 \pm \sqrt{4^2 - 4(1)(-87)}}{2(1)}$ $y = \pm\sqrt{91} - 2$ $y = -11{,}54$ $y = \frac{-4 \pm \sqrt{364}}{2}$ **or / *of*** $y \neq 7{,}54$ $y = -11{,}54$ **or / *of*** $y \neq 7{,}54$	✓correct substitution into distance formula / *korrekte vervanging in die afstandsformule* ✓simplification / *vereenvoudiging* ✓ $y = -11{,}54$
		(6)

3.2		
3.2.1	$m_{PQ} = \tan\theta$ $\tan\theta = 1$ $\theta = 45°$ $\hat{P}_1 = 35°$ vertical opp ∠s / *regoorst ∠e* QR ‖ to the *x*-axis / *aan die x-as* $\hat{T}_1 = 35° + 45°$ ext ∠of Δ / *buite ∠ v Δ* $\hat{T}_1 = 80°$ $\alpha = \hat{T}_1 = 80°$ corr ∠s ST‖QR / *ooreenkomstige ∠e ST‖QR* **OR / *OF*** $m_{PQ} = \tan\theta$ $\tan\theta = 1$ $\theta = 45°$ QR ‖ to the *x*-axis / *aan die x-as* $\hat{S}_1 = \hat{Q} = 45°$ corr ∠'s ST‖QR / *ooreenkomstige ∠'e ST‖QR* $\hat{P}_1 = 35°$ vertical opp∠s / *regoorst ∠e* $\alpha = 35° + 45°$ $\alpha = 80°$ ext ∠of Δ / *buite ∠ v Δ*	✓ $m_{PQ} = \tan\theta$ ✓ $\theta = 45°$ ✓ $\hat{P}_1 = 35°$ ✓ $\hat{T}_1 = 80°$ ✓ $\alpha = \hat{T}_1 = 80°$ **OR / *OF*** ✓ $m_{PQ} = \tan\theta$ ✓ $\theta = 45°$ ✓ $\hat{S}_1 = \hat{Q} = 45°$ ✓ $\hat{P}_1 = 35°$ ✓ $\alpha = \hat{T}_1 = 80°$
		(5)

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3.2.2	x at/*by* U: $\frac{U_2+(-8)}{2}=1$ $\therefore U_x = 10$ units / *eenhede* QU = 18 units / *eenhede* x at/*by* W = x at / *by* U = 10 y at/*by* W: $y = 10+\frac{2}{3}$ $=\frac{32}{3}$ WU $= \frac{32}{3}+5=\frac{47}{3}$ $\therefore$ Area ΔQWU $= \frac{1}{2}(18)\left(\frac{47}{3}\right)$ $= 141$ square units / *eenhede kwadraat*	✓ $U_x = 10$ units / *eenhede* ✓ QU = 18 units / *eenhede* ✓ U = 10 ✓ WU $= \frac{47}{3}$ ✓ correct substitution in area formula / *korrekte vervanging in oppv. formule* ✓ 141 square units / *eenhede kwadraat* (6)
		[24]

QUESTION / *VRAAG* 4

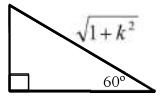


4.1	$T\hat{U}S = 180° - 101{,}31° = 78{,}69°$ adj supp ∠s / *aangrensende suppl* ∠e $m_{TU} = \tan 78{,}69° = 5$ $c = 6$ $y = 5x + 6$	✓ $T\hat{U}S = 78{,}69°$ ✓ $m_{TU} = 5$ ✓ $y = 5x + 6$ (3)
4.2	x – int / *afsnit* $y = 0$ $\frac{-1}{5}x+\frac{4}{5}=0$ $-x+4=0$ $x=4$ $\therefore$ S(4; 0) M $= \left(\frac{-6+4}{2};\frac{2+0}{2}\right)$ $\therefore$ M(−1; 1) **OR / *OF***	✓ S(4; 0) ✓ substitute correctly / *korrekte vervanging* ✓ M(−1; 1)

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	$5x+6=-\frac{1}{3}x+\frac{4}{5}$ $\frac{26}{5}x=-\frac{26}{5}$	✓ $5x+6=-\frac{1}{3}x+\frac{4}{5}$
	At M: $x=-1$	✓$x=-1$
	$y=-1$	✓$y=1$
	$\therefore$ M(−1;1) **CANDIDATE MUST SHOW CALCULATIONS TO GET MARKS IN THIS QUESTION / *KANDIDAAT MOET BEREKENINGS TOON OM PUNTE IN HIERDIE VRAAG TE VERDIEN***	(3)
4.3	$(x+1)^2+(y-1)^2=r^2$ $(-6+1)^2+(2-1)^2=r^2$	✓substitute / *vervang* (−6;2)
	$r^2=26$	✓$r^2=26$
	$(x+1)^2+(y-1)^2=26$	✓$(x+1)^2+(y-1)^2=26$
	OR / *OF*	**OR / *OF***
	$(x+1)^2+(y-1)^2=r^2$ $(4+1)^2+(0-1)^2=r^2$	✓substitute / *vervang* (4;0)
	$r^2=26$	✓$r^2=26$
	$(x+1)^2+(y-1)^2=26$	✓$(x+1)^2+(y-1)^2=26$ (3)
4.4	$m_{MP}=-\frac{1}{5}$ $m_{MP}\times m_{KL}=-1$	✓$m_{MP}=-\frac{1}{5}$
	$m_{KL}=5$ radius ⊥ tan / *radius ⊥ raaklyn*	✓$m_{KL}=5$
	$m_{TU}=5$ proven / *reeds bewys*	✓$m_{TU}=5$
	$\therefore m_{TU}=m_{KL}=5$ KL ∥ TU	(3)
4.5	$VM=\sqrt{\left(-1+\frac{1}{2}\right)^2+(1-7)^2}$	
	$=6{,}02$	✓ VM = 6,02
	radius $=\sqrt{26}=5{,}1$	
	$6{,}02>5{,}1$	✓6,02>5,1
	$\therefore V\left(-\frac{1}{2};7\right)$	
	does not lie within the circle./ *lê nie binnedie sirkel nie.*	✓conclusion / *gevolgtrekking* (3)
		[15]

QUESTION / *VRAAG* 5

5.1.1	$x^2=\left(\sqrt{1+k^2}\right)^2-(1)^2$ (Pythagoras) $x^2=k^2$ $x=k$ $\tan 16°=\frac{1}{k}$ 	✓ $x=k$ ✓ $\tan 16°=\frac{1}{k}$ (2)
5.1.2	$\cos 32°$ $=\cos 2(16°)$ $=2\cos^2 16°-1$ $=2\left(\frac{k}{\sqrt{1+k^2}}\right)^2-1$	✓$\cos 2(16°)$ ✓$2\cos^2 16°-1$ ✓correct substitution / *korrekte vervanging*
	OR / *OF*	**OR / *OF***
	$\cos 32°$ $=\cos 2(16°)$ $=\cos^2 16°-\sin^2 16°$ $=\left(\frac{k}{\sqrt{1+k^2}}\right)^2-\left(\frac{1}{\sqrt{1+k^2}}\right)^2$	✓$\cos 2(16°)$ ✓$\cos^2 16°-\sin^2 16°$ ✓correct substitution / *korrekte vervanging*
	OR / *OF*	**OR / *OF***
	$\cos 32°$ $=\cos 2(16°)$ $=1-2\sin^2 16°$ $=1-2\left(\frac{1}{\sqrt{1+k^2}}\right)^2$	✓$\cos 2(16°)$ ✓$1-2\sin^2 16°$ ✓correct substitution / *korrekte vervanging* (3)
5.2	$\frac{\cos(90°+x)\sin(x-180°)-\cos^2(180°-x)}{\cos(-2x)}$	
	$=\frac{(-\sin x)(-\sin x)-\cos^2 x}{\cos 2x}$	✓$-\sin x$ ✓$-\sin x$
	$=\frac{\sin^2 x-\cos^2 x}{\cos^2 x-\sin^2 x}$ **OR / *OF*** $\frac{-\cos 2x}{\cos 2x}$	✓$-\cos^2 x$ ✓$\cos 2x$
	$=\frac{-(\cos^2 x-\sin^2 x)}{\cos^2 x-\sin^2 x}$ $=-1$	✓$-(\cos^2 x-\sin^2 x)$ **OR / *OF*** $-\cos 2x$
	$=-1$	✓ -1 (6)

