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WTS LAST DANCE REVISION

MATHS PAPER TWO

GRADE 12

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**WHERE TO START
MATHS & SCIENCE TUTORING**

REGISTRATION NUMBER: 149 – 892 NPO

2022 WTS LAST DANCE CAMP

SUBJECTS : MATHS / MATHS LIT & PHYSICS,
ACCOUNTING, LIFE SCIENCES, BUSINESS
STUDIES, EMS, EGD, TECH MATHS/
SCIENCES & NS

PROVINCE : KWAZULU NATAL

DURBAN : 03 TO 09 OCTOBER 2022

GRADE : 08 TO 12

PRICE : R2500

VENUE : MASIBUMBANE SCHOOL

TIME : 08:00 TO 23:00 DAILY

TRANSPORT ARRANGEMENTS PLEASE CONTACT 078 380 6604

**ONE ON ONE LESSONS: RICHARDS BAY, MTUBA, ESKHALENI,
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**FOR MORE INFORMATION CONTACT: PROF KWV SIBIYA: 082 6727
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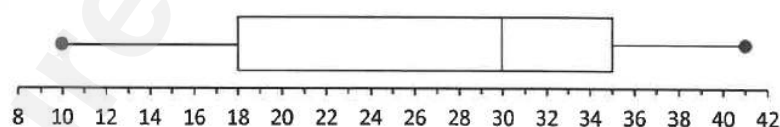
MATHS PAPER TWO**KWV 01****QUESTION 1**

A bakery kept a record of the number of loaves of bread a tuck-shop ordered daily over the last 18 days. The information is shown in the table below.

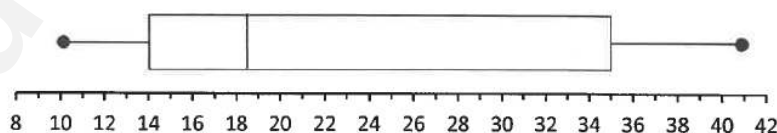
10	11	13	14	14	15	16	18	18
19	19	20	21	35	35	37	40	41

- 1.1 Calculate the:
- 1.1.1 Mean number of loaves of bread ordered daily (2)
- 1.1.2 Standard deviation of the data (1)
- 1.1.3 Number of days on which the number of loaves of bread ordered was more than one standard deviation above the mean (2)
- 1.2 The tuck-shop owner was not able to sell all the loaves of bread delivered daily. He calculated the mean number of loaves sold over the 18 days to be 20. Calculate the number of loaves of bread which were NOT sold over the 18 days. (2)
- 1.3 One of the two box and whisker diagrams drawn below represents the data given in the table above.

Graph A:



Graph B:



- 1.3.1 Which ONE of the two box and whisker diagrams, drawn above, correctly represents the data? Write down a reason for your answer. (2)
- 1.3.2 Describe the skewness of the data. (1)
- [10]

QUESTION 2

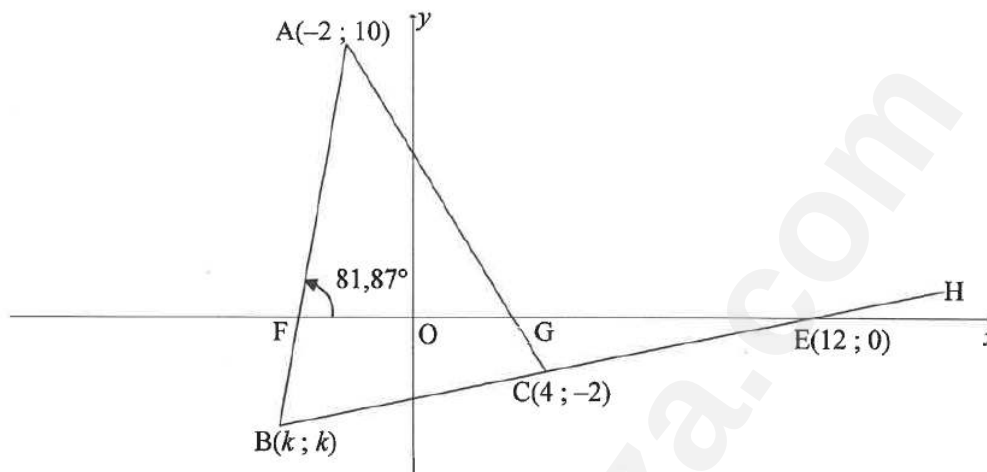
A farm stall sells milk in 5-litre containers to the local community. The price varies according to the availability of milk at the farm stall. The price of milk, in rands per 5-litre container, and the number of 5-litre containers of milk sold, are recorded in the table below.

Price of milk in rands per 5-litre container (x)	26	32	36	28	40	33	29	34	27	30
Number of 5-litre containers of milk sold (y)	48	30	26	44	23	32	39	29	42	33

- 2.1 On the grid provided in the ANSWER BOOK, draw the scatter plot to represent the data. (3)
- 2.2 Determine the equation of the least squares regression line for the data. (3)
- 2.3 If the farmer sells a 5-litre container of milk for R38, predict the number of 5-litre containers of milk he will sell. (2)
- 2.4 Refer to the correlation between the price of 5-litre containers of milk and the number of 5-litre containers of milk sold, and comment on the accuracy of your answer to QUESTION 2.3. (2)
- [10]**

QUESTION 3

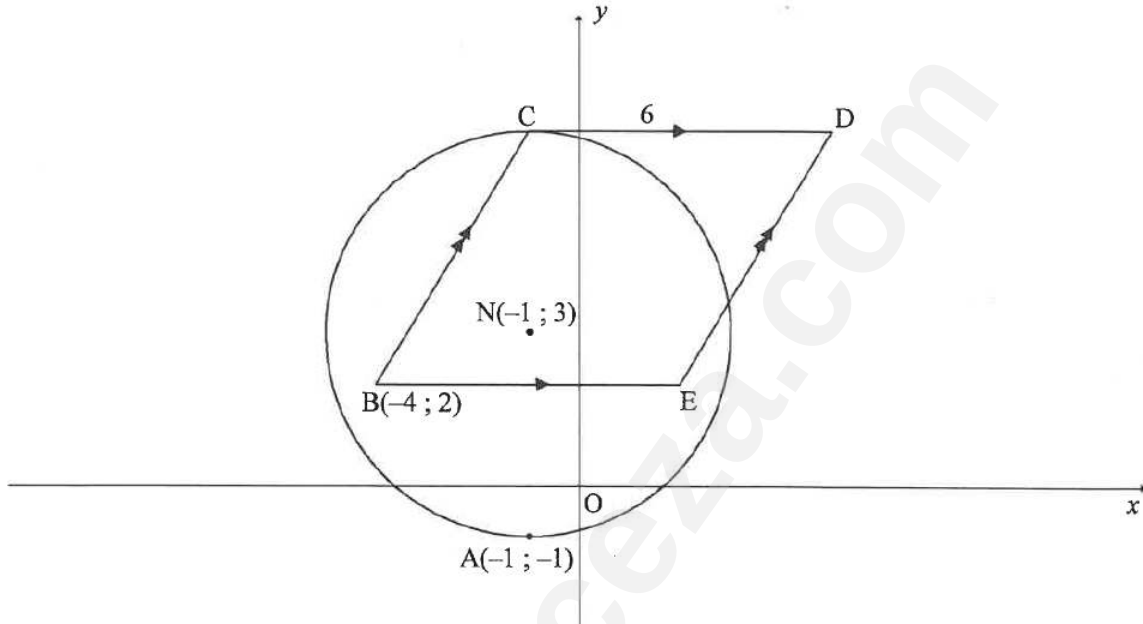
In the diagram, $A(-2; 10)$, $B(k; k)$ and $C(4; -2)$ are the vertices of $\triangle ABC$. Line BC is produced to H and cuts the x -axis at $E(12; 0)$. AB and AC intersect the x -axis at F and G respectively. The angle of inclination of line AB is $81,87^\circ$.



- 3.1 Calculate the gradient of:
- 3.1.1 BE (2)
- 3.1.2 AB (2)
- 3.2 Determine the equation of BE in the form $y = mx + c$ (2)
- 3.3 Calculate the:
- 3.3.1 Coordinates of B , where $k < 0$ (2)
- 3.3.2 Size of $\hat{A}$ (4)
- 3.3.3 Coordinates of the point of intersection of the diagonals of parallelogram $ACES$, where S is a point in the first quadrant (2)
- 3.4 Another point $T(p; p)$, where $p > 0$, is plotted such that $ET = BE = 4\sqrt{17}$ units.
- 3.4.1 Calculate the coordinates of T . (5)
- 3.4.2 Determine the equation of the:
- (a) Circle with centre at E and passing through B and T in the form $(x - a)^2 + (y - b)^2 = r^2$ (2)
- (b) Tangent to the circle at point $B(k; k)$ (3)
- [24]

QUESTION 4

In the diagram, the circle centred at $N(-1; 3)$ passes through $A(-1; -1)$ and C . $B(-4; 2)$, C , D and E are joined to form a parallelogram such that BE is parallel to the x -axis. CD is a tangent to the circle at C and $CD = 6$ units.



