



KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

MATHEMATICS P2

PREPARATORY EXAMINATIONS

SEPTEMBER 2023

MARKS: 150

Stanmorephysics.com

TIME: 3 hours

**N.B. This question paper consists of 12 pages and 1 information sheet.
This paper has an Answer Booklet.**

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of **11** questions.
2. Answer **ALL** the questions.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Clearly show **ALL** calculations, diagrams, graphs, etc. that you have used in determining your answers.
5. Answers only will **NOT** necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers to **TWO** decimal places, unless stated otherwise.
8. Diagrams are **NOT** necessarily drawn to scale.
9. An information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.

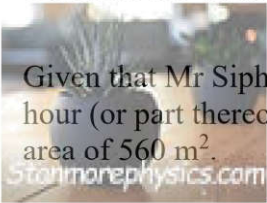


QUESTION 1

Mr Siphokazi supplements his pension by mowing lawns for customers. He measures the areas (x) (in m^2) of 12 of his customers' lawns and the time (y) in minutes, it takes him to mow these lawns. He works 8 hours a day. He recorded the data.

Area (x) (m^2)	360	120	845	602	1 190	530	245	486	350	1 005	320	250
Time (y) (minutes)	50	28	130	75	120	95	55	70	48	110	55	60

- 1.1 Determine the equation of the least squares regression line. (3)
- 1.2 Calculate the value of r , the correlation coefficient for the data. (2)
- 1.3



Given that Mr Siphokazi charges a flat call out fee of R150, as well as R50 per half hour (or part thereof), estimate the charge for mowing a customer's lawn that has an area of 560 m^2 .

(For example: 100 minutes would be taken as 2 hours).

(3)
- 1.4 The local high school wants Mr Siphokazi to mow their rugby field which is rectangular, 100 meters long by 70 meters wide.
- 1.4.1 Use the regression equation found in 1.1 to calculate the time it would take to mow this area. (1)

1.4.2 Is it possible for him to complete this job in a day?
Give a reason for your answer. (1)

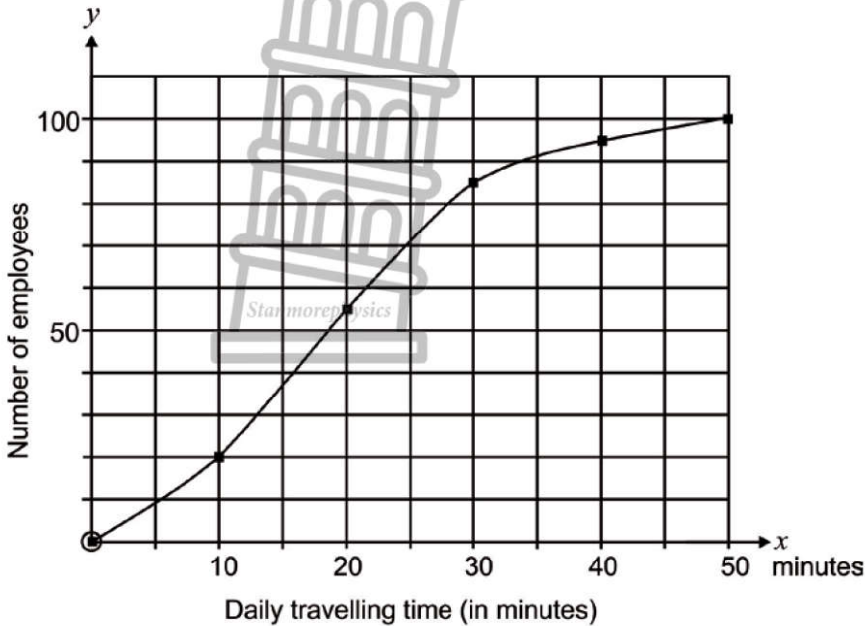
[10]

QUESTION 2

The following table gives the frequency distribution of the daily travelling time (in minutes) from home to work for the employees of a certain company.

Daily travelling time x (in minutes)	Number of employees (f)	Midpoint of Interval	
$0 \leq x < 10$	20		
$10 \leq x < 20$	35		
$20 \leq x < 30$	30		
$30 \leq x < 40$	10		
$40 \leq x < 50$	5		

- 2.1 Calculate the estimated mean travelling time. (3)
- 2.2 Write the modal class of the data. (2)
- 2.3 An ogive was drawn for the given data.
Construct a box-whisker plot for the data in the ANSWER BOOK. (3)

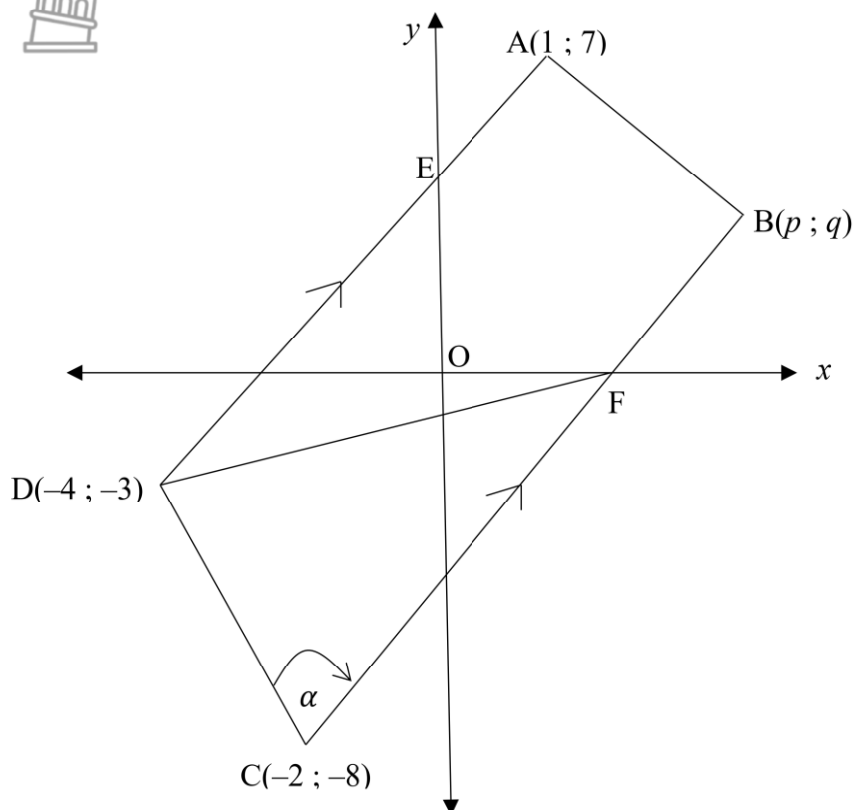


- 2.4 State whether the following statements are TRUE or FALSE.
- 2.4.1 The distribution of these travelling times is positively skewed. (1)
- 2.4.2 The inter-quartile range for the data is 25. (1)
- 2.4.3 35 employees take less than 20 minutes. (1)

[11]

QUESTION 3

Trapezium $ABCD$ is drawn below with $AD \parallel BC$ is drawn. The coordinates of the vertices are $A(1; 7)$, $B(p; q)$, $C(-2; -8)$ and $D(-4; -3)$. BC intersects the x -axis at F . $\widehat{DCB} = \alpha$. AD intersects the y -axis at E .



