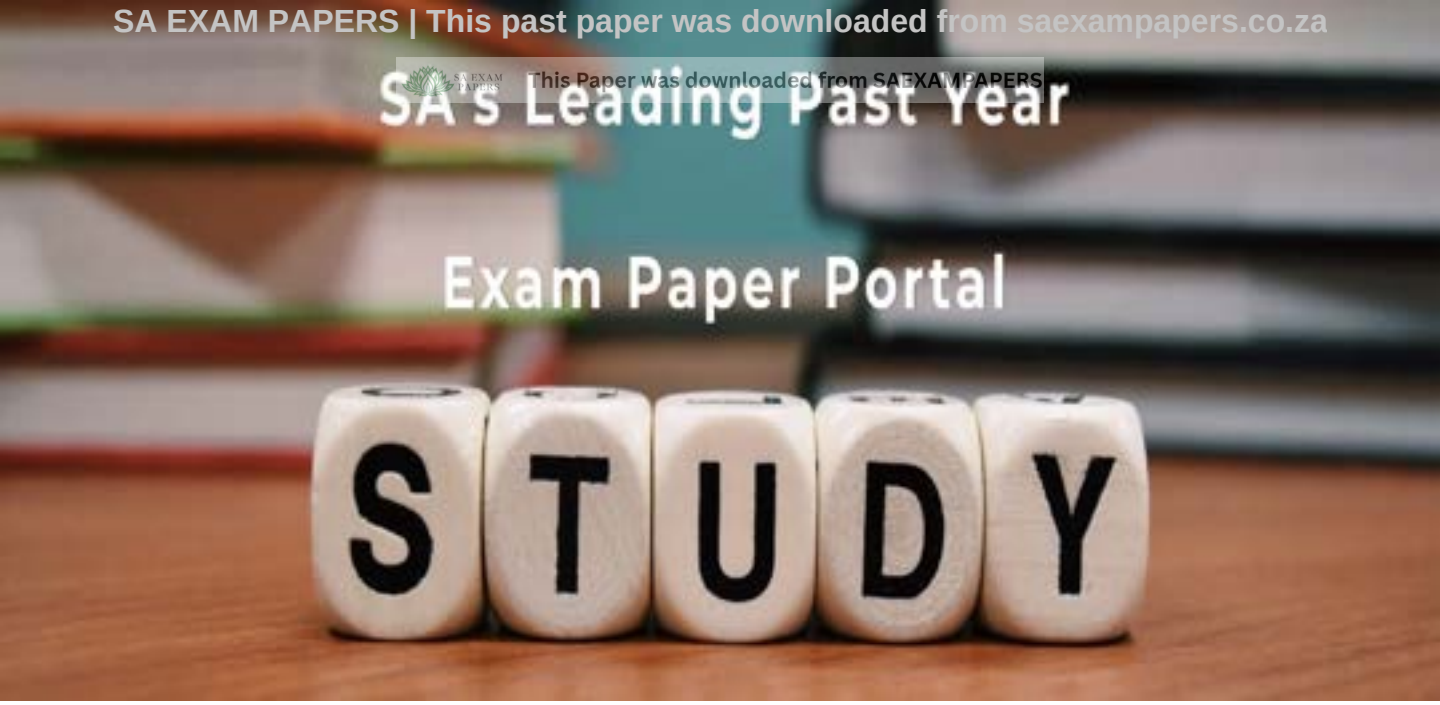

GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION
GRADE 12

2025

TECHNICAL MATHEMATICS
(PAPER 2)

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

	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**			
				TOTAL				

TIME: 3 hours

MARKS: 150

35 pages + a 2-page information sheet

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 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 margin.
11. Indicate the questions 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. In the event that 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.

