GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION
2025

11092

TECHNICAL MATHEMATICS
(PAPER 2)

SCHOOL:										
SURNAME:										
NAME:										
DATE:	**2**	**0**	**2**	**5**	**-**	**M**	**M**	**-**	**D**	**D**

	MARKER				MODERATOR			
QUESTION	**MARKS**			**MARKER'S INITIALS**	**MARKS**			**MODERATOR'S INITIALS**
1	**0**				**0**			
2	**0**				**0**			
3	**0**				**0**			
4	**0**				**0**			
5	**0**				**0**			
6	**0**				**0**			
7	**0**				**0**			
8	**0**				**0**			
9	**0**				**0**			
10	**0**				**0**			
11	**0**				**0**			
12	**0**				**0**			
				TOTAL				

TIME: 3 hours

MARKS: 150

25 pages + a 2-page information sheet

P.T.O.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of TWELVE questions.

2. Answer ALL the questions in the spaces provided.

3. Clearly show ALL calculations, diagrams, graphs, etc. that you have used in determining your answers.

4. Answers only will NOT necessarily be awarded full marks.

5. If necessary, round-off answers to TWO decimal places, unless stated otherwise.

6. Diagrams are NOT necessarily drawn to scale.

7. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.

8. A 2-page INFORMATION SHEET with formulae is included at the end of the question paper.

9. Candidates may NOT retain a question paper or remove it from the examination room. Question papers must be returned to the invigilator at the end of the examination session.

10. Answers must be written in blue/black ink as distinctly as possible. Do NOT write in the margins.

11. Indicate the questions that you have answered by drawing a circle around the relevant numbers on the front cover of the question paper where marks are to be recorded.

12. Draw a neat line through any work/rough work that must NOT be marked.

13. If you use the additional space provided:

    13.1 Write down the number of the question.
    13.2 Leave a line and rule off after your answer.

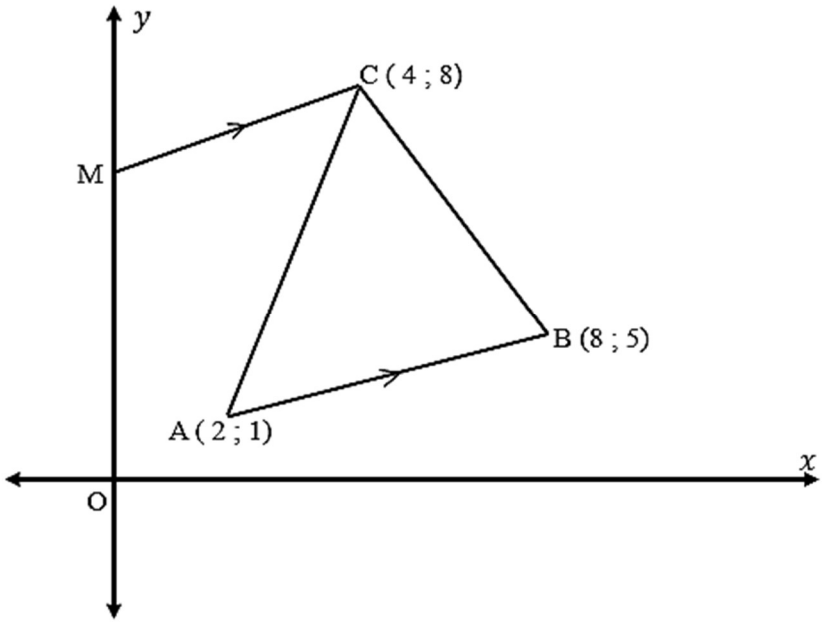
14. Write neatly and legibly.

KEEP THIS PAGE BLANK.

QUESTION 1

In the diagram below, ΔABC with vertices A (2 ; 1); B (8 ; 5) and C (4 ; 8) is given.

