MATHEMATICS ASSESSMENT FRAMEWORK

2025 JUNE EXAMINATION

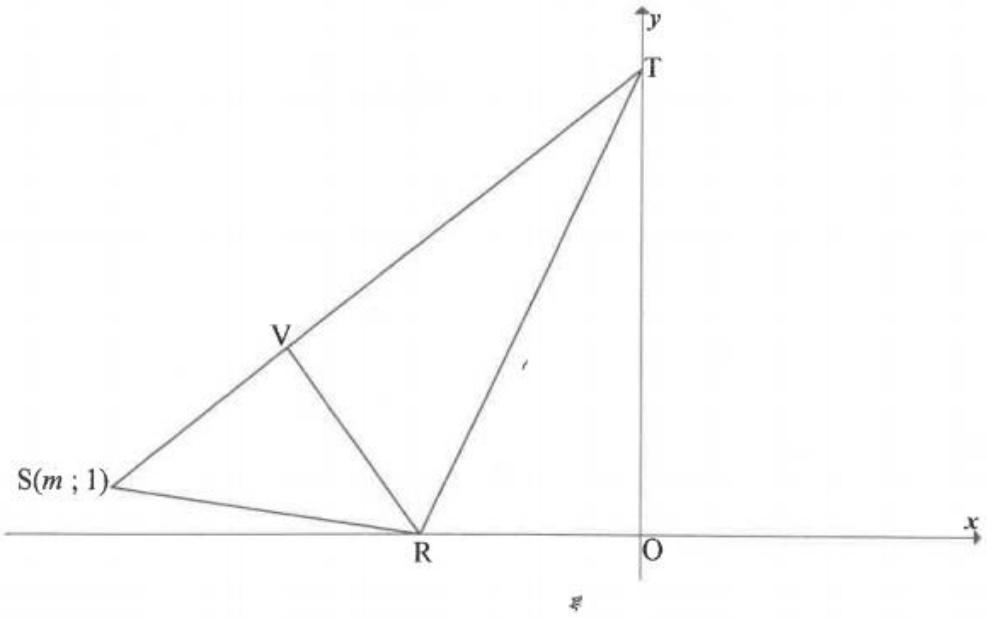
GRADE 12

PAPER 2

QUESTION	TOPICS/CONCEPTS	MARKS
1	**Analytical Geometry – Grade 11 textbook** • Length, Gradient and angle of inclination • Coordinates of the Mid-point • Equation of a straight line • Area of a triangle/polygons	24
2	**Analytical Geometry – Grade 12 textbook** • Circle and tangent	14

QUESTION 3

In the diagram below, ΔSRT is drawn where R lies on the x-axis and S lies to the left of R. T lies on the y-axis and the coordinates of S are $(m\ ;\ 1)$. The equation of RT is $2x - y + 10 = 0$.



3.1 Calculate the coordinates of R. (2)

3.2 Calculate the length of RT. Leave your answer in surd form. (3)

3.3 If it is also given that $2RT^2 = 5SR^2$, calculate the value of m. (4)

3.4 It is further given that V lies on ST such that VR is perpendicular to ST. Determine the equation of VR in the form $y = mx + c$. (5)

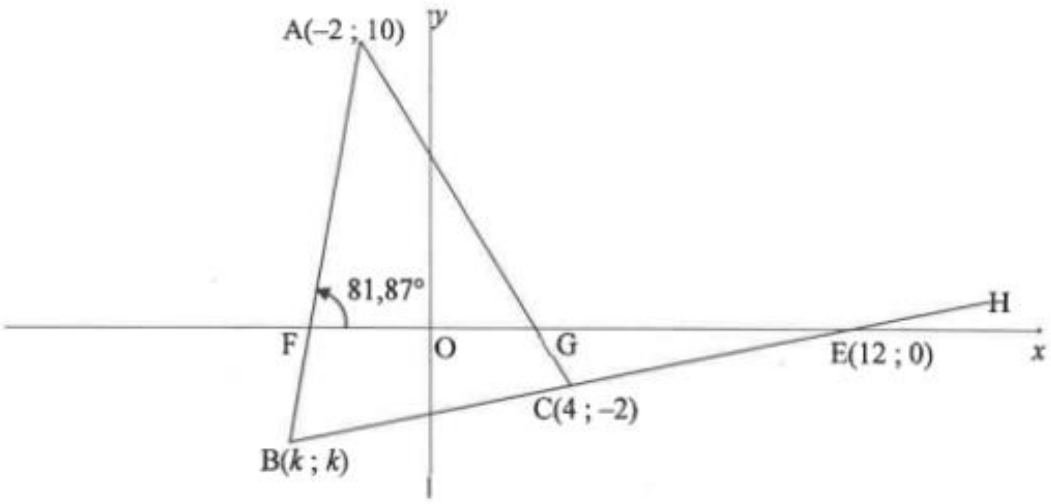
3.5 Hence, show that the coordinates of V are $(-8\ ;\ 4)$. (2)