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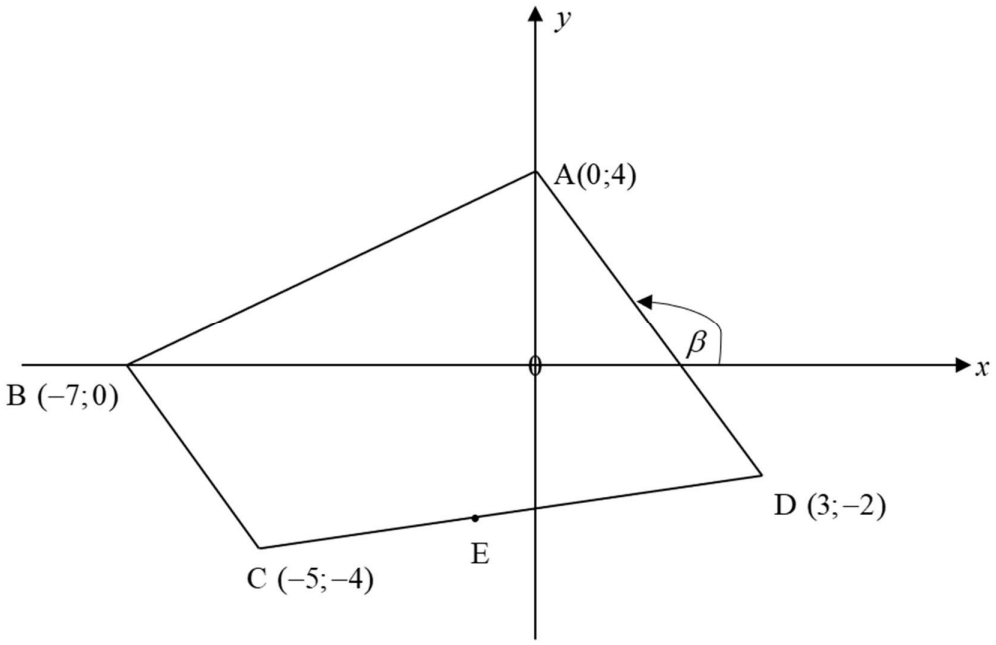
QUESTION 1

In the diagram below, $A(0\,;4)$, $B(-7\,;0)$,C $(-5\,;-4)$and $D(3\,;-2)$ are the vertices of a quadrilateral ABCD. E is a midpoint of CD.



1.1	Determine the length of AB. (Leave your answer in surd form.)	(2)
1.2	Determine the coordinates of E, the midpoint of CD.	(2)

1.3	Determine the gradient of AD.	(2)
1.4	Determine the size of β.	(4)
1.5	Determine the equation of line AD.	(2)
		[12]

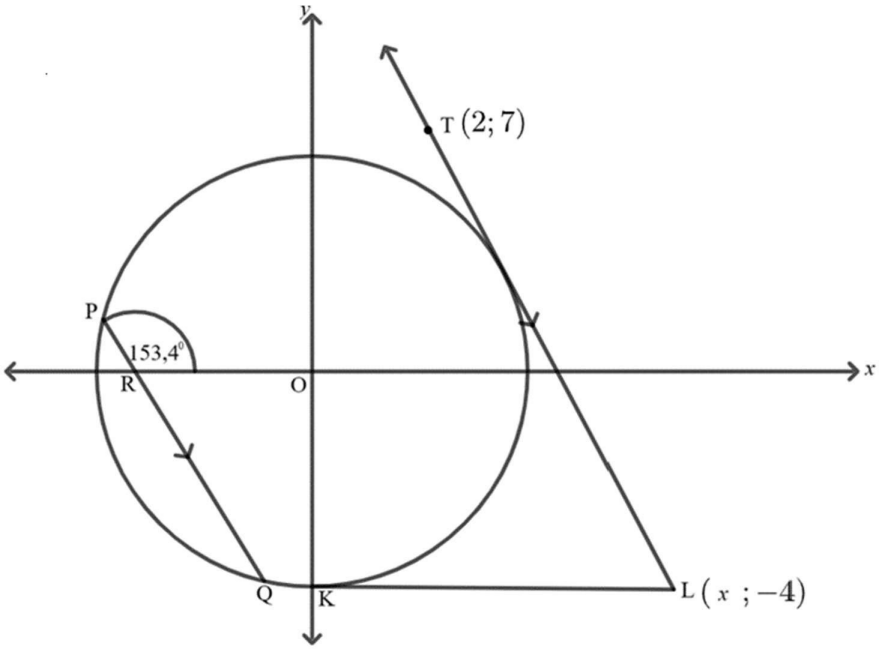
QUESTION 2

2.1 The diagram below is a circle with centre O, at the origin.

KL is parallel to the x-axis and PQ ∥ TL.