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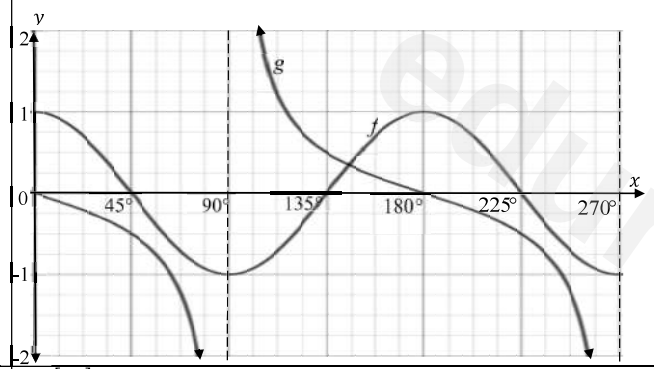
5.3	$\cos75°.\cos45° - \cos15°.\cos45°$ $= \cos75°.\cos45° - \sin75°.\sin45°$ $= \cos(75°+45°)$ $= \cos120°$ $= -\cos60°$ $= -\frac{1}{2}$ **OR / *OF*** $\cos75°.\cos45° - \cos15°.\cos45°$ $= \sin15°.\cos45° - \cos15°.\sin45°$ $= \sin(15°-45°)$ $= \sin(-30°)$ $= -\sin30°$ $= -\frac{1}{2}$	✓ $\cos75°.\cos45° - \sin75°.\sin45°$ ✓ $\cos(75°+45°)$ ✓ $-\cos60°$ ✓ $-\frac{1}{2}$ **OR / *OF*** ✓ $\sin15°.\cos45° - \cos15°.\sin45°$ ✓ $\sin(15°-45°)$ ✓ $-\sin30°$ ✓ $-\frac{1}{2}$ (4)
5.4.1	$\tan\theta\left(\sin2\theta + \frac{3\cos^2\theta}{\sin\theta}\right)$ $= \frac{\sin\theta}{\cos\theta}\left(2\sin\theta\cos\theta + \frac{3\cos^2\theta}{\sin\theta}\right)$ $= 2\sin^2\theta + 3\cos\theta$ $= 2(1-\cos^2\theta) + 3\cos\theta$ $= -2\cos^2\theta + 3\cos\theta + 2$	✓ $2\sin\theta\cos\theta$ and / *en* $\frac{\sin\theta}{\cos\theta}$ ✓ simplification / *vereenvoudiging* ✓ $1-\cos^2\theta$ (3)
5.4.2	$-2\cos^2\theta + 3\cos\theta + 2 = 0$ $2\cos^2\theta - 3\cos\theta - 2 = 0$ $(2\cos\theta+1)(\cos\theta-2) = 0$ $\cos\theta = -\frac{1}{2}$ **or / *of*** $\cos\theta = 2$ no solution / *geenoplossing* ref / *verwy* $\angle = 60°$ $\theta = \pm120° + k360°;\ k \in Z$ **OR / *OF*** $\theta = 120° + k360°; k \in Z$ $\theta = 240° + k360°; k \in Z$	✓ factors / *faktore* $(2\cos\theta+1)(\cos\theta-2)$ ✓ both equations / *beide vergelykings* $\cos\theta = -\frac{1}{2}$ **or / *of*** $\cos\theta = 2$ ✓ no solution / *geen oplossing* ✓ $\theta = \pm120° + k360°\ \ k \in Z$ **OR / *OF*** $\theta = 120° + k360°; k \in Z$ $\theta = 240° + k360°; k \in Z$ (4)

5.5	$\cos(a+b) = -\frac{\sqrt{2}}{2}$ ref ∠ / *verw* ∠ = 45° $a+b = 180° - 45°$ $a+b = 135°$ ..... (1)	✓ $a+b = 135°$
	$\cos(a-2b) = \frac{1}{2}$ ref ∠ / *verw* ∠ = 60° $a-2b = 60°$ ..... (2)	✓ $a-2b = 60°$
	$3b = 75°$ (1) − (2) $b = 25°$ $a = 110°$	✓ $b = 25°$ ✓ $a = 110°$ (4)
		[26]

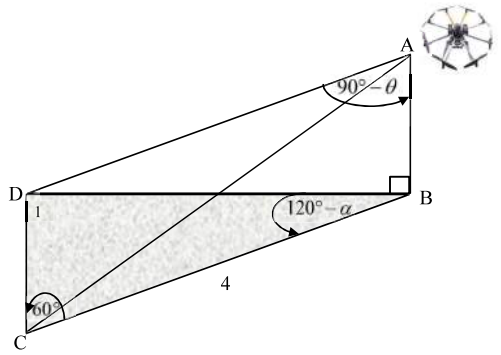
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QUESTION / *VRAAG* 6

6.1		✓ $\left(45°;-\frac{1}{2}\right)$ ✓ *x*-intercepts / *x-afsnitte* ✓shape / *vorm* ✓asymptotes / *asimptote* (4)
6.2	$y \in [2;4]$ **OR / *OF*** $2 \le y \le 4$	✓ $y \in [2;4]$ **OR / *OF*** $2 \le y \le 4$ (1)
6.3	$x \in [135°;180°]$ **OR / *OF*** $135° \le x \le 180°$ $x \in [225°;270°)$ **OR / *OF*** $225° \le x < 270°$	✓ $x \in [135°;180°]$ **OR / *OF*** $135° \le x \le 180°$ ✓ $x \in [225°;270°)$ **OR / *OF*** $225° \le x < 270°$ (2)
		[7]

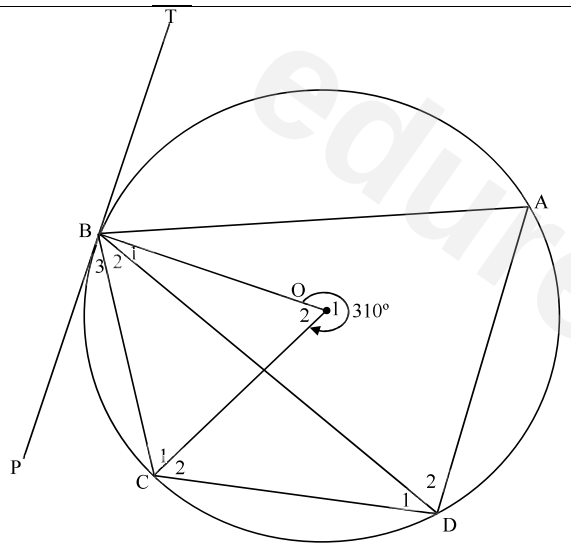
QUESTION / *VRAAG* 7



7.1	$\hat{D}_1 = 180° - 60° - (120° - \alpha)$ (sum of ∠s of Δ / *somvd ∠e v Δ*) $\hat{D}_1 = \alpha$	✓ $\hat{D}_1 = 180° - 60° - (120° - \alpha)$ ✓ $\hat{D}_1 = \alpha$ (2)
7.2	$\frac{BD}{\sin 60°} = \frac{4}{\sin\alpha}$ $BD\sin\alpha = 4\sin 60°$ $BD = \frac{4\left(\frac{\sqrt{3}}{2}\right)}{\sin\alpha}$ $BD = \frac{2\sqrt{3}}{\sin\alpha}$	✓substitution into correct sin rule / *vervang in korrekte sin reël* ✓simplification / *vereenvoudiging* ✓answer / *antwoord* (3)
7.3	In ΔADB : $A\hat{D}B = \theta$ (∠s of a Δ) $\frac{AB}{BD} = \tan\theta$ $AB = BD.\tan\theta$ $= \frac{2\sqrt{3}}{\sin\alpha}.\tan\theta$ $AB = \frac{2\sqrt{3}\tan\theta}{\sin\alpha}$	✓ $A\hat{D}B = \theta$ ✓trig ratio / *trig verhouding* ✓substitution of BD / *vervanging van BD* (3)
		[8]

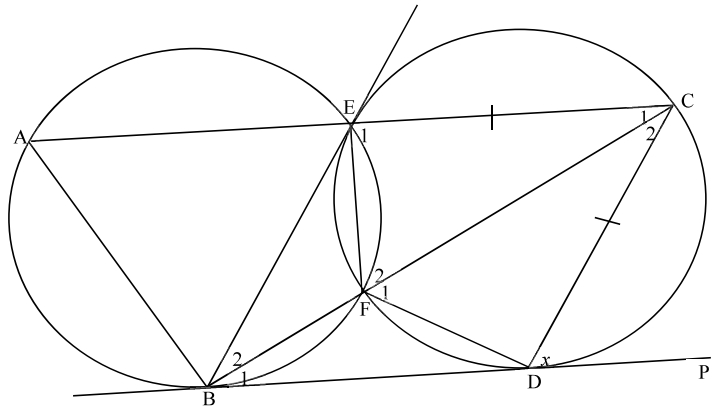
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QUESTION / *VRAAG* 8



