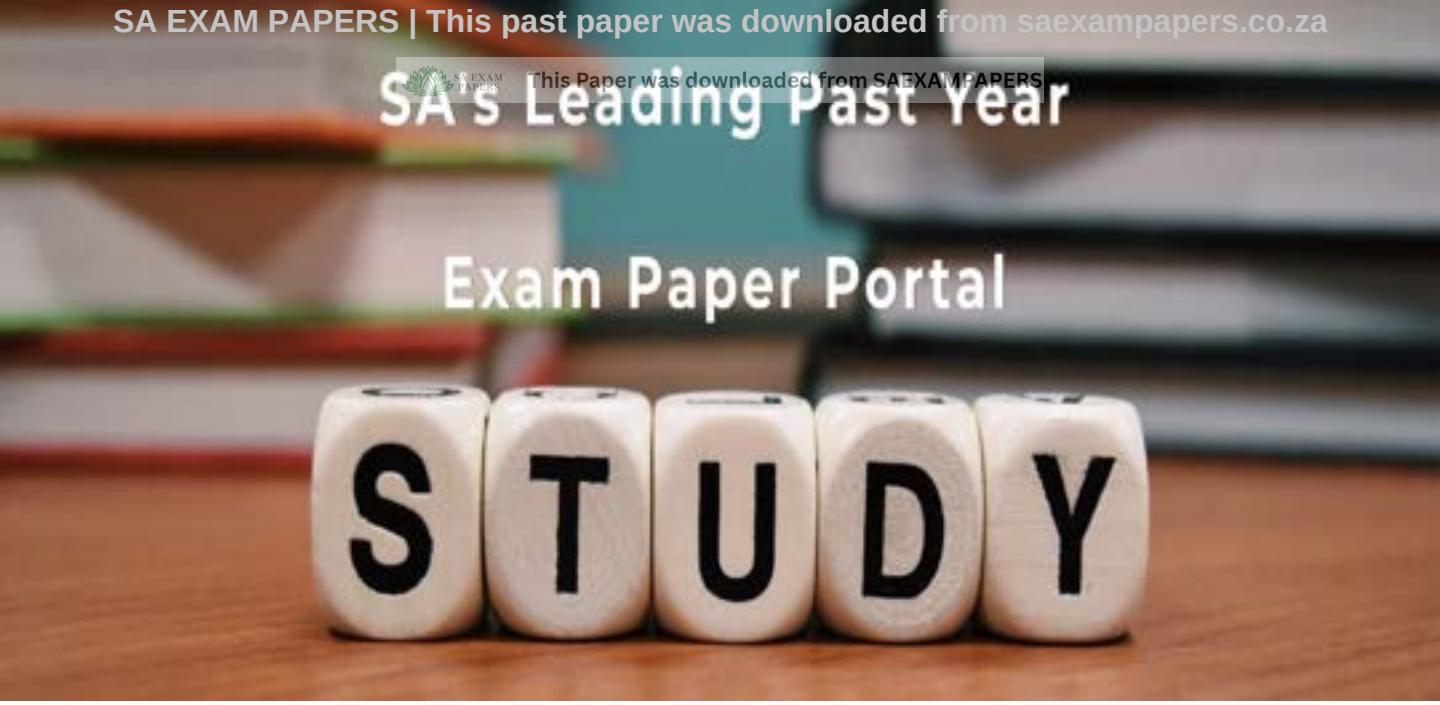


education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 12

TECHNICAL MATHEMATICS P2

JUNE 2025

MARKS: 150

TIME: 3 hours

This question paper consists of 15 pages and a 2-page information sheet.

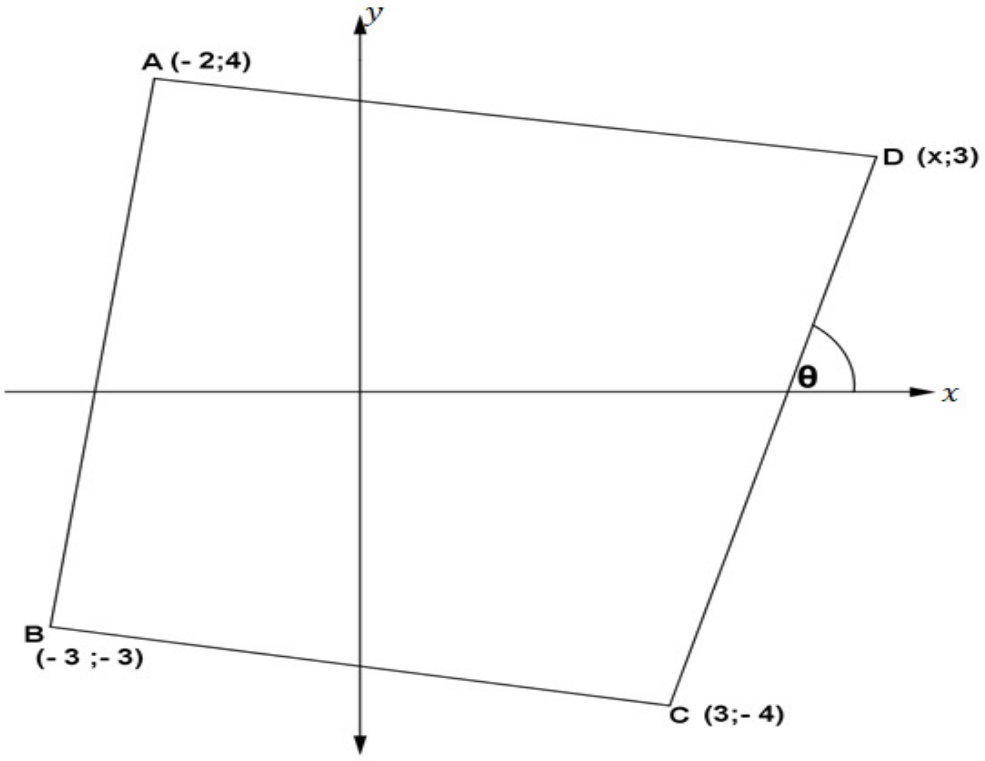
INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK 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. An information sheet with formulae is included at the end of the question paper.
9. Write neatly and legibly.