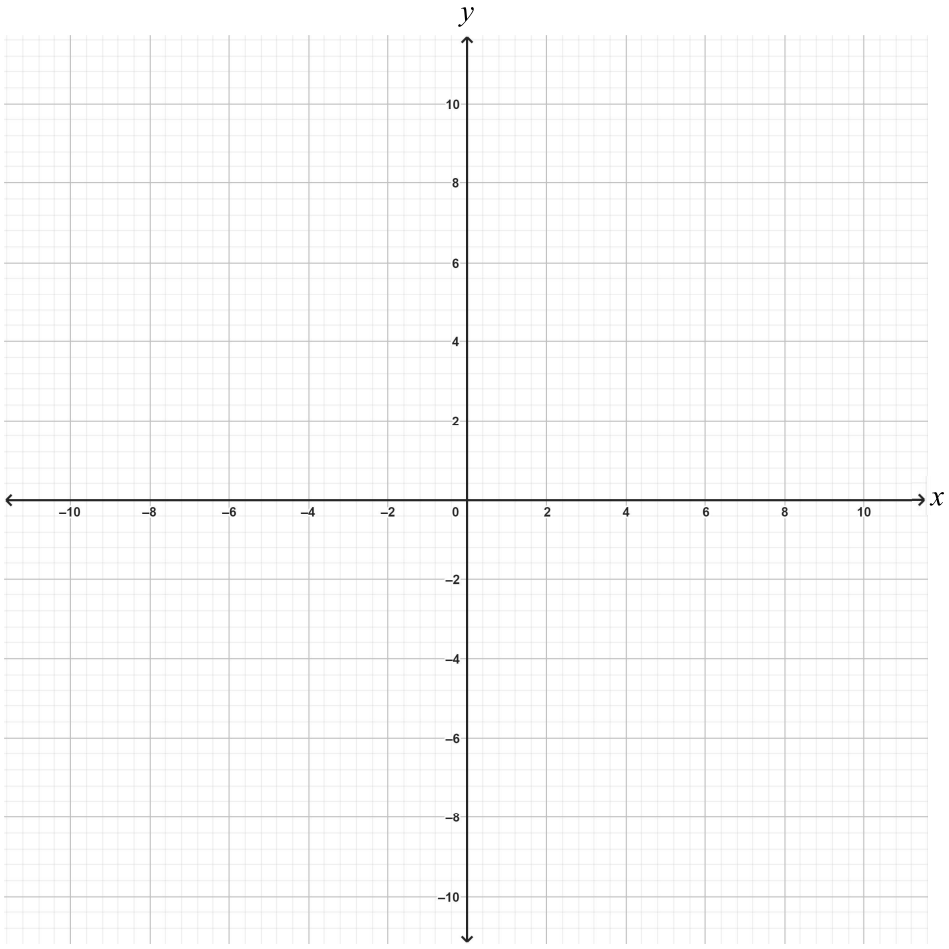
TL is a tangent to the circle.

$P\hat{R}O = 153{,}4°$ is the angle of inclination.



2.1.1	Write down the coordinates of K.	(2)
2.1.2	Hence, determine the equation of the circle.	(2)

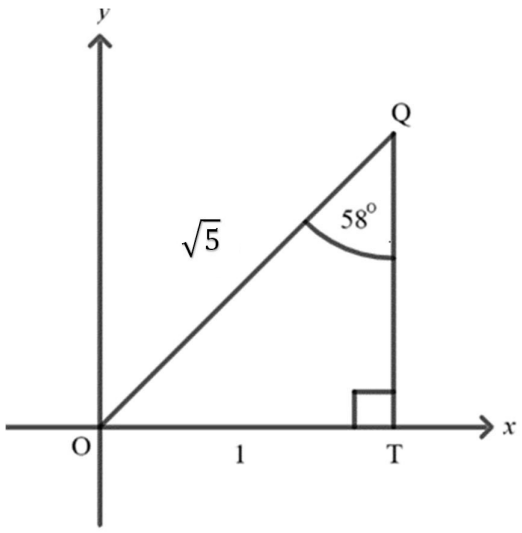
2.1.3	Determine the gradient of PQ. (Give your answer to one decimal place.)	(1)
2.1.4	Hence, determine the equation of line TL.	(3)

2.2	Given: $\frac{x^2}{16}+\frac{y^2}{4}=1$	
2.2.1	Determine the equation of the ellipse in the form: $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$	
		(2)
2.2.2	Hence, sketch the graph defined in QUESTION 2.2.1, clearly showing all the intercepts with the axes.	
		(2)
		[12]

QUESTION 3

3.1	Given: $\hat{P} = \frac{\pi}{4}$ and $\hat{Q} = 90°$	
3.1.1	Convert $\hat{P}$ to degrees.	
		(1)
3.1.2	Determine the value of $\cot^2 \hat{P} + \sin \hat{Q}$.	
		(3)

3.2 Given the sketch below:



Determine, **WITHOUT the use of a calculator**, the value of each of the following:		
3.2.1	The length of QT	(2)
3.2.2	$(\cos 58°)^2$	(2)

3.2.3	$\sin 32° + \sin \frac{29}{90}\pi$	(4)
3.3	Solve for t: $\cos 60° + 2\sin t = 0 \quad \text{for} \quad t \in [90°; 270°]$	(4)
		[16]

