basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS/
NATIONAL SENIOR CERTIFICATE EXAMINATIONS

TECHNICAL MATHEMATICS P2

MAY/JUNE 2026

MARKS: 150

TIME: 3 hours

This question paper consists of 15 pages, a 2-page information sheet and a 24-page SPECIAL ANSWER BOOK.

Copyright reserved

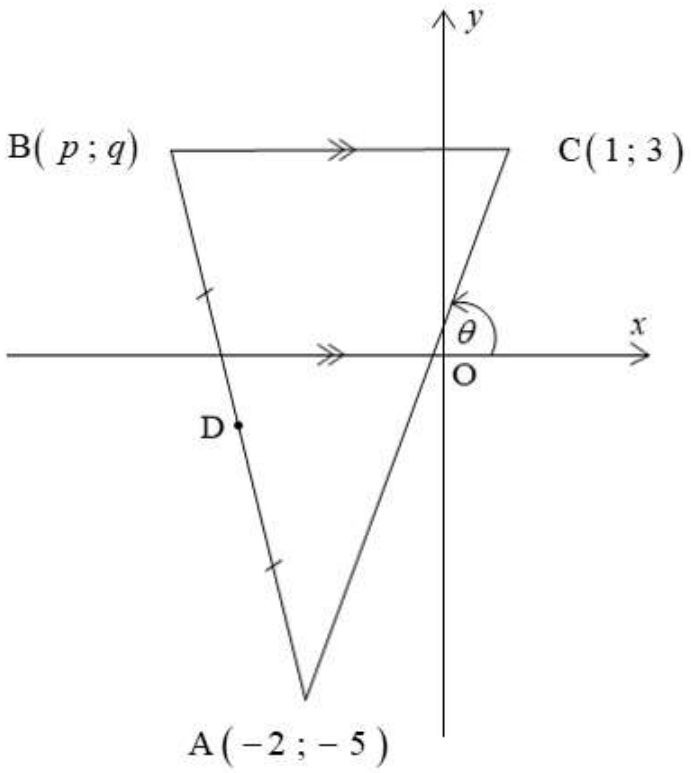
INSTRUCTIONS AND INFORMATION

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 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

1.1 The diagram below shows ΔABC with $A(-2;-5)$, $B(p;q)$ and $C(1;3)$.
BC $\parallel$ x-axis and D is the midpoint of AB.
The angle of inclination of AC with the positive x-axis is θ.



1.1.1 Write down the numerical value of q. (1)

1.1.2 Write down the numerical value of p if the length of BC = 5 units. (1)

1.1.3 Determine the gradient of AC. (2)

1.1.4 Hence, determine the size of angle θ. (2)

1.1.5 Determine the coordinates of D. (2)

1.2 Given the equation of the line $2x - 5y = 10$

1.2.1 Write this equation in the form $y = \ldots$ (1)

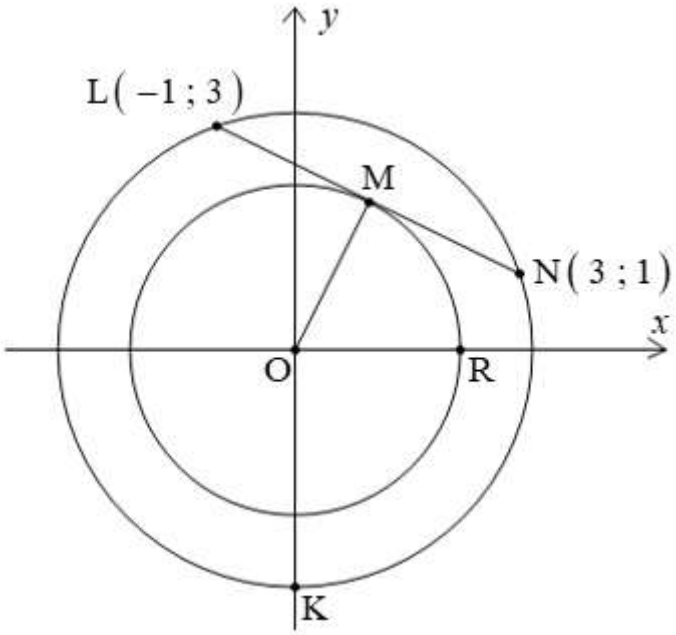
1.2.2 Hence, write down the gradient of a line perpendicular to $2x - 5y = 10$. (1)

1.2.3 Hence, determine the equation of a line that passes through point T(5 ; 0) and that is perpendicular to $2x - 5y = 10$ (2)

[12]

QUESTION 2

2.1 In the diagram below, O is the centre of both circles.
$L(-1\ ;\ 3)$ and $N(3\ ;\ 1)$ are on the circumference of the larger circle and M is on the circumference of the smaller circle.
LN is a tangent to the smaller circle at point M.
R is an *x*-intercept of the smaller circle and K is a *y*-intercept of the larger circle.