- 4.1 Write down the length of the radius of the circle. (1)
 - 4.2 Calculate the:
 - 4.2.1 Coordinates of C (2)
 - 4.2.2 Coordinates of D (2)
 - 4.2.3 Area of $\triangle BCD$ (3)
 - 4.3 The circle, centred at N , is reflected about the line $y = x$. M is the centre of the new circle which is formed. The two circles intersect at A and F .
Calculate the:
 - 4.3.1 Length of NM (3)
 - 4.3.2 Midpoint of AF (4)
- [15]**

QUESTION 5

- 5.1 Without using a calculator, simplify the following expression to ONE trigonometric ratio:

$$\frac{\sin 140^\circ \cdot \sin(360^\circ - x)}{\cos 50^\circ \cdot \tan(-x)} \quad (6)$$

- 5.2 Prove the identity: $\frac{-2\sin^2 x + \cos x + 1}{1 - \cos(540^\circ - x)} = 2\cos x - 1$ (4)

- 5.3 Given: $\sin 36^\circ = \sqrt{1 - p^2}$

Without using a calculator, determine EACH of the following in terms of p :

5.3.1 $\tan 36^\circ$ (3)

5.3.2 $\cos 108^\circ$ (4)
[17]

QUESTION 6

- 6.1 Given: $\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$

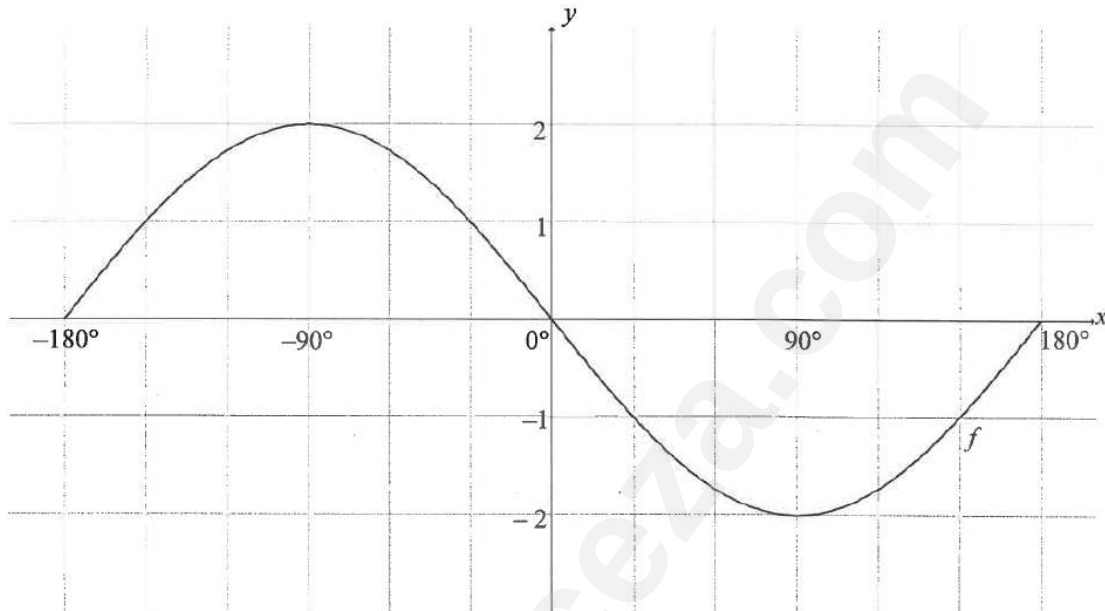
6.1.1 Use the given identity to derive a formula for $\cos(\alpha + \beta)$ (3)

6.1.2 Simplify completely: $2\cos 6x \cos 4x - \cos 10x + 2\sin^2 x$ (5)

- 6.2 Determine the general solution of $\tan x = 2\sin 2x$ where $\cos x < 0$. (7)
[15]

QUESTION 7

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

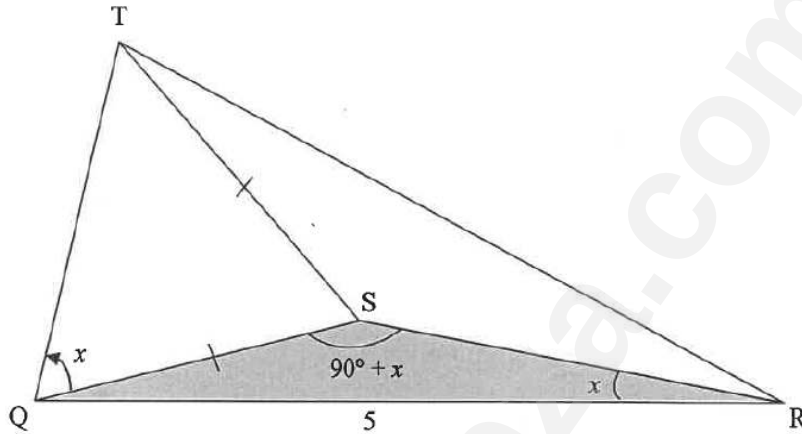


- 7.1 On the grid provided in the ANSWER BOOK, draw the graph of $g(x) = \cos(x - 60^\circ)$ for $x \in [-180^\circ; 180^\circ]$. Clearly show ALL intercepts with the axes and turning points of the graph. (3)
- 7.2 Write down the period of $f(3x)$. (2)
- 7.3 Use the graphs to determine the value of x in the interval $x \in [-180^\circ; 180^\circ]$ for which $f(x) - g(x) = 1$. (1)
- 7.4 Write down the range of k , if $k(x) = \frac{1}{2}g(x) + 1$. (2)
- [8]

QUESTION 8

In the diagram below, T is a hook on the ceiling of an art gallery. Points Q, S and R are on the same horizontal plane from where three people are observing the hook T. The angle of elevation from Q to T is x .

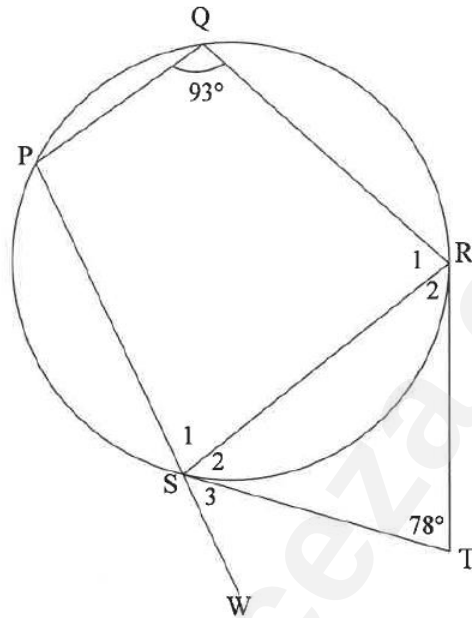
$\hat{QSR} = 90^\circ + x$, $\hat{QRS} = x$, $QR = 5$ units and $TS = SQ$.



- 8.1 Prove that $QS = 5 \tan x$ (3)
- 8.2 Prove that the length of $QT = 10 \sin x$ (5)
- 8.3 Calculate the area of $\triangle TQR$ if $\hat{TQR} = 70^\circ$ and $x = 25^\circ$. (2)
- [10]**

QUESTION 9

In the diagram, PQRS is a cyclic quadrilateral. PS is produced to W. TR and TS are tangents to the circle at R and S respectively. $\hat{T} = 78^\circ$ and $\hat{Q} = 93^\circ$.



9.1 Give a reason why $ST = TR$. (1)

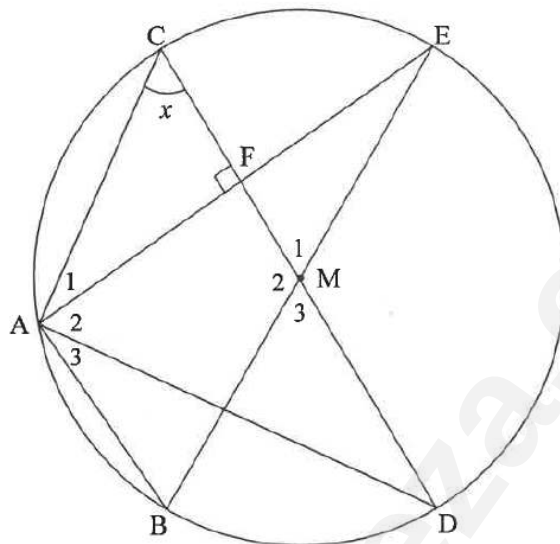
9.2 Calculate, giving reasons, the size of:

9.2.1 $\hat{S}_2$ (2)

9.2.2 $\hat{S}_3$ (2)
[5]

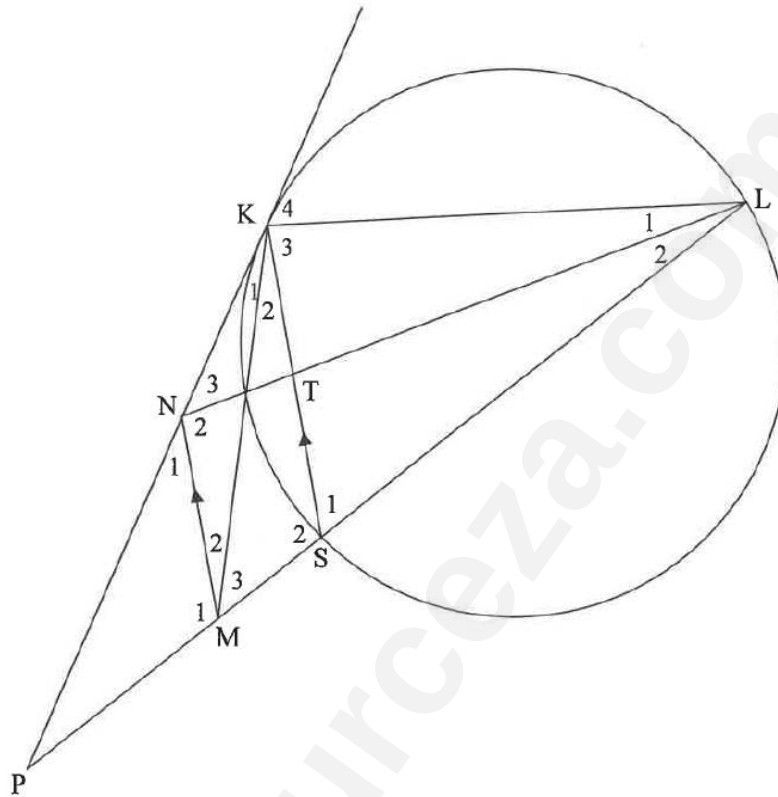
QUESTION 10

In the diagram, BE and CD are diameters of a circle having M as centre. Chord AE is drawn to cut CD at F. $AE \perp CD$. Let $\hat{C} = x$.