- 3.1 Calculate the gradient of AD . (2)
- 3.2 Determine the equation of BC in the form $y = mx + c$. (3)
- 3.3 Determine the coordinates of F . (2)
- 3.4 $AMCD$ is a parallelogram, with M on BC . Determine the coordinates of M . (2)
- 3.5 Show that $\alpha = 48,37^\circ$. (4)
- 3.6 Calculate the area of $\triangle DCF$. (4)

[17]



QUESTION 4

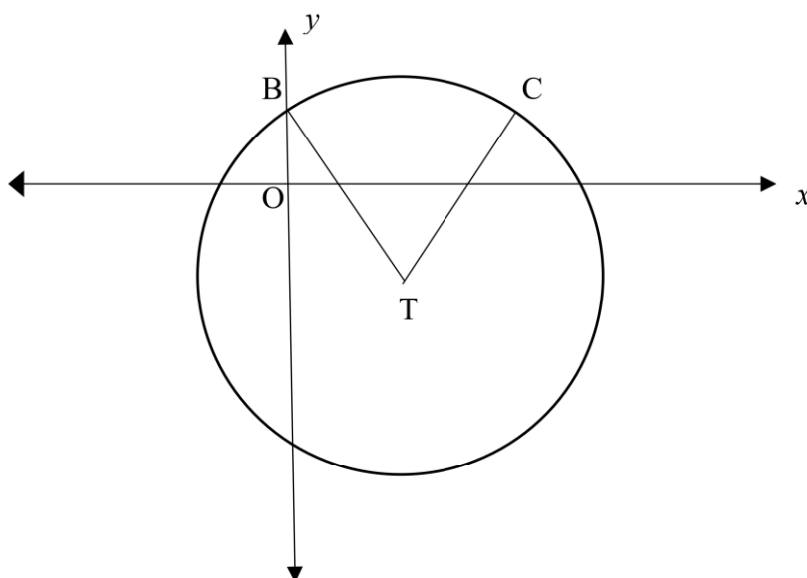
4.1 The equation of a circle is $x^2 + y^2 - 8x + 6y = 15$.

4.1.1 Show that P(2 ; -9) lies on the circle. (2)

4.1.2 Determine the equation of the tangent to the circle at point P(2 ; -9). (6)

4.1.3 A tangent is drawn from Q(-10 ; 12) to the circle. Calculate the length of the tangent. (4)

4.2 The circle, with centre T, and equation $(x - 3)^2 + (y + 2)^2 = 25$ is given below. B is the y - intercept of the circle.



4.2.1 Determine the coordinates of B. (4)

4.2.2 Write down the coordinates of C, if C is the reflection of B in the line $x = 3$. (2)

4.2.3 Another circle with centre M and equation $(x - 12)^2 + (y - 10)^2 = 100$ is given.

(a) Calculate the distance, TM, between the centres. (2)

(b) Do these circles touch or intersect each other? Justify your answer. (2)

[22]

QUESTION 5

5.1 If $\sin 38^\circ = p$, determine the value of the following, **without using a calculator**:

5.1.1 $\cos 218^\circ$ (3)

5.1.2 $\cos 14^\circ$ (3)

5.1.3 $\sin 26^\circ \cos 26^\circ$ (2)

5.2 Evaluate the following trigonometric expression **without using a calculator**:

$$\frac{2 \sin 165^\circ \cos 195^\circ}{\cos 45^\circ \sin 15^\circ - \cos 15^\circ \sin 45^\circ} \quad (5)$$

5.3 Given: $K = \sqrt{3} \cos x + \sin x$.

5.3.1 Write K in the form of $t \sin(x + \theta)$. (3)

5.3.2 Hence, calculate the value of t and θ . (1)

5.3.3 Write down the maximum value of K . (1)

5.4 Prove the identity:

5.4.1 $\frac{2 \tan \theta - \sin 2\theta}{2 \sin^2 \theta} = \tan \theta$ (6)

5.4.2 Hence, determine the values of θ , $\theta \in [180^\circ; 360^\circ]$ which will make the above identity undefined. (2)

[26]

QUESTION 6

6.1 Sketch the graphs of $f(x) = 2 \sin x$ and $g(x) = \cos(x - 30^\circ)$ for $x \in [-180^\circ; 180^\circ]$ on the grid in the ANSWER BOOK. Indicate the intercepts with the axes and also the turning points. (6)

6.2 Use your graphs to answer the following questions:

6.2.1 Write down the period of g . (1)

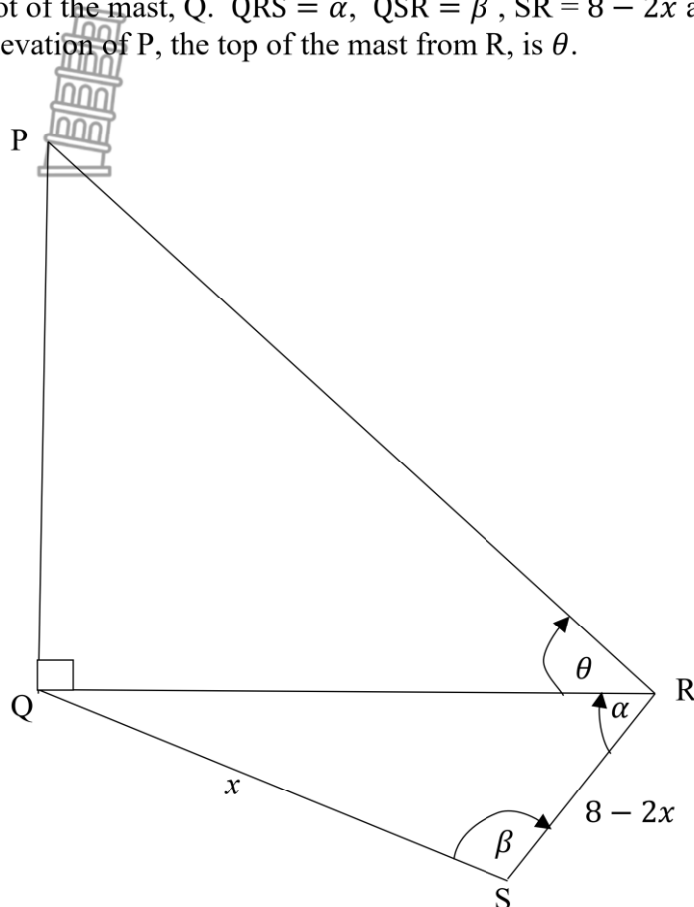
6.2.2 Determine the values of x for which $f(x) > g(x)$. (4)

6.2.3 Write down the values of x for which $f(x) = 1,5 + g(x)$. (2)

[13]

QUESTION 7

In the diagram below, PQ is a vertical mast. R and S are two points in the same horizontal plane as the foot of the mast, Q. $\widehat{QRS} = \alpha$, $\widehat{QSR} = \beta$, $SR = 8 - 2x$ and $SQ = x$. The angle of elevation of P, the top of the mast from R, is θ .