3.6 If R′ is the reflection of R about the line $x = 0$, calculate the area of RVTR′. (5)

[21]

QUESTION 3

In the diagram, A(–2 ; 10), B(k ; k) and C(4 ; –2) are the vertices of ΔABC. Line BC is produced to H and cuts the x-axis at E(12 ; 0). AB and AC intersects the x-axis at F and G respectively. The angle of inclination of line AB is 81,87°.



3.1 Calculate the gradient of:

3.1.1 BE (2)

3.1.2 AB (2)

3.2 Determine the equation of BE in the form $y = mx + c$ (2)

3.3 Calculate the:

3.3.1 Coordinates of B, where $k < 0$ (2)

3.3.2 Size of $\hat{A}$ (4)

3.3.3 Coordinates of the point of intersection of the diagonals of parallelogram ACES, where S is a point in the first quadrant (2)

3.4 Another point T(p ; p), where $p > 0$, is plotted such that ET = BE = $4\sqrt{17}$ units.

3.4.1 Calculate the coordinates of T. (5)

3.4.2 Determine the equation of the:

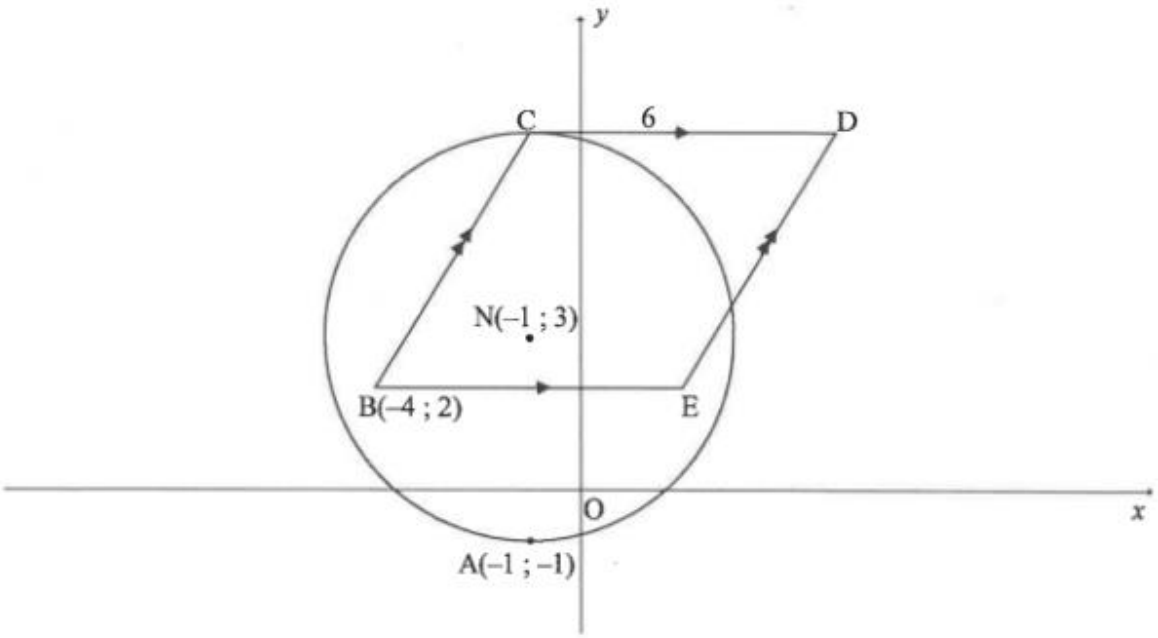
(a) Circle with centre at E and passing through B and T in the form $(x-a)^2 + (y-b)^2 = r^2$ (2)