- 10.1 Give a reason why $AF = FE$. (1)
- 10.2 Determine, giving reasons, the size of $\hat{M}_1$ in terms of x . (3)
- 10.3 Prove, giving reasons, that AD is a tangent to the circle passing through A, C and F. (4)
- 10.4 Given that $CF = 6$ units and $AB = 24$ units, calculate, giving reasons, the length of AE. (5)
- [13]

- 11.2 In the diagram, PK is a tangent to the circle at K. Chord LS is produced to P. N and M are points on KP and SP respectively such that $MN \parallel SK$. Chord KS and LN intersect at T.



11.2.1 Prove, giving reasons, that:

(a) $\hat{K}_4 = \hat{NML}$ (4)

(b) KLMN is a cyclic quadrilateral (1)

11.2.2 Prove, giving reasons, that $\triangle LKN \parallel \triangle KSM$. (5)

11.2.3 If $LK = 12$ units and $3KN = 4SM$, determine the length of KS. (4)

11.2.4 If it is further given that $NL = 16$ units, $LS = 13$ units and $KN = 8$ units, determine, with reasons, the length of LT. (4)
[23]

KWV 02**QUESTION 1**

- 1.1 Sam recorded the amount of data (in MB) that she had used on each of the first 15 days in April. The information is shown in the table below.

26	13	3	18	12	34	24	58	16	10	15	69	20	17	40
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- 1.1.1 Calculate the:

(a) Mean for the data set (2)

(b) Standard deviation for the data set (1)

- 1.1.2 Determine the number of days on which the amount of data used was greater than one standard deviation above the mean. (2)

- 1.1.3 Calculate the maximum total amount of data that Sam must use for the remainder of the month if she wishes for the overall mean of April to be 80% of the mean for the first 15 days. (3)

- 1.2 The wind speed (in km per hour) and temperature (in °C) for a certain town were recorded at 16:00 for a period of 10 days. The information is shown in the table below.

WIND SPEED IN km/h (x)	2	6	15	20	25	17	11	24	13	22
TEMPERATURE IN °C (y)	28	26	22	22	16	20	24	19	26	19

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

- 1.2.2 Predict the temperature at 16:00 if, on a certain day, the wind speed of this town was 9 km per hour. (2)

- 1.2.3 Interpret the value of b in the context of the data. (1)

[14]

QUESTION 2

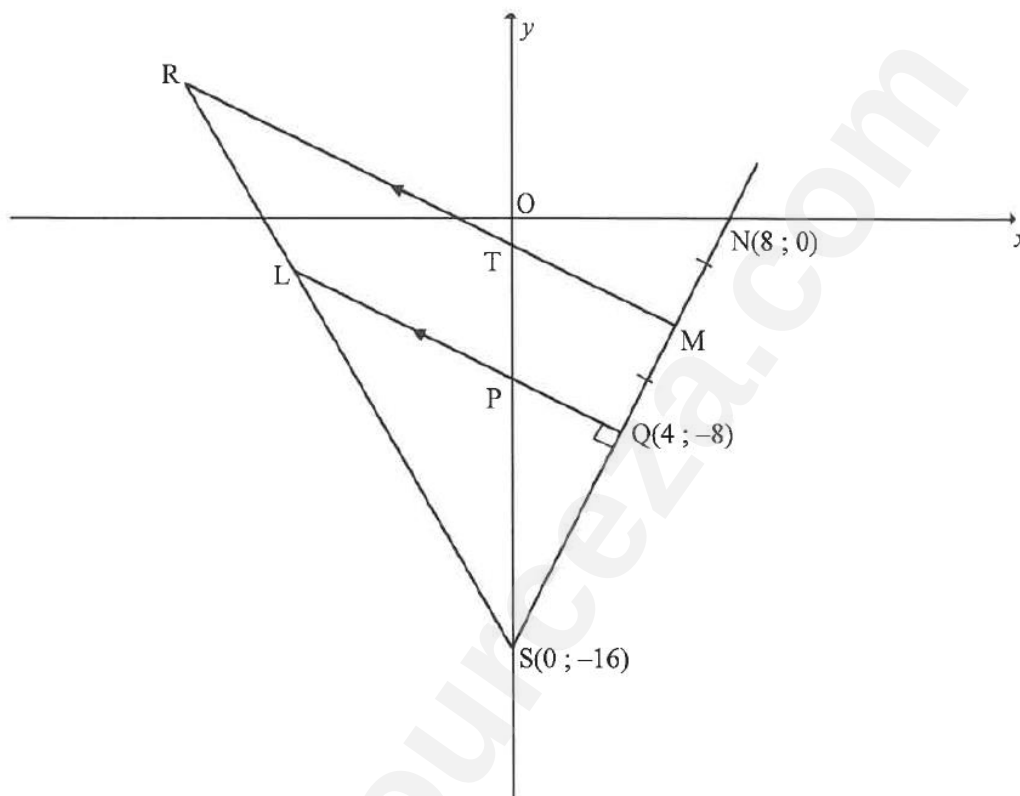
The number of days that Grade 8 learners were absent at a certain high school during a year was recorded. This information is represented in the table below.

NUMBER OF DAYS ABSENT	NUMBER OF LEARNERS
$0 \leq x < 5$	34
$5 \leq x < 10$	45
$10 \leq x < 15$	98
$15 \leq x < 20$	43
$20 \leq x < 25$	7
$25 \leq x < 30$	3

- 2.1 Write down the modal class for the data. (1)
- 2.2 How many learners were absent from school for less than 15 days? (1)
- 2.3 How many Grade 8 learners are at the school? (1)
- 2.4 Draw a cumulative frequency graph (ogive) to represent the data above on the grid provided in the ANSWER BOOK. (4)
- 2.5 Use the cumulative frequency graph to determine the median number of days the Grade 8 learners were absent. (2)
- [9]

QUESTION 3

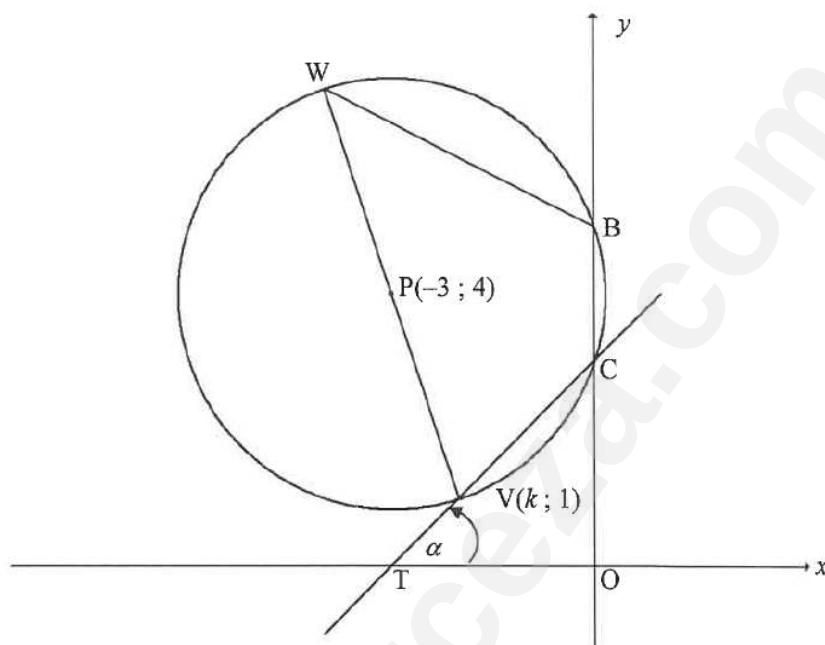
In the diagram, $S(0; -16)$, L and $Q(4; -8)$ are the vertices of $\triangle SLQ$ having LQ perpendicular to SQ . SL and SQ are produced to points R and M respectively such that $RM \parallel LQ$. SM produced cuts the x -axis at $N(8; 0)$. $QM = MN$. T and P are the y -intercepts of RM and LQ respectively.



- 3.1 Calculate the coordinates of M . (2)
 - 3.2 Calculate the gradient of NS . (2)
 - 3.3 Show that the equation of line LQ is $y = -\frac{1}{2}x - 6$. (3)
 - 3.4 Determine the equation of a circle having centre at O , the origin, and also passing through S . (2)
 - 3.5 Calculate the coordinates of T . (3)
 - 3.6 Determine $\frac{LS}{RS}$. (3)
 - 3.7 Calculate the area of $PTMQ$. (4)
- [19]

QUESTION 4

In the diagram, $P(-3 ; 4)$ is the centre of the circle. $V(k ; 1)$ and W are the endpoints of a diameter. The circle intersects the y -axis at B and C . $BCVW$ is a cyclic quadrilateral. CV is produced to intersect the x -axis at T . $\widehat{OTC} = \alpha$.