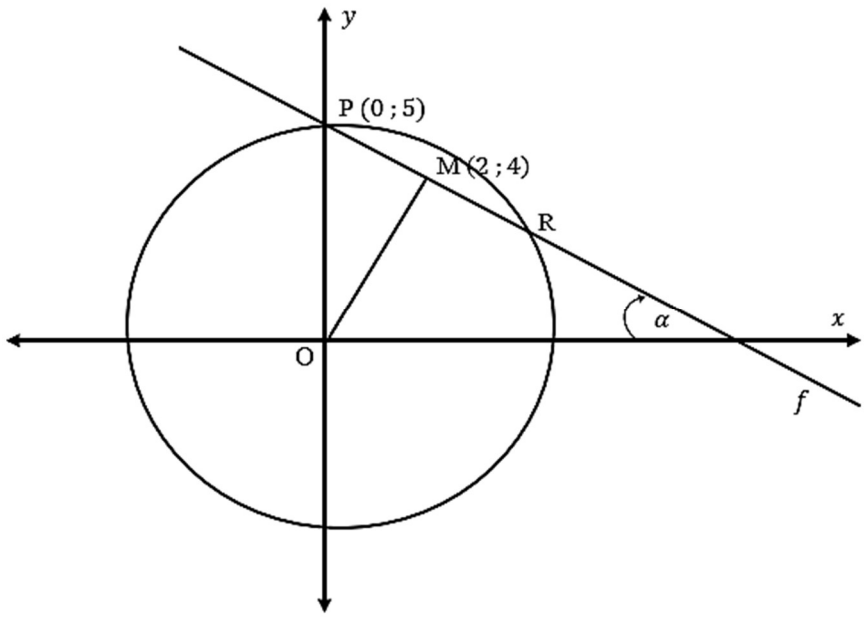
Point M $(x\ ;y)$ lies on the y-axis such that MC // AB.

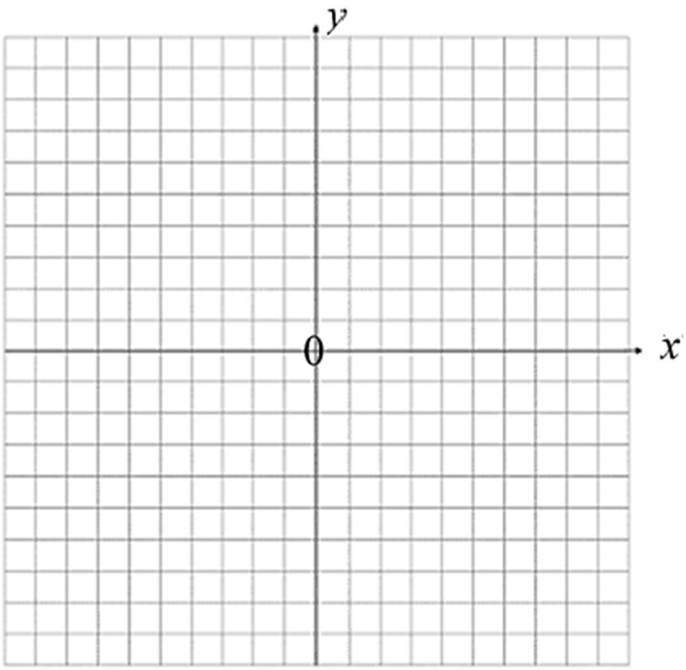


1.1 Determine the length of BC. (2)

1.2 Determine the gradient of AB. (2)

1.3	Determine the equation of CM.	(3)
1.4	Determine the coordinates of M.	(2)
1.5	Determine the value of t if E$(t\ ;\ 6)$ is a point on straight line CM.	(3)
		[12]