QUESTION 1

The diagram below shows quadrilateral ABCD with vertices $A(-2;4)$, $B(-3;-3)$, $C(3;-4)$ and $D(x;3)$. The angle of inclination of the line DC with the x- axis is θ.



Determine:

1.1 the gradient of BC (2)

1.2 the equation of BC (2)

1.3 the x-coordinate of D if the gradient of AD is $-\frac{1}{7}$ (2)

1.4 whether BC is parallel to AD, give a reason for your answer (2)

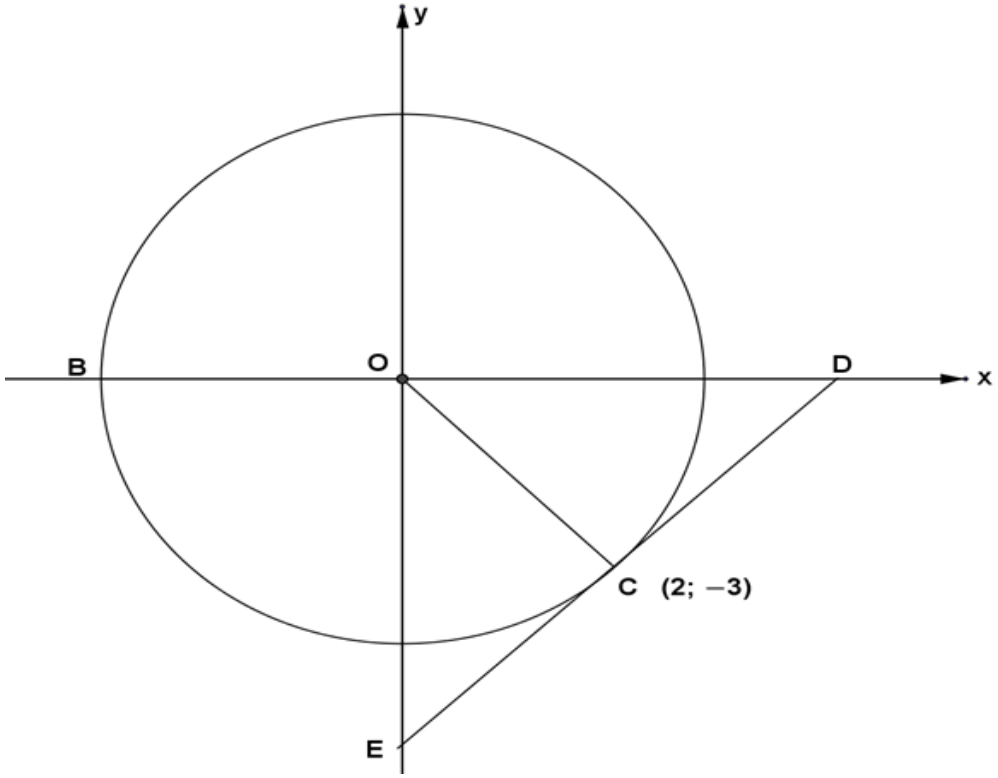
1.5 the midpoint of AB (2)

1.6 the equation of the line perpendicular to BC and passing through $(-1;-4)$ (3)

1.7 the value of θ (3)
[16]

QUESTION 2

2.1 In the diagram below, O is the centre of the circle.
OC is the radius, ED is a tangent to the circle at point C.



Determine the:

2.1.1 equation of the circle (2)

2.1.2 coordinates of B (2)

2.1.3 gradient of OC (1)

2.1.4 equation of ED (3)

2.1.5 coordinates of D, the *x*-intercept of the tangent. (2)

2.2 Given: $\frac{x^2}{(\sqrt{7})^2} + \frac{y^2}{3^2} = 1$

Hence, sketch the graph defined by the equation given above. (3)
[13]

QUESTION 3

3.1 Determine the following if $\cos\beta = \frac{3}{5}$; $\beta \in (0°; 90°)$ and $\alpha = \frac{\pi}{6}$

3.1.1 β (Round off to the nearest whole number) (2)

3.1.2 Convert α to degrees. (1)

3.1.3 $\sin(2\beta) - \sec\alpha$ (3)