(b) Tangent to the circle at point B(k ; k) (3)

[24]

QUESTION 4

In the diagram, the circle centred at N(–1 ; 3) passes through A(–1 ; –1) and C. B(–4 ; 2), C, D and E are joined to form a parallelogram such that BE is parallel to the x-axis. CD is a tangent to the circle at C and CD = 6 units.



4.1 Write down the length of the radius of the circle. (1)

4.2 Calculate the:

4.2.1 Coordinates of C (2)

4.2.2 Coordinates of D (2)

4.2.3 Area of ΔBCD (3)

4.3 The circle, centred at N, is reflected about the line $y = x$. M is the centre of the new circle which is formed. The two circles intersect at A and F.

Calculate the:

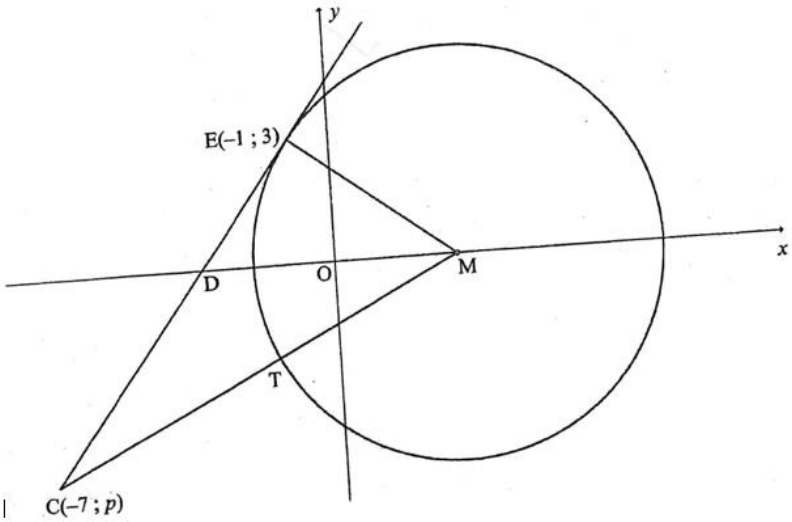
4.3.1 Length of NM (3)

4.3.2 Midpoint of AF (4)

[15]

QUESTION 4

In the diagram, M is the centre of the circle having equation $(x-3)^2+y^2=25$. E(–1 ; 3) and T are points on the circle. EC is a tangent to the circle at E and cuts the x-axis at D. $ED=\frac{15}{4}$ units. MT is produced to meet the tangent at C(–7 ; p).



4.1 Write down the size of $C\hat{E}M$. (1)

4.2 Determine the equation of the tangent EC in the form $y=mx+c$. (4)

4.3 Calculate the length of DM. (3)

4.4 Show that $p=-5$ (1)

4.5 Calculate the coordinates of S if SEMC is a parallelogram and $x_s<0$. (3)

4.6 If the radius of the circle, centred at M, is increased by 7 units, determine whether S lies inside or outside the new circle. Support your answer with the necessary calculations. (3)

4.7 If ET is drawn, calculate the size of $E\hat{T}M$. (5)

[20]

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3	**Trigonometry – Grade 10-12 textbook** • Identities - Double and compound angles • Reduction formula • Solving triangle – right-angled • Solving General Equations	**38**
4	**Trigonometry** **Trigonometry Grade 10 & 11 textbook** • Graphs • Domain/range/amplitude/period • All related characteristics, e.g $f(x)=g(x)$ $f(x)\leq g(x)$ $f(x).g(x)>0$	**15**
5	**Trigonometry – Grade 11 & 12 textbook** • 3D Exercises ✓ Use the given information to analyse the related diagram. ✓ Use different colours pencils on the diagram to identify triangles and angles. ✓ Use ratios and sine, cosine rule to find the missing angles and sides. ✓ **Right-angled triangle** (Pythagoras and Trigonometry ratios) ✓ **Other triangles** - sine and cosine rule	**14**