2.1.1 Determine the equation of the larger circle. (2)

2.1.2 Hence, write down the coordinates of point K. (2)

2.1.3 Give a reason why LM = MN. (1)

2.1.4 Hence, determine the coordinates of R. (5)

2.2 Given: $\frac{x^2}{9}+\frac{y^2}{25}=1$

2.2.1 Write the equation in the form $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ (1)

2.2.2 Hence, sketch the graph defined by $\frac{x^2}{9}+\frac{y^2}{25}=1$ (2)

[13]

QUESTION 3

3.1 Given: $T = 3,2\pi$ and $R = 22,8°$

3.1.1 Convert T to degrees. (1)

3.1.2 Determine $\text{cosec}(T - R)$ (3)

3.2 If $\sec\theta = -\frac{5}{3}$ and $\theta \in [180°\,;\,360°]$, determine the value of $\cot\theta - \tan\theta$ **without the use of a calculator**. (5)

3.3 Given: $\sin x = -\frac{1}{4}$ for $x \in [0°\,;\,360°]$

3.3.1 Write down the quadrants in which x lies. (2)

3.3.2 Hence, determine the value(s) of x. (3)
[14]

QUESTION 4

4.1 Given: $\dfrac{\cos(\pi + x)\cdot\tan(360° - x)}{\left[\cos^2(\pi + x) - \sin x\cdot\sin(360° - x)\right]}$

4.1.1 Complete the reduction: $\cos(\pi + x) = ...$ (1)

4.1.2 Complete the identity: $\cos^2 x + \sin^2 x = ...$ (1)

4.1.3 Simplify: $\dfrac{\cos(\pi + x)\cdot\tan(360° - x)}{\left[\cos^2(\pi + x) - \sin x\cdot\sin(360° - x)\right]}$ (5)

4.2 Given: $\dfrac{2}{\text{cosec}^2 x\cdot\sec x} \times \dfrac{1}{2\sin x - 2\sin x\cdot\cos^2 x} = \cot x$

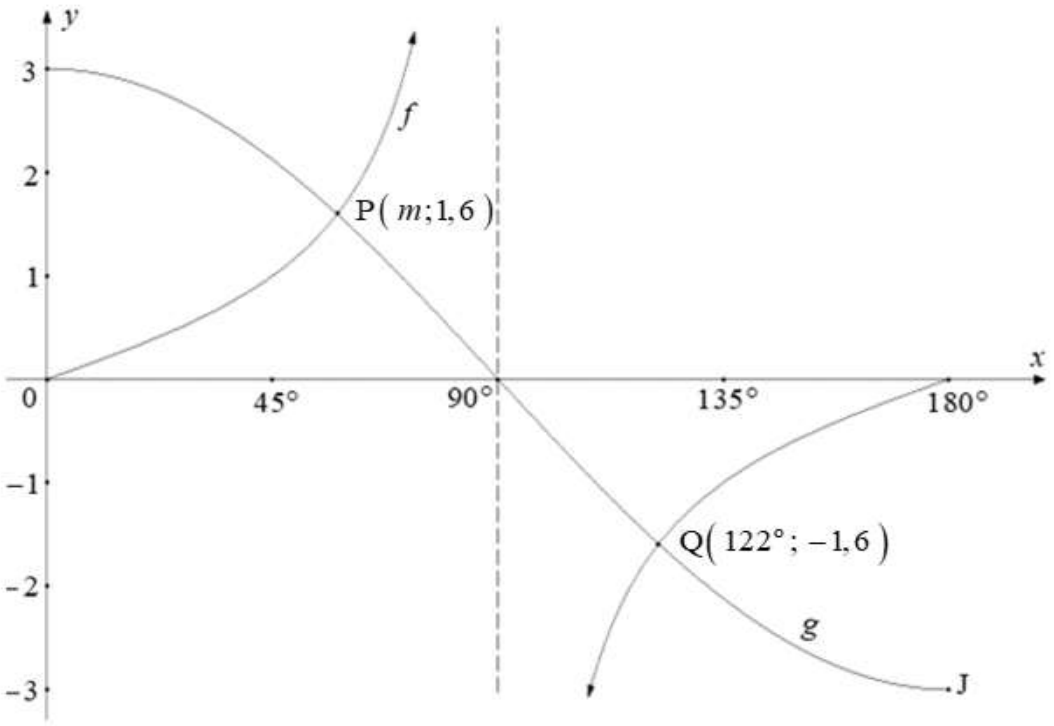
4.2.1 Write down $\dfrac{1}{\text{cosec}^2 x}$ in terms of $\sin x$. (1)