- 4.1 The radius of the circle is $\sqrt{10}$. Calculate the value of k if point V is to the right of point P . Clearly show ALL calculations. (5)
- 4.2 The equation of the circle is given as $x^2 + 6x + y^2 - 8y + 15 = 0$. Calculate the length of BC . (4)
- 4.3 If $k = -2$, calculate the size of:
 - 4.3.1 α (3)
 - 4.3.2 $\widehat{VWB}$ (2)
- 4.4 A new circle is obtained when the given circle is reflected about the line $y = 1$. Determine the:
 - 4.4.1 Coordinates of Q , the centre of the new circle (2)
 - 4.4.2 Equation of the new circle in the form $(x - a)^2 + (y - b)^2 = r^2$ (2)
 - 4.4.3 Equations of the lines drawn parallel to the y -axis and passing through the points of intersection of the two circles (2)

[20]

QUESTION 5

- 5.1 Simplify the expression to a **single trigonometric term**:

$$\tan(-x) \cdot \cos x \cdot \sin(x - 180^\circ) - 1 \quad (5)$$

- 5.2 Given: $\cos 35^\circ = m$

Without using a calculator, determine the value of EACH of the following in terms of m :

5.2.1 $\cos 215^\circ \quad (2)$

5.2.2 $\sin 20^\circ \quad (3)$

- 5.3 Determine the general solution of:

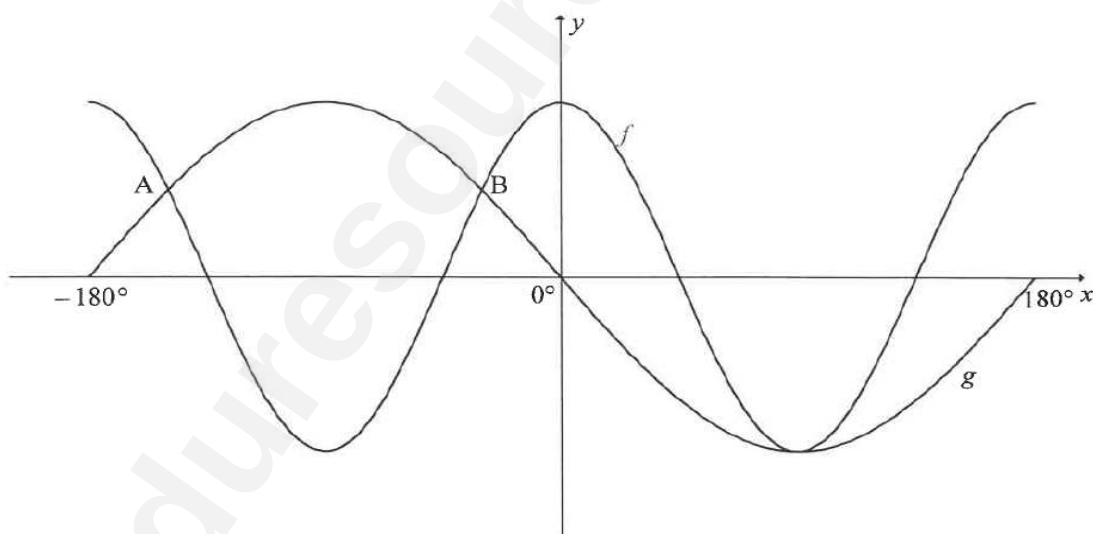
$$\cos 4x \cdot \cos x + \sin x \cdot \sin 4x = -0,7 \quad (4)$$

- 5.4 Prove the identity: $\frac{\sin 4x \cdot \cos 2x - 2 \cos 4x \cdot \sin x \cdot \cos x}{\tan 2x} = \cos^2 x - \sin^2 x \quad (4)$

[18]

QUESTION 6

In the diagram below, the graphs of $f(x) = \cos 2x$ and $g(x) = -\sin x$ are drawn for the interval $x \in [-180^\circ; 180^\circ]$. A and B are two points of intersection of f and g .



- 6.1 **Without using a calculator**, determine the values of x for which $\cos 2x = -\sin x$ in the interval $x \in [-180^\circ; 180^\circ]$. (6)

- 6.2 Use the graphs above to answer the following questions:

6.2.1 How many degrees apart are points A and B from each other? (2)

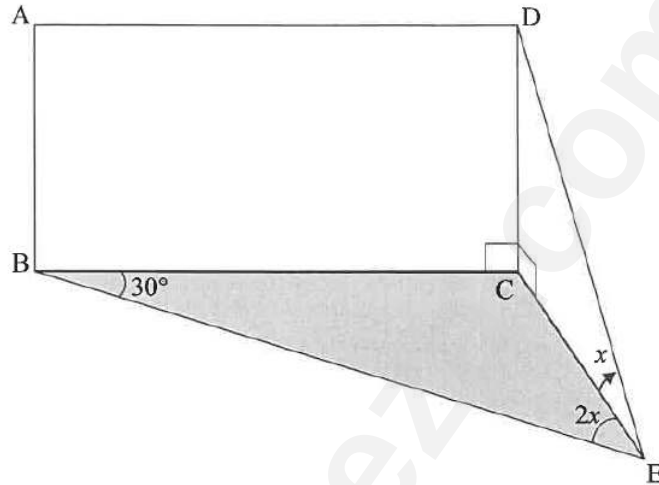
6.2.2 For which values of x in the given interval will $f'(x) \cdot g'(x) > 0$? (2)

6.2.3 Determine the values of k for which $\cos 2x + 3 = k$ will have no solution. (3)

[13]

QUESTION 7

Points B, C and E lie in the same horizontal plane. ABCD is a rectangular piece of board. CDE is a triangular piece of board having a right angle at C. Each piece of board is placed perpendicular to the horizontal plane and joined along DC, as shown in the diagram. The angle of elevation from E to D is x . $\hat{BEC} = 2x$ and $\hat{EBC} = 30^\circ$.

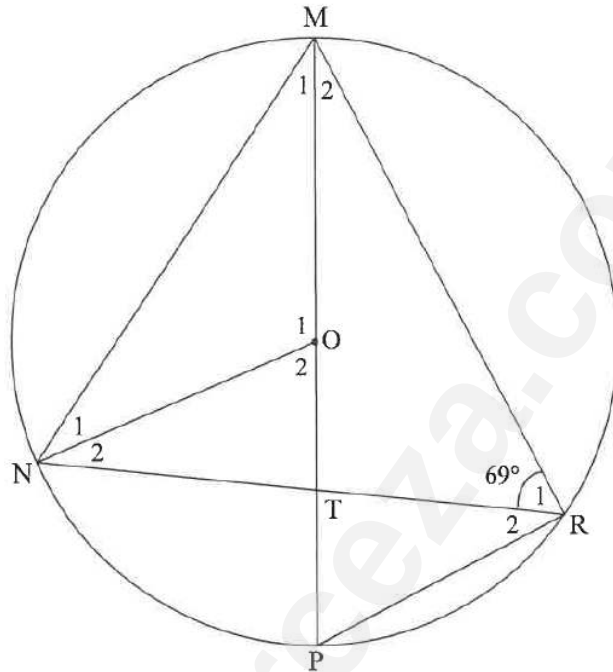


7.1 Show that $DC = \frac{BC}{4\cos^2 x}$ (6)

7.2 If $x = 30^\circ$, show that the area of $ABCD = 3AB^2$. (3)
[9]

QUESTION 8

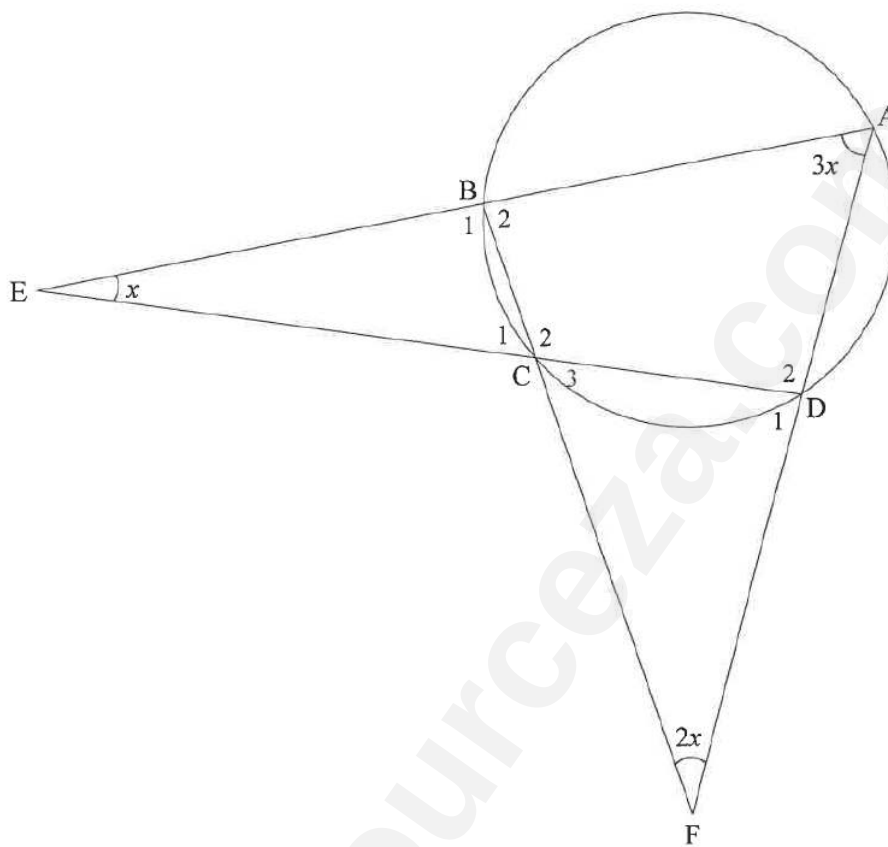
- 8.1 In the diagram, MP is a diameter of a circle centered at O . MP cuts the chord NR at T . Radius NO and chords PR , MN and MR are drawn. $\hat{R}_1 = 69^\circ$.



Determine, giving reasons, the size of:

- 8.1.1 $\hat{R}_2$ (2)
- 8.1.2 $\hat{O}_1$ (2)
- 8.1.3 $\hat{M}_1$ (2)
- 8.1.4 $\hat{M}_2$, if it is further given that $NO \parallel PR$ (4)

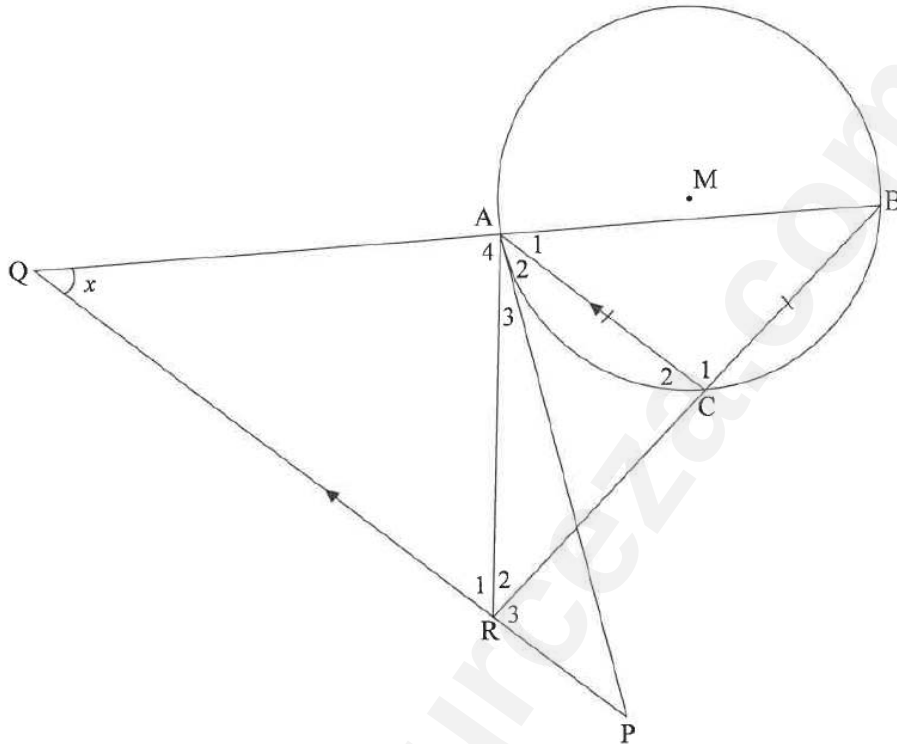
- 8.2 In the diagram below, ABCD is a cyclic quadrilateral. AB and DC are produced to meet at E. AD and BC are produced to meet at F. $\angle AEB = 2x$, $\angle DAB = 3x$ and $\angle AED = x$.