8.1	$\hat{O}_2 = 50°$ $\hat{D}_1 = 25°$	$\angle s$ around a point / $\angle e$ *om 'n punt* $\angle$ centre $= 2\times\angle$ at circumference *midpts* $\angle = 2 \times$ *omtreks* $\angle$	✓ S ✓S ✓R (3)
8.2	$\hat{B}_3 = 25°$	tan chord theorem / *raaklyn koordstelling*	✓S ✓R (2)
8.3	$B\hat{C}D = 120°$ $\hat{B}_2 = 35°$ $O\hat{B}C = O\hat{C}B = 65°$ $\therefore \hat{B}_1 = 65°–35°$ $\hat{B}_1 = 30°$ **OR / *OF*** $B\hat{C}D = 120°$ $\hat{B}_2 = 35°$ $\hat{B}_1 + \hat{B}_2 + \hat{B}_3 = 90°$ $\hat{B}_1 = 30°$	opp $\angle s$ of a cyclic quad /*teenoorst* $\angle e$ *v kvh* sum of $\angle s$ of a triangle / *som* $\angle e$ *v* Δ $\angle s$ opp. equal radii / $\angle e$ *teenoor gelyke radiuse* **OR / *OF*** opp $\angle s$ of a cyclic quad/*teenoorst* $\angle e$ *vkvh* sum of $\angle s$ of a triangle / *som* $\angle e$ *v* Δ radius $\perp$ tangent / *radius* $\perp$ *raaklyn*	✓S / R ✓S ✓S ✓answer / *antwoord* ✓S / R ✓S ✓S ✓answer / *antwoord* (4)
			[9]

QUESTION / *VRAAG* 9

9.1	Equal / *gelyk.*		✓answer / *antwoord* (1)
9.2			
9.2.1	$\hat{D}_1 = \hat{F}_1 = x$ $\hat{F}_1 = \hat{F}_2 = x$	tan chord theorem / *raaklyn koordstelling* = chords subtend = $\angle s$ *= koorde onderspan =* $\angle e$	✓S / R ✓S ✓R (3)
9.2.2	$\hat{F}_2 = \hat{A} = x$ $\hat{D}_1 = \hat{A} = x$ ABDC is a cyclic quad / *ABDC is 'n kvh*	ext. $\angle$ of cyclic quad / *buite* $\angle$ *v kvh* ext $\angle$ = opp int $\angle$ **OR** converse of ext. $\angle$ of cyclic quad / *buite* $\angle$ *= oorst binne* $\angle$ ***OF*** *omgekeerde buite* $\angle$ *v kvh*	✓S ✓R ✓R (3)
9.2.3	$\hat{B}_1 + \hat{B}_2 = \hat{A}$ $\hat{A} = \hat{D}_1$ $\hat{B}_1 + \hat{B}_2 = \hat{D}_1$ BE ∥ CD	tan chord theorem / *raaklyn koordstelling* proved / *reeds bewys* correspond $\angle s$ = / *ooreenkomst* $\angle e$ =	✓S ✓R (2)

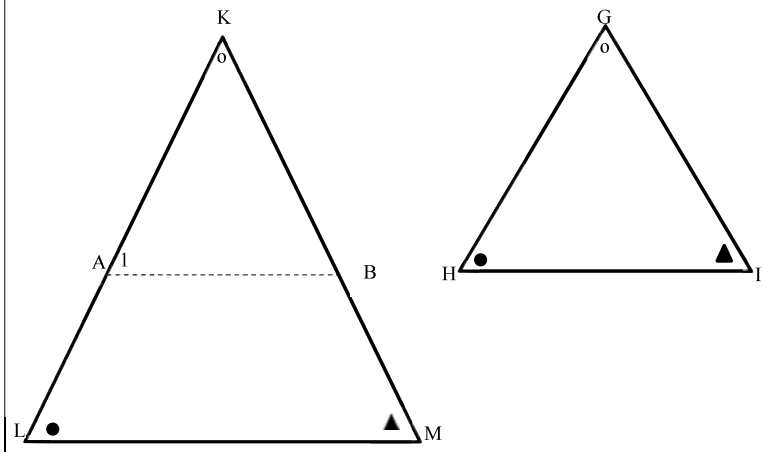
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9.2.4	$\hat{C}_1+\hat{C}_2+\hat{F}_1+\hat{F}_2=180°$	opp $\angle s$ of a cyclic quad / *teenoorst* $\angle e$ *v kvh*	✓S ✓R
	$\hat{C}_1=\hat{C}_2$	diag rhombus bisect $\angle$ / *diag ruit halveer* $\angle$	✓S
	$\hat{F}_1=\hat{F}_2$	proved / *reeds bewys*	
	$2\hat{C}_1+2\hat{F}_2=180°$		
	$\hat{C}_1+\hat{F}_2=90°$		✓S
	$\hat{E}_1=90°$	sum of $\angle s$ of Δ / *som van* $\angle e$ *v* Δ	
	FC is a diameter of circle FDCE. *FC is 'n middellyn van sirkel FDCE.*	converse $\angle$ in a semi circle / *omgekeerde* $\angle$ *in half sirkel*	✓R
	OR / *OF*		**OR / *OF***
	Let $\hat{F}_1=\hat{F}_2=x$	proved / *reeds bewys*	✓S
	$\hat{C}=180°-2x$	opp $\angle s$ of a cyclic quad / *teenoorst* $\angle e$ *v kvh*	✓R
	$\hat{C}_1=\hat{C}_2=90°-x$	diag rhombus bisect $\angle$ / *diag ruit halveer* $\angle$	✓S
	In ΔFDC **or / *of*** ΔEFC $\hat{D}=90°$ **or / *of*** $\hat{E}=90°$	sum of $\angle s$ of Δ / *som van* $\angle e$ *v* Δ	✓S
	FC is a diameter of circle FDCE. *FC is 'n middellyn van sirkel FDCE.*	converse $\angle$ in a semi circle / *omgekeerde* $\angle$ *in half sirkel*	✓R (5)
			[14]

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QUESTION / *VRAAG* 10

10.1

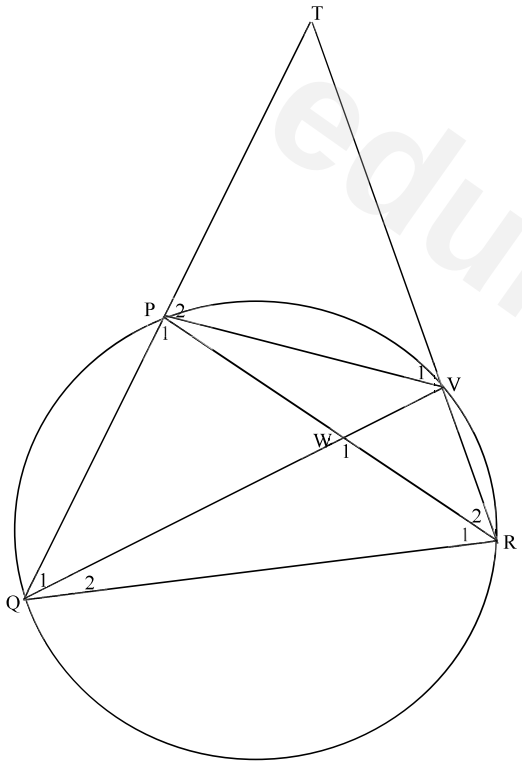


NB: NO construction 0 / 5 / *GEEN konstruksie 0 / 5*

On sides KL and KM of ΔKLM mark points A and B respectively such that KA = GH and KB = GI. Draw AB *Op sye KL en KM van* Δ*KLM plaas A en B onderskeidelik sodat KA = GH en KB = GI. Trek lyn AB.*		✓construction / *konstruksie*
Proof / Bewys		
In ΔGHI and/*en* ΔKAB		
$KA=GH$	construction / *konstruksie*	
$\hat{K}=\hat{G}$	given / *gegee*	
$KB=GI$	construction / *konstruksie*	
$\therefore \Delta GHI \equiv \Delta KAB$	S$\angle$S	✓S / R ΔGHI ≡ ΔKAB S$\angle$S
$\therefore \hat{A}_1=\hat{H}$		✓S
but $\hat{L}=\hat{H}$	given / *gegee*	
$\therefore \hat{A}_1=\hat{L}$		
$\therefore AB \parallel LM$	corr.$\angle$s = / *ooreenkoms.* $\angle e$=	✓R
$\frac{KL}{KA}=\frac{KM}{KB}$	line $\parallel$ one side Δ/*lyn* $\parallel$ *een sy v* Δ	✓S / R
$\therefore \frac{KL}{GH}=\frac{KM}{GI}$		(5)