4.2.2 Factorise the expression: $2\sin x - 2\sin x\cdot\cos^2 x$ (1)

4.2.3 Hence, show that: $\dfrac{2}{\text{cosec}^2 x\cdot\sec x} \times \dfrac{1}{2\sin x - 2\sin x\cdot\cos^2 x} = \cot x$ (3)
[12]

QUESTION 5

The graph below represents the functions defined by $f(x) = \tan x$ and $g(x) = a\cos x$ for $x \in [0°;180°]$.
P$(m\,;1,6)$ and Q$(122°\,;-1,6)$ are the points of intersection of f and g.
J is a point on g.



Write down:

5.1 The numerical value of a (1)

5.2 The equation of the asymptote of f (1)

5.3 The coordinates of J (2)

5.4 The range of g (2)

5.5 The value of m (2)

5.6 The values of x for which $f(x) \leq g(x)$ (4)

5.7 The value of $f(180°) - g(180°)$ (1)

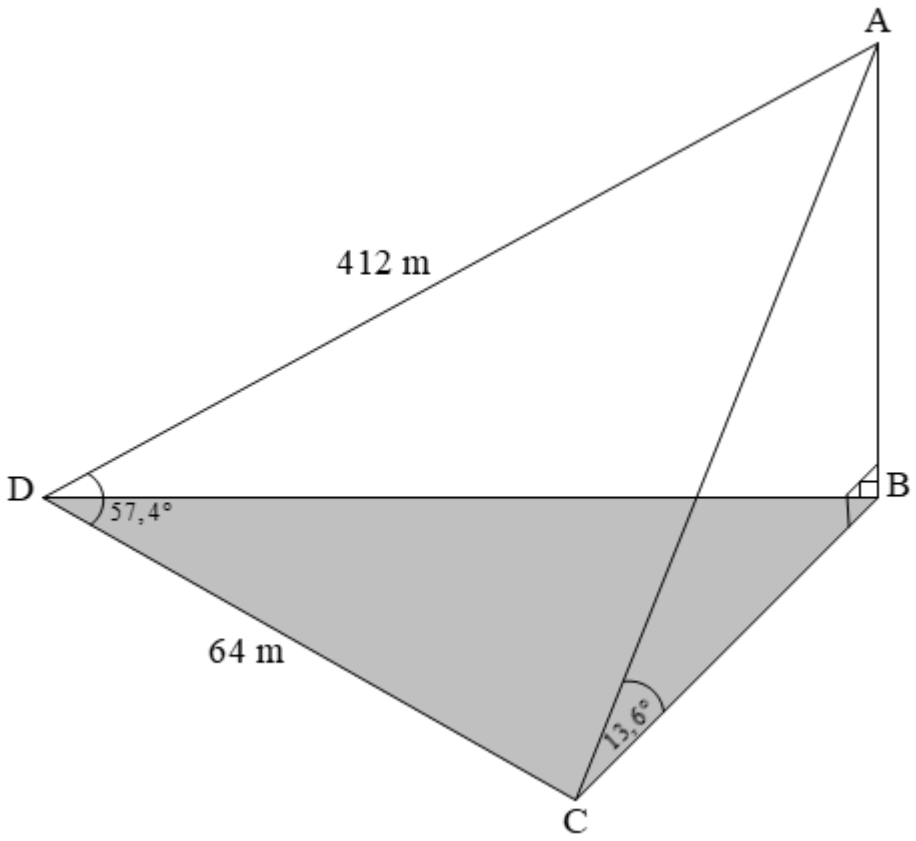
5.8 The new equation of h, if h is the reflection of g about the x-axis and shifted 1 unit upwards (2)

[15]

QUESTION 6

In the diagram below, A is the top of the vertical tower AB.
D, C and B are in the same horizontal plane.
$DC = 64\,m$ and $DA = 412\,m$
The angle of elevation of A from C is $13,6°$.