7.1 Express PQ in terms of QR and a trigonometric ratio of θ . (1)

7.2 Show that: $PQ = \frac{x \sin \beta \tan \theta}{\sin \alpha}$ (4)

7.3 If $\beta = 60^\circ$, show that the area of $\triangle QSR = 2\sqrt{3}x - \frac{\sqrt{3}}{2}x^2$. (3)

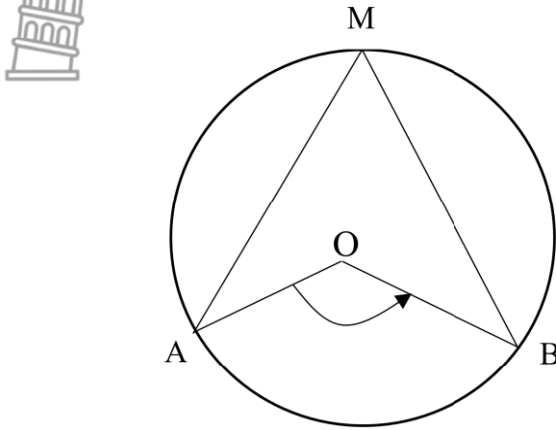
7.4 Determine the value of x for which the area of $\triangle QSR$ will be at a maximum. (3)

[11]



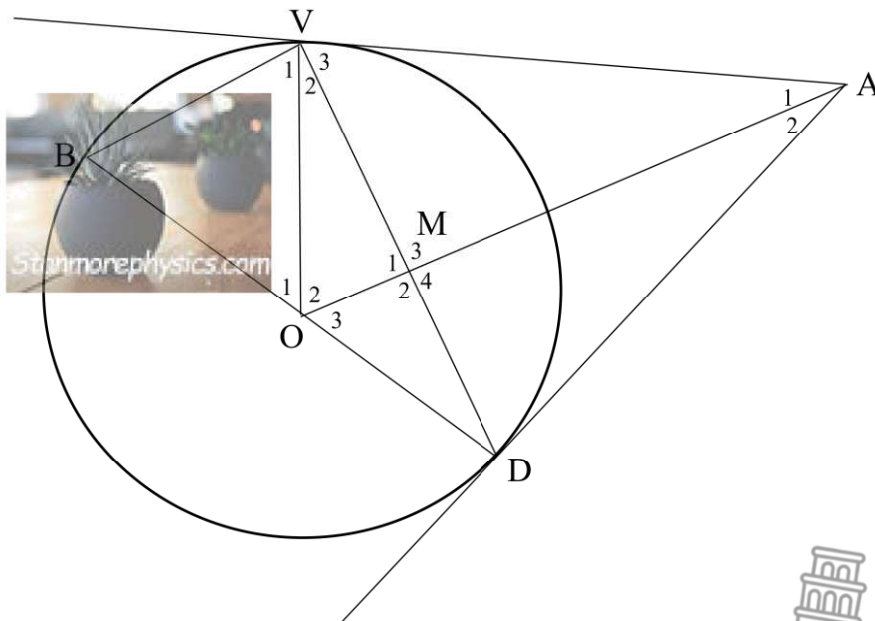
QUESTION 8

- 8.1 In the diagram O is the centre of the circle and M is a point on the circumference of the circle. Arc AB subtends $\hat{AOB}$ at the centre of the circle and $\hat{M}$ at the circumference of the circle.



Use the diagram to prove the theorem that states that $\hat{AOB} = 2\hat{M}$. (5)

- 8.2 From a point A outside the circle, center O, two tangents AD and AV are drawn. AO and VD intersect at M. BOD is a diameter of the circle. BV and VO are drawn. $\hat{VAD} = 40^\circ$



8.2.1 Prove that quadrilateral VODA is cyclic. (2)

8.2.2 Calculate the magnitude of $\hat{O}_1$. (2)

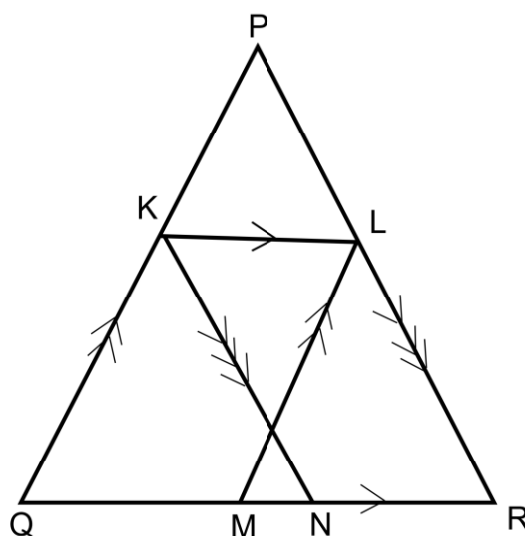
8.2.3 Prove that $BV \parallel OA$. (5)

[14]

QUESTION 9

9.1 Complete the following statement: A line drawn parallel to one side of a triangle ... (2)

9.2 In the figure, $KL \parallel QR$. M and N are points on QR such that $KN \parallel PR$ and $LM \parallel PQ$. $PK = 3$ units, $PL = 4$ units, $LR = 6$ units and $MN = 1,8$ units.



9.2.1 Calculate the length of KQ. (2)

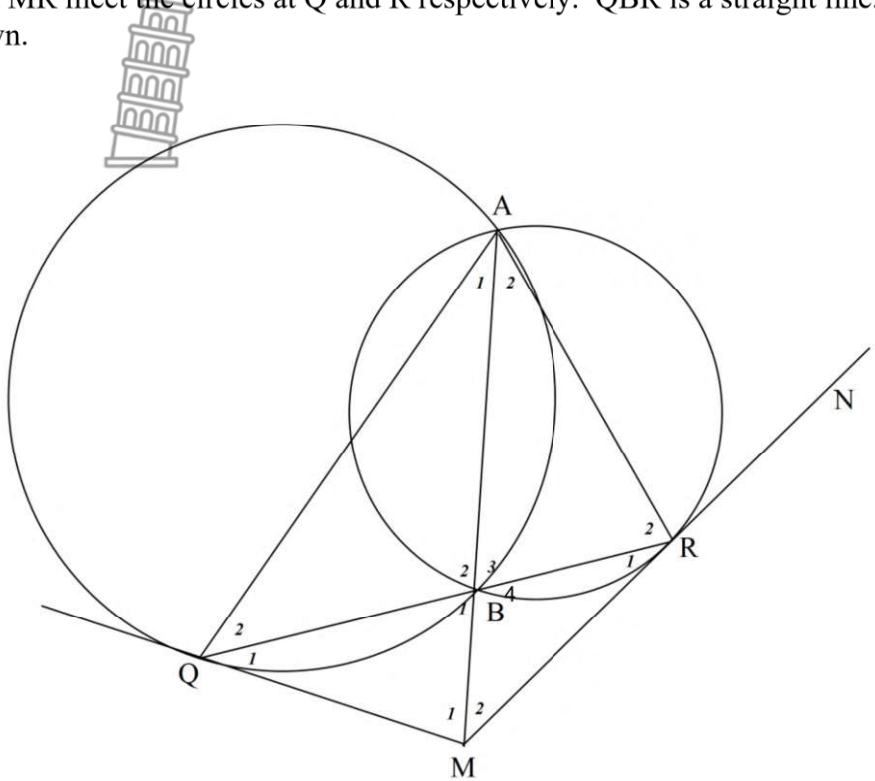
9.2.2 Prove that $QM = NR$. (2)