3.2 Given: $\tan\theta = -\frac{4}{5}$ and , $\theta \in [0°; 180°]$

3.2.1 Draw a diagram to illustrate the above ratio. (1)

3.2.2 Hence, use the diagram to determine $cos^2\theta + sin^2\theta$ **without the use of a calculator.** (3)

3.3 Determine the value of x if $8\cos x - 2 = 2$ for $x \in [0°; 360°]$ (3)
[13]

QUESTION 4

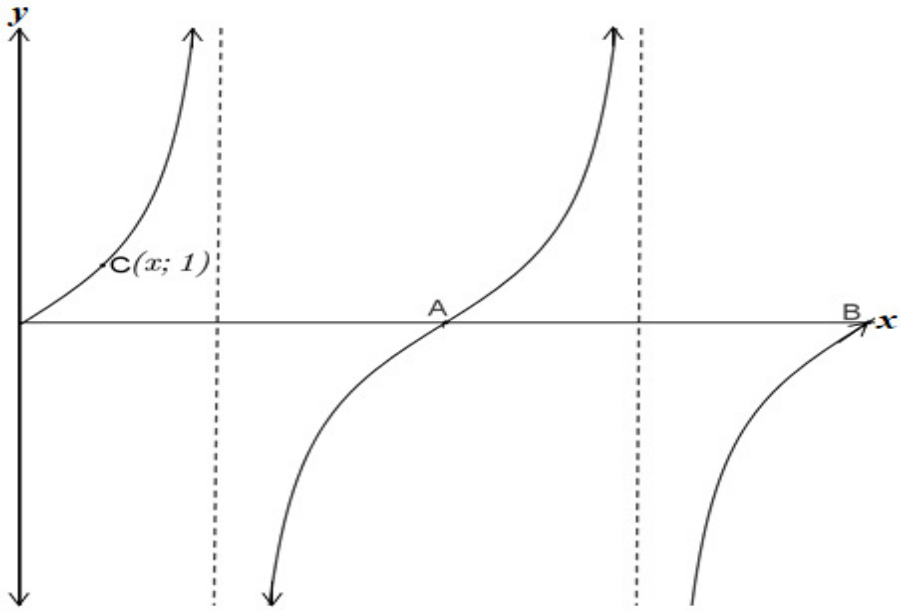
4.1 Simplify the following:

$$\frac{cos(\pi + \theta).tan(180° + \theta).sin^2(180° - \theta)}{-tan(180° - \theta).sin\theta.cos(180 - \theta).\frac{1}{sec\,\theta}}$$ (7)

4.2 Prove that: $\frac{sin^2\theta}{cos^2\theta} + \frac{cos^2\theta}{cos^2\theta} = \frac{1}{cos^2\theta}$ (4)
[11]

QUESTION 5

The graph below represents the function defined by $g(x) = \tan x$ for $0° \leq x \leq 360°$



5.1 Use the graph above to determine the following:

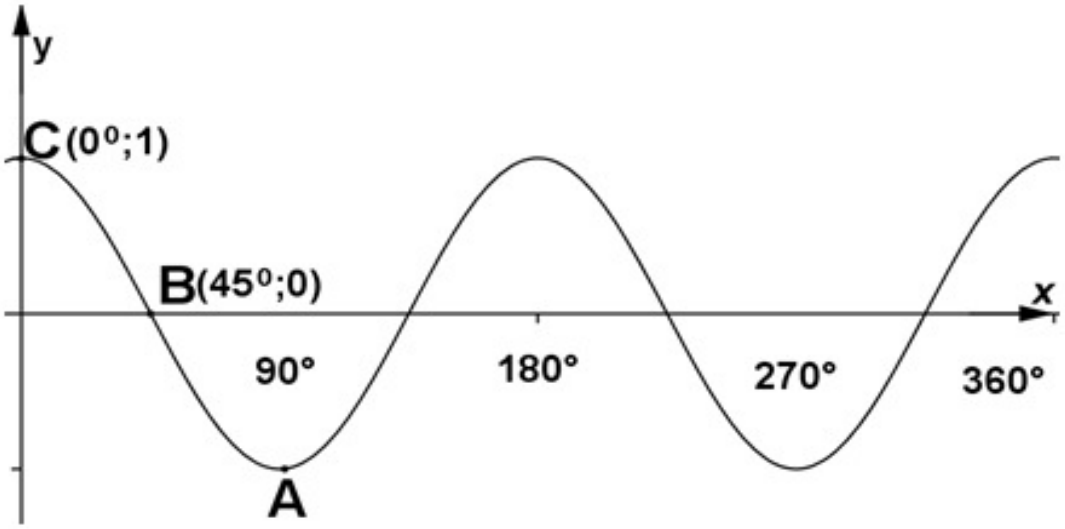
5.1.1 the equations of the asymptotes. (2)

5.1.2 the period of g (1)

5.1.3 the value of the x-coordinate at point C (1)

5.1.4 the coordinates of A (2)