$A\hat{D}C = 57,4°$



6.1 Determine the area of ΔADC. (3)

6.2 Determine the height of the tower. (6)
[9]

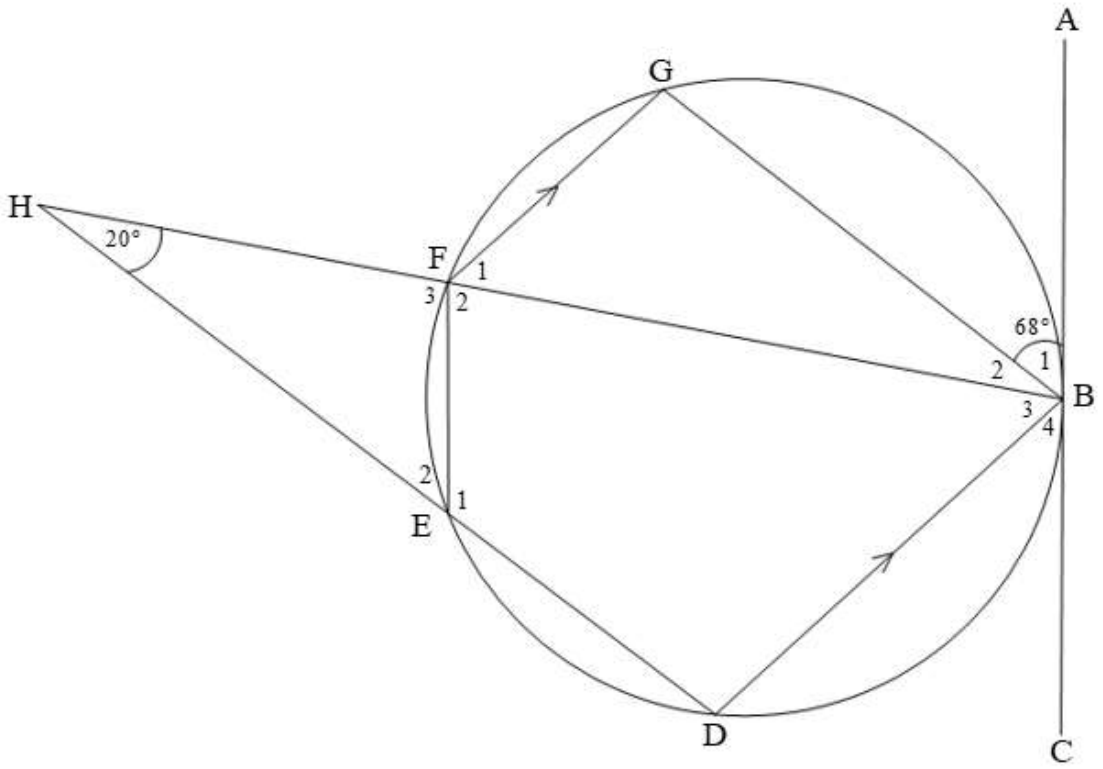
Give reasons for your statements in QUESTIONS 7, 8 and 9.

QUESTION 7

7.1 Complete the following theorem statement:

The exterior angle of a triangle is equal to the sum of the … interior angles. (1)

7.2 In the diagram below, B, D, E , F and G are points on the circumference of the circle.
BF and DE are produced to meet in H.
ABC is a tangent to the circle at point B.
BD||FG, $\hat{B}_1 = 68°$ and $\hat{H} = 20°$



Determine, stating reasons, the size of the following:

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

7.2.2 $\hat{B}_3$ (2)