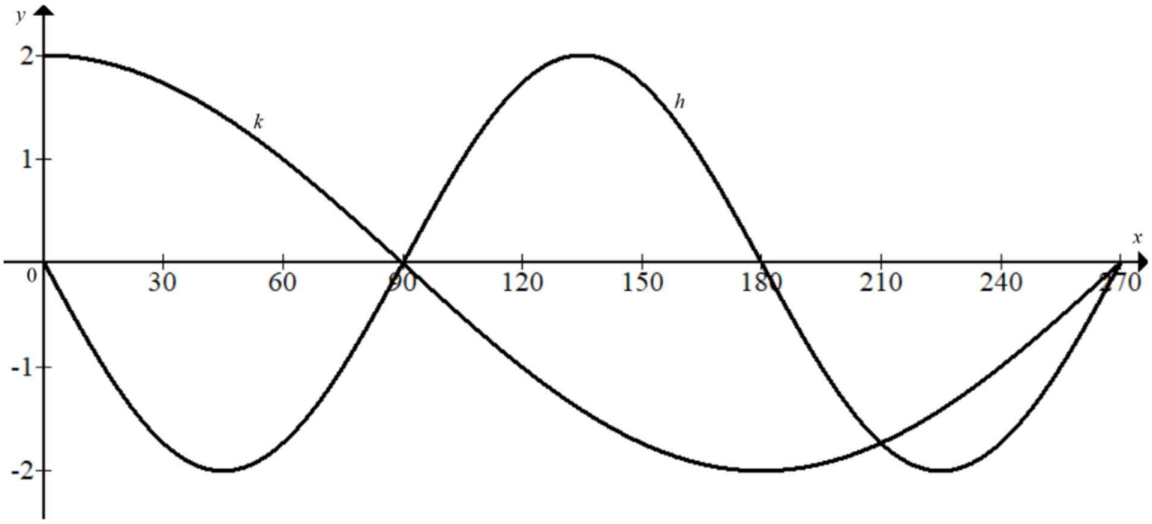
QUESTION 4

4.1	Simplify, **WITHOUT the use of a calculator.**	
4.1.1	$\sec(180^\circ + B)$	(1)
4.1.2	$\tan^2(2\pi - \mathrm{B})$	(1)
4.1.3	$\dfrac{\cos 120^\circ . \sec(180^\circ + \mathrm{B})}{\tan^2(2\pi - \mathrm{B}) + 1} \div \dfrac{\cos(360^\circ + \mathrm{B})}{2}$	(6)

4.2	Complete the identity: $1-\cos^2 A = ...$	(1)
4.3	Prove the identity: $\frac{1}{1+\cos A}+\frac{1}{1-\cos A}=2\text{cosec}^2 A$	(4)
		[13]

QUESTION 5

The diagram below shows the graphs of the functions of $h(x) = a\sin 2x$ and $k(x) = 2\cos x$.



5.1	Write down the value of a.	(1)
5.2	Write down the domain of h.	(2)
5.3	Determine the period of k.	(1)
5.4	Write down the interval(s) for which $h(x) \leq k(x)$.	(4)

5.5	The graph of f is obtained when the graph of h is shifted $30°$ to the left and one unit down. Write down the equation of f in its simplest form.	
		(2)
		[10]