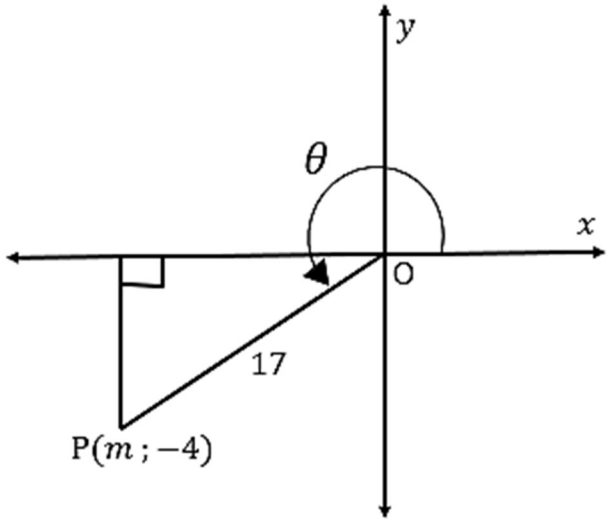
QUESTION 2		
2.1	In the diagram below, the circle with the origin as its centre cuts the straight line f at points P$(0\,;5)$ and R. The point M$(2\,;4)$ is the midpoint of PR, and α is the size of the acute angle that f makes with the x-axis.  	
2.1.1	Determine the equation of the circle.	(2)
2.1.2	Write down the coordinates of R.	(3)
2.1.3	Show, by using analytical methods, that OM ⊥ PR.	(4)

2.1.4	Calculate the size of α correct to one decimal place.	(2)
2.2	Draw the following ellipse and clearly indicate ALL intercepts with axes. $\frac{x^2}{4}+\frac{y^2}{25}=1$ 	(3)
		[14]

QUESTION 3

3.1 In the diagram below, OP $= 17$ units and point P$(m\,;-4)$ is given.

$\widehat{XOP} = \theta$



3.1.1 Determine the value of m. (Leave your answer in simplified surd form.) (3)

3.1.2 Determine the value of $sec^2\theta - 1$, **without the use of a calculator.** (2)

3.1.3 Determine the magnitude of θ. (4)

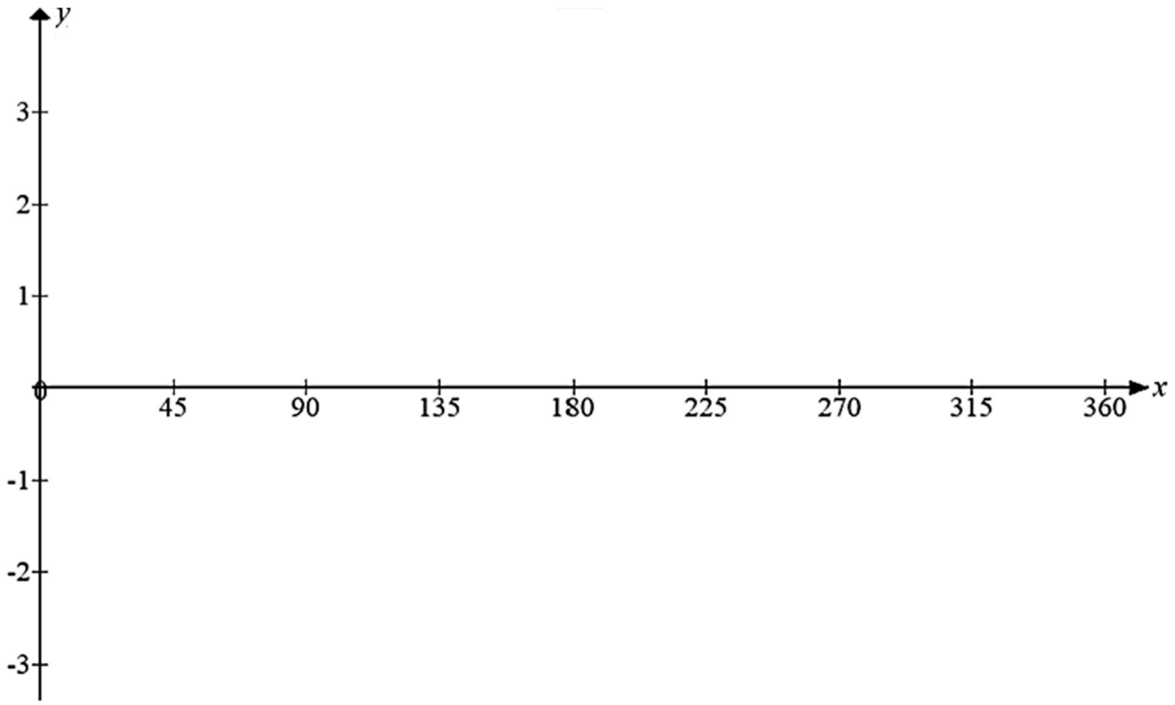
3.2	Calculate the value of $\text{cosec}\left(2\pi - \frac{5}{3}\pi\right)$, correct to three decimal places.	(3)
		[12]
QUESTION 4		
4.1	Complete: $1 - \cos^2\theta = \ldots$	(1)
4.2	Simplify the following, **without the use of a calculator**, to a numerical value: $\dfrac{\sin(180^\circ - \theta).\cos(2\pi - \theta).\tan(180^\circ + \theta)}{1 + \cos\theta.\cos(180^\circ - \theta)}$	(7)