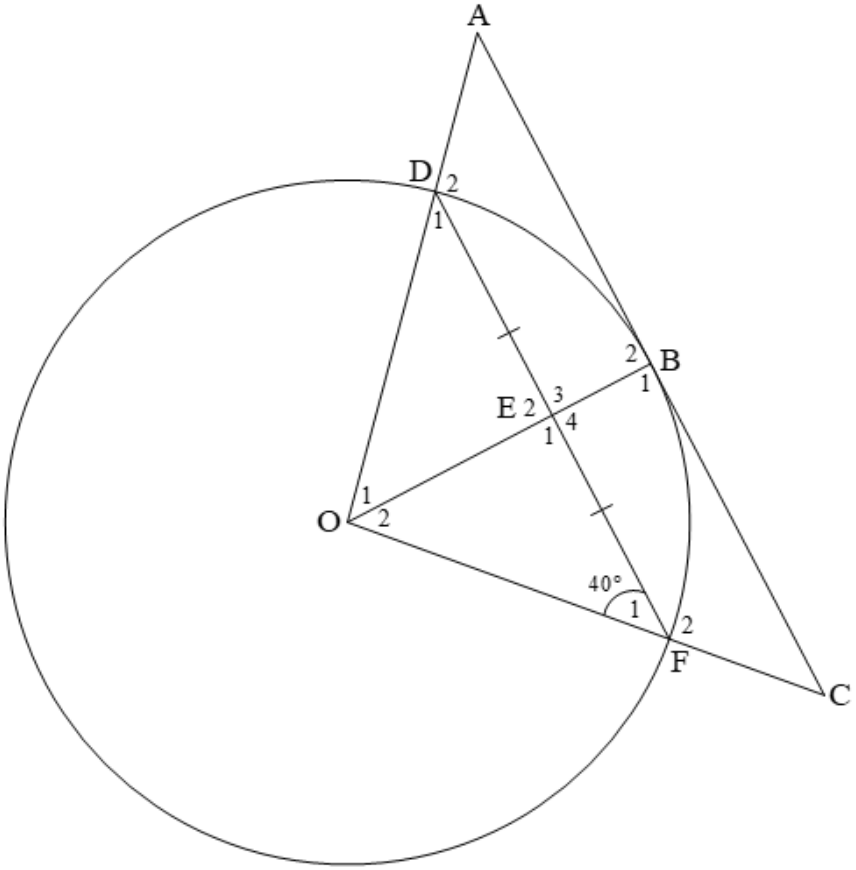
7.2.3 $\hat{E}_2$ (2)

7.2.4 $\hat{F}_2$ (2)

7.2.5 $\hat{D}$ (2)
[11]

QUESTION 8

8.1 In the diagram below, D, B and F are points on the circle with centre O.
E is a point on OB.
Chord DF is drawn such that DE = EF.
AC is a tangent to the circle at point B.
$\hat{F}_1 = 40°$



8.1.1 Give reasons for the statements in the table below.

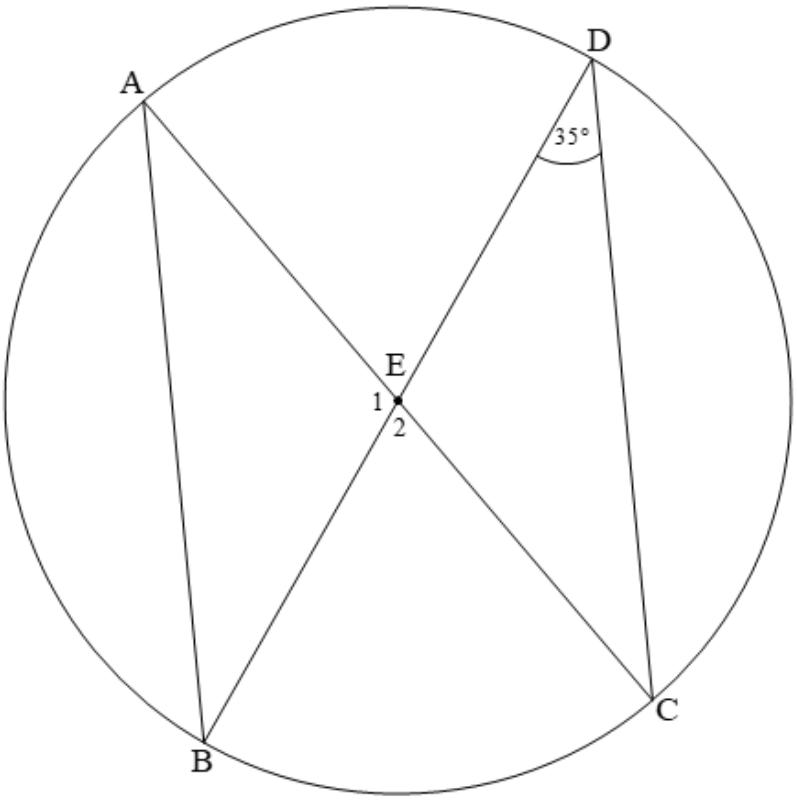
STATEMENT	REASON
(a) $OE \perp DF$	…
(b) $OB \perp AC$	…
(c) $AC \parallel DF$	…