[6]



QUESTION 10

In the figure, two circles intersect at A and B. AB produced to M bisects $\widehat{Q\hat{A}R}$. Tangents MQ and MR meet the circles at Q and R respectively. QBR is a straight line. AQ and AR are drawn.



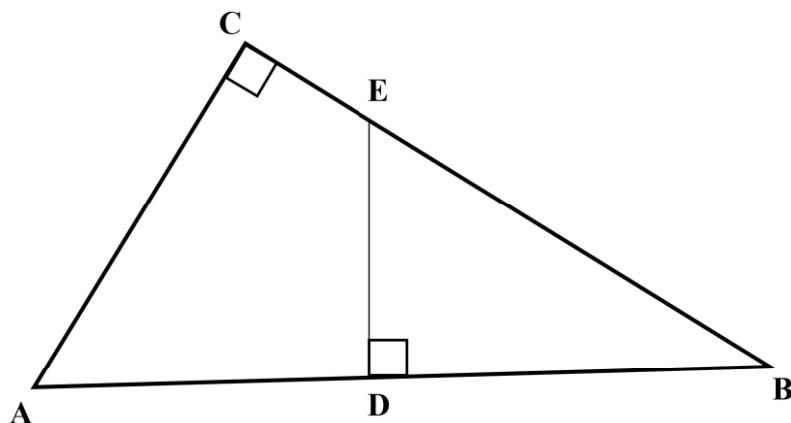
Prove:

- 10.1 $\triangle MQA \parallel \triangle MBQ$. (3)
- 10..2 $MR^2 = AM \cdot MB$ (5)
- 10.3 $\frac{MQ^2}{MR^2} = 1$ (4)

[12]

QUESTION 11

- 11 $\triangle ABC$ is right angled at C. $ED \perp AB$ with E on CB and D on AB.
 $AC = 4,8$ cm and $AB = 8$ cm. $AD = DB$.



- 11.1 Calculate BC, correct to 1 decimal digit. (2)
- 11.2 Complete: $\triangle BAC \parallel \dots$ (1)
- 11.3 Hence, or otherwise calculate the area of ADEC. (5)

[8]

GRAND TOTAL: 150

INFORMATION SHEET: MATHEMATICS
INLIGTING BLADSY

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

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

$$T_n = a + (n - 1)d$$

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

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1}; \quad r \neq 1$$

$$S_\infty = \frac{a}{1 - r}; \quad -1 < r < 1$$

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

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

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

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

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A \quad \text{area } \triangle ABC = \frac{1}{2} ab \cdot \sin C$$

$$\sin(\alpha + \beta) = \sin \alpha \cdot \cos \beta + \cos \alpha \cdot \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cdot \cos \beta - \cos \alpha \cdot \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cdot \cos \beta - \sin \alpha \cdot \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cdot \cos \beta + \sin \alpha \cdot \sin \beta$$

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

$$\sin 2\alpha = 2\sin \alpha \cdot \cos \alpha$$

$$\bar{x} = \frac{\sum f \cdot x}{n}$$

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

$$P(A) = \frac{n(A)}{n(S)}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$\hat{y} = a + bx$$

$$b = \frac{\sum (x - \bar{x})(y - \bar{y})}{\sum (x - \bar{x})^2}$$



FINAL



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EDUCATION
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**NATIONAL
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GRADE 12

MATHEMATICS P2

MARKING GUIDELINE



PREPARATORY EXAMINATIONS

SEPTEMBER 2023

MARKS: 150

This marking guideline consists of 14 pages.



NB: CA APPLIES TO ALL SUB-QUESTIONS IN THIS MARKING GUIDELINE.

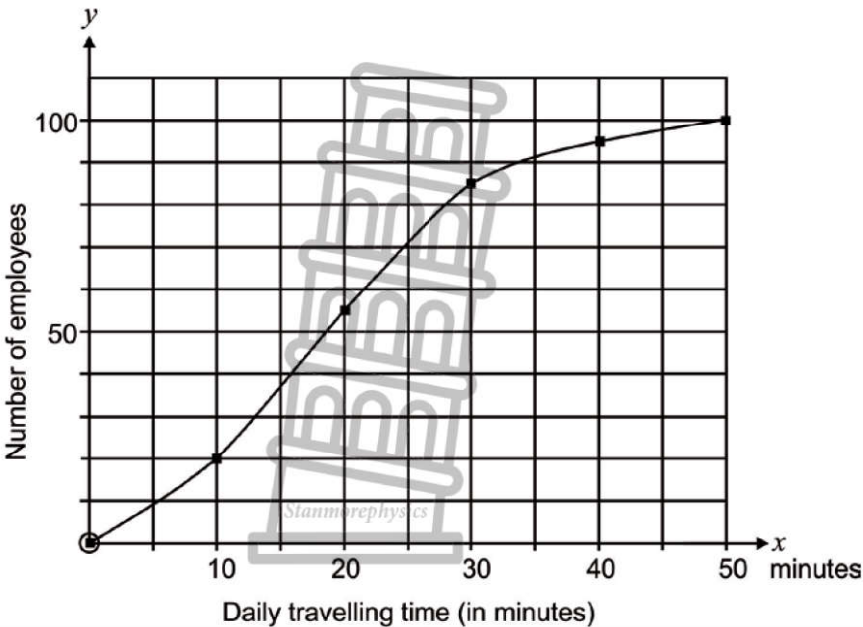
QUESTION 1

1.1	$a = 34,90$ $b = 0,08$ $y = 34,90 + 0,08x$ Answer only: Full Marks		✓A Value of a ✓A Value of b ✓CA Equation	(3)
1.2	$r = 0,88$		✓A ✓A Answer	(2)
1.3	$y = 34,90 + 0,08x$ $y = 34,90 + 0,08(560)$ $y = 79,7$ minutes = 1.33 hours Total cost = R150 + R150 = R300		✓CA Substitution ✓CA 79,7 minutes ✓CA Answer	(3)
1.4.1	Area = $100 \times 70 = 7000$ square meters $y = 34,90 + 0,08(7000)$ $y = 594,9$ minutes = 9.92 hours		✓CA Calculation	(1)
1.4.2	No. The time taken will exceed his daily 8 hour working hours.		✓CA Justification	(1)
				[10]