5.2 The graph below represents the function defined by:
$f(x) = \cos 2x$ for $0° \leq x \leq 360°$



5.2.1 What is the amplitude of f ? (1)

5.2.2 What is the period of f ? (1)

5.2.3 Determine the coordinates of the turning point at A. (2)

5.3 Use the graph above to determine the following:

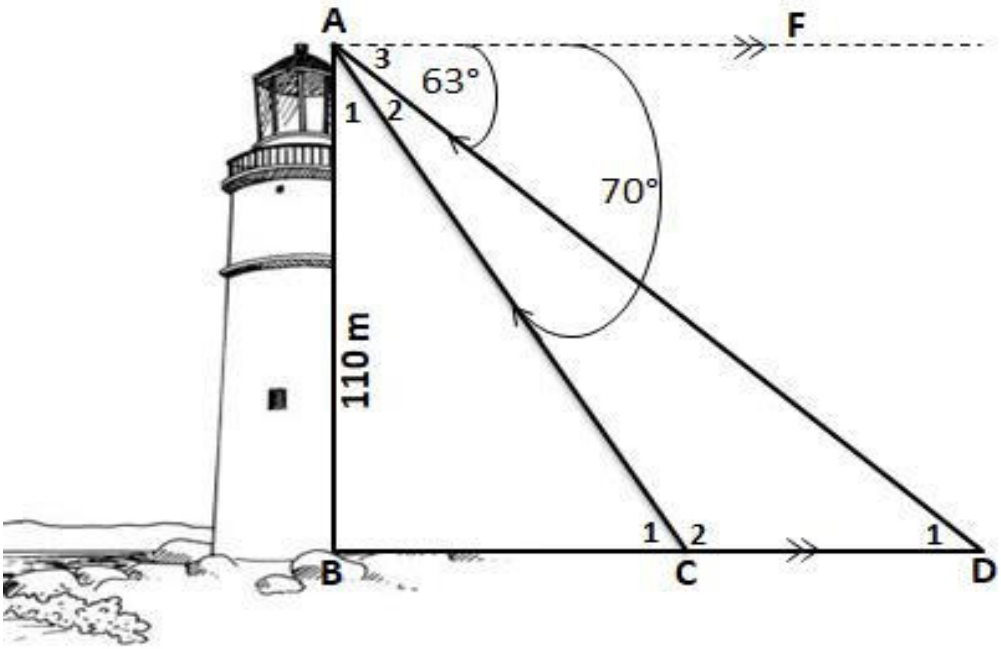
5.3.1 the value(s) of x for which f is increasing if $x \in (0°; 180°)$ (2)

5.3.2 the value(s) of x for which $f(x) < 0$ if $x \in (0°; 180°)$ (2)

5.4 Write down the range of f. (2)
[16]

QUESTION 6

The sketch below shows AB, a light house perpendicular to the horizontal level at B.
The light house is 110 m high.
C and D represent the position of two boats respectively.
$\hat{A}_3 = 63°$ and $F\hat{A}C = 70°$



6.1 Determine with reason the sizes of:

6.1.1 $\hat{C}_1$ (2)

6.1.2 $\hat{A}_2$ (1)

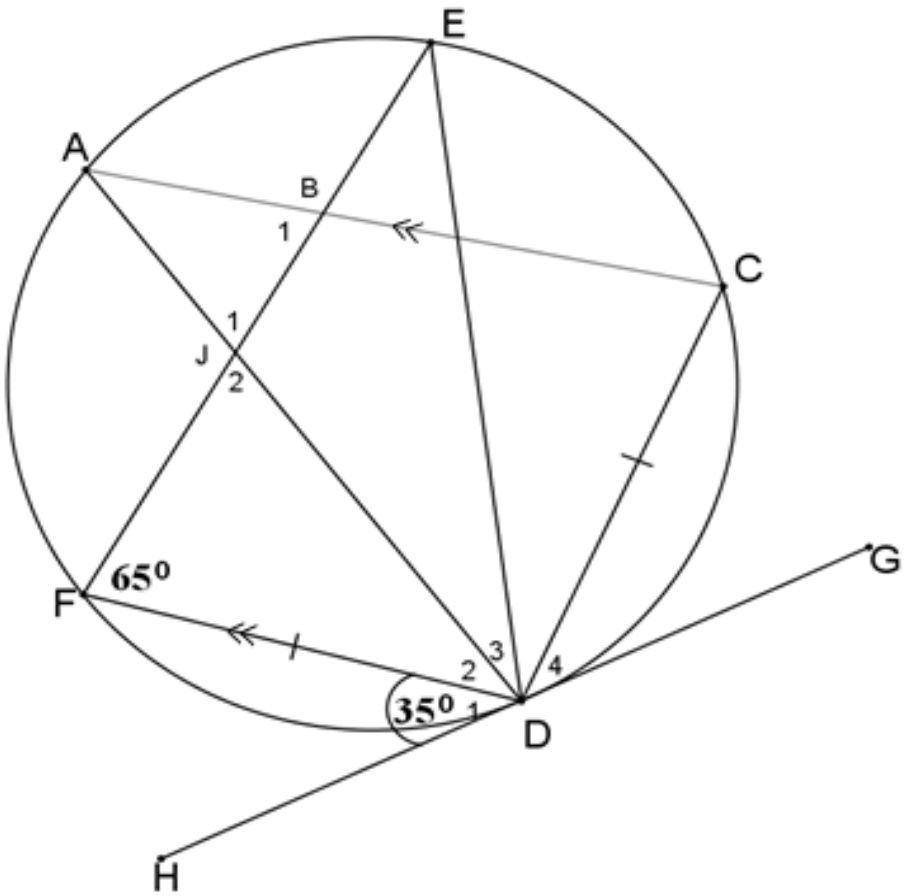
6.2 Determine the length of AC. (2)