Determine, giving reasons, the value of x .

(6)
[16]

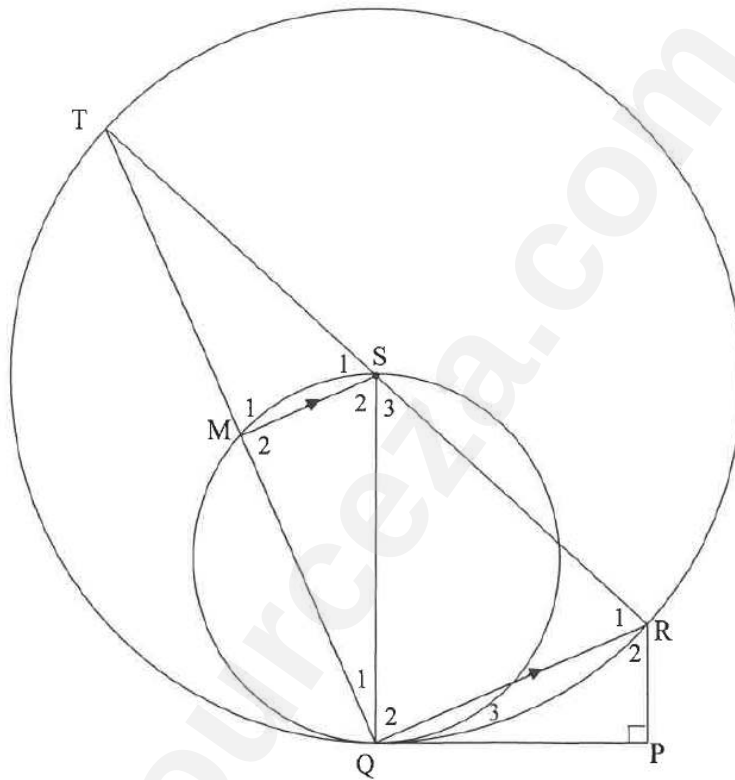
- 9.2 In the diagram, M is the centre of the circle. A , B and C are points on the circle such that $AC = BC$. PA is a tangent to the circle at A . PQ is drawn parallel to CA to meet BA produced at Q . BC produced meets PQ at R and AR is drawn. Let $\hat{Q} = x$.



- 9.2.1 Determine, giving reasons, FOUR other angles EACH equal to x . (6)
- 9.2.2 Prove that $ABPR$ is a cyclic quadrilateral. (2)
- 9.2.3 Prove that $\frac{BA}{BQ} = \frac{BC}{QR}$. (3)
- [17]

QUESTION 10

In the diagram, TSR is a diameter of the larger circle having centre S . Chord TQ of the larger circle cuts the smaller circle at M . PQ is a common tangent to the two circles at Q . SQ is drawn.
 $RP \perp PQ$ and $MS \parallel QR$.



10.1 Prove, giving reasons that:

10.1.1 SQ is the diameter of the smaller circle (3)

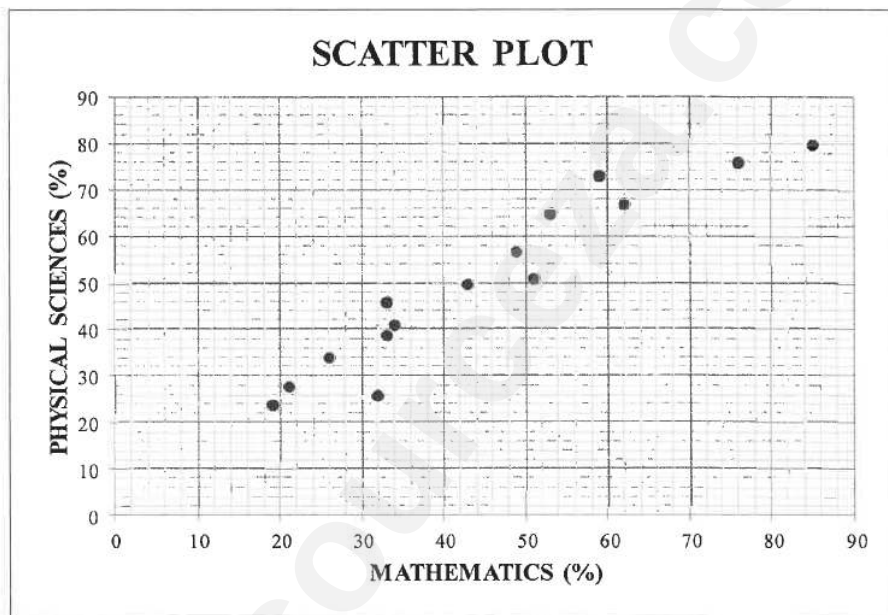
10.1.2 $RT = \frac{RQ^2}{RP}$ (6)

10.2 If $MS = 14$ units and $PQ = \sqrt{640}$ units, calculate, giving reasons, the length of the radius of the larger circle. (6)
 [15]

KWV 03**QUESTION 1**

A Mathematics teacher was curious to establish if her learners' Mathematics marks influenced their Physical Sciences marks. In the table below, the Mathematics and Physical Sciences marks of 15 learners in her class are given as percentages (%).

MATHEMATICS (AS %)	26	62	21	33	53	76	32	59	43	33	49	51	19	34	85
PHYSICAL SCIENCES (AS %)	34	67	28	46	65	76	26	73	50	39	57	51	24	41	80



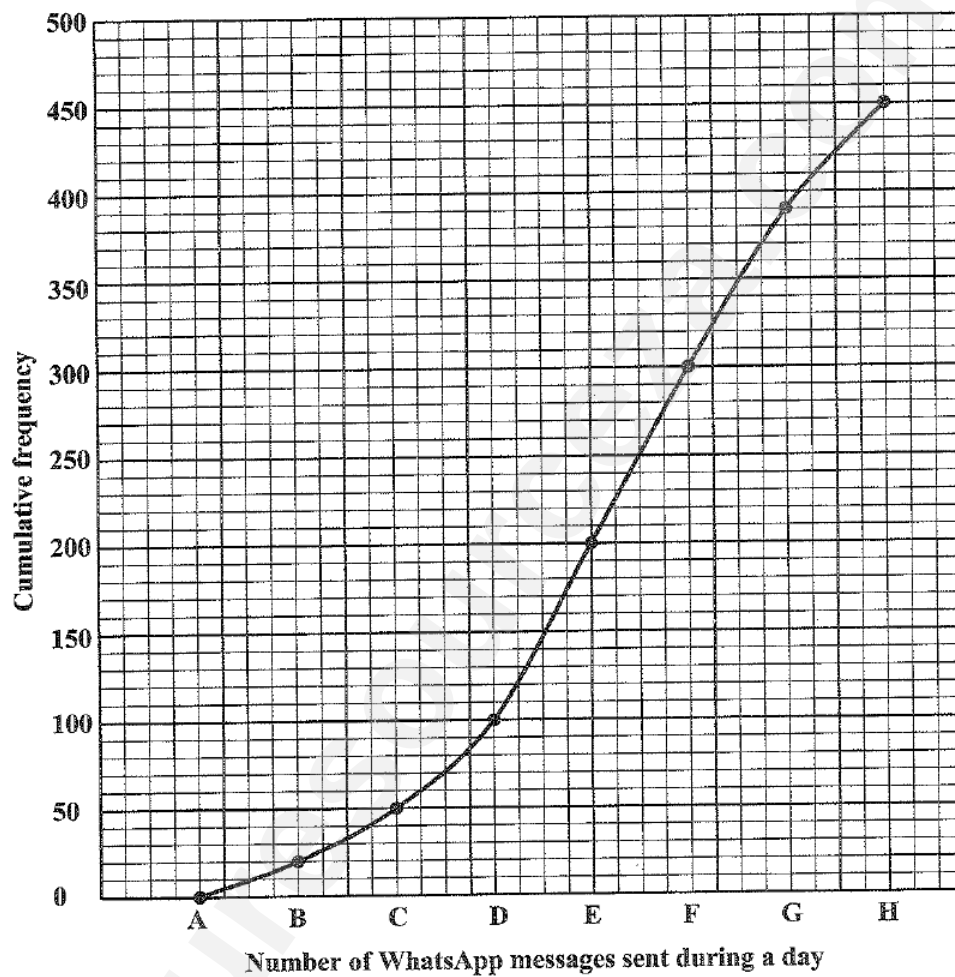
- 1.1 Determine the equation of the least squares regression line for the data. (3)
 - 1.2 Draw the least squares regression line on the scatter plot provided in the ANSWER BOOK. (2)
 - 1.3 Predict the Physical Sciences mark of a learner who achieved 69% for Mathematics. (2)
 - 1.4 Write down the correlation coefficient between the Mathematics and Physical Sciences marks for the data. (1)
 - 1.5 Comment on the strength of the correlation between the Mathematics and Physical Sciences marks for the data. (1)
 - 1.6 What trend did the teacher observe between the results of the two subjects? (1)
- [10]**

QUESTION 2

A survey was conducted among a number of learners who were using the same cellphone company to establish the number of WhatsApp messages that they sent during a day. The results were summarised in the partially completed cumulative frequency graph (ogive) below.