QUESTION 5

5.1 If $\cos\theta = -\frac{5}{13}$ where $180° < \theta < 360°$, determine, **without using a calculator**, the value of:

5.1.1 $\sin^2\theta$ (3)

5.1.2 $\tan(360° - \theta)$ (2)

5.1.3 $\cos(\theta - 135°)$ (4)

5.2 Simplify the expression to a single trigonometric term: $\frac{2\cos(180° - x)\sin(-x)}{1 - 2\cos^2(90° - x)}$ (6)

5.3 Calculate the value of the following expression **without using a calculator**: $(\tan 92°)(\tan 94°)(\tan 96°) \ldots (\tan 176°)(\tan 178°)$ (4)

[19]

QUESTION 6

6.1 Prove that $2\cos^2(45° + x) = 1 - \sin 2x$. (4)

6.2 Consider the expression: $\sin(A - B) - \sin(A + B)$

6.2.1 Prove that $\sin(A - B) - \sin(A + B) = -2\cos A \sin B$. (2)

6.2.2 Simplify the following expression to a single term: $\sin 4x - \sin 10x$ (2)

6.2.3 Hence, determine the solution for $\sin 4x - \sin 10x = \sin 3x$ for $x \in [0°; 30°]$. (5)

QUESTION 5

5.1 If $\cos 2\theta = -\frac{5}{6}$, where $2\theta \in [180°; 270°]$, calculate, **without using a calculator**, the values in simplest form of:

5.1.1 $\sin 2\theta$ (4)

5.1.2 $\sin^2 \theta$ (3)

5.2 Simplify $\sin(180° - x).\cos(-x) + \cos(90° + x).\cos(x - 180°)$ to a single trigonometric ratio. (6)

5.3 Determine the value of $\sin 3x.\cos y + \cos 3x.\sin y$ if $3x + y = 270°$. (2)

5.4 Given: $2\cos x = 3\tan x$

5.4.1 Show that the equation can be rewritten as $2\sin^2 x + 3\sin x - 2 = 0$. (3)

5.4.2 Determine the general solution of x if $2\cos x = 3\tan x$. (5)

5.4.3 Hence, determine two values of y, $144° \leq y \leq 216°$, that are solutions of $2\cos 5y = 3\tan 5y$. (4)

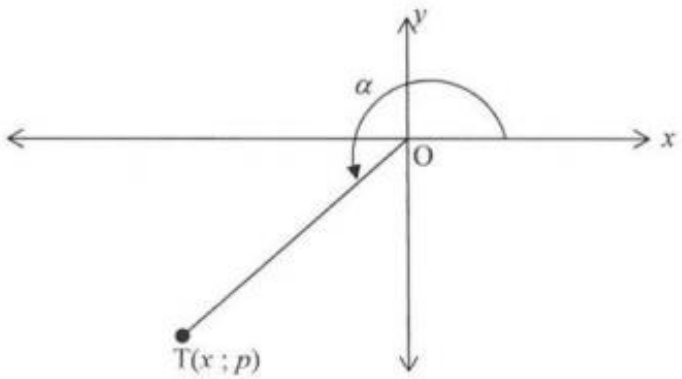
QUESTION 5

5.1 If $x = 3\sin\theta$ and $y = 3\cos\theta$, determine the value of $x^2 + y^2$. (3)

5.2 Simplify to a single term:

$$\sin(540° - x).\sin(-x) - \cos(180° - x).\sin(90° + x)$$ (6)

5.3 In the diagram below, $T(x\ ;\ p)$ is a point in the third quadrant and it is given that $\sin\alpha = \dfrac{p}{\sqrt{1+p^2}}$.