6.3 Determine the distance between the two boats, CD. (3)

6.4 Use the cosine rule to determine the length of AD. (2)
[10]

QUESTION 7

7.1 In the diagram below, HG is a tangent to the circle at D.
$D\hat{F}E = 65°$ and $\hat{D}_1 = 35°$
A, E, C, D and F are on the circumference of the circle.
$CD = DF$ and $AC \parallel FD$



7.1.1 Write down, stating reasons, THREE other angles equal to 35°. (6)

Determine, with reason(s), the size of the following angles:

7.1.2 $A\hat{D}H$ (1)

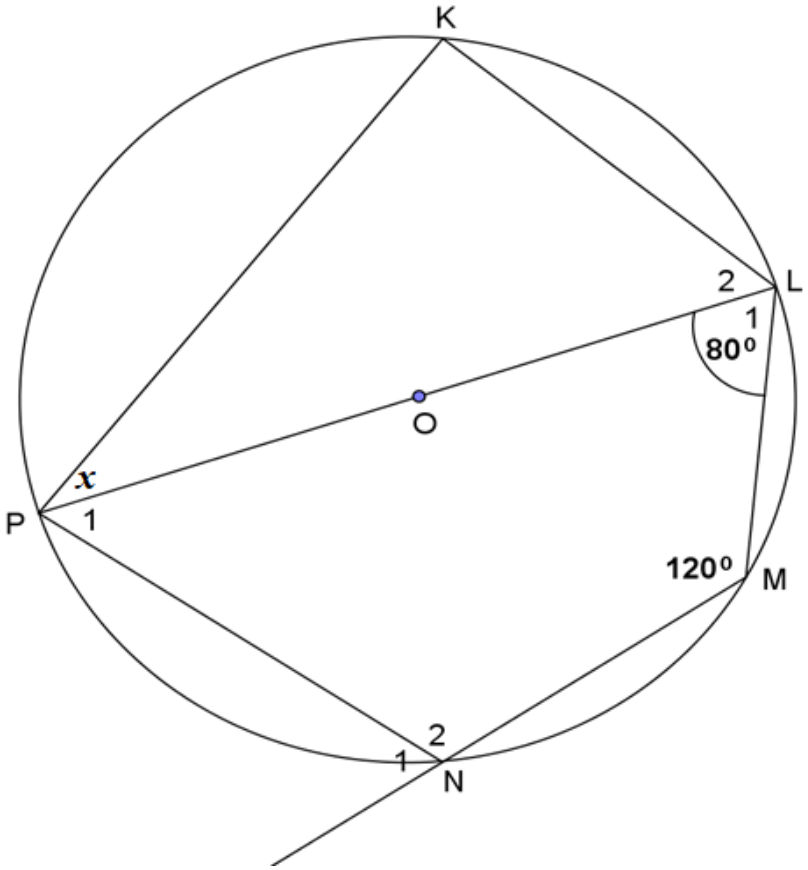
7.1.3 $\hat{C}$ (2)

7.1.4 $C\hat{D}F$ (2)

7.1.5 $\hat{D}_3$ (2)

7.1.6 Prove that $\Delta JAB \;|||\; \Delta JDF$ (3)

7.2 In the diagram below, O is the centre of the circle.
PLMN is cyclic quadrilateral.
$\hat{L}_1 = 80°$ and $\hat{M} = 120°$.
MN is extended and forms a straight line.



Determine, by giving reason(s), the following:

7.2.1 $\hat{N}_1$ (2)

7.2.2 $\hat{P}_1$ (2)

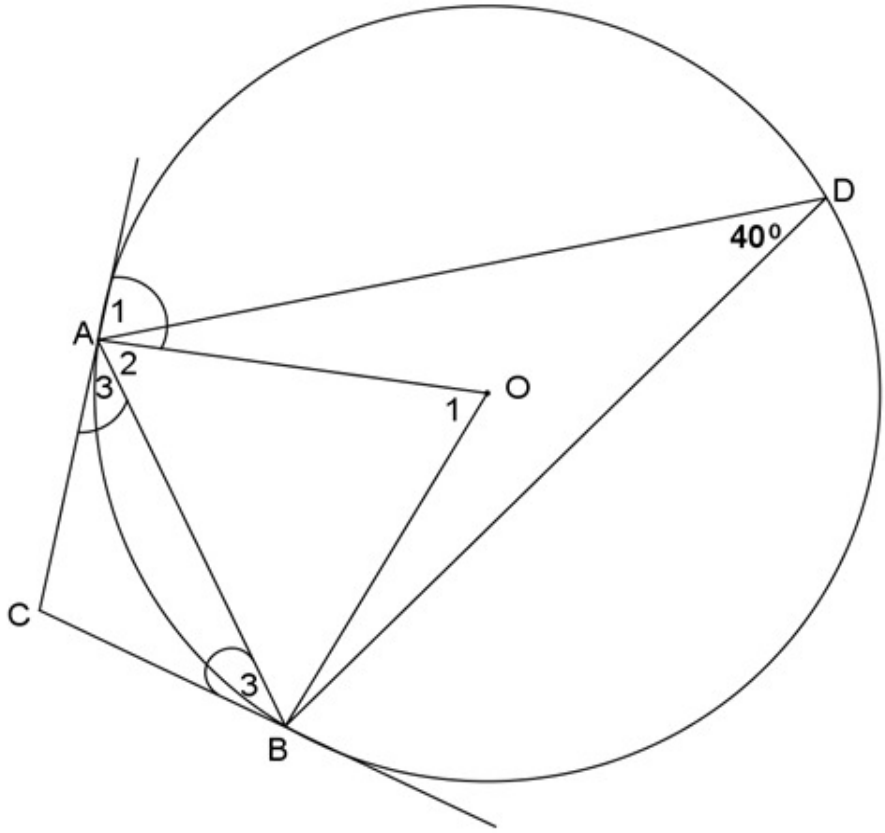
7.2.3 $\hat{K}$ (2)