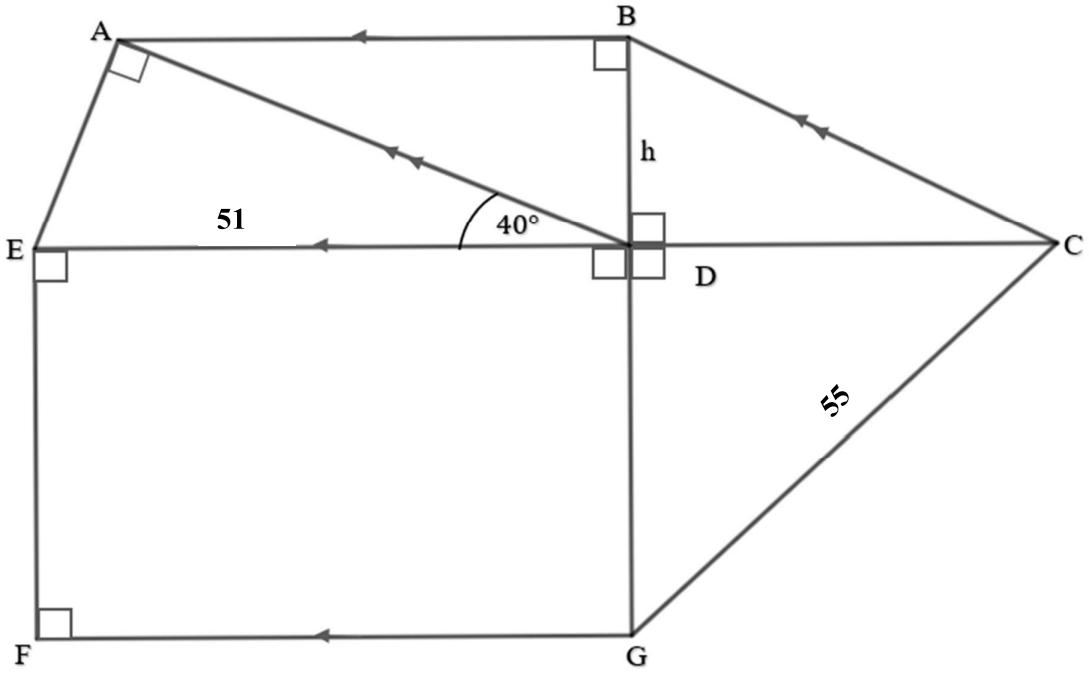
QUESTION 6

In the diagram below, ABCD is a parallelogram. With DA ⊥ AE, BD ⊥ AB, BD ⊥ DC and DG ⊥ DC

$A\hat{D}E = 40°$

GC = 55 units

DE = 51 units



6.1.	Calculate the size of $A\hat{E}D$.	(1)
6.2	Calculate the length of AD to the nearest integer.	(3)

6.3	State with a reason why BC = AD.	(1)
6.4	If the area of ABCD is 912 units^2 and h = 24 units, calculate the length of DC, to the nearest integer. (**Hint:** Use Area = base × height)	(2)
6.5	Calculate the size of $D\hat{C}G$.	(3)

6.6	Calculate the area of rectangle EFGD (to the nearest integer).	(5)
		[15]

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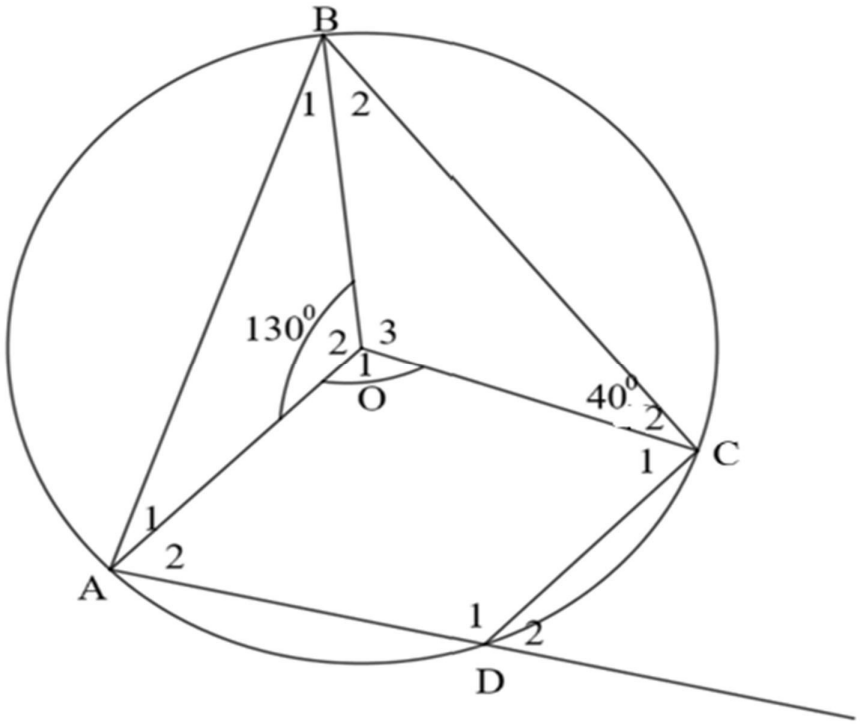
Give reasons for your statements in QUESTIONS 7, 8 and 9.

QUESTION 7

In the diagram below, O is the centre of the circle. ˆ

O_2=130° and $\hat{C}_2$=40°.



Determine, with reasons, the sizes of the following angles:		
7.1	$\hat{B}_2$	(2)
7.2	$\hat{O}_3$	(2)

7.3	$\hat{O}_1$	(2)
7.4	$\hat{D}_2$	(4)
		[10]