Cumulative Frequency Graph (Ogive)



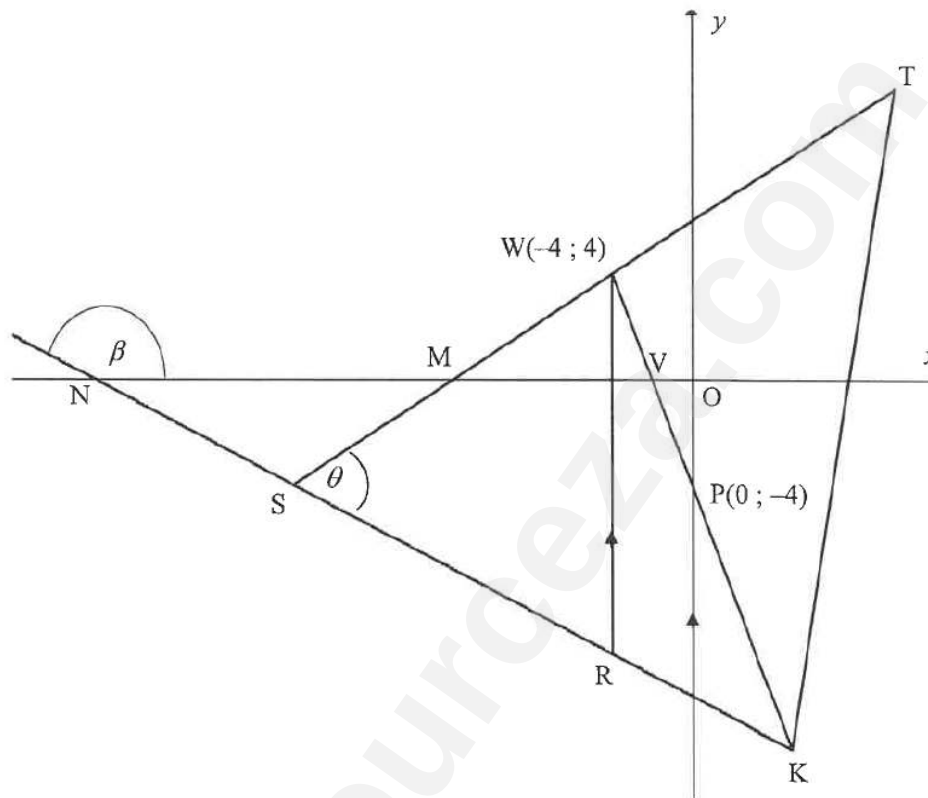
The data shown in the cumulative frequency graph is also summarised in the partially completed frequency table below.

WhatsApp messages sent	Frequency
$40 \leq x < 80$	20
$80 \leq x < 120$	30
$120 \leq x < 160$	Q
$160 \leq x < 200$	R
$200 \leq x < 240$	100
$240 \leq x < 280$	90
$280 \leq x < 320$	60

- 2.1 Write down the value of A, a tick mark on the horizontal axis of the cumulative frequency curve. (1)
- 2.2 How many learners participated in this survey? (1)
- 2.3 Calculate the values of Q and R, the frequencies in the frequency table above. (3)
- 2.4 Estimate the mean number of WhatsApp messages sent per day. (2)
- 2.5 Calculate the interquartile range. (3)
- 2.6 The cellphone company wants to introduce a new rule where you are not allowed to send more than 200 WhatsApp messages per day. If this rule is applied to this group of learners on the existing data, how would the standard deviation for the data be affected? Motivate your answer. (2)
- [12]

QUESTION 3

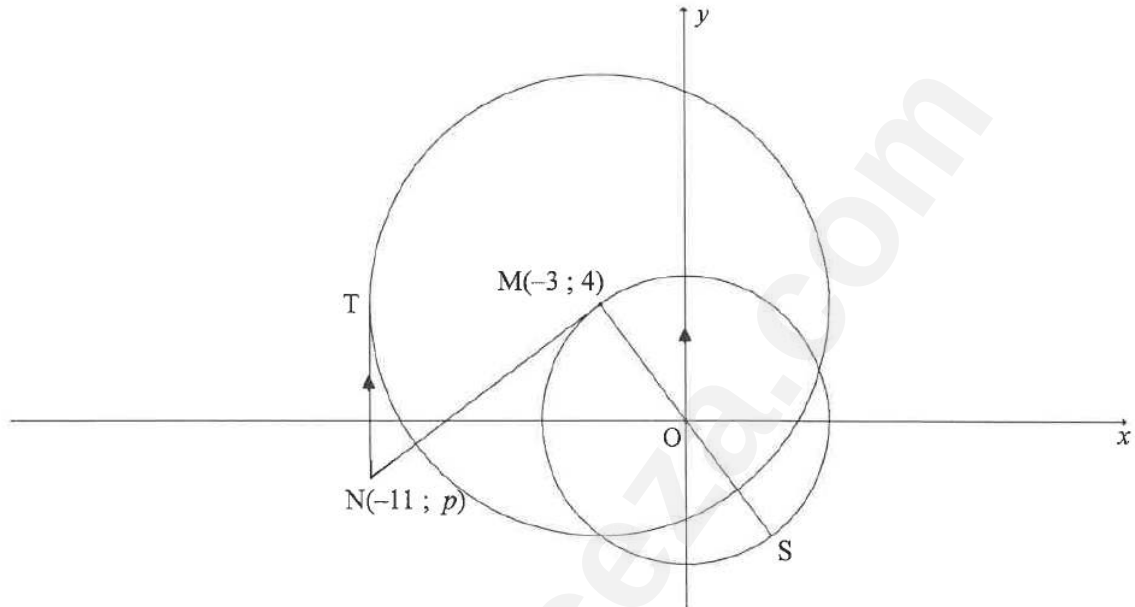
$\triangle TSK$ is drawn. The equation of ST is $y = \frac{1}{2}x + 6$ and ST cuts the x -axis at M . $W(-4; 4)$ lies on ST and R lies on SK such that WR is parallel to the y -axis. WK cuts the x -axis at V and the y -axis at $P(0; -4)$. KS produced cuts the x -axis at N . $\hat{TSK} = \theta$.



- 3.1 Calculate the gradient of WP . (2)
 - 3.2 Show that $WP \perp ST$. (2)
 - 3.3 If the equation of SK is given as $5y + 2x + 60 = 0$, calculate the coordinates of S . (4)
 - 3.4 Calculate the length of WR . (4)
 - 3.5 Calculate the size of θ . (5)
 - 3.6 Let L be a point in the third quadrant such that $SWRL$, in that order, forms a parallelogram. Calculate the area of $SWRL$. (4)
- [21]**

QUESTION 4

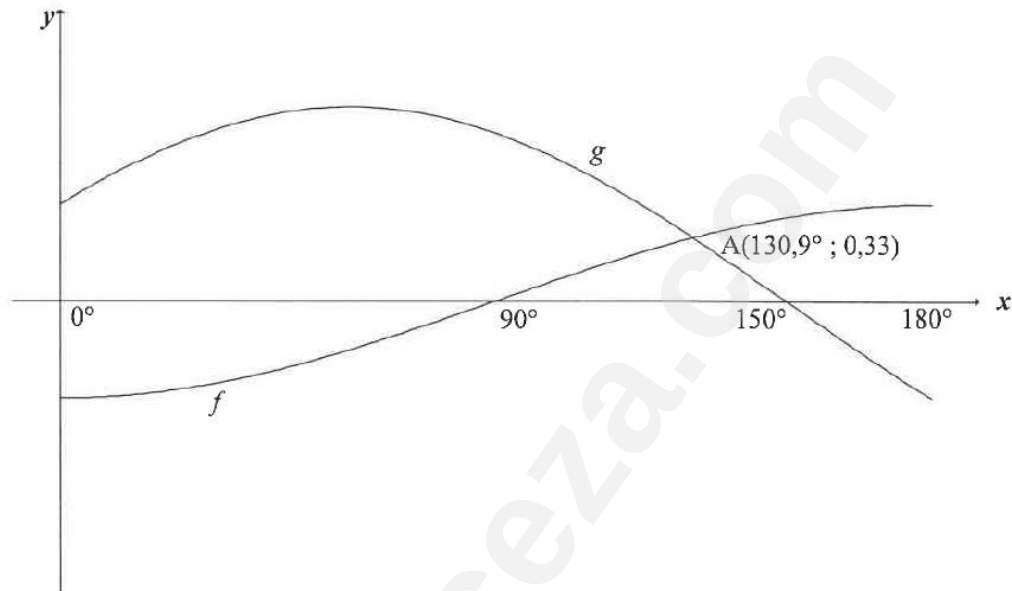
$M(-3 ; 4)$ is the centre of the large circle and a point on the small circle having centre $O(0 ; 0)$. From $N(-11 ; p)$, a tangent is drawn to touch the large circle at T with NT is parallel to the y -axis. NM is a tangent to the smaller circle at M with MOS a diameter.