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10.2



10.2.1

$\hat{R}_1 = 60°$	equilateral Δ / *gelyksydige* Δ	✓S
$\hat{W}_1 = \hat{P}_1 + \hat{Q}_1$	ext. $\angle$ of a Δ / *buite* $\angle$ *v* Δ	✓S
$= 60° + \hat{Q}_1$		
$= \hat{R}_1 + \hat{Q}_1$		
$\hat{Q}_1 = \hat{R}_2$	$\angle$s in the same segment/ *$\angle$e in dieselfde segment*	✓S / R
$\therefore \hat{W}_1 = T\hat{R}Q$		(3)

10.2.2

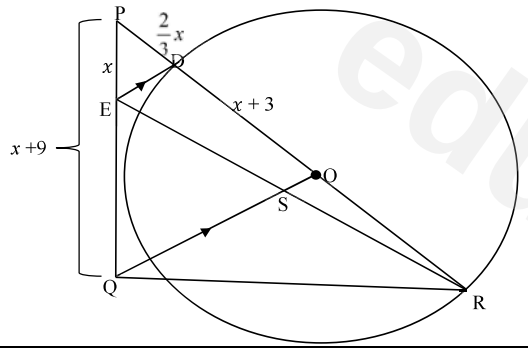
In ΔTQR and / *en* ΔQRV		
1. $\hat{W}_1 = T\hat{R}Q$	proved / *reedsbewys*	✓S
2. $\hat{R}_1 = T\hat{Q}R$	equilateral Δ / *gelyksydige* Δ	✓S
3. $\hat{Q}_2 = \hat{T}$	sum $\angle$s of Δ / *som van* $\angle$*e v* Δ	
$\therefore \Delta WRQ \|\|\| \Delta RQT$	$\angle\angle\angle$	✓R
		(3)

10.2.3

In ΔTPV and / *en* ΔWQR		
1. $P\hat{Q}R = \hat{R}_1$	both 60° / *albei* 60°	✓S
$P\hat{Q}R = \hat{V}_1$	ext. $\angle$ of a cyclicquad. / *buite* $\angle$ *v kvh*	✓S / R
$\hat{V}_1 = \hat{R}_1$		✓S
2. $\hat{P}_2 = T\hat{R}Q$	ext. $\angle$ of a cyclicquad. / *buite* $\angle$ *v kvh*	✓S
but / *maar* $\hat{W}_1 = T\hat{R}Q$	proved / *reedsbewys*	
$\hat{P}_2 = \hat{W}_1$		
3. $\hat{T} = \hat{Q}_2$	sum of $\angle$s of Δ / *som v* $\angle$*e v* Δ	✓S
$\Delta VPT \|\|\| \Delta RWQ$	$\angle\angle\angle$	✓R
$\frac{VP}{RW} = \frac{PT}{WQ} = \frac{VT}{RQ}$	corresponding sides in prop/ *ooreenkomstige sye in verhouding*	
$\therefore \frac{PT}{WQ} = \frac{PV}{WR}$		(6)
		[17]

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QUESTION / *VRAAG* 11



11.1	$\frac{PE}{EQ}=\frac{PD}{DO}$	line ‖ one side ΔPOQ **OR** prop theorem ED‖OQ / *lyn ‖ een sy* ΔPOQ ***OF*** *eweredigheid stelling ED‖OQ*	✓S ✓R	
	$\frac{x}{9}=\frac{\frac{2}{3}x}{x+3}$			
	$x^2+3x=6x$			
	$x^2-3x=0$			
	$x(x-3)=0$			
	$x=0$ or/*of* $x=3$			
	N.A / *n.v.t*		✓$x=3$	
	DO = 6			
	DO = OR	radii / *radiusse*		
	OR = 6 units / *eenhede*		✓OR = 6	(4)
11.2	S is the midpoint of RE / *S is die middelpunt van RE*			
	DE =2OS	midpoint theorem / *middelpunt stelling*	✓R	
	DE = 2,8 units / *eenhede*		✓answer	(2)
11.3	$\frac{\text{Area }\Delta PED}{\text{Area }\Delta PER}=\frac{PD}{PR}$	same height (DE) / *dieselfde hoogte (DE)*	✓S ✓R	
	$=\frac{2}{14}$			
	$=\frac{1}{7}$		✓$\frac{1}{7}$	
	Area ΔPER = 7 × Area ΔPED			
	= 18,9 units^2 / *eenhede*^{2}		✓18,9	(4)
				[10]

TOTAL / *TOTAAL* [150]

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MATHEMATICS (PAPER 2) (10612)
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NOTE:
- If a candidate answers a question TWICE, mark only the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out version.
- Consistent accuracy applies in ALL aspects of the marking guidelines. Stop marking at the second calculation error.
- Assuming answers/values in order to solve a problem is NOT acceptable.

LET WEL:
- *As 'n kandidaat 'n vraag TWEE KEER beantwoord, sien slegs die EERSTE poging na.*
- *As 'n kandidaat 'n antwoord van 'n vraag doodtrek en nie oordoen nie, sien die doodgetrekte poging na.*
- *Volgehoue akkuraatheid word in ALLE aspekte van die nasienriglyne toegepas. Hou op nasien by die tweede berekeningsfout.*
- *Aannames van antwoorde/waardes om 'n probleem op te los, word NIE toegelaat nie.*

GEOMETRY / *MEETKUNDE*	
S	A mark for a correct statement (A statement mark is independent of a reason.)
	'n Punt vir 'n korrekte bewering *('n Punt vir 'n bewering is onafhanklik van die rede.)*
R	A mark for a correct reason (A reason mark may only be awarded if the statement is correct.)
	'n Punt vir 'n korrekte rede *('n Punt word slegs vir die rede toegeken as die bewering korrek is.)*
S / R	Award a mark if the statement AND reason are both correct.
	(Ken 'n punt toe as beide die bewering EN rede korrek is.)

QUESTION / *VRAAG* 1

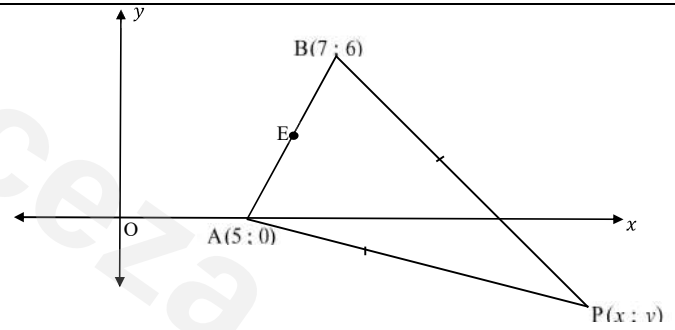
1.1	$\bar{x} = \frac{1\,581}{31}$ $= 51$ **OR / *OF*** $\bar{x} = 51$ (calculator method / *sakrekenaar metode*)	✓$\frac{1\,581}{31}$ ✓ 51 **OR / *OF*** ✓✓51 (2)
1.2	∴ skewed to the right (positevely skewed) *∴ skeef na regs (positief skeef)*	✓ answer / *antwoord* (1)
1.3	Physical Sciences performed better. Q_1 is 40% in Physical Sciences and 28% in Mathematics which indicates the lower 25% of the class performed much better in Physical Sciences than in Mathematics. *Fisiese Wetenskappe presteer beter.* *Q_1 is 40% in Fisiese Wetenskappe en 28% in Wiskunde wat aandui dat die onderste 25% van die klas heelwat beter presteer in Fisiese Wetenskappe as in Wiskunde.*	✓ answer / *antwoord* ✓ reason / *rede* (2)
1.4	Accept any mark between 40 – 50. *Aanvaar enige punt tussen 40 – 50 .*	✓✓ answer / *antwoord* (2)
1.5	The greatest difference is 87%−71%=16% ∴ the Physical Sciences mark is 71%. *Die grootste verskil is* 87%−71%=16% *∴ die Fisiese Wetenskappe punt is* 71%.	✓ 87%−71%=16% ✓ answer / *antwoord* **answer only full marks /** ***antwoord alleenlik volpunte*** (2)
		[9]

QUESTION / *VRAAG* 2

2.1	$a = 12{,}41$ $b = 0{,}49$ $\hat{y} = 12{,}41 + 0{,}49x$	✓ $a = 12{,}41$ ✓ $b = 0{,}49$ ✓ $\hat{y} = 12{,}41 + 0{,}49x$ (3)
2.2	$\hat{y} = 12{,}41 + 0{,}49x$ $= 12{,}41 + 0{,}49(150)$ $= 85{,}91 \approx 86\%$ **OR/OF** $\hat{y} = 85{,}17$	✓substitution / *vervanging* ✓ answer / *antwoord* **OR/OF** ✓✓ $\hat{y} = 85{,}17$ (2)
2.3	$\hat{y} = 12{,}41 + 0{,}49x$ The y-intercept is 12,41 which means that a learner who did not begin the exam achieved 12,41%. This is clearly impossible. *Die y-afsnit is 12,41 wat beteken dat 'n leerling wat die eksamen nie begin het nie, alreeds12,41% behaal het. Dit is onmoontlik.*	✓conclusion / *gevolgtrekking* (1)