4.3	Solve for x: $\tan 2x = \sin 41,3^{\circ} + \sin 153,6^{\circ}$ for $x \in [0^0 ; 90^0]$	
		(4)
		[12]

QUESTION 5

Given: The functions defined by $f(x) = \sin 2x$ and $g(x) = 2\cos x$ for $x \in [0^\circ; 360^\circ]$.

5.1 Draw a sketch graph of f and g on the same set of axes. Clearly show ALL turning points and intercepts with the axes.



(6)

5.2 Write down the period of f.

(1)

5.3 Determine the range of g.

(2)

5.4 Use the graph in QUESTION 5.1 to write down the value(s) of x for which:

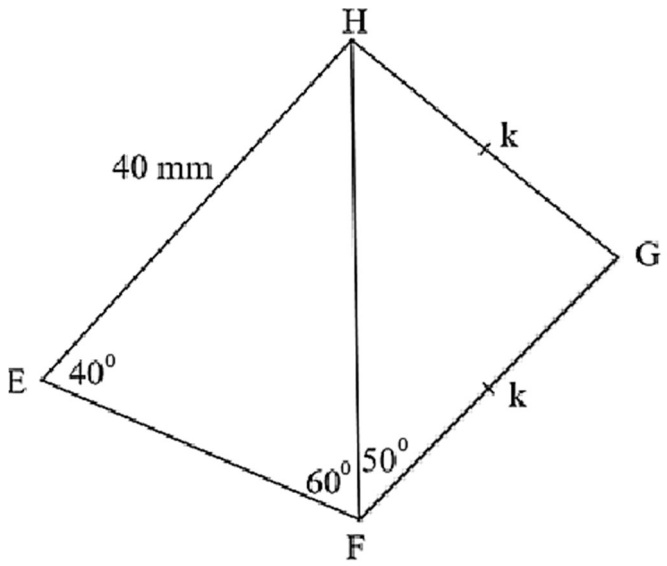
5.4.1 $\sin 2x = 2\cos x$

(2)

5.4.2 $2\cos x - \sin 2x = 2$

(2)

[13]

QUESTION 6		
6.1	Complete for any ΔABC: Area of $\Delta ABC = \frac{1}{2} \times ac \times \ldots$	(1)
6.2	In the diagram below $\hat{E} = 40^{\circ}$, $E\hat{F}H = 60^{\circ}$, $G\hat{F}H = 50^{\circ}$, $EH = 40\ mm$ and $FG = HG = k$  	
6.2.1	Determine the length of FH using ΔEHF.	(3)
6.2.2	Calculate the size of $\hat{G}$.	(1)

6.2.3	Hence, use the cosine rule to show that $HF^2 = 2k^2(1 - \cos 80^\circ)$.	(2)
6.2.4	Hence, calculate the value of k correct to the nearest mm.	(3)
6.2.5	Determine the area of ΔHFG (correct to two decimal places).	(3)
		[13]

QUESTION 7

7.1 Fill in the missing word(s) in the following theorem statement:

The tangent to a circle is ... to the radius of the circle at the point of contact.