QUESTION 8

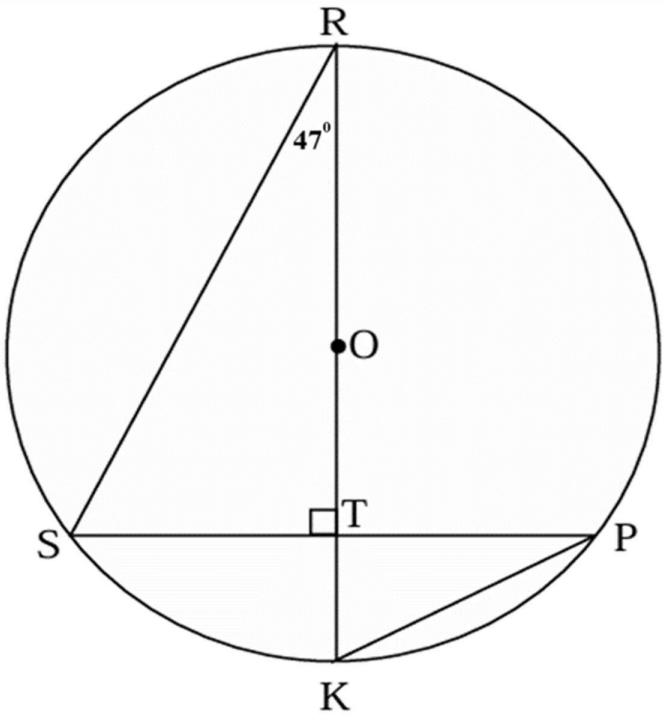
8.1	Complete the following theorem statement:	
8.1.1	Angles subtended by the chord of a circle, on the same side of the chord, are …	(1)
8.2	In the diagram below BCDE is a semicircle. AB is a tangent to the semicircle at B and CE is produced to intersect AB at F. CF intersects BD at G. CD and BF are produced to meet at A. DE = BE $D\hat{C}F = 34°$ and $AB \perp CB$	
8.2.1	Why is $\hat{D}_1 = C\hat{E}B = 90°$?	(1)

8.2.2	Determine the size of $\hat{C}_1$.	(2)
8.2.3	Determine the size of $D\hat{E}C$.	(3)
8.2.4	Prove, whether ADEF is a cyclic quadrilateral or not.	(4)

8.3 In the diagram below, O is the centre of the circle with diameter KR.

PS $\perp$ KR and KR intersect PS at T.

$\hat{R} = 47°$



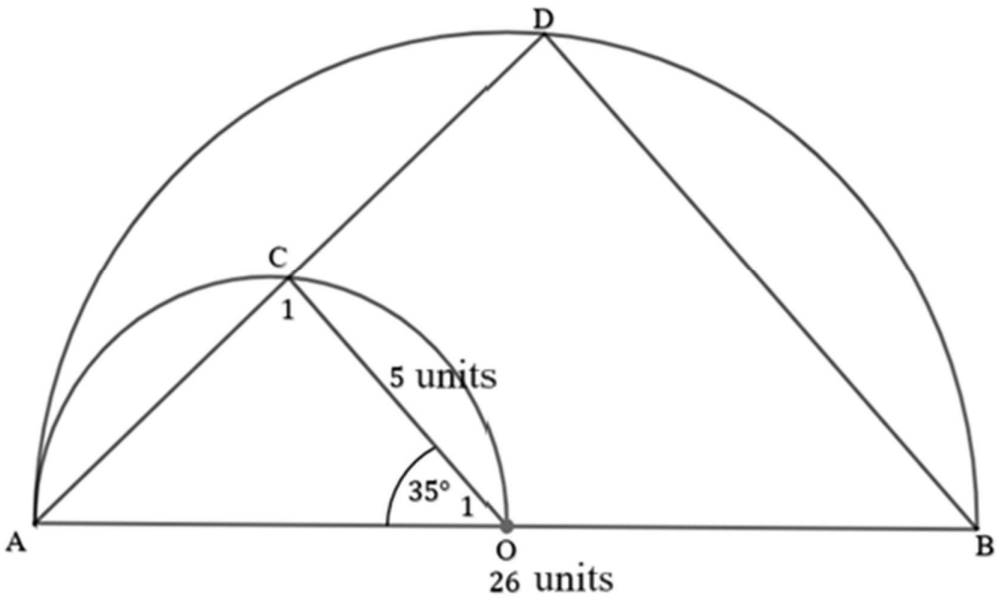
8.3.1 If PS = $4x$, write down the length of ST in terms of x. (1)

8.3.2 Prove that ΔRST is similar to ΔPKT. (3)

8.3.3	It is further given that TK = x and RT = 320 mm. Hence, calculate the value of x.	(3)
		[18]

QUESTION 9

9.1	Complete the following theorem statement: A line drawn parallel to one side of a triangle divides the other two sides …	(1)
9.2	In the diagram below, O is the centre of the semicircle. AOB is the diameter of semicircle ABD and OA is the diameter of semicircle ACO. AB = 26 units, OC = 5 units and $\hat{O}_1 = 35°$.	