5.3.1 Show that $x = -1$. (3)

5.3.2 Write $\cos(180° + \alpha)$ in terms of p in its simplest form. (2)

5.3.3 Show that $\cos 2\alpha$ can be written as $\dfrac{1-p^2}{1+p^2}$. (3)

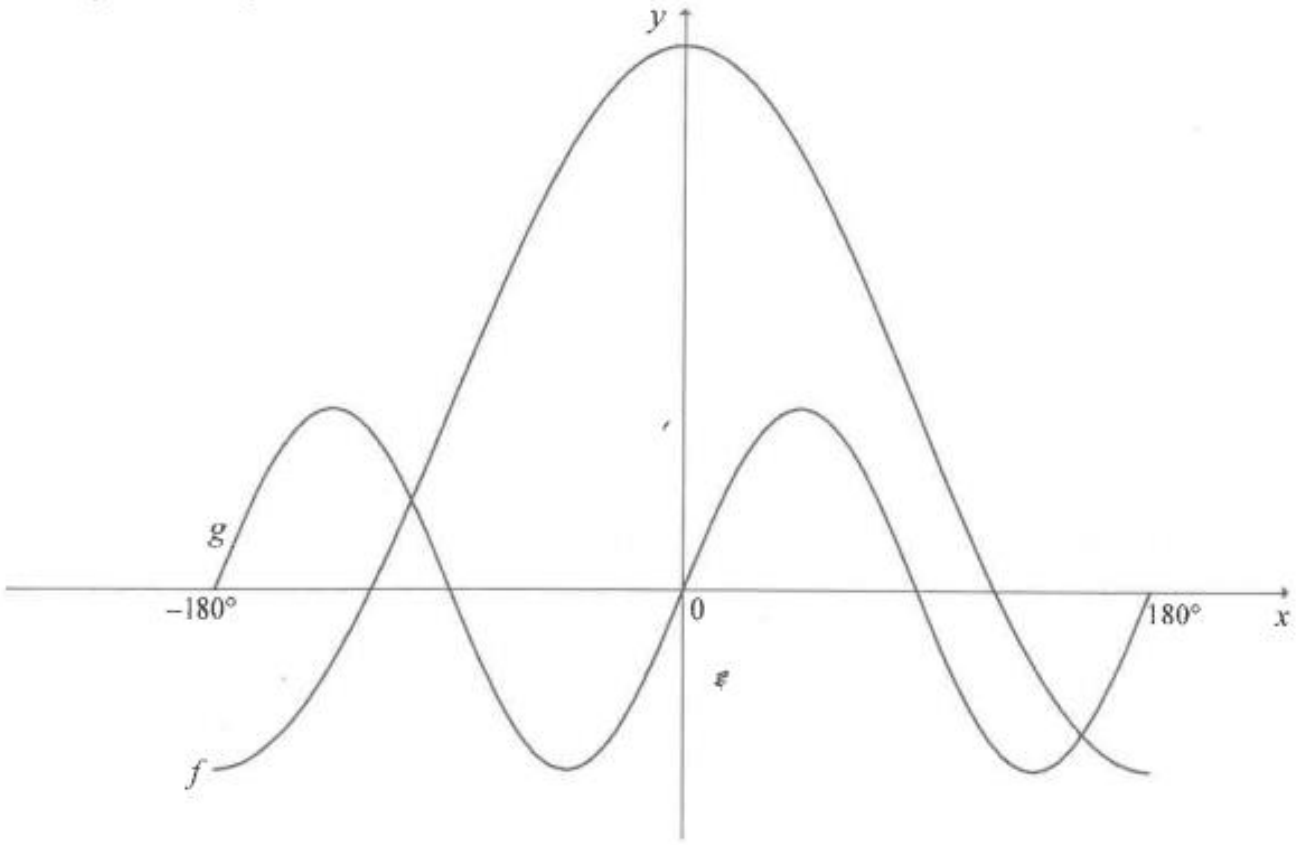
5.4 5.4.1 For which value(s) of x will $\dfrac{2\tan x - \sin 2x}{2\sin^2 x}$ be undefined in the interval $0° \le x \le 180°$? (3)

5.4.2 Prove the identity: $\dfrac{2\tan x - \sin 2x}{2\sin^2 x} = \tan x$ (6)

[26]

QUESTION 7

In the diagram, the graphs of $f(x) = 2\cos x + 1$ and $g(x) = \sin 2x$ are drawn for the interval $x \in [-180°; 180°]$.