(1)

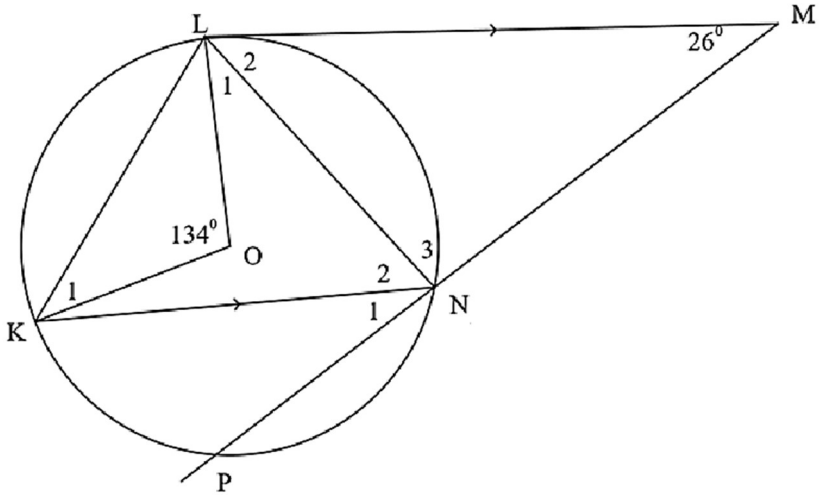
7.2 In the diagram below, K, L, N and P are points on a circle with centre O.

LM is a tangent to the circle.

LM is parallel to KN.

MNP is a straight line that cuts the circle at N and P.

$L\widehat{M}N = 26°$ and $K\widehat{O}L = 134°$.



Determine, stating reasons, the size of the following angles:

7.2.1 $\widehat{K}_1$

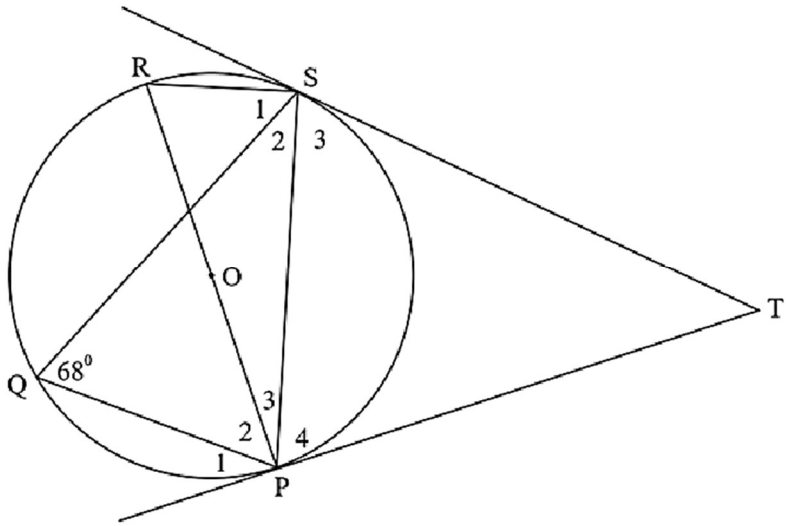
(3)

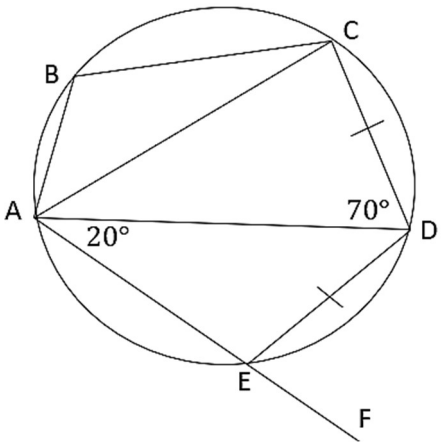
7.2.2 $\widehat{N}_2$

(2)

7.2.3 $\widehat{L}_1$

(4)