2.4	10,28	✓✓10,28 (2)
2.5	$63{,}9 - \sigma = p$ $63{,}9 + \sigma = 103{,}59$ $127{,}92 = p + 103{,}59$ $p = 24{,}33$ **OR / *OF*** $\sigma = 103{,}59 - 63{,}96$ $= 39{,}63$ $p = 63{,}96 - 39{,}63$ $= 24{,}33$	✓ $63{,}9 - \sigma = p$ ✓ $63{,}9 + \sigma = 103{,}59$ ✓ $p = 24{,}33$ **OR / *OF*** ✓ $\sigma = 39{,}63$ ✓ $63{,}96 - 39{,}63$ ✓ $p = 24{,}33$ (3)
		[11]

QUESTION / *VRAAG* 3



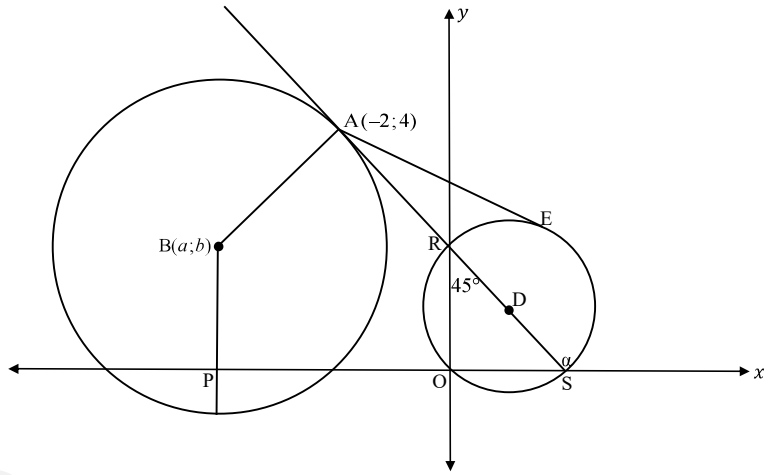
3.1	$E\left(\frac{12}{2}; \frac{6}{2}\right)$ E(6 ; 3)	✓6 ✓3 (2)
3.2	$m_{BA} = \frac{6-0}{7-5}$ $= 3$ $y = mx + c$ $y = 3x + c$ $6 = 3(7) + c$ $c = -15$ $y = 3x - 15$ **OR / *OF*** $y - y_1 = m(x - x_1)$ $y - 6 = 3(x - 7)$ $y = 3x - 21 + 6$ $y = 3x - 15$	✓ $m_{BA} = 3$ ✓substitution of m and (7 ; 6) / (5 ; 0) *Vervanging van m en* (7 ; 6) / (5 ; 0) ✓ $y = 3x - 15$

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	$y=mx+c$ $y=3x+c$ $0=3(5)+c$ **OR / *OF*** $y-y_1=m(x-x_1)$ $c=-15$ $y-0=3(x-5)$ $y=3x-15$ $y=3x-15$	(3)

3.3	$rx-3y+5=0$ $-3y=-rx-5$ $y=\frac{r}{3}x+\frac{5}{3}$ $3=\frac{r}{3}$ $r=9$	✓standard form / *standaardvorm* ✓ $3=\frac{r}{3}$ ✓ $r=9$ (3)
3.4	Area $\Delta AOP=10$ $\frac{1}{2}\times AO\times \perp h=10$ $\frac{1}{2}\times 5\times \perp h=10$ $\perp h=4$ but / *maar* $y<0$ $\therefore y=-4$ $AP=BP$ $AP^2=BP^2$ $(x-5)^2+(-4-0)^2=(x-7)^2+(-4-6)^2$ $x^2-10x+25+16=x^2-14x+49+100$ $4x=108$ $x=27$ P (27 ; –4)	✓ $\frac{1}{2}\times 5\times \perp h=10$ ✓ $\perp h=4$ ✓ $y=-4$ ✓ $(x-5)^2+(-4-0)^2$ and / *en* $(x-7)^2+(-4-6)^2$ ✓equate the two lengths / *gelykstel van die twee lengtes* ✓ $4x=108$ ✓ $x=27$ (7)
		[15]

QUESTION / *VRAAG* 4



4.1	$\alpha=135°$ ext $\angle$of Δ / *buite* $\angle$*van* Δ $\tan(135°)=m$ $m=-1$ $y=mx+c$ $y=-1x+c$ $4=-1(-2)+c$ **OR / *OF*** $y-4=-1(x+2)$ $c=2$ $y=-1x-2+4$ $y=-x+2$ $y=-x+2$	✓ $\tan(135°)=m$ ✓ $m=-1$ ✓substitute m and $(-2;4)$ / *vervang m en* $(-2;4)$ ✓ equation / *vergelyking* (4)
4.2	$P(-4;0)$ $a=-4$ $m_{BA}.m_{AS}=-1$ $m_{BA}=1$ $m_{BA}=\frac{4-b}{-2+4}$ $1=\frac{4-b}{2}$ $2=4-b$ $b=2$	✓ $a=-4$ ✓ $m_{BA}=1$ ✓substitute / *vervang* ✓ $b=2$ (4)

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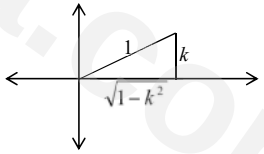
4.3	$(x-a)^2+(y-b)^2=r^2$ $(x+4)^2+(y-2)^2=r^2$ $(-2+4)^2+(4-2)^2=r^2$ $4+4=r^2$ $(x+4)^2+(y-2)^2=8$	✓substitute midpoint in correct formula / *vervang middelpunt in korrekte formule* ✓substitute / *vervang* $(-2;4)$ ✓ $(x+4)^2+(y-2)^2=8$ (3)
4.4	$x^2-2x+y^2-2y=0$ $(x^2-2x+1)+(y^2-2y+1)=1+1$ $(x-1)^2+(y-1)=2$	✓ $(x-1)^2$ ✓ $(y-1)^2$ ✓ 2 (3)
4.5	D (1 ; 1)	✓answer / *antwoord* (1)
4.6	DE = $\sqrt{2}$ DA = $\sqrt{(-2-1)^2+(4-1)^2}$ $=\sqrt{9+9}$ $=\sqrt{18}$ **OR/*OF*** $=3\sqrt{2}$ $D\hat{E}A=90°$ radius ⊥ tangent / *radius ⊥ raaklyn* $AD^2=DE^2+AE^2$ pythagoras $\left(\sqrt{18}\right)^2=\left(\sqrt{2}\right)^2+AE^2$ $18-2=AE^2$ $AE=4$	✓DE = $\sqrt{2}$ ✓correct substitution in correct formula / *korrekte vervanging in korrekte formule* ✓DA = $\sqrt{18}$ **OR/*OF*** $3\sqrt{2}$ ✓ $D\hat{E}A=90°$ ✓ $\left(\sqrt{18}\right)^2=\left(\sqrt{2}\right)^2+AE^2$ ✓ $AE=4$ (6)
		[21]