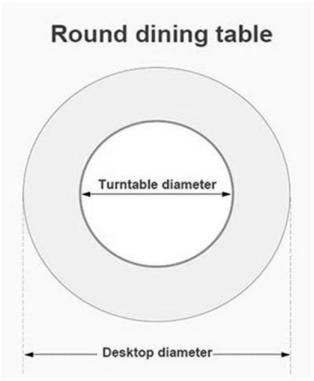
9.2.1	Determine the length of AC.	(2)

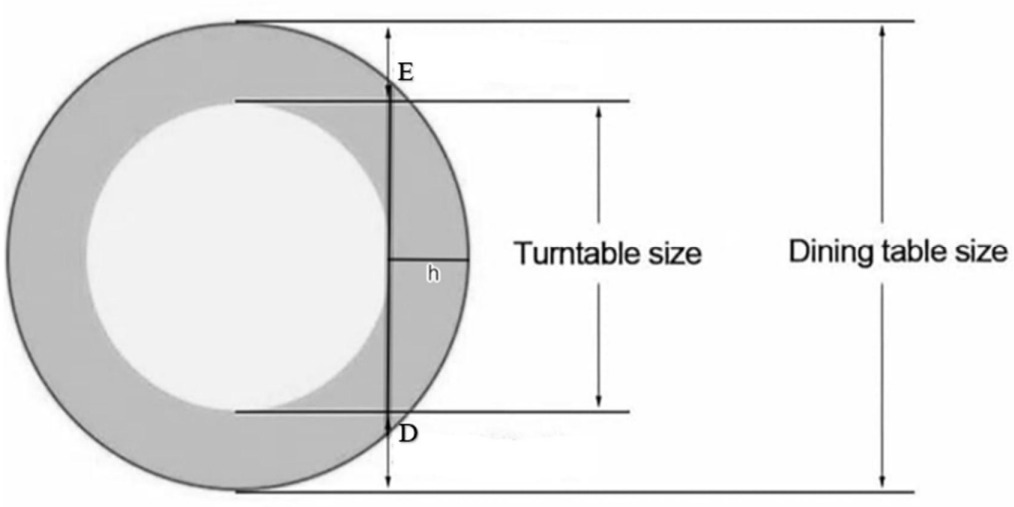
9.2.2	Show, with reasons, that OC ∥ BD.	(3)
9.2.3	Determine, with reasons, the length of BD.	(2)
9.2.4	Determine: $\frac{\text{Area of } \Delta AOC}{\text{Area of } \Delta ABD}$ (Show all calculations.)	(4)
		[12]

QUESTION 10

10.1 The picture below shows a lazy Susan turntable that you need to build for your Civil Technology practical examination.

The turntable rotates at 45 revolutions per minute.

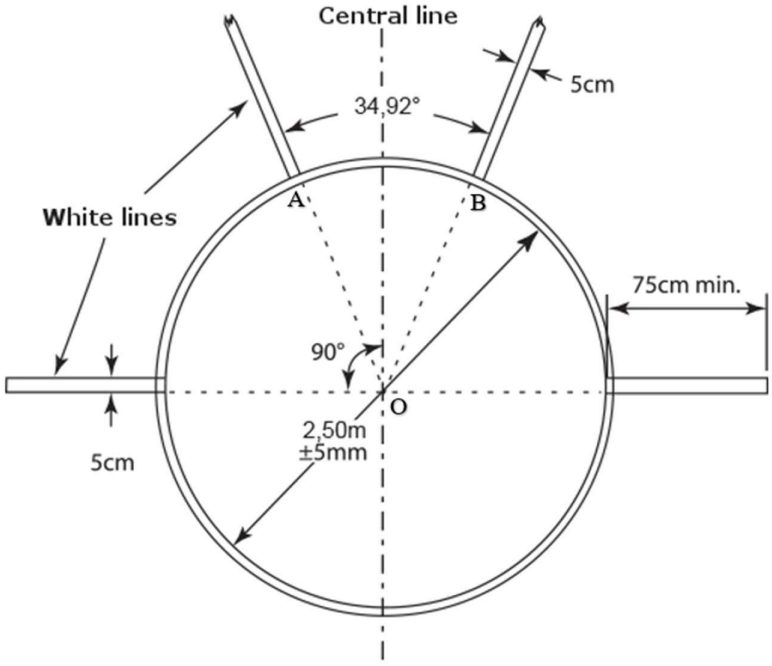




10.1.1 Write down the rotational frequency in revolutions per second. (2)

10.1.2	Determine the circumferential velocity (in metres per second) of the lazy Susan turntable, if the diameter of the turntable is 140 cm.	(4)
10.1.3	Determine the length of chord DE, if the height = 25 cm and diameter = 140 cm.	(4)

10.2	The picture below shows a discus circle at your school, with centre O. The length of the diameter is 2,5 m and $A\hat{O}B = 34{,}92°$.