QUESTION 2

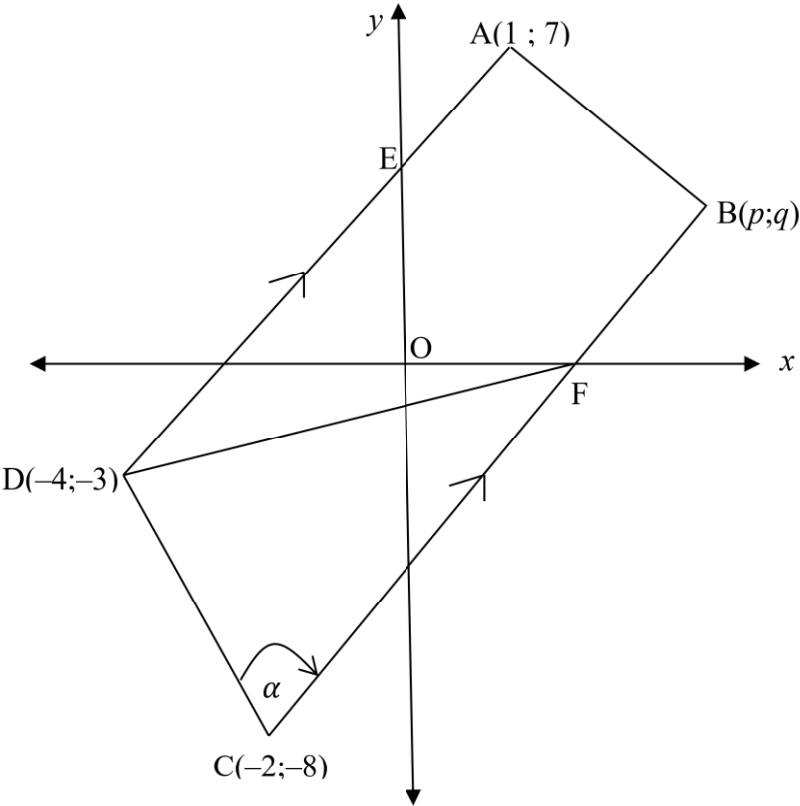
Daily travelling time x(in minutes)	Number of employees (f)	Midpoint of Interval (x)	f . x
$0 \leq x < 10$	20	5	100
$10 \leq x < 20$	35	15	525
$20 \leq x < 30$	30	25	750
$30 \leq x < 40$	10	35	350
$40 \leq x < 50$	5	45	225
Total	100		1950



2.1	Estimated Mean = $\frac{1950}{100} = 19,5$ Answer only: Full Marks	✓A 1950 ✓A 100 ✓CA Answer	(3)
2.2	$10 \leq x < 20$	✓A ✓A Answer	(2)
2.3	See Diagram	✓A Minimum and Maximum value ✓A 1 st and 3 rd Quartiles ✓A 2 nd Quartile	(3)
	Five number summary: 0 ; 12 ; 18 ; 26 ; 50 Accept: ± 1 deviation on quartiles		

2.4.1	True	✓A	Answer	(1)
2.4.2	False	✓A	Answer	(1)
2.4.3	True	✓A	Answer	(1)
				[11]

QUESTION 3

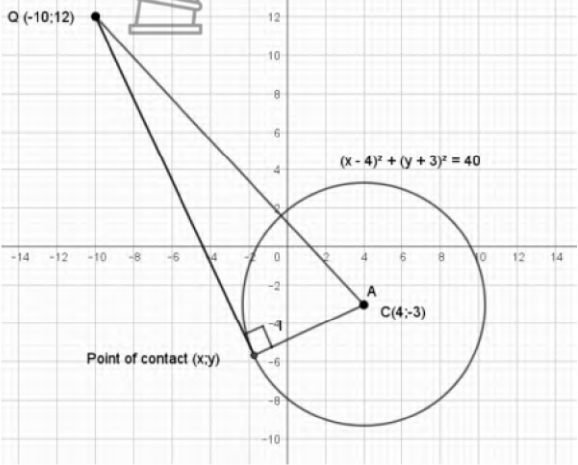


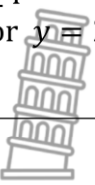
3.1	$m_{AD} = \frac{7 + 3}{1 + 4} = \frac{10}{5} = 2$	✓A Substitution of points A and D ✓CA Answer	(2)
3.2	$m_{AD} = m_{BC} = 2 \dots (AD \parallel BC)$ $y = mx + c$ $-8 = 2(-2) + c$ $-4 = c$ $y = 2x - 4$	✓CA Gradient of BC ✓CA Substitution of point C and gradient ✓CA Answer	(3)



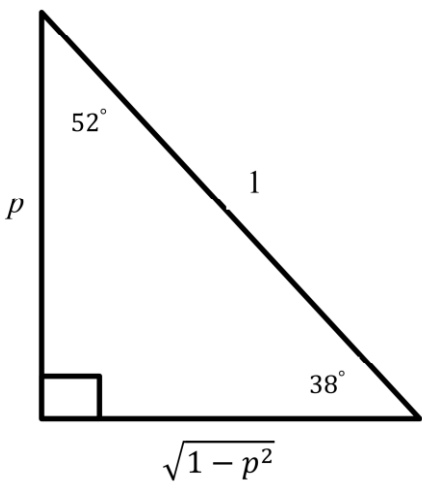
3.3	Let $y = 0$: $0 = 2x - 4$ $x = 2$ $F(2 ; 0)$ 	✓CA $0 = 2x - 4$ ✓CA x – value	(2)
3.4	$M(3 ; 2)$	✓A x – value ✓A y – value	(2)
3.5	$m_{CD} = \frac{-3 + 8}{-4 + 2} = \frac{5}{-2}$ Inclination of CD: $\tan \theta_1 = 180^\circ - 68,2^\circ = 111,8^\circ$ Inclination of CF: $\tan \theta_2 = 2$ $\theta_2 = 63,43^\circ$ Therefore $\alpha = 111,8^\circ - 63,43^\circ$ $= 48,37^\circ$ OR $DF = \sqrt{(2 + 4)^2 + (0 + 3)^2}$ $= \sqrt{45}$ $DC = \sqrt{29}$ $CF = \sqrt{80}$ $(\sqrt{45})^2 = (\sqrt{29})^2 + (\sqrt{80})^2 - 2\sqrt{29}\sqrt{80}\cos \alpha$ $\alpha = 48,37^\circ$	✓A Gradient of CD ✓A Inclination of CD ✓A Inclination of CF ✓A subtraction of the angles ✓A Distance of DF ✓A Distance of DC ✓A Distance of CF ✓A subst. into cosine rule	(4)
3.6	$DC = \sqrt{(-3 + 8)^2 + (-4 + 2)^2} = \sqrt{29}$ $FC = \sqrt{(0 + 8)^2 + (2 + 2)^2} = \sqrt{80}$ $\text{Area of } \triangle DCF = \frac{1}{2}(\sqrt{29})(\sqrt{80}) \sin 48,37^\circ$ $= 18 \text{ square units.}$	✓A Length of CD ✓CA Length of FC ✓CA Substitution into area formula ✓CA Answer 	(4)
			[17]