7.2.4 Solve for x if KL ∥ PN (2)
[24]

QUESTION 8

8.1 Complete the following theorem:
Two tangents from the same point outside the circle are … (1)

8.2 In the diagram below, O is the centre of the circle.
AC and BC are tangents to the circle.
D is a point on the circumference of the circle and forms chords AD and BD.
$\widehat{D} = 40°$



Determine, by stating reason(s), the size of the following angles:

8.2.1 $\hat{O}_1$ (2)

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

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

8.2.4 $\hat{A}_3$ (1)

8.2.5 $\hat{C}$ (3)

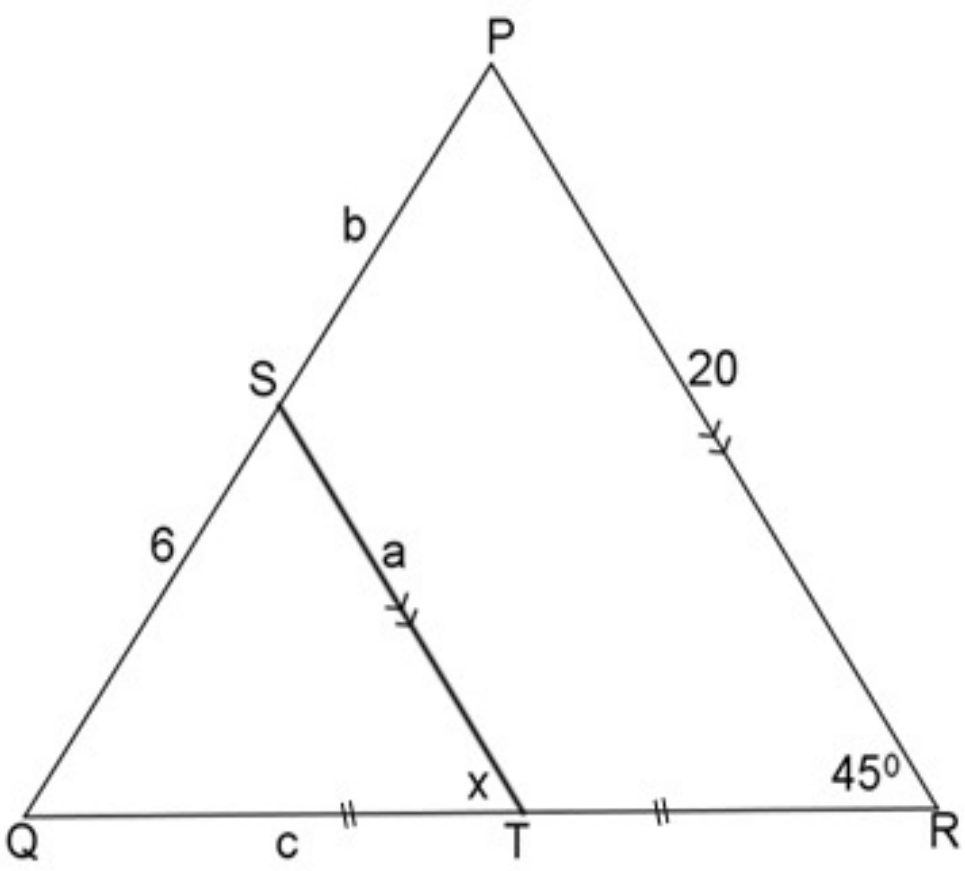
[11]

QUESTION 9

9.1 Complete the following theorem:

The line through the midpoint of one side of a triangle and parallel to another side of a triangle is … of the third side. (1)

9.2 In the diagram below, ST ∥ PR, $\hat{R} = 45°$, QS = 6 ; PR = 20 and QT = c



Write down, stating reasons, the values of the following:

9.2.1 a (2)