10.2.1	Convert angle $A\hat{O}B$ into radians.	(2)
10.2.2	Determine the area of the minor sector AOB.	(4)
		[16]

QUESTION 11

11.1 Marthinus lives in Gordons Bay and takes tourists out on his boat during daylight hours to go fishing at sea.

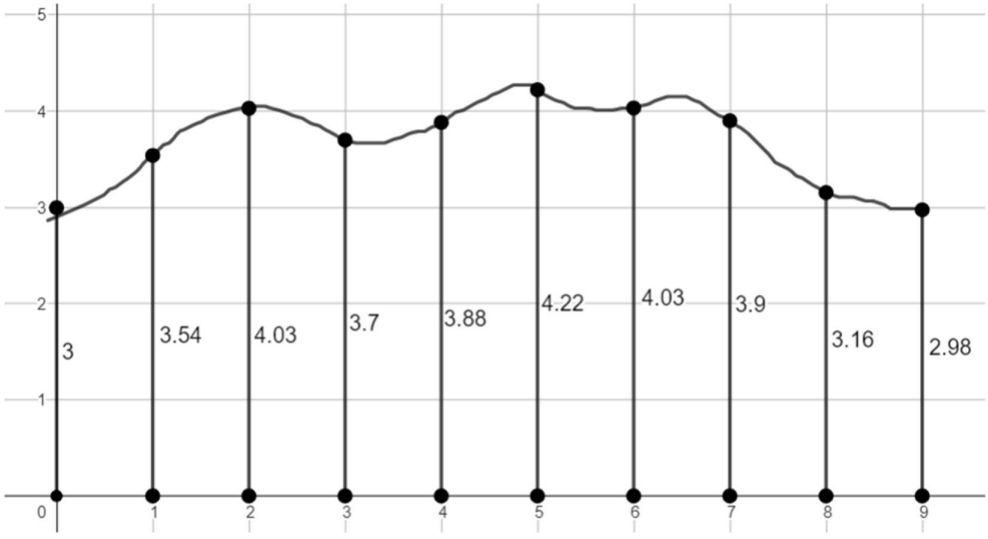
In November, the sun rises at approximately 05:40 and sets at approximately 19:45.

The ideal water temperature for fishing is above 16 °C.

Martinus takes his boat out at high tide and returns to the harbour within 2 hours of high tide.

The side view of the sea where he goes fishing appears as follows.

All measurements are in kilometres.



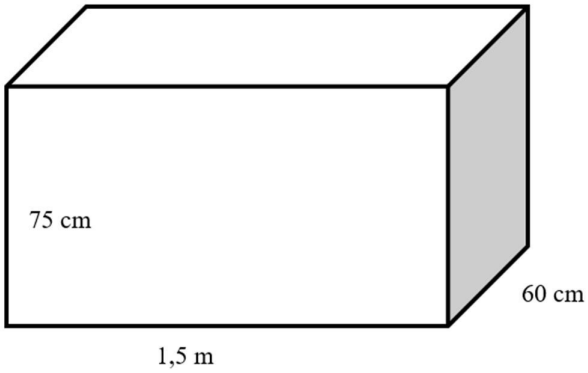
11.1.1 What is the distance between each ordinate? (in kilometres)

(1)

11.1.2	Determine the area of the fishing section of the sea.	(4)
11.2	When the anglers on Marthinus' boat did not want to take home the fish that they caught , because they are usually tourists, he cleans and freezes the fish for them. The inside dimensions of his chest freezer are 1,5 metres by 75 centimeters by 60 centimeters.	

Defy CF530HC Eco Chest Freezer

Source: ***www.pricecheck.co.za***]



Surface area of a rectangular prism $= 2lb + 2bh + 2lh$

Volume of a rectangular prism $= l \times b \times h$

Capacity: $1\ cm^3 = 1\ ml$

11.2.1	Convert 1,5 metres to centimetres.	(2)
11.2.2	Determine the volume of the chest freezer in cm^3.	(2)
11.2.3	Determine the capacity of the chest freezer in litres.	(2)
11.2.4	The chest freezer is 20% full of fish. Calculate the remaining volume available in the chest freezer in m^3.	(5)
		[16]

ADDITIONAL SPACE		

ADDITIONAL SPACE		

TOTAL: 150

END

INFORMATION SHEET: TECHNICAL MATHEMATICS

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

$a^x = b \Leftrightarrow x = log_a\, b,$ $\quad a > 0, a \neq 1$ and $b > 0$

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

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

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

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

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

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

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

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

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

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

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

GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION
GRADE 12

2025

TECHNICAL MATHEMATICS
(PAPER 2)

TECHNICAL MATHEMATICS P2

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