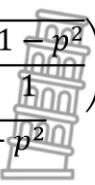
QUESTION 4

4.1.1	$x^2 + y^2 - 8x + 6y = 15$ $\text{LHS} = (2)^2 + (-9)^2 - 8(2) + 6(-9)$ $= 4 + 81 - 16 - 54$ $= 15$ $= \text{RHS}$	✓A Subst. of point ✓A Simplification	(2)
4.1.2	 $(x - 4)^2 + (y + 3)^2 = 40$ Centre: C(4 ; -3) P(2 ; -9) $m_{\text{Radius}} = \frac{-3 + 9}{4 - 2} = \frac{6}{2} = 3$ $m_{\text{Tangent}} = -\frac{1}{3}$ Equation of Tangent: $y = mx + c$ $-9 = -\frac{1}{3}(2) + c$ $-\frac{25}{3} = c$ $y = -\frac{1}{3}x - \frac{25}{3}$	✓A writing the equation as $(x - 4)^2 + (y + 3)^2 = 40$ ✓CA Centre of circle ✓CA Gradient of radius ✓CA Gradient of tangent ✓CA Substitution ✓CA Answer	(6)
4.1.3	$r^2: (x - 4)^2 + (y + 3)^2 = 40$ $r^2 = 40$ $(\text{distance } Q \text{ to the centre})^2 = (-10 - 4)^2 + (12 + 3)^2$ $= 421$ $(\text{Length of tangent})^2 = 421 - 40 = 381$ Length of tangent $= \sqrt{381}$	✓CA Calculation of r^2 ✓CA distance calculation ✓CA Tangent calculation ✓CA Answer	(4)

4.2.1	$(x - 3)^2 + (y + 2)^2 = 25$ Let $x = 0$: $(0 - 3)^2 + (y + 2)^2 = 25$ $(y + 2)^2 = 16$ $y + 2 = \pm 4$ $y = -6$ or $y = 2$ $B(0 ; 2)$ 	✓A Letting $x = 0$ ✓A Simplification ✓CA y – values ✓CA Answer	(4)
4.2.2	$C(6 ; 2)$ 	✓CA x – value ✓CA y – value	(2)
4.2.3 (a)	$T(3 ; -2)$ and $M(12 ; 10)$ $TM^2 = (12 - 3)^2 + (10 + 2)^2 = 225$ $TM = 15$ units	✓A Coordinates of M ✓CA Answer	(2)
(b)	Radius, center T = 5 units and Radius, center M = 10 units Sum of radii = 15 units Circles touch . $TM =$ Sum of radii	✓CA Sum of radii ✓CA Justification	(2)
			[22]

QUESTION 5

5.1			
5.1.1	$\cos 218^\circ$ $= -\cos 38^\circ$ $= -\frac{\sqrt{1-p^2}}{1}$	✓A Calculation of $\sqrt{1-p^2}$ ✓A Reduction ✓CA Answer 	(3)

5.1.2	$\cos 14^\circ$ $= \cos(52^\circ - 38^\circ)$ $= \cos 52^\circ \cos 38^\circ + \sin 52^\circ \sin 38^\circ$ $= \left(\frac{p}{1}\right) \left(\frac{\sqrt{1-p^2}}{1}\right) + \left(\frac{\sqrt{1-p^2}}{1}\right) \left(\frac{p}{1}\right)$ $= 2p\sqrt{1-p^2}$  OR $\cos 24^\circ = \sin 76^\circ$ $= \sin 2(38^\circ)$ $= 2 \sin 38^\circ \cos 38^\circ$ $= 2p\sqrt{1-p^2}$	✓ A Writing as difference ✓ A Expansion ✓ CA Answer ✓ $\sin 76^\circ$ ✓ double angle ✓ answer	(3)
5.1.3	$\sin 26^\circ \cos 26^\circ$ $= \frac{1}{2} \sin 52^\circ$ $= \frac{1}{2} \sqrt{1-p^2}$	✓ A Double angle ✓ CA Answer	(2)
5.2	$\frac{2 \sin 165^\circ \cos 195^\circ}{\cos 45^\circ \sin 15^\circ - \cos 15^\circ \sin 45^\circ}$ $= \frac{2 \sin 15^\circ \cdot (-\cos 15^\circ)}{\cos 45^\circ \sin 15^\circ - \cos 15^\circ \sin 45^\circ}$ $= \frac{-2 \sin 30^\circ}{\sin(15^\circ - 45^\circ)}$ $= \frac{-2 \sin 30^\circ}{\sin(-30^\circ)}$ $= \frac{-2 \sin 30^\circ}{-\sin 30^\circ}$ $= 2$	✓ A $-\cos 15^\circ$ ✓ A $-2 \sin 30^\circ$ ✓ A $\sin(15^\circ - 45^\circ)$ ✓ A $-\sin 30^\circ$ ✓ CA Answer	(5)
5.3.1	$K = \sqrt{3} \cos x + \sin x$ $K = 2 \left(\frac{\sqrt{3}}{2} \cos x + \frac{1}{2} \sin x \right)$ $K = 2(\sin 60^\circ \cos x + \cos 60^\circ \sin x)$ $K = 2 \sin(60^\circ + x)$	 ✓ A $2 \left(\frac{\sqrt{3}}{2} \cos x + \frac{1}{2} \sin x \right)$ ✓ A $\sin 60^\circ$ and $\cos 60^\circ$ ✓ A $2 \sin(60^\circ + x)$	(3)