7.1 Write down the range of f. (1)

7.2 Write down the period of g. (1)

7.3 For which values of x, in the interval $x \in [-180°; 180°]$, is f increasing? (1)

7.4 Use the graphs to determine the values of x, in the interval $x \in [-180°; 180°]$, for which:

7.4.1 $g(x).f'(x) < 0$ (2)

7.4.2 $\cos x \leq -\frac{1}{2}$ (3)

7.5 Graph g is shifted $45°$ to the right to obtain a new graph h. Determine the equation of h in its simplest form. (2)

[10]

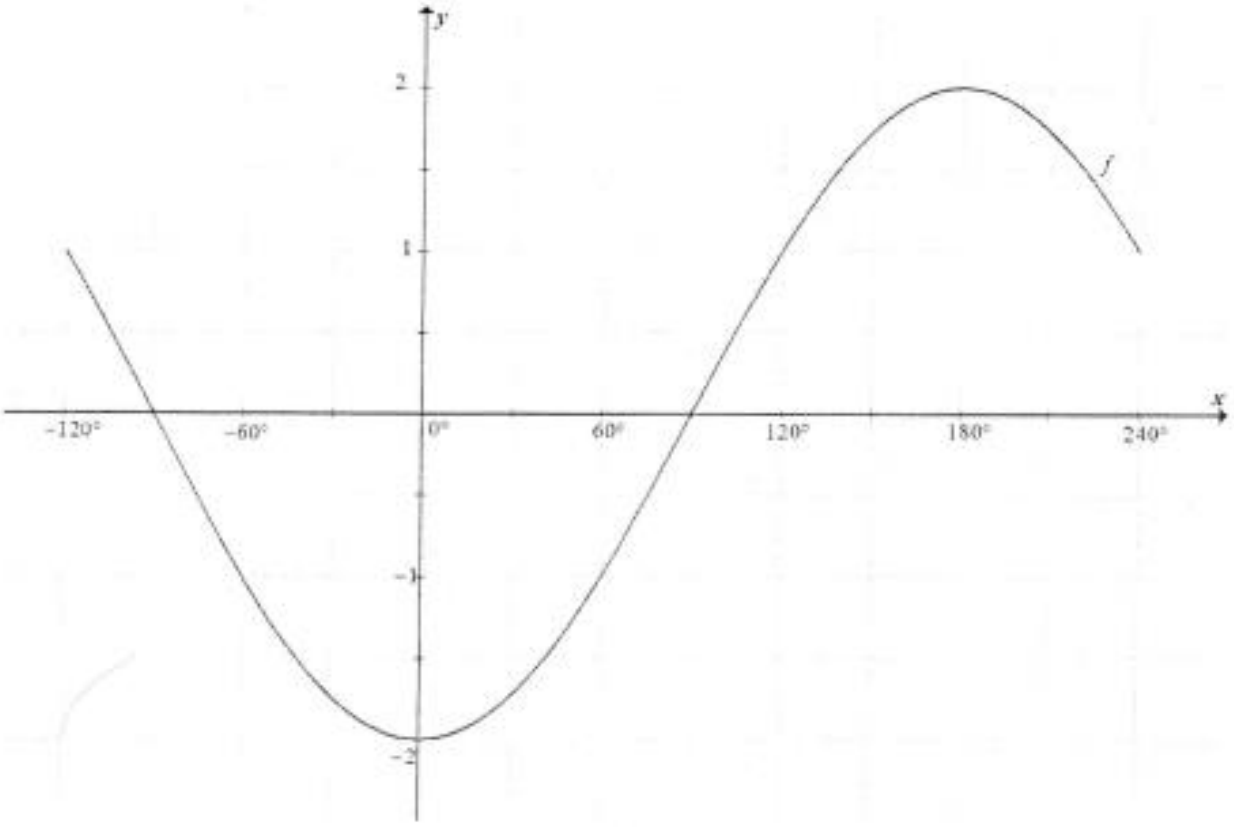
QUESTION 6

Given the equation: $\sin(x + 60°) + 2\cos x = 0$

6.1 Show that the equation can be rewritten as $\tan x = -4 - \sqrt{3}$. (4)

6.2 Determine the solutions of the equation $\sin(x + 60°) + 2\cos x = 0$ in the interval $-180° \leq x \leq 180°$. (3)