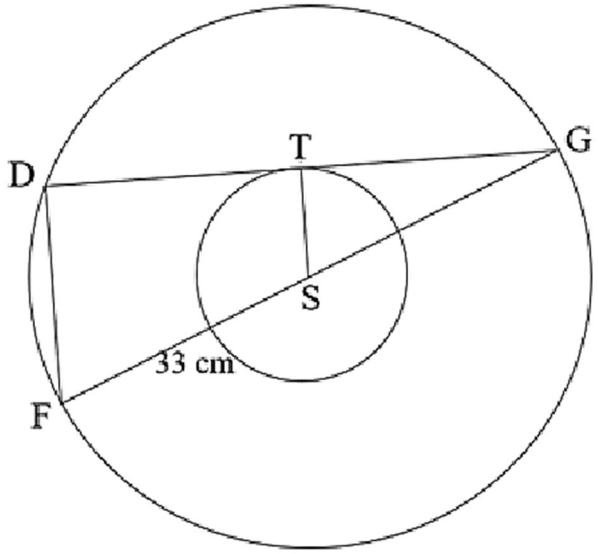
7.2.4	$\widehat{N}_3$	(2)
		[12]
QUESTION 8		
8.1	Complete the following: Two tangents drawn to a circle from the same point outside the circle are …	(1)
8.2	In the diagram below, P, Q, R, and S are points on the circle with centre O. RP is a diameter. PT and ST are tangents to the circle at P and S respectively. $P\widehat{Q}S = 68°$.  	
8.2.1	State, with reasons, THREE angles that are equal to 90° .	(5)

8.2.2	Determine, stating reasons, the size of the following angles:		
	(a)	$\widehat{R}$	(2)
	(b)	$\widehat{T}$	(4)
8.3	Complete the following statement. The … angle of a cyclic quadrilateral is equal to the interior opposite angle.		(1)
8.4	In the diagram below, A, B, C, D and E are points on a circle. $DE = CD$, $D\widehat{A}E = 20°$ and $A\widehat{D}C = 70°$. AE is produced to F.  		
8.4.1	Give a reason why $C\widehat{A}D = 20°$.		(1)

8.4.2	Show that AD is the diameter of the circle.	
		(3)
8.4.3	Hence, determine with reason(s), the size of $D\hat{E}F$.	
		(2)
		[19]

QUESTION 9

In the diagram below, FG is the diameter of the larger circle.
S is the centre of both the smaller circle and the larger circle.
DTG is a tangent to the smaller circle at T.
FS = 33 cm



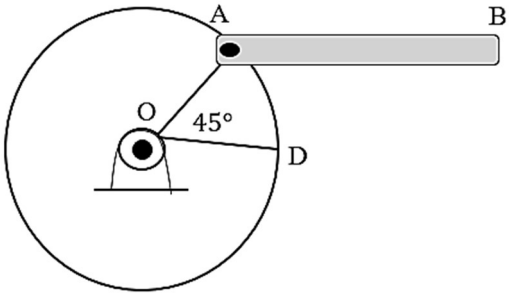
9.1	Write down the length of GS. Give a reason for the answer.	(2)
9.2	State, with reasons, why TS is parallel to DF.	(3)
9.3	Show that ΔGDF ||| ΔGTS.	(3)
		[8]

QUESTION 10

10.1 The picture below shows a tractor pulling a disc plough. Alongside is the disc plough and beneath it is a diagram of one of the discs (not drawn to scale) represented as a circle with a radius of 2,25 m and a central angle of 45°. The disc is connected to the disc plough by a rod marked AB. The disc rotates in an anticlockwise direction at 12 revolutions per minute.







10.1.1 Determine the reflex angle AOD in radians. (2)

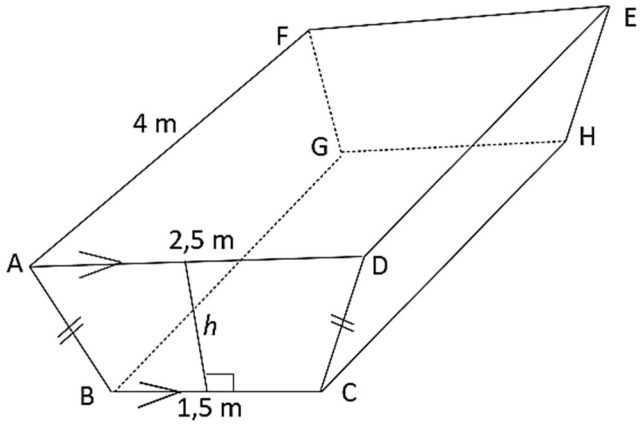
10.1.2 Hence, calculate the length of the major arc AD. (3)