- 4.1 Determine the equation of the small circle. (2)
- 4.2 Determine the equation of the circle centred at M in the form $(x - a)^2 + (y - b)^2 = r^2$ (3)
- 4.3 Determine the equation of NM in the form $y = mx + c$ (4)
- 4.4 Calculate the length of SN . (5)
- 4.5 If another circle with centre $B(-2 ; 5)$ and radius k touches the circle centred at M , determine the value(s) of k , correct to ONE decimal place. (5)
- [19]

QUESTION 5

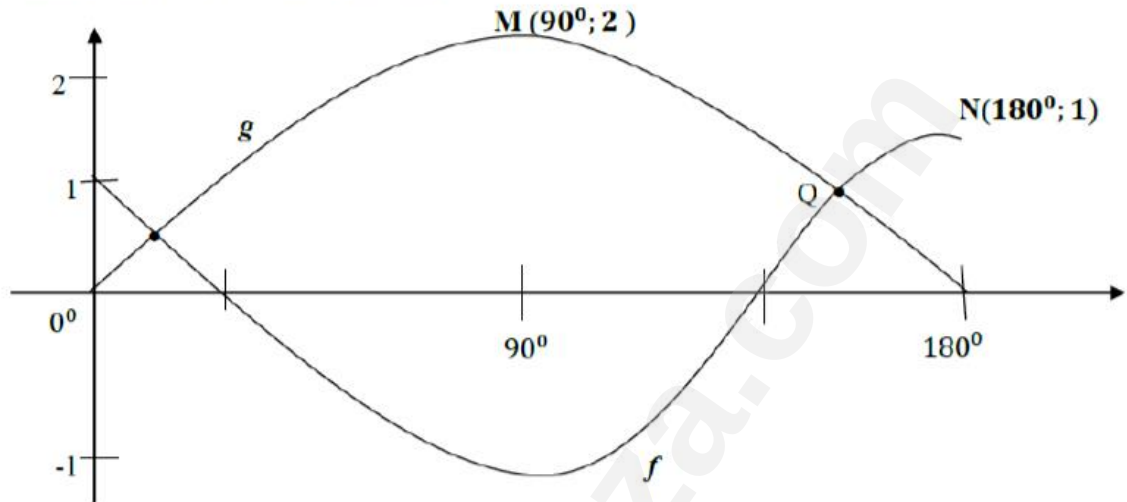
The graphs of $f(x) = -\frac{1}{2}\cos x$ and $g(x) = \sin(x + 30^\circ)$, for the interval $x \in [0^\circ; 180^\circ]$, are drawn below. $A(130,9^\circ; 0,33)$ is the approximate point of intersection of the two graphs.



- 5.1 Write down the period of g . (1)
- 5.2 Write down the amplitude of f . (1)
- 5.3 Determine the value of $f(180^\circ) - g(180^\circ)$. (1)
- 5.4 Use the graphs to determine the values of x , in the interval $x \in [0^\circ; 180^\circ]$, for which:
- 5.4.1 $f(x - 10^\circ) = g(x - 10^\circ)$ (1)
- 5.4.2 $\sqrt{3} \sin x + \cos x \geq 1$ (4)
- [8]

QUESTION 6

The diagram below shows the graph of $f(x) = a \cos bx$ and $g(x) = c \sin dx$ in the interval $x \in [0^\circ; 180^\circ]$. The graph of f and g intersect at points P and Q. $M(90^\circ; 2)$ is the turning point of g and $N(180^\circ; 1)$ is an end point of f .

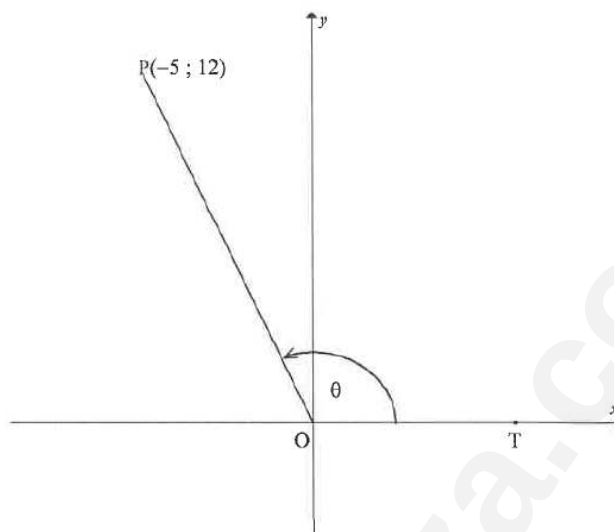


- 6.1 Write down the numerical value of a , b , c and d . (4)
- 6.2 If $(158,56^\circ; 0.73)$ are the coordinates of Q, write down the coordinates of P. (2)
- 6.3 If $x \in (0^\circ; 180^\circ)$, determine the values of x for which :
 - 6.3.1 $g(x) - f(x) = 3$ (1)
 - 6.3.2 $f(x) \cdot g(x) \leq 0$ (2)

[9]

QUESTION 6

- 6.1 In the diagram, $P(-5; 12)$ and T lies on the positive x -axis. $\hat{POT} = \theta$



Answer the following **without using a calculator**:

- 6.1.1 Write down the value of $\tan \theta$ (1)
- 6.1.2 Calculate the value of $\cos \theta$ (3)
- 6.1.3 $S(a; b)$ is a point in the third quadrant such that $\hat{TOS} = \theta + 90^\circ$ and $OS = 6,5$ units. Calculate the value of b . (4)
- 6.2 Determine, **without using a calculator**, the value of the following trigonometric expression: (5)
- $$\frac{\sin 2x \cdot \cos(-x) + \cos 2x \cdot \sin(360^\circ - x)}{\sin(180^\circ + x)}$$
- 6.3 Determine the general solution of the following equation: (6)
- $$6\sin^2 x + 7\cos x - 3 = 0$$
- 6.4 Given: $x + \frac{1}{x} = 3 \cos A$ and $x^2 + \frac{1}{x^2} = 2$ (5)
- Determine the value of $\cos 2A$ **without using a calculator**. [24]

QUESTION 5

- 5.1 If $5 \tan \theta + 2\sqrt{6} = 0$ and $0^\circ < \theta < 270^\circ$, 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 $\frac{14 \cos \theta + 7\sqrt{6} \sin \theta}{\cos(-240^\circ) \cdot \tan 225^\circ}$ (4)

- 5.2 Prove the identity:

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

- 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: $\sin \theta \cdot \cos \beta = -1$

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

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

[21]

QUESTION 5

- 5.1 Simplify the following expression to a single trigonometric ratio:

$$\frac{\cos(x-180^\circ) \cdot \tan(-x) \cdot \sin^2(90^\circ-x)}{\sin(180^\circ-x)} - 4\cos^2 x \quad (7)$$

- 5.2 Consider: $\cos(A-B) - \cos(A+B) = 2\sin A \sin B$

- 5.2.1 Prove the identity. (2)

- 5.2.2 Hence or otherwise calculate, **without using a calculator**, the value of $\cos 15^\circ - \cos 75^\circ$. (4)

- 5.3 **Without using a calculator**, determine the value of:

$$\frac{\cos 36^\circ}{\cos 12^\circ} - \frac{\sin 36^\circ}{\sin 12^\circ} \quad (4)$$

- 5.4 Consider: $\frac{2\sin^2 x + \sin 2x}{\cos 2x} = \frac{2\sin x}{\cos x - \sin x}$

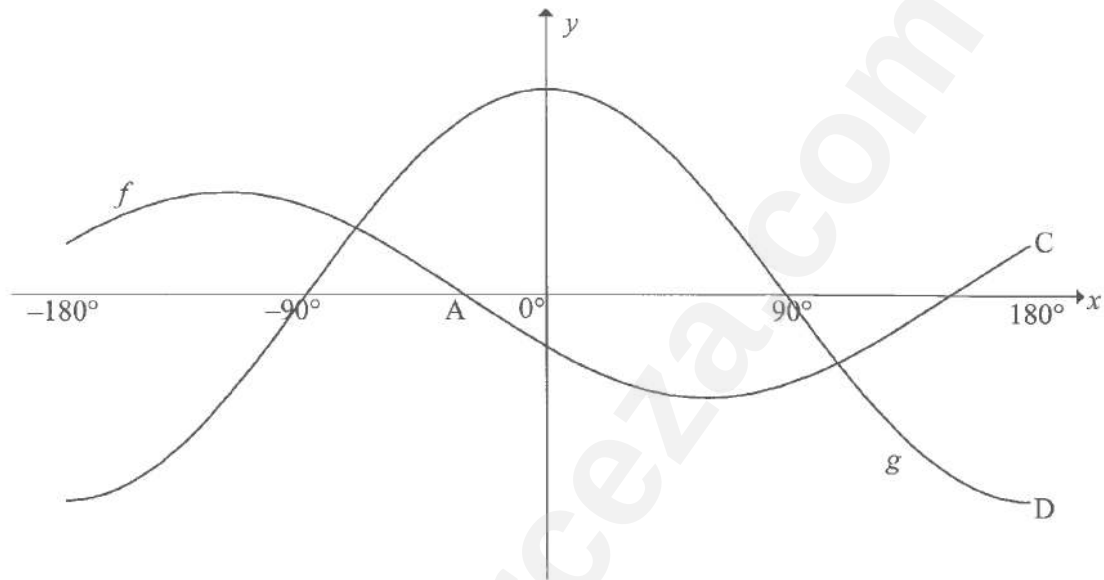
- 5.4.1 Prove the identity. (4)

- 5.4.2 For which value(s) of x in the interval $x \in [-90^\circ; 180^\circ]$ will the identity not be valid? (2)

- 5.5 A line is drawn from A ($\cos \theta$; $\sin \theta$) to B (6; 7). If $AB = \sqrt{86}$, determine the value of $\tan \theta$. (5)
[28]

QUESTION 7

In the diagram below, the functions $f(x) = -\sin(x + 30^\circ)$ and $g(x) = 2\cos x$ are drawn in the interval $x \in [-180^\circ; 180^\circ]$. A is an x -intercept of f and C and D are the endpoints of the graphs of f and g at 180° .