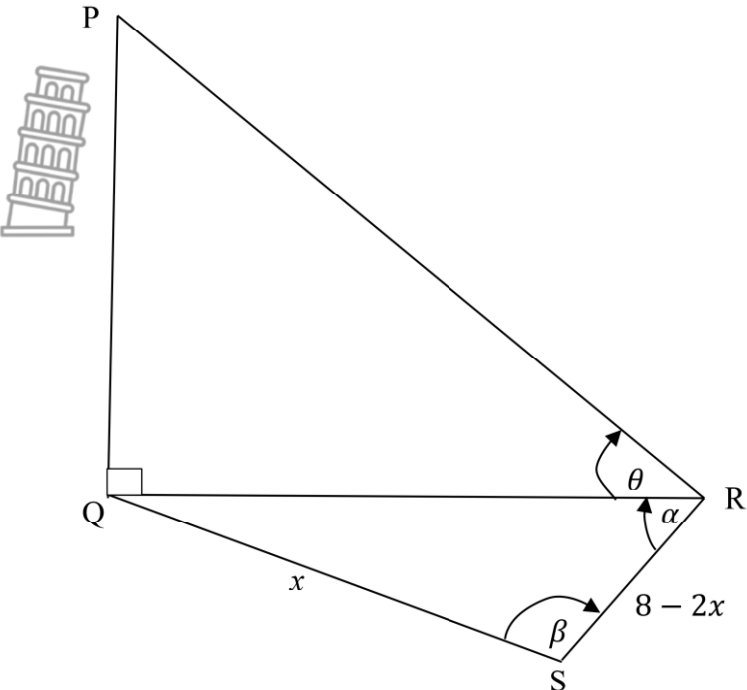
5.3.2	$t = 2$ and $\theta = 60^\circ$	✓CA t -value and $\theta = 60^\circ$	(1)
5.3.3	2	✓CA Answer	(1)
5.4.1	$\text{LHS} = \frac{2 \tan \theta - \sin 2\theta}{2 \sin^2 \theta}$ $= \frac{2 \left(\frac{\sin \theta}{\cos \theta} \right) - 2 \sin \theta \cos \theta}{2 \sin^2 \theta} \times \frac{\cos \theta}{\cos \theta}$ $= \frac{2 \sin \theta - 2 \sin \theta \cos^2 \theta}{2 \sin^2 \theta \cos \theta}$ $= \frac{2 \sin \theta (1 - \cos^2 \theta)}{2 \sin^2 \theta \cos \theta}$ $= \frac{2 \sin \theta \cdot \sin^2 \theta}{2 \sin^2 \theta \cdot \cos \theta}$ $= \frac{\sin \theta}{\cos \theta}$ $= \tan \theta$ $= \text{LHS}$	✓A $\frac{\sin \theta}{\cos \theta}$ ✓A $2 \sin \theta \cos \theta$ ✓A simplification ✓A factorizing ✓A $1 - \cos^2 \theta = \sin^2 \theta$ ✓A simplified to $\frac{\sin \theta}{\cos \theta}$	(6)
5.4.2	$2 \sin^2 \theta = 0$ $\sin \theta = 0$ $\therefore \theta = 180^\circ \text{ and } 360^\circ$ $\theta = 270^\circ$	✓ 180° and 360° ✓ 270°	(2)
			[26]



QUESTION 6

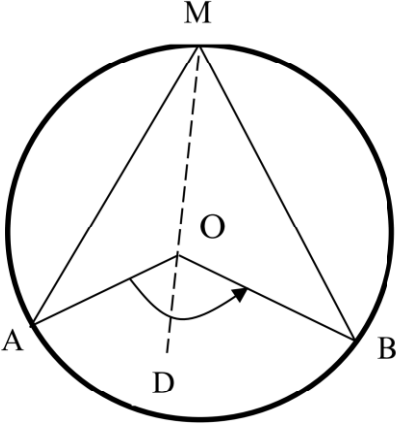
6.1			
	Graph of f: 1A mark for x – intercepts 1A marks for minimum and maximum points 1A mark for shape Graph of g: 1A mark for end points 1A mark for x – intercepts 1A mark for y – intercept (6)		
6.2.1	360°	✓A Answer	(1)
6.2.2	$x \in [-180^\circ; -150^\circ) \cup (30^\circ; 180^\circ]$	$[-180^\circ; -150^\circ)$ ✓A : Notation ✓CA : values $(30^\circ; 180^\circ]$ ✓A : Notation ✓CA : values	(4)
6.2.3	$f(x) = 1.5 + g(x)$ $f(x) - g(x) = 1.5$ $x = 90^\circ$ or $x = 150^\circ$	✓A $f(x) - g(x) = 1.5$ ✓A Answer	(2)
			[13]

QUESTION 7

		
7.1	$\frac{PQ}{QR} = \tan \theta$ $PQ = QR \tan \theta$	✓ A Answer (1)
7.2	$\frac{QR}{\sin \hat{S}} = \frac{QS}{\sin \angle QRS}$ $\frac{QR}{\sin \beta} = \frac{x}{\sin \alpha}$ $QR = \frac{x \sin \beta}{\sin \alpha}$ $PQ = \frac{x \sin \beta \tan \theta}{\sin \alpha}$	✓ A Sine rule formula ✓ A Subs. Sine rule ✓ A Making QR a subj. of the formula ✓ A Subst. of QR (4)
7.3	$\text{Area of } \triangle QSR = \frac{1}{2}(x)(8 - 2x) \sin 60^\circ$ $= \frac{1}{2}(x)(8 - 2x) \left(\frac{\sqrt{3}}{2}\right)$ $= \frac{\sqrt{3}}{4}(x)(8 - 2x)$ $= \sqrt{3}(x) \left(2 - \frac{1}{2}x\right)$ $= 2\sqrt{3}x - \frac{\sqrt{3}}{2}x^2$	✓ A Subst. into Area rule ✓ A $\frac{\sqrt{3}}{2}$ ✓ A Simplifying  (3)

7.4	For Max Area: $x = -\frac{b}{2a}$ $x = -\frac{(2\sqrt{3})}{2\left(-\frac{\sqrt{3}}{2}\right)}$ $x = 2$ 	✓ A Formula ✓ A Substitution into formula ✓ CA Answer	(3)
			[11]