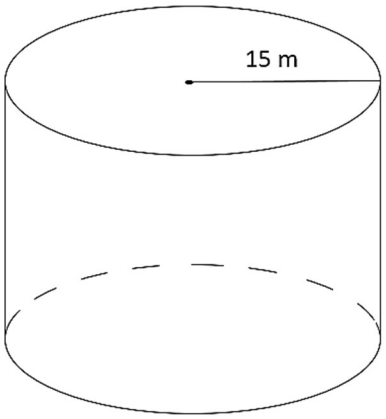
10.1.3 Determine the circumferential velocity of the disc in metres per second. (4)

10.1.4	Calculate the angular velocity in radians per second.	(3)
10.2	The major sector of the disc is covered by mud after a day in the field. Calculate the area of the major sector AOD.	(3)
		[15]

QUESTION 11

11.1 In the diagram, ABCDEFGH is a water trough, with base BCHG.
The cross-section ABCD is an isosceles trapezium with AD parallel to BC.
AD = 2,5 m, BC = 1,5 m and AB = DC. The trough is 4 m long.
The water trough is filled from a cylindrical reservoir with a radius of 15 m.





$$\textbf{Area of a trapezium} = \frac{\textbf{sum of parallel sides}}{\textbf{2}} \times \textbf{h}$$

$$\textbf{Area of a rectangle} = \textbf{length} \times \textbf{breadth}$$

$$\textbf{Volume of a trapezoid} = \textbf{area of base} \times \textbf{height}$$

$$\textbf{Volume of a cylinder} = \pi \textbf{r}^2\textbf{h}$$

Given: The area of the isosceles trapezium ABCD is 8 m^2.

Calculate:

11.1.1 The height h

(2)

11.1.2 The length of AB

(3)

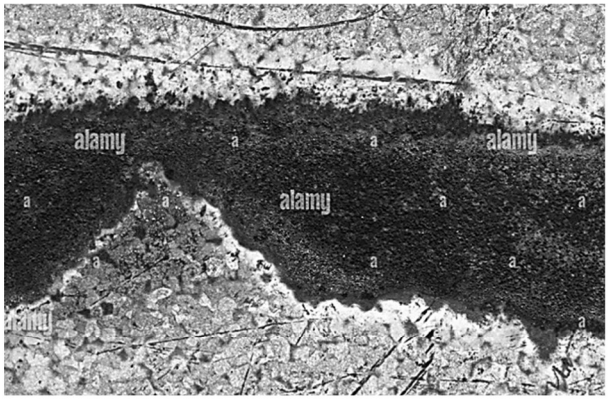
11.2 Calculate the cost of painting the interior of the trough, if paint costs R70 per m^2.

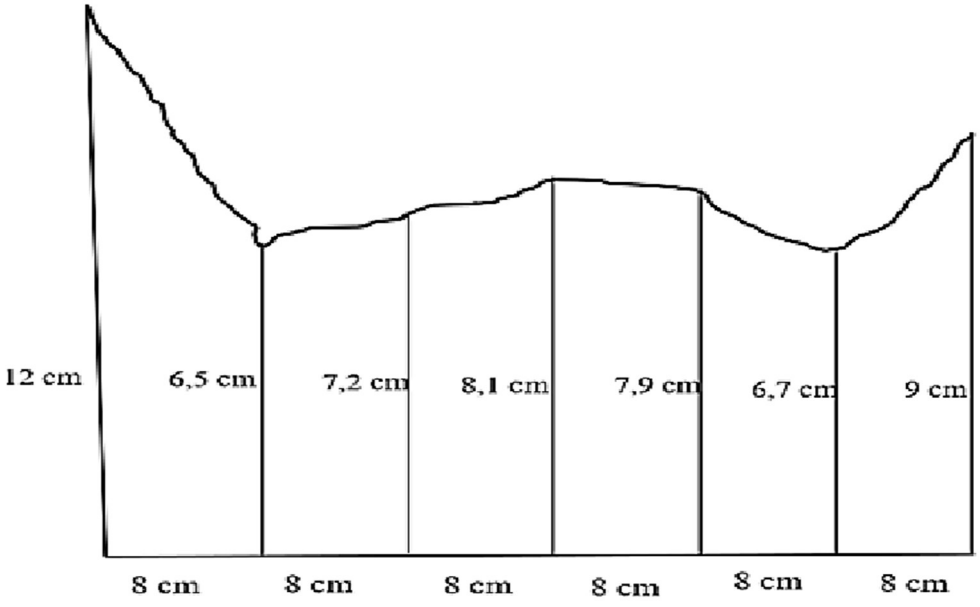
(3)