QUESTION / *VRAAG* 5

5.1	$1-4\sin^2 15°$ $=1-4\sin^2(45°-30°)$ $=1-4[\sin 45°\cos 30°-\cos 45°\sin 30°]^2$ $=1-4\left[\frac{\sqrt{2}}{2}\cdot\frac{\sqrt{3}}{2}-\frac{\sqrt{2}}{2}\cdot\frac{1}{2}\right]^2$ $=1-4\left[\frac{\sqrt{6}-\sqrt{2}}{4}\right]^2$ $=1-4\left[\frac{6-4\sqrt{3}+2}{16}\right]$ $=1-4\left[\frac{8-4\sqrt{3}}{16}\right]$ $=1-\left[\frac{8-4\sqrt{3}}{4}\right]$ $=\sqrt{3}-1$ **OR/*OF*** $1-4\sin^2 15°$ $=1-4\sin^2(60°-45°)$ $=1-4[\sin 60°\cos 45°-\cos 60°\sin 45°]^2$ $=1-4\left[\frac{\sqrt{3}}{2}\cdot\frac{\sqrt{2}}{2}-\frac{1}{2}\cdot\frac{\sqrt{2}}{2}\right]^2$ $=1-4\left[\frac{\sqrt{6}-\sqrt{2}}{4}\right]^2$ $=1-4\left[\frac{6-4\sqrt{3}+2}{16}\right]$ $=1-4\left[\frac{8-4\sqrt{3}}{16}\right]$ $=1-\left[\frac{8-4\sqrt{3}}{4}\right]$ $=\sqrt{3}-1$	✓ $1-4\sin^2(45°-30°)$ ✓ $\sin 45°\cos 30°-\cos 45°\sin 30°$ ✓ $\frac{\sqrt{2}}{2}\cdot\frac{\sqrt{3}}{2}-\frac{\sqrt{2}}{2}\cdot\frac{1}{2}$ ✓ $1-4\left[\frac{6-4\sqrt{3}+2}{16}\right]$ ✓ $\sqrt{3}-1$ **OR/*OF*** ✓ $1-4\sin^2(60°-45°)$ ✓ $\sin 60°\cos 45°-\cos 60°\sin 45°$ ✓ $\frac{\sqrt{3}}{2}\cdot\frac{\sqrt{2}}{2}-\frac{1}{2}\cdot\frac{\sqrt{2}}{2}$ ✓ $1-4\left[\frac{6-4\sqrt{3}+2}{16}\right]$ ✓ $\sqrt{3}-1$ (5)

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5.2	$\dfrac{\sqrt{3}\sin x.\sin^2 72°+\sin^2 198°.\sqrt{3}\cos(x-90°)}{\tan 120°.\sin x}$ $=\dfrac{\sqrt{3}\sin x.\sin^2(90°-18°)+\sin^2(180°+18°).\sqrt{3}\sin x}{\tan(180°-60°).\sin x}$ $=\dfrac{\sqrt{3}\sin x.\cos^2 18°+\sin^2 18°.\sqrt{3}\sin x}{-\tan 60°.\sin x}$ $=\dfrac{\sqrt{3}\sin x(\cos^2 18°+\sin^2 18°)}{-\sqrt{3}.\sin x}$ $=-1$ **OR/*OF*** $\dfrac{\sqrt{3}\sin x.\sin^2 72°+\sin^2 18°.\sqrt{3}\sin x}{-\tan 60°.\sin x}$ $=\dfrac{\sqrt{3}\sin x(\sin^2 72°+\cos^2 72°)}{-\sqrt{3}.\sin x}$ $=\dfrac{\sqrt{3}\sin x(1)}{-\sqrt{3}.\sin x}$ $=-1$	✓ $\sin x$ ✓ $\cos^2 18°$ ✓ $\sin^2 18°$ ✓ $-\tan 60°$ ✓ factorise / *faktoriseer* ✓ -1 **OR/*OF*** ✓ $\sin^2 18°$ ✓ $\sin x$ ✓ $-\tan 60°$ ✓ factorise / *faktoriseer* ✓ $\cos^2 72°$ ✓ -1 (6)
5.3	$6\sin x.\cos x+3\cos x-4\sin^2 x-2\sin x=0$ $3\cos x(2\sin x+1)-2\sin x(2\sin x+1)=0$ $(2\sin x+1)(3\cos x-2\sin x)=0$ $\sin x=-\dfrac{1}{2}$ **OR/*OF*** $3\cos x=2\sin x$ $\tan x=\dfrac{3}{2}$ RA $=30°$ RA $=56{,}31°$ $x=210°+k.360°$ $x=56{,}31°+k.180°$ $x=330°+k.360°$ $x=236{,}31°+k.180°;k\in Z$ **OR/*OF***	✓grouping / *groepeer* ✓ factorise / *faktoriseer* ✓ $\sin x=-\dfrac{1}{2}$ ✓ $\tan x=\dfrac{3}{2}$ ✓ $210°+k.360°$ ✓ $330°+k.360°$, ✓ $56{,}31°+k.180°, k\in Z$ **OR/*OF***

	$6\sin x.\cos x+3\cos x-4\sin^2 x-2\sin x=0$ $(6\sin x.\cos x+3\cos x)-(4\sin^2 x+2\sin x)=0$ $3\cos x(2\sin x+1)-2\sin x(2\sin x+1)=0$ $(2\sin x+1)(3\cos x-2\sin x)=0$ $\sin x=-\dfrac{1}{2}$ **OR/*OF*** $3\cos x=2\sin x$ $\tan x=\dfrac{3}{2}$ $x=-30°+k.360°$ $x=56{,}31°+k.180°$ $;k\in Z$ $x=210°+k.360°$	✓grouping / *groepeer* ✓ factorise / *faktoriseer* ✓ $\sin x=-\dfrac{1}{2}$ ✓ $\tan x=\dfrac{3}{2}$ ✓ $-30°+k.360°$ ✓ $210°+k.360°$ ✓ $56{,}31°+k.180°; k\in Z$ (7)
5.4	$(1-\tan A)\left(\dfrac{\cos A}{\cos 2A}\right)=\dfrac{1}{\cos A+\sin A}$ LHS/*LK* $=(1-\tan A)\left(\dfrac{\cos A}{\cos 2A}\right)$ $=\left(1-\dfrac{\sin A}{\cos A}\right)\left(\dfrac{\cos A}{\cos^2 A-\sin^2 A}\right)$ $=\left(\dfrac{\cos A-\sin A}{\cos A}\right)\left(\dfrac{\cos A}{(\cos A-\sin A)(\cos A+\sin A)}\right)$ $=\dfrac{1}{\cos A+\sin A}$ LHS / *LK* = RHS / *RK*	✓ $\dfrac{\sin A}{\cos A}$ ✓ $\cos^2 A-\sin^2 A$ ✓ $\dfrac{\cos A-\sin A}{\cos A}$ ✓ $(\cos A-\sin A)(\cos A+\sin A)$ (4)
5.5.1	$\cos 2\theta$ $=\sqrt{1-k^2}$  **OR/*OF*** $\cos^2 2\theta=1-\sin^2 2\theta$ $=1-k^2$ $\cos 2\theta=\sqrt{1-k^2}$	✓✓ $\sqrt{1-k^2}$ **OR/*OF*** ✓ $\cos^2 2\theta=1-\sin^2 2\theta$ ✓ $\sqrt{1-k^2}$ (2)

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5.5.2	$\frac{\sin 2\theta}{\tan\theta}$ $=\frac{2\sin\theta.\cos\theta}{\frac{\sin\theta}{\cos\theta}}$ $=2\sin\theta.\cos\theta.\frac{\cos\theta}{\sin\theta}$ $=2\cos^2\theta$ But/*maar* $\cos 2\theta=\sqrt{1-k^2}$ $2\cos^2\theta-1=\sqrt{1-k^2}$ $2\cos^2\theta=\sqrt{1-k^2}+1$ $\frac{\sin 2\theta}{\tan\theta}=\sqrt{1-k^2}+1$	✓ $2\sin\theta.\cos\theta$ ✓ $\frac{\sin\theta}{\cos\theta}$ ✓ $2\cos^2\theta$ ✓ $2\cos^2\theta-1$ ✓ $\sqrt{1-k^2}+1$ (5)
		[29]

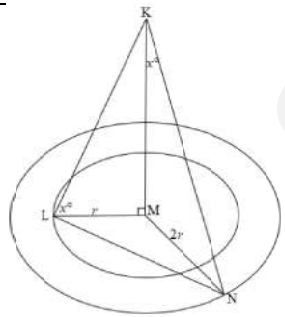
QUESTION / *VRAAG* 6

6.1	$a=-1$ $d=2$	✓ $a=-1$ ✓ $d=2$ (2)
6.2	D$\left(-150°;\frac{1}{2}\right)$	✓ $\left(-150°;\frac{1}{2}\right)$ (1)
6.3.1	$-90°< x <90°$ **OR / *OF*** $x\in(-90°;90°)$	✓ $-90°$ and / *en* $90°$ ✓ correct inequality / *korrekte ongelykheid* (2)
6.3.2	$-135°< x <-45°$ **OR / *OF*** $x\in(-135°;-45°)$	✓ $-135°$ and / *en* $-45°$ ✓ correct inequality / *korrekte ongelykheid* (2)
		[7]

If learner gives all three answers, then maximum 1/2 / *Indien 'n leerling al drie die antwoorde gee, dan maksimum 1/2*
$x\in(-135°;-45°)$ or/*of* $(0°;45°)$ or/*of* $(135°;180°)$