(1)
(1)
(1)

8.1.2 Show that $\hat{A} = 40°$ (3)

8.1.3 Give a reason why ADFC is a cyclic quadrilateral. (1)

8.2 Given below is circle ABCD with centre E.
AC and BD are diameters.
Chords AB and DC are drawn.
$\hat{D} = 35°$



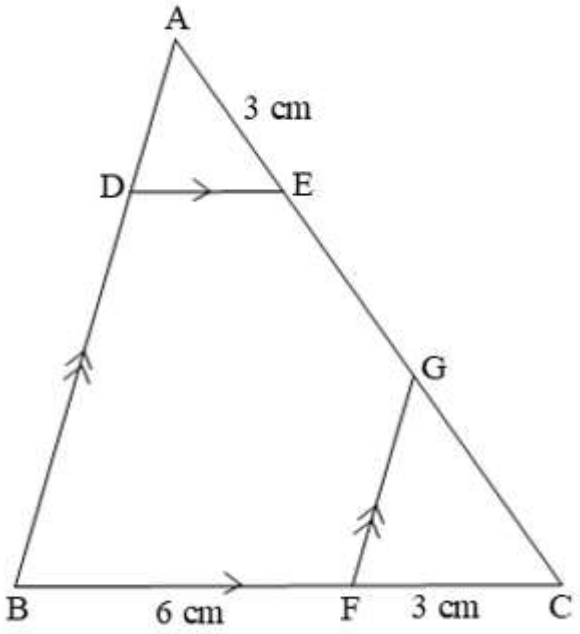
8.2.1 Name THREE other angles, with reasons, that are equal to $35°$. (6)

8.2.2 Determine, stating reasons, the size of $\hat{E}_2$. (2)

8.2.3 Give a reason why $\Delta AEB \equiv \Delta DEC$. (1)
[16]

QUESTION 9

In the diagram below, ABC is a triangle.
D is on AB and F is on BC.
E and G are on AC such that DE || BC and AB || FG.
AD : DB = 1 : 3, AE = 3 cm, BF = 6 cm and FC = 3 cm



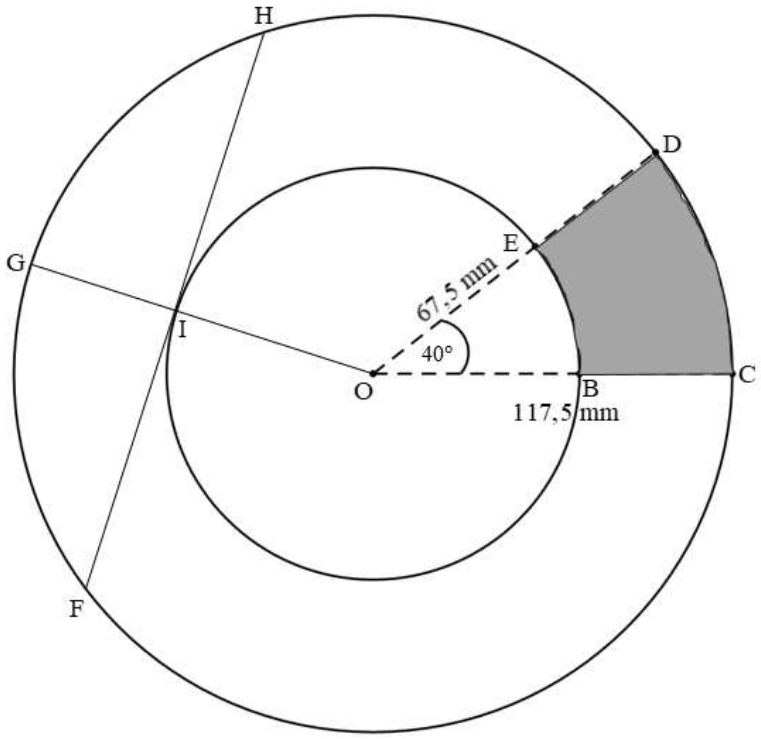
9.1 Calculate, giving reasons, the length of EC. (4)