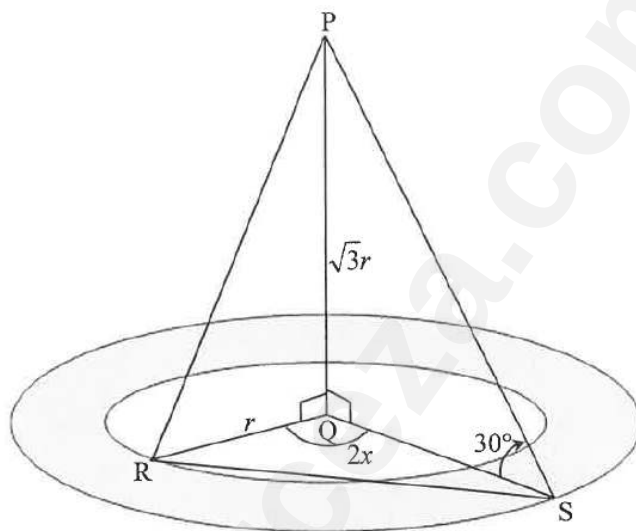


- 7.1 Calculate the:
- 7.1.1 Coordinates of A. (1)
- 7.1.2 Distance CD. (2)
- 7.2 Write down the period of g . (1)
- 7.3 Determine the general solution of the equation $2\cos x + \sin(x + 30^\circ) = 0$. (6)
- 7.4 For which values of x in the interval $x \in [-180^\circ; 180^\circ]$ will $2\cos(x + 20^\circ) + \sin(x + 50^\circ) > 0$? (3)
- [13]

QUESTION 7

A landscape artist plans to plant flowers within two concentric circles around a vertical light pole PQ. R is a point on the inner circle and S is a point on the outer circle. R, Q and S lie in the same horizontal plane. RS is a pipe used for the irrigation system in the garden.

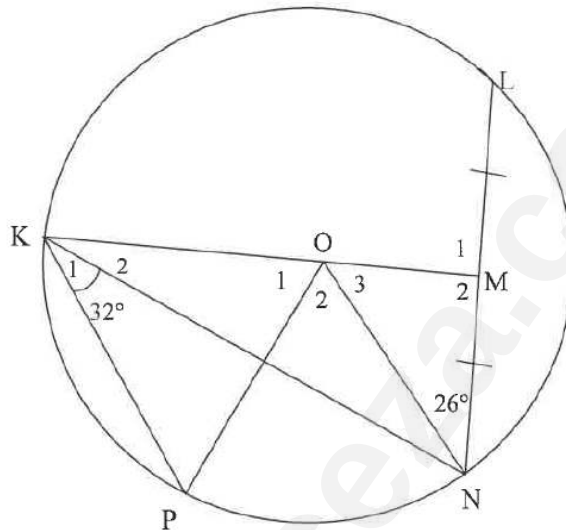
- The radius of the inner circle is r units and the radius of the outer circle is QS .
- The angle of elevation from S to P is 30° .
- $\angle RQS = 2x$ and $PQ = \sqrt{3}r$



- 7.1 Show that $QS = 3r$ (3)
- 7.2 Determine, in terms of r , the area of the flower garden. (2)
- 7.3 Show that $RS = r\sqrt{10 - 6\cos 2x}$ (3)
- 7.4 If $r = 10$ metres and $x = 56^\circ$, calculate RS. (2)
- [10]

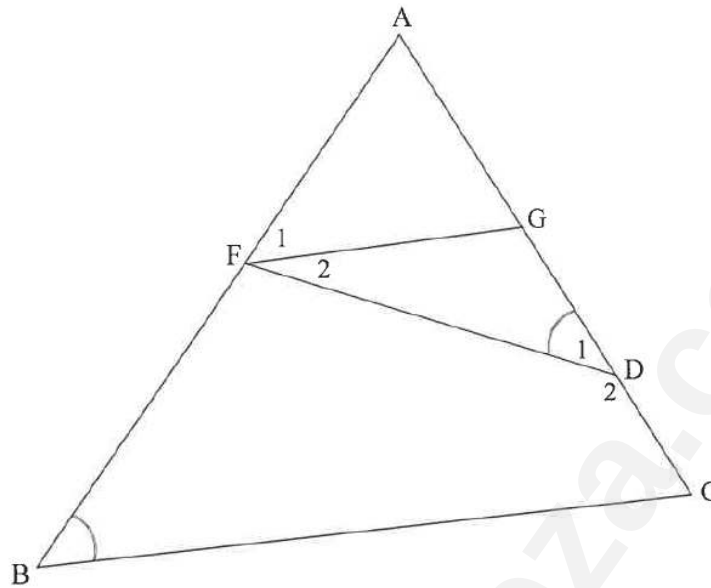
QUESTION 8

- 8.1 O is the centre of the circle.. KOM bisects chord LN and $\hat{MNO} = 26^\circ$. K and P are points on the circle with $\hat{NKP} = 32^\circ$. OP is drawn.



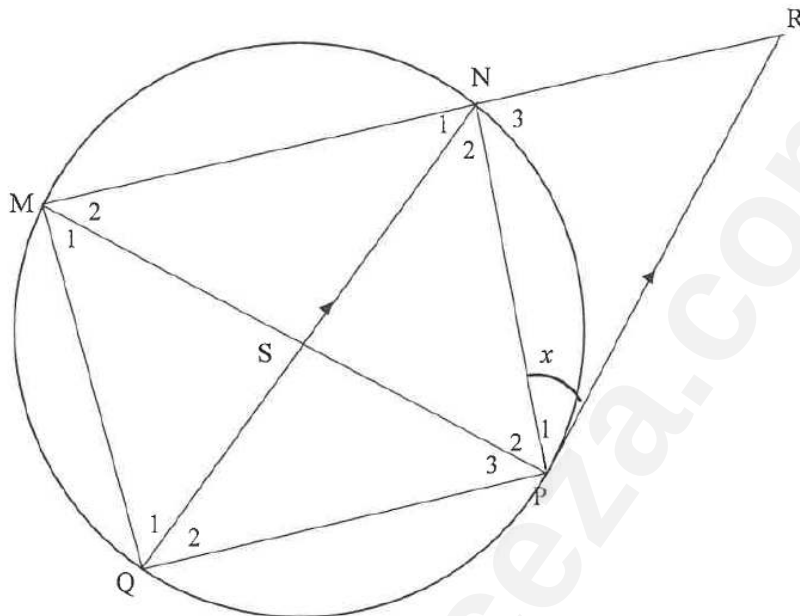
- 8.1.1 Determine, giving reasons, the size of:
- (a) $\hat{O}_2$ (2)
- (b) $\hat{O}_1$ (4)
- 8.1.2 Prove, giving reasons, that KN bisects $\hat{OKP}$. (3)

- 8.2 In $\triangle ABC$, F and G are points on sides AB and AC respectively. D is a point on GC such that $\hat{D}_1 = \hat{B}$.



- 8.2.1 If AF is a tangent to the circle passing through points F, G and D, then prove, giving reasons, that $FG \parallel BC$. (4)
- 8.2.2 If it is further given that $\frac{AF}{FB} = \frac{2}{5}$, $AC = 2x - 6$ and $GC = x + 9$, then calculate the value of x . (4)
[17]

- 9.2 Chord QN bisects $\hat{MNP}$ and intersects chord MP at S. The tangent at P meets MN produced at R such that $QN \parallel PR$. Let $\hat{P}_1 = x$.



- 9.2.1 Determine the following angles in terms of x . Give reasons

(a) $\hat{N}_2$ (2)

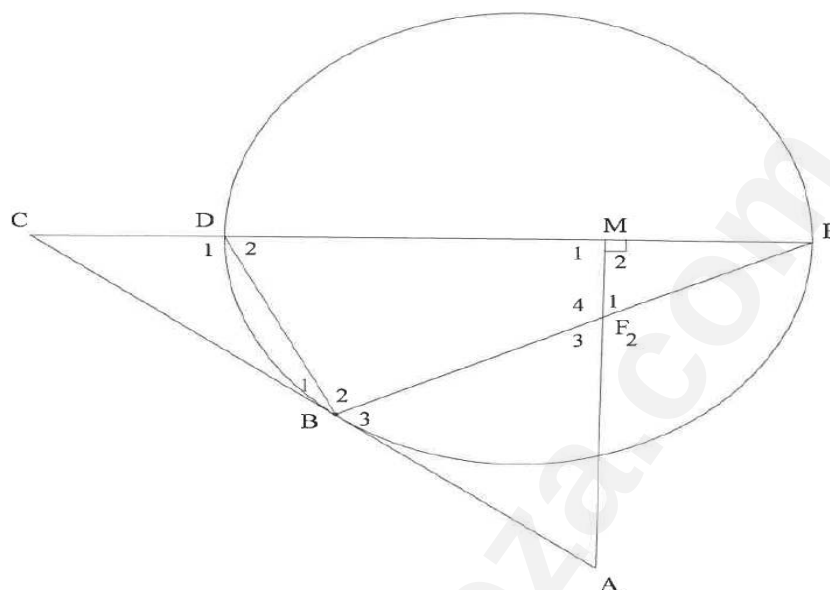
(b) $\hat{Q}_2$ (2)

- 9.2.2 Prove, giving reasons, that $\frac{MN}{NR} = \frac{MS}{SQ}$ (6)

[15]

QUESTION 10

In the diagram, a circle passes through D, B and E. Diameter ED of the circle is produced to C and AC is a tangent to the circle at B. M is a point on DE such that $AM \perp DE$. AM and chord BE intersect at F.



10.1 Prove, giving reasons, that:

10.1.1 FBDM is a cyclic quadrilateral (3)

10.1.2 $\hat{B}_3 = \hat{F}_1$ (4)

10.1.3 $\triangle CDB \parallel \triangle CBE$ (3)

10.2 If it is further given that $CD = 2$ units and $DE = 6$ units, calculate the length of:

10.2.1 BC (3)

10.2.2 DB (4)
[17]

KWV 4

In the sketch alongside $PQ \parallel AC$ and $PR \parallel BC$.

$BQ : QC = 4 : 3$.

Determine

(a) $\frac{\text{Area of } \triangle ABQ}{\text{Area of } \triangle ACQ}$

(b) $\frac{\text{Area of } \triangle BPQ}{\text{Area of } \triangle ABQ}$

(c) $\frac{\text{Area of } \triangle APR}{\text{Area of } \triangle ABC}$

(d) $\frac{\text{Area of } \triangle BPQ}{\text{Area of } \triangle ACQ}$