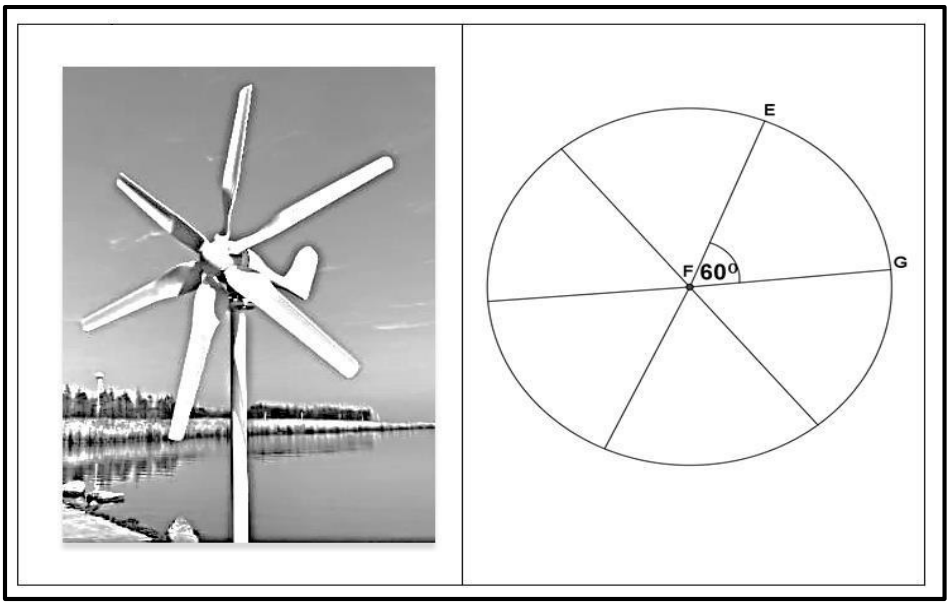
9.2.2 b (1)

9.2.3 *x* (2)

9.2.4 Determine the length of QR in terms of *c*. (1)
[7]

QUESTION 10

10.1 The picture below shows a small 6 blade wind turbine for residents to generate their own electricity. The diameter of the turbine is 1,2 m. The turbine is rotating at 20 revolutions per minute.
The diagram next to the picture represents the 6 blades. The angles between the blades are 60° each.

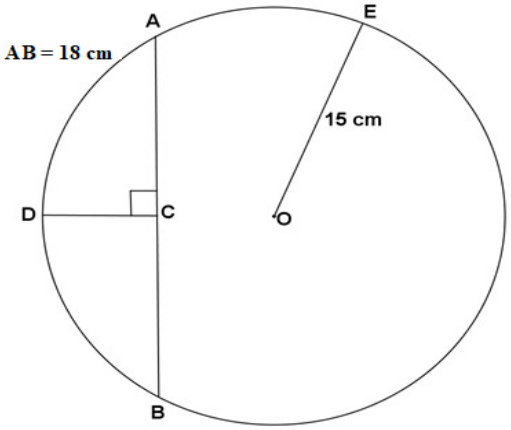


10.1.1 Determine the angular velocity in radians per second. (4)

10.1.2 Determine the circumferential velocity of the turbine. (4)

10.1.3 Calculate the area of sector EFG. (4)

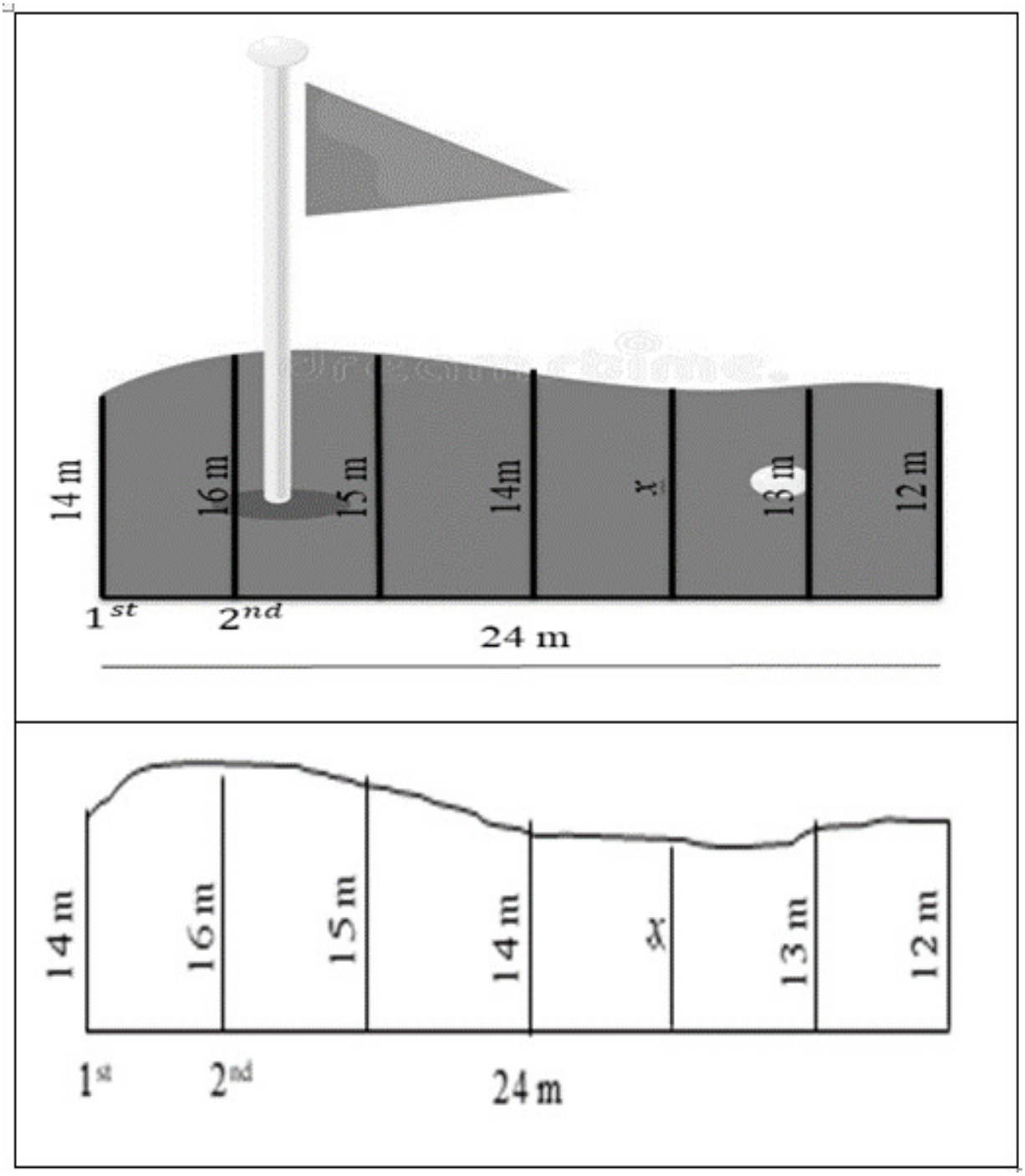
10.2 In the diagram below, the length of chord $AB = 18\ cm$ and $OE = 15\ cm$.
Determine the length of DC.