9.2 Calculate, giving reasons, the length of CG. (3)

9.3 Show that $\Delta ADE \;|||\; \Delta ABC$. (3)
[10]

QUESTION 10

10.1 The picture and diagram below show the brake disc of a vehicle.
The inner circle has a radius OE = 67,5 mm and the outer circle has a radius OC = 117,5 mm.
The central angle for minor arc CD is 40°.
The shaded area BCDE indicates a damaged area on the disc.

Picture of a brake disc of a vehicle	**Diagram of the brake disc of a vehicle**
	

10.1.1 Convert 40° to radians. (1)

10.1.2 Calculate the length of minor arc CD. (3)

10.1.3 Calculate the area of sector OBE. (3)

10.1.4 Chord FH is a tangent to the inner circle at I.
Determine the length of chord FH. (4)

10.1.5 If the area of the outer circle is equal to $\frac{55\ 225}{4}\pi\ \text{mm}^2$, determine $\frac{\text{Area of outer circle}}{\text{Area of BCDE}}$ (5)

10.2 A lathe machine will be used in the workshop to skim the braking surface of the brake disc. During skimming, the brake disc will be spinning at an angular velocity of 90π rad/s .

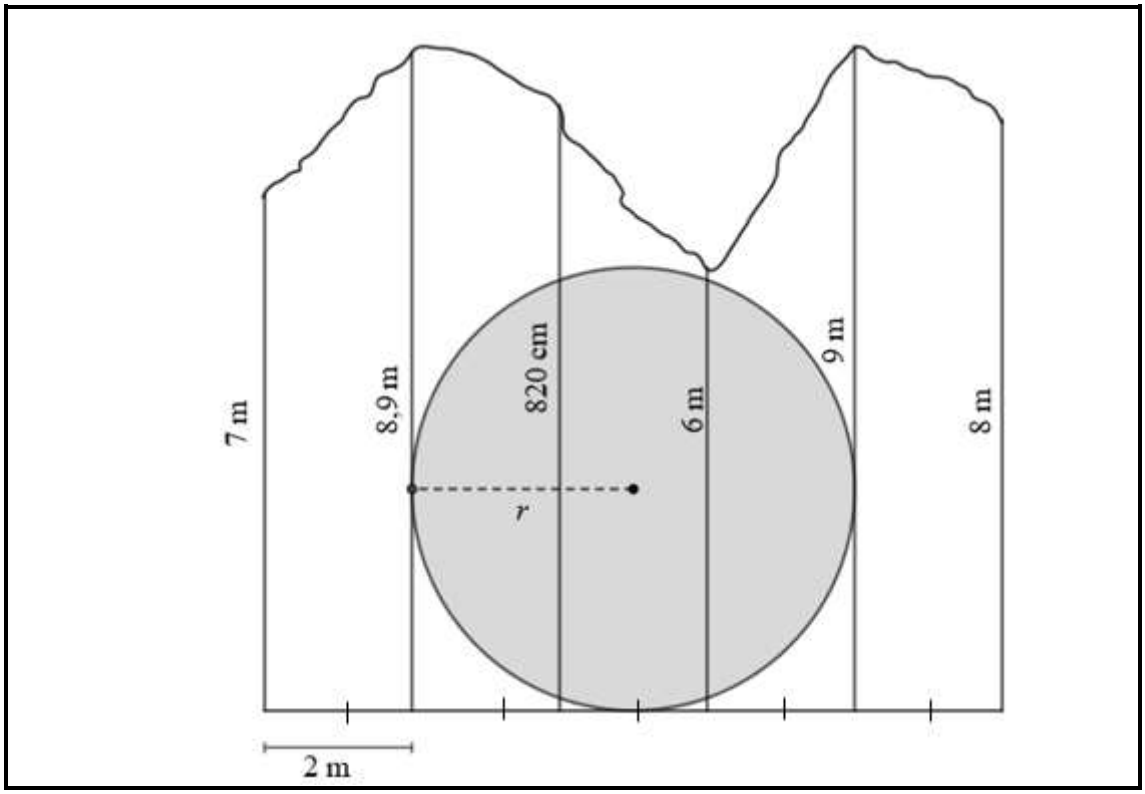
10.2.1 Determine the rotational frequency at which the brake disc will be spinning. (3)

10.2.2 Determine the circumferential velocity of the brake disc in mm/s. (3)
[22]

QUESTION 11

11.1 The diagram below shows a circular swimming pool built in an irregularly shaped garden. The garden has one straight side which is divided into 5 equal parts.