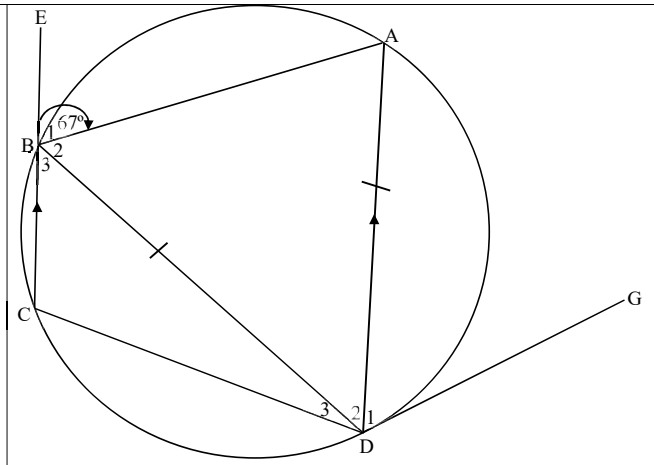
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QUESTION / *VRAAG* 7



7.1	In Δ KLM		
	$\frac{KM}{LM} = \tan x$		✓correct trig ratio / *korrekte trig verhouding*
	$\frac{KM}{r} = \tan x$		
	$KM = r \tan x$		✓ $KM = r \tan x$ (simplification / *vereenvoudiging*)
	In Δ KMN		
	$\frac{MN}{KM} = \tan x$		
	$\frac{2r}{KM} = \tan x$	**OR/*OF*** $KM = \frac{2r}{\tan x}$	✓ $\frac{2r}{KM} = \tan x$
	$\frac{2r}{r \tan x} = \tan x$	$r \tan x = \frac{2r}{\tan x}$	✓ $\frac{2r}{r \tan x}$
	$2 = \tan^2 x$		
	$\sqrt{2} = \tan x$		✓ $\sqrt{2} = \tan x$
	$x = 54{,}74°$		✓ $x = 54{,}74°$ (6)
7.2	$LN^2 = LM^2 + MN^2 - 2LM.MN\cos M$		
	$LN^2 = (5)^2 + (10)^2 - 2(5).(10)\cos 110°$		✓correct substitution in cos-rule / *korrekte vervanging in cos-reël*
	$LN^2 = 159{,}20$		
	$LN = \sqrt{159{,}20}$		
	$LN = 12{,}62\,m$		✓ $12{,}62m$ (2)
			[8]

QUESTION / *VRAAG* 8



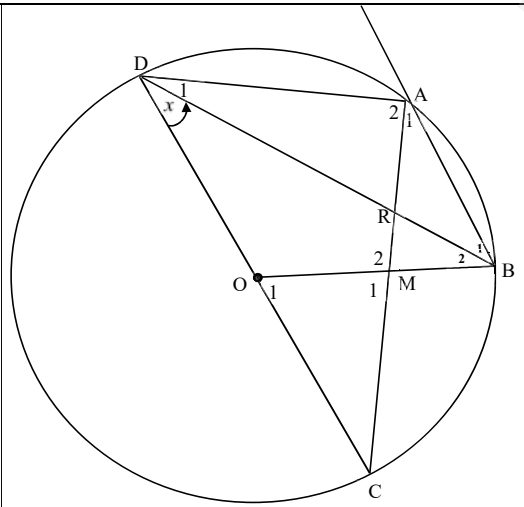
8.1.1	$A\hat{D}C = 67°$	ext. ∠ of cyclic quad / *buite ∠ van kvh*	✓S ✓R
	OR / *OF*		**OR / *OF***
	$\hat{B}_2 + \hat{B}_3 = 113°$	$\angle^s$ straight line / $\angle^e$ *op reguit lyn*	
	$A\hat{D}C = 67°$	opp $\angle^s$ of cyclic quad / *oorst* $\angle^e$ *van kvh*	✓S ✓R (2)
8.1.2	$\hat{C} = 180° - 67°$ $= 113°$	co-int $\angle^s$ BC ‖ AD / *ko-binne* $\angle^e$ *BC ‖ AD*	✓S/R (1)
8.1.3	$\hat{A} = 67°$	opp $\angle^s$ of cyclic quad / alt $\angle^s$ BC‖AD / alt $\angle^s$ EC ‖ AD *oorst* $\angle^e$ *van kvh / verwisselende* $\angle^e$ *BC‖AD / verwis* $\angle^e$ *EC ‖ AD*	✓S/R (1)
8.1.4	$\hat{B}_2 = 67°$	$\angle^s$ opposite = sides / $\angle^e$ *teenoor = sye*	✓S ✓R
	$\hat{D}_2 = 180° - 67° - 67°$ $= 46°$	sum of $\angle^s$ in Δ / *som vd* $\angle^e$ *v* Δ	✓S (3)
8.1.5	$B\hat{D}G = 113°$	tan chord theorem / *raaklyn koordstelling*	✓S ✓R
	OR / *OF*		**OR / *OF***
	$\hat{D}_1 = 67°$	tan chord theorem / *raaklyn koordstelling*	✓R
	$B\hat{D}G = 113°$		✓S (2)

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8.2	$\hat{B}_3 = \hat{D}_2 = 46°$ AB = CD **OR/*OF*** $A\hat{D}C = \hat{A}$ AB = CD	alt $\angle^s$ BC||AD / *verwisselende* $\angle^e$ BC||AD $\angle^s$ subtend = chords / $\angle^e$ *onderspan* = *koorde* both = 67° sides opp equal angles in trapezium ABCD /*sye teenoor gelyke hoeke in trapesium* ABCD	✓S ✓R **OR/*OF*** ✓S ✓R (2)
			[11]

QUESTION / *VRAAG* 9

9.1



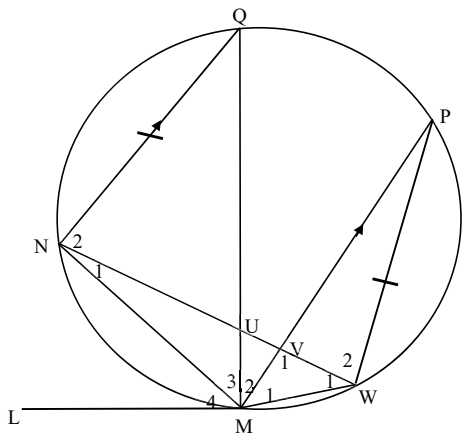
9.1.1(a)	$\hat{O}_1 = 2x$	$\angle$ centre = 2 × $\angle$ circumference / *middelpunts* $\angle$ = 2 × *omtreks* $\angle$	✓S/R (1)

9.1.1(b)	$\hat{A}_1 = C\hat{D}B = x$	$\angle^s$ in the same segment / $\angle^e$ *in dies. segment*	✓S/R
	$\hat{M}_2 = 90°$	line from centre to midpoint of chord / *lyn van middelpunt van sirkel na middelpunt van koord*	✓S ✓R
	$\therefore A\hat{B}O = 90° - x$	sum of $\angle^s$ in Δ / ext $\angle$ of a Δ / *som vd* $\angle^e$ *v* Δ / *buite* $\angle$ *v* Δ	✓S
	OR/*OF*		**OR/*OF***
	$\hat{O}_1 = 2x$	proved/*reeds bewys*	✓S
	$\hat{M}_1 = 90°$	line from centre to midpoint of chord / *lyn van middelpunt van sirkel na middelpunt van koord*	✓R
	$\hat{C} = 90° - 2x$	sum of $\angle^s$ in Δ / *som vd* $\angle^e$ *v* Δ	✓S
	$\hat{B}_1 = 90° - 2x$ $A\hat{B}O = 90° - x$	$\angle^s$ in the same segment / $\angle^e$ *in dies. segment*	✓S/R (4)

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9.1.2	AD‖OB	midpoint theorem / *middelpunt stelling*	✓S ✓R
	$\hat{O}_1 = A\hat{D}C = 2x$	corresponding $\angle^s$ AD ‖ OB / *ooreenkom* $\angle^e$ *AD ‖ OB*	✓S
	$\therefore \hat{D}_1 = x$		✓S
	$\hat{A}_1 = x$	proved / *reeds bewys*	
	$\therefore \hat{D}_1 = \hat{A}_1$		✓S
	AB is a tangent / *is 'n raaklyn*	converse tan chord theorem / *omgekeerde raaklyn koordstelling*	✓R
	OR / *OF*		**OR / *OF***
	$\hat{A}_2 = 90°$	$\angle$ in a semi-circle / $\angle$ *in halwe sirkel*	✓S ✓R
	$\therefore$ AD‖OB	corr $\angle^s$ are equal / *ooreenk* $\angle^e$ *gelyk*	✓R
	$C\hat{D}A = \hat{O}_1 = 2x$	corr $\angle^s$ DA ‖ OB / *ooreenk* $\angle^e$ DA ‖ OB	✓S
	$\therefore \hat{D}_1 = x$		
	$\hat{D}_1 = \hat{A}_1$		✓S
	AB is a tangent / *is 'n raaklyn*	converse tan chord theorem / *omgekeerde raaklyn koord*	✓R (6)
9.1.3	$DC^2 = AD^2 + AC^2$	Pythagoras	✓S
	but / *maar* AC = 2AM and / *en* DC = 2DO		✓S
	$(2DO)^2 = AD^2 + (2AM)^2$		
	$4DO^2 = AD^2 + 4AM^2$		
	but / *maar* In ΔABM $AM^2 = AB^2 - MB^2$	Pythagoras	✓S
	$\therefore 4DO^2 = AD^2 + 4(AB^2 - MB^2)$		✓substitution / *vervanging*
	$AD^2 = 4DO^2 - 4AB^2 + 4MB^2$		(4)