(4)
[16]

QUESTION 11

11.1 Determine the area of a part of a golf green, by using the mid-ordinate rule.
The length of 24 m is divided into 6 equal parts.
The value of x is equal to the sum of the 1st and 2nd ordinate divided by 2. (5)

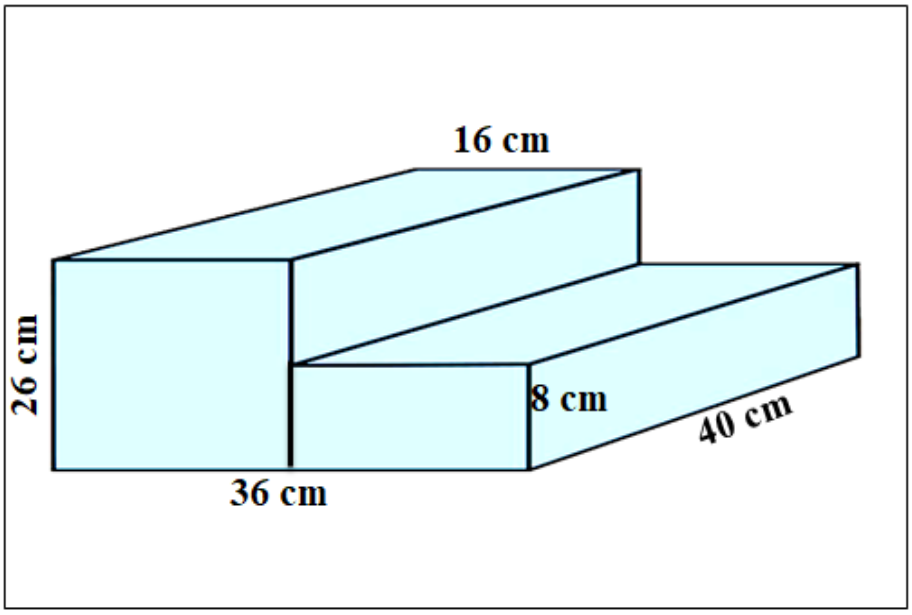


11.2 In the diagram below is a solid two-step wooden stair with an **open basis.** The stair is build out of two rectangular wooden boxes that is glued together.

The following formulae may be used:

$$\textbf{Surface area of rectangular prism} = 2lb + 2lh + 2bh$$

$$\textbf{Volume} = l \times b \times h$$



11.2.1 Determine the volume of the wooden stair. (4)

11.2.2 Calculate the surface area of each of the two rectangular parts separately. (3)

11.2.3 Determine the total surface area of the wooden stair. (1)
[13]

TOTAL: 150

FORMATION SHEET: TECHNICAL MATHEMATICS

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

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

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

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

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

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C \quad , \quad n \neq -1$$

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

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

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

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

In ΔABC: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$ $\qquad a^2 = b^2 + c^2 - 2bc \cdot \cos A$

$$\text{area of } \Delta ABC = \frac{1}{2} ab \cdot \sin C$$

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

$\pi rad = 180°$

Angular velocity $= \omega = 2\pi n$	Where n = rotation frequency
Angular velocity $= 360°n$	where n = rotation frequency
Circumferencial velocity $= v = \pi Dn$	where D = diameter and n = rotation frequency
Cirfumferential 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 sector = $\frac{rs}{2}$	where r = radius, s = arc length
Area of a sector = $\frac{r^2\theta}{2}$	where r = radius, s = arc length 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
$A_T = a(m_1 + m_2 + m_3 + \ldots + m_n)$	where a = width of equal parts, $m_1 = \frac{o_1 + o_2}{2}$ and n = number of ordinates

OR

$A_T = a\left(\frac{o_1 + o_n}{2} + o_2 + o_3 + o_4 + \ldots + o_{n-1}\right)$	where a = width of equal parts, $o_n = n^{th}$ ordinate and n = number of ordinate