- The width of each equal part is 2 m.
- The ordinates dividing these parts are 7 m, 8,9 m, 820 cm, 6 m, 9 m and 8 m respectively.
- The straight side, as well as the 2nd and 5th ordinates, are tangents to the swimming pool.



11.1.1 Write down the total length of the straight side of the garden. (1)

11.1.2 Write down the value of r, the radius of the circular swimming pool. (1)

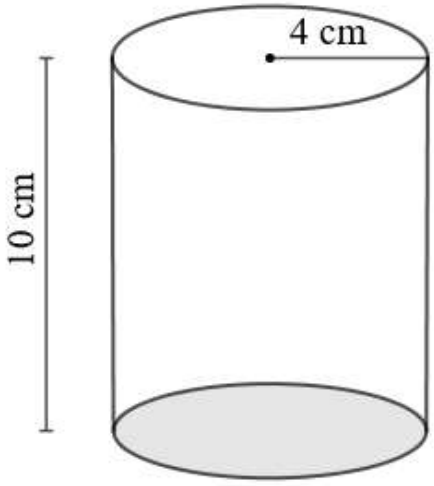
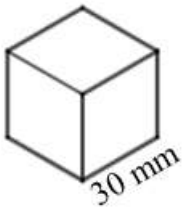
11.1.3 Convert 820 cm to metres. (1)

11.1.4 The owner of the garden wants to pave the entire garden (excluding the swimming pool). Each paving brick has an area of 0,02 m^2. Determine if 2 500 paving bricks will be sufficient for this task.

HINT: Area of circle $= \pi r^2$ (6)

11.2 The picture below shows a cylindrical glass with some water inside. Three ice cubes are placed in the glass.
The diagrams alongside the picture give the inner dimensions of the cylindrical glass, as well as the dimensions of one ice cube.

- The inner radius and the height of the cylindrical glass are 4 cm and 10 cm respectively.
- Each ice cube has sides of length 30 mm.

Cylindrical glass with some water in it	**Inner dimensions of the cylindrical glass**	**Dimensions of one ice cube**
		

The following formulae may be used:

Total surface area of cylinder $= 2\pi r^2 + 2\pi rh$ **Total surface area of cube** $= 6\,l^2$

Volume of cylinder $= \pi r^2 h$ **Volume of cube** $= l^3$

11.2.1 Convert 30 mm to centimetres. (1)

11.2.2 The glass contains 250 ml of water. Determine how much space remains in the glass after three ice cubes have been added.

HINT: 1 ml = 1 cm^3 (6)
[16]

TOTAL: 150

Copyright reserved

INFORMATION SHEET: TECHNICAL MATHEMATICS

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

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

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

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

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

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

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

$$\int k a^{nx} dx = k \cdot \frac{a^{nx}}{n \ln a} + C \quad , a > 0$$

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

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

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

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

$$\text{Area of } \Delta ABC = \frac{1}{2} ab. \sin C$$

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

Copyright reserved

π rad $= 180°$

Angular velocity $= \omega = 2\ \pi\ n$ where n = rotation frequency

Circumferential velocity $= v = \pi D n$ 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 $= \frac{r\,s}{2}$ where r = radius, s = arc length

Area of a sector $= \frac{r^2\,\theta}{2}$ where r = radius and θ = central angle in radians

$4h^2 - 4d\,h + x^2 = 0$ where h = height of segment, d = diameter of circle and x = length of chord

$A_T = a\left(m_1 + m_2 + m_3 + ... + m_n\right)$ where $a =$ width of equal parts, $m_1 = \frac{o_1 + o_2}{2}$ $o_n = n^{th}$ ordinate and n = number of ordinates

OR

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

Copyright reserved