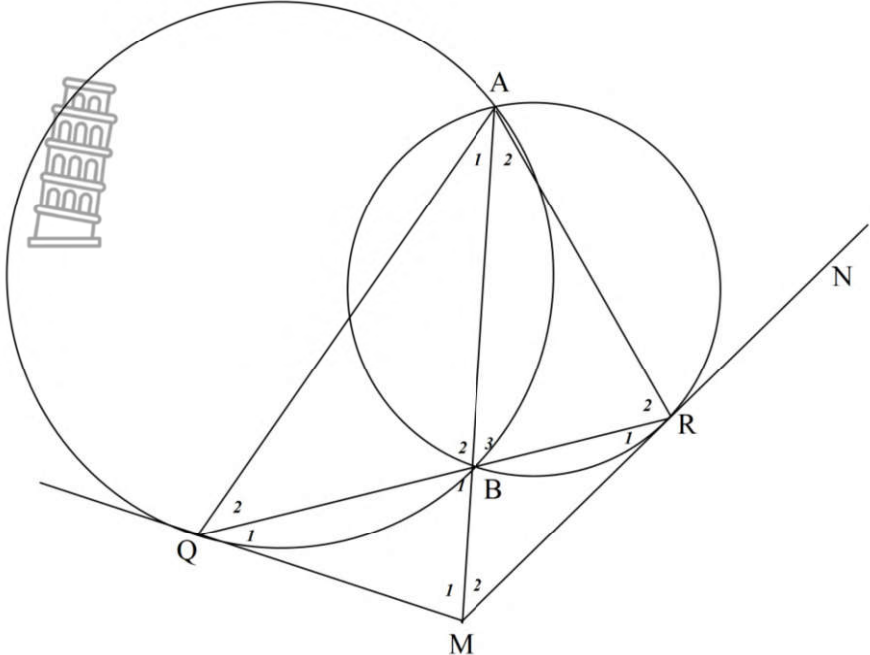
QUESTION 8

8.1	 <u>Constr:</u> Join MO and produce to D. $\widehat{AÔD} = \widehat{OÂM} + \widehat{AÔM} \dots$ (Ext. o $\angle$ f Δ) $\widehat{BÔD} = \widehat{OÔB} + \widehat{BÔM} \dots$ (Ext. $\angle$ of Δ) But $\widehat{OÂM} = \widehat{AÔM}$ and $\widehat{OÔB} = \widehat{BÔM} \dots$ (Radii =) $\therefore \widehat{AÔD} + \widehat{BÔD} = 2\widehat{AÔM} + 2\widehat{BÔM}$ $\widehat{AÔB} = 2(\widehat{AÔM} + \widehat{BÔM})$ $\widehat{AÔB} = 2\widehat{M}$ NOTE No construction : No marks	✓ A Construction ✓ A S/R ✓ A S ✓ A S ✓ A S	(5)
8.2.1	$\widehat{OÔA} = \widehat{OÔD} = 90^\circ \dots$ (Radius $\perp$ Tangent) VODA is a cyclic quad. (Converse of opposite angles of quad. Supplementary)	✓ A S/R ✓ A R	(2)
8.2.2	$\widehat{O}_1 = 40^\circ \dots$ (Exterior angle of cyclic quad = int. opp. Angle)	✓ S ✓ R	(2)

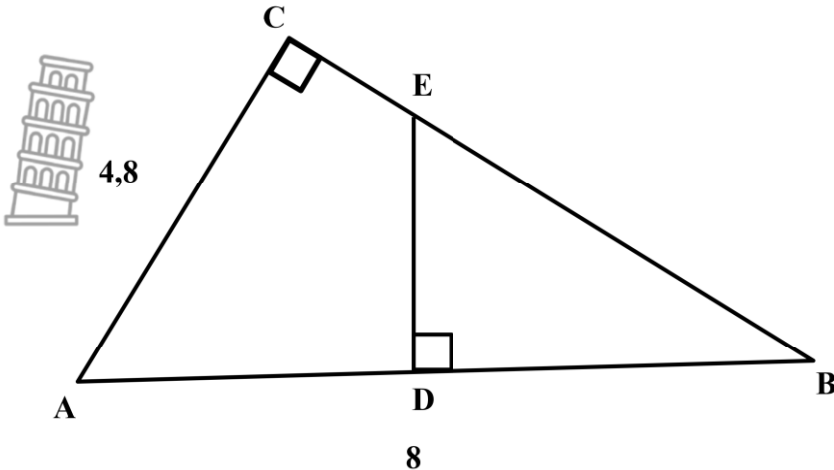
8.2.3	$\hat{V}_1 = \frac{180^\circ - 40^\circ}{2} = 70^\circ$(sum of $\angle$s of Δ; radii) $\hat{A}\hat{D}\hat{M} = \frac{180^\circ - 40^\circ}{2} = 70^\circ$(sum of $\angle$s of Δ; Tangents drawn from a common point A) $\hat{A}\hat{D}\hat{M} = \hat{O}_2 = 70^\circ$... (Angles subtended by common chord AV) BV $\parallel$ OA(Converse of Alt $\angle$s or Alt $\angle$s are =) OR In ΔOVA and ΔODA OV=OD.....(radii) OA=OA.....(common) AV=AD.....(tangents from the same point) $\Delta OVA \equiv \Delta ODA$.....(SSS) $A_1 = A_2$.....($\equiv \Delta$s) $= 20^\circ$ $A_2 = V_2$.....($\angle$s in the same segment) $= 20^\circ$ $V_1 = 90^\circ - 20^\circ = 70^\circ$ $O_2 = 180^\circ - [\hat{O}VA + \hat{A}_1]$ $= 180^\circ - [90^\circ + 20^\circ]$ $= 70^\circ$ $\therefore \hat{V}_1 = \hat{O}_2$.....(both $= 70^\circ$) $\therefore BV \parallel OA$..... (alt $\angle$s are = or conv.alt $\angle$s)	✓ S/R ✓ S/R ✓S ✓R ✓ R ✓A $\Delta OVA \equiv \Delta ODA$.....(SSS) ✓A S/R ✓A $V_1 = 70^\circ$ ✓A $O_2 = 70^\circ$ ✓A R	(5)
			[14]



QUESTION 10

			
10.1	In Δ's MQA and MBQ $\widehat{M}_1 = \widehat{M}_1$(Common) $\widehat{A}_1 = \widehat{Q}_1$(Tan-Chord Theorem) $\widehat{AQM} = \widehat{B}_1$(Remaining $\angle$s of Δ's) $\Delta MQA \parallel \Delta MBQ$(AAA)	✓ S/R ✓ S/R ✓ R	(3)
10.2	In Δ's MAR and MRB $\widehat{M}_2 = \widehat{M}_2$(Common) $\widehat{A}_2 = \widehat{R}_1$(Tan-Chord Thm) $\widehat{ARM} = \widehat{RBM}$(Remaining $\angle$s of Δ's) $\Delta MAR \parallel \Delta MRB$(AAA) $\frac{MA}{MR} = \frac{MR}{MB}$(Δ's similar) $MR^2 = AM \cdot MB$	✓ S ✓ S/R ✓ R ✓ S A✓R	(5)
10.3	$\frac{MQ}{MB} = \frac{MA}{MQ}$(from 10.1) $MQ^2 = MB \cdot MA = \dots \dots (1)$ Also $MR^2 = AM \cdot MB$ Now $\frac{MQ^2}{MR^2} = \frac{MB \cdot MA}{AM \cdot MB}$ $\therefore \frac{MQ^2}{MR^2} = 1$	✓ $\frac{MQ}{MB} = \frac{MA}{MQ}$ ✓ $MQ^2 = MB \cdot MA$ ✓✓ $\frac{MQ^2}{MR^2} = \frac{MB \cdot MA}{AM \cdot MB}$	(4)
			[12]

QUESTION 11

			
11.1	$BC^2 = 8^2 - 4,8^2 \dots\dots\dots(\text{ TOP})$ $BC = 6,4 \text{ cm}$	✓ S ✓ S	(2)
11.2	$\triangle BED$	✓ S	(1)
11.3	$\frac{BA}{BE} = \frac{AC}{ED} = \frac{BC}{BD}$ $\frac{8}{BE} = \frac{4,8}{ED} = \frac{6,4}{4}$ $ED = \frac{4,8 \times 4}{6,4} = 3 \text{ cm}$ Area of $\triangle EDB$ $= \frac{1}{2}(4)(3) = 6 \text{ cm}^2$ Area of $\triangle ABC$ $= \frac{1}{2}(4,8)(6,4) = 15,6 \text{ cm}^2$ Therefore, Area of ADEC $= 15,6 - 6 = 9,6 \text{ cm}^2$ $\triangle BAC \parallel \triangle BED$	✓A S ✓CA Value of ED ✓CA Area of $\triangle EDB$ ✓CA Area of $\triangle ABC$ ✓CA Area of ADEC 	(5)
			[8]

GRAND TOTAL: 150