9.2

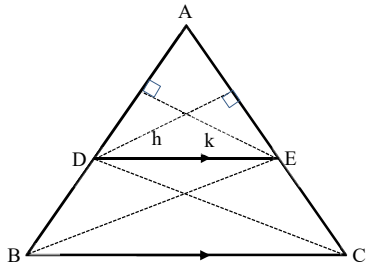


9.2.1	$\hat{M}_2 = \hat{Q}$	alternate $\angle^s$ NQ ‖ MP / *verwissel* $\angle^e$ *NQ ‖MP*	✓S
	$\hat{M}_4 = \hat{Q} = \hat{M}_2$	tan chord theorem / *raaklyn koordstelling*	✓S/R
	$\hat{W}_1 = \hat{Q} = \hat{M}_2$	$\angle^s$ in the same segment / tan chord theorem / $\angle^e$ *dieselfde sirkel segment / raaklyn koord stelling*	✓S/R
	OR/*OF*		
	$\hat{W}_1 = \hat{M}_4 = \hat{M}_2$	tan chord theorem / *raaklyn koordstelling*	(3)
9.2.2	In ΔWMV and/*en* ΔQMN		
	$\hat{W}_1 = \hat{Q}$	proved / *reeds bewys*	✓S
	$\hat{M}_1 = \hat{M}_3$	equal chords subtend equal $\angle^s$ / *gelyke koorde onderspan gelyke* $\angle^e$	✓S/R
	$\hat{V}_1 = \hat{N}_1 + \hat{N}_2$	sum of $\angle^s$ in Δ / *som vd* $\angle^e$ *v* Δ	✓S
	$\therefore \Delta WMV \| \Delta QMN$	$\angle\angle\angle$	
	OR / *OF*		**OR / *OF***
	In ΔWMV and/*en* ΔQMN		
	$\hat{W}_1 = \hat{Q}$	proved/*reeds bewys*	✓S
	$\hat{M}_1 = \hat{M}_3$	equal chords subtend equal $\angle^s$ / *gelyke koorde onderspan gelyke* $\angle^e$	✓S/R
	$\therefore \Delta WMV \| \Delta QMN$	$\angle\angle\angle$	✓R (3)

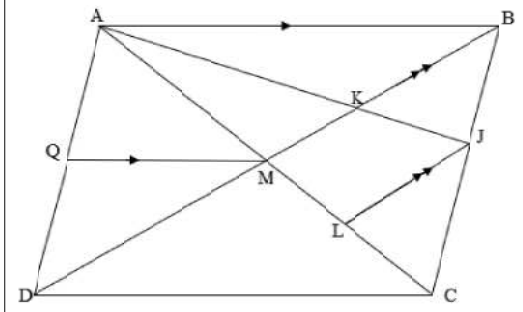
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9.2.3	$\frac{MV}{MN} = \frac{WV}{QN}$	$\Delta WMV \parallel\parallel \Delta QMN$ / Δ^s	✓S ✓R
	$\frac{MV}{WV} = \frac{MN}{QN}$		
	$MV \times QN = MN \times WV$	given / *gegee*	
	but / *maar* $QN = PW$		✓S
	$MV \times PW = MN \times WV$		
	$\frac{MV}{WV} = \frac{MN}{PW}$		(3)
			[24]

QUESTION / *VRAAG* 10



10.1	Construction: Join DC and BE and altitudes k and h *Konstruksie: Verbind DC en BE asook die hoogtelyne k en h*		✓construction / *konstruksie*
	$\frac{\text{Area } \Delta ADE}{\text{Area } \Delta DEB} = \frac{\frac{1}{2} \times AD \times k}{\frac{1}{2} \times DB \times k} = \frac{AD}{DB}$		✓S
	$\frac{\text{Area } \Delta ADE}{\text{Area } \Delta DEC} = \frac{\frac{1}{2} \times AE \times h}{\frac{1}{2} \times EC \times h} = \frac{AE}{EC}$		✓S
	but / *maar* Area ΔDEB = Area ΔDEC	same base, same height / *gelyke hoogte, dieselfde basis*	✓S ✓R
	$\therefore \frac{\text{Area } \Delta ADE}{\text{Area } \Delta DEB} = \frac{\text{Area } \Delta ADE}{\text{Area } \Delta DEC}$		✓S
	$\therefore \frac{AD}{DB} = \frac{AE}{EC}$		(6)

10.2			
10.2.1 (a)	$\frac{ML}{LC} = \frac{BJ}{JC} = \frac{2}{3}$	line $\parallel$ one side ΔBCM **OR** prop theorem MB$\parallel$JL / *lyn* $\parallel$ *aan een sy van* ΔBCM ***OF*** *eweredigheidsstelling MB$\parallel$JL*	✓S ✓R (2)
10.2.1 (b)	$\frac{MC}{ML} = \frac{BC}{BJ} = \frac{5}{2}$	line $\parallel$ one side ΔBMC **OR** prop theorem MB$\parallel$JL / *lyn* $\parallel$ *aan een sy van* ΔBMC ***OF*** *eweredigheidsstelling MB* $\parallel$ *JL*	✓S
	AM = MC	diagonals of a parm bisect / *hoeklyne van parm halveer*	✓S/R
	$\frac{AM}{ML} = \frac{5}{2}$		
	$\frac{AK}{KJ} = \frac{AM}{ML} = \frac{5}{2}$	line $\parallel$ one side ΔAJL **OR** prop theorem MK$\parallel$JL / *lyn* $\parallel$ *aan een sy van* ΔAJL ***OF*** *eweredigheidsstelling MK* $\parallel$ *JL*	✓S (3)
10.2.2	AB $\parallel$ CD AB $\parallel$ QM In ΔADC $\therefore$ QM $\parallel$ CD AM = MC $\therefore$ AQ = QD	opposite sides of parm / *oorst sye van parm* proved / *reeds bewys* line passing through the midpoint of 1 side $\parallel$ to second side / *lyn sny die middelpunt van 1 sy* $\parallel$ *aan tweede sy*	✓S ✓S / R
	but AD = BC $AQ = \frac{1}{2}AD$ $= \frac{1}{2}\left(\frac{2\sqrt{10}}{3}\right)$ $\therefore AQ = QD = \frac{2}{3}\sqrt{10} \div 2$ $= \frac{\sqrt{10}}{3}$ units	opposite sides of parm / *oorst sye van parm*	✓S ✓S

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	OR / *OF*		**OR / *OF***
	In ΔABD BM = MD QM ∥ AB	diag of a parm / *hoeklyne van parm* given / *gegee*	✓S
	∴ AQ=QD	Line passing through the midpoint of 1 side ∥ 2nd side / *lyn deur middelpunt aan een sy ∥ tweede sy* **OR/*OF***	✓S/R
	$\therefore QM = \frac{1}{2}AB$ AQ = QD	midpoint theorem / *middelpunt stelling*	✓S/R
	$AQ = \frac{1}{2}\left(\frac{2}{3}\sqrt{10}\right)$ $= \frac{\sqrt{10}}{3}$ units/*eenhede*		✓S
	OR / *OF*		**OR / *OF***
	Let/stel BC = 2k en/and AB = 3k		
	$3k = \sqrt{10}$ $k = \frac{\sqrt{10}}{3}$		
	$BC = \frac{2\sqrt{10}}{3}$		✓S
	$\frac{AQ}{AD} = \frac{AM}{AC} = \frac{5}{10}$	line ∥ one side ΔADC **OR** prop theorem QM∥DC / *lyn ∥ aan een sy van* ΔADC ***OF*** *ewerdigheidsstelling* QM∥DC	✓S/R
	$AQ = \frac{1}{2}AD$		
	$AD = BC = \frac{2\sqrt{10}}{3}$	opposite sides of parm / *oorst sye van parm*	✓R
	$AQ = \frac{\sqrt{10}}{3}$		✓S (4)
			[15]

TOTAL / *TOTAAL*: [150]

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