11.3	Calculate, the capacity of the trough, in litres.	(3)
11.4	The trough was filled with water from the cylindrical reservoir. Calculate the drop in the water level (height) of the cylindrical reservoir, giving your answer in centimetres. ($\pi = \frac{22}{7}$).	(3)
		[14]

QUESTION 12

The picture below shows a corroded metal sheet. The students of a welding class have been tasked to clean this piece of metal sheet before it is galvanised.





12.1. If the metal sheet is divided into 6 equal parts of 8 cm each, and the ordinates are 12 cm; 6,5 cm; 7,2 cm; 8,1 cm; 7,9 cm; 6,7 cm and 9 cm, calculate the area of the corroded part using the mid-ordinate rule. (3)

12.2	If the width of the metal sheet is 2,2 m, calculate the total area that needs to be galvanised in m^2.	
		(3)
		[6]

ADDITIONAL SPACE		

TOTAL: 150

END

INFORMATION SHEET: TECHNICAL MATHEMATICS

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

$$a^x = b \Leftrightarrow x = log_a\, b, \qquad a > 0, a \neq 1 \text{ and } b > 0$$

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

$$i_{eff} = \left(1 + \frac{i}{m}\right)^m - 1$$

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

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C, n \neq -1 \qquad \int kx^n dx = k.\frac{x^{n+1}}{n+1} + C, n \neq -1$$

$$\int \frac{1}{x} dx = \ln x + C, x > 0 \qquad \int \frac{k}{x} dx = k\, ln\, x + C, x > 0$$

$$\int a^x\, dx = \frac{a^x}{\ln a} + C, a > 0 \qquad \int ka^{nx} dx = k.\frac{a^{nx}}{n \ln a} + C, a > 0$$

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

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

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

In ΔABC: $\qquad \frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinC} \qquad a^2 = b^2 + c^2 - 2bc.cosA$

Area of $\Delta ABC = \frac{1}{2} ab.sinC$

$$sin^2\theta + cos^2\theta = 1 \qquad 1 + tan^2\theta = sec^2\theta \qquad 1 + cot^2\theta = cosec^2\theta$$

$\pi rad = 180°$

Angular velocity $= \omega = 2\pi n$	where n = rotation frequency
Angular velocity $= \omega = 360°n$	where n = rotation frequency
Circumferential velocity $= v = \pi Dn$	where D = diameter and n = rotation frequency
Circumferential velocity = $v = \omega r$	where ω = angular velocity and r = radius
Arc length $= s = r\theta$	where r = radius and θ = central angle in radians
Area of a sector $= \frac{rs}{2}$	where r = radius, s = arc length
Area of a sector $= \frac{r^2\theta}{2}$	where r = radius and θ = central angle in radians
$4h^2 - 4dh + x^2 = 0$	where h = height of segment, d = diameter of circle and x = length of chord
$A_T = a(m_1 + m_2 + m_3 + \cdots + m_n)$	where a = width of the equal parts, $m_1 = \frac{o_1+o_2}{2}$ $O_n = n^{th}$ ordinate and n = number of ordinates
	OR
$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + \cdots + o_{n-1}\right)$	where a = width of the equal parts, $o_n = n^{th}$ ordinate and n =number of ordinates

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TECHNICAL MATHEMATICS
(PAPER 2)

TECHNICAL MATHEMATICS: Paper 2

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