6.3 In the diagram below, the graph of $f(x) = -2\cos x$ is drawn for $-120° \leq x \leq 240°$.



6.3.1 Draw the graph of $g(x) = \sin(x + 60°)$ for $-120° \leq x \leq 240°$ on the grid provided in the ANSWER BOOK. (3)

6.3.2 Determine the values of x in the interval $-120° \leq x \leq 240°$ for which $\sin(x + 60°) + 2\cos x > 0$. (3)

[13]

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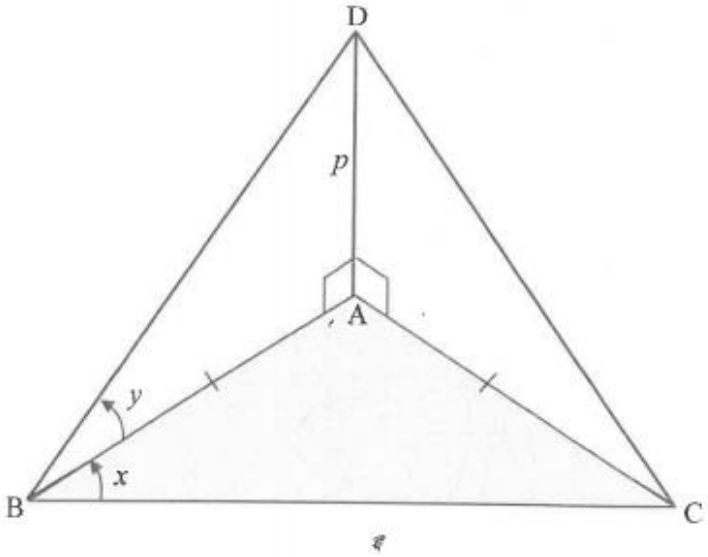
QUESTION 8

In the diagram, A, B and C lie in the same horizontal plane with $AB = AC$. D is directly above A such that $2AD = BC$. Also, $AD = p$, $A\hat{B}C = x$ and $D\hat{B}A = y$.



8.1 Determine AB in terms of p and y. (2)

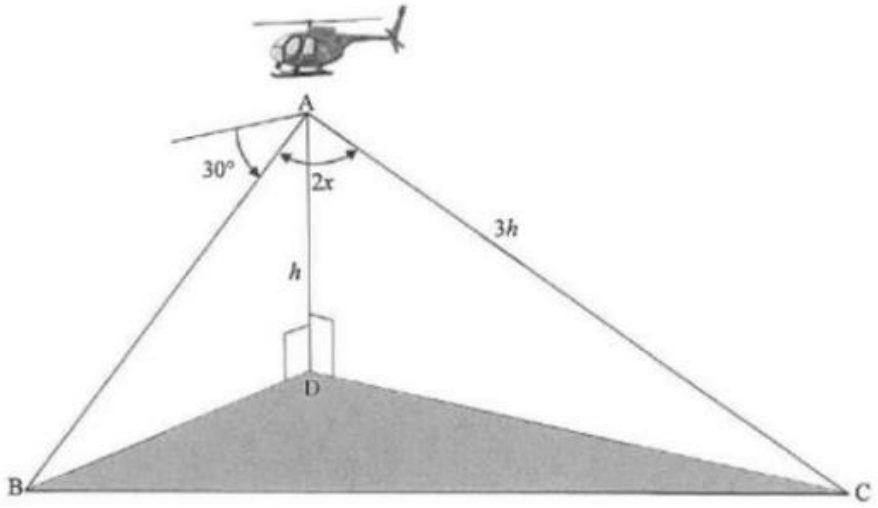
8.2 Show that $\cos x = \tan y$. (4)

8.3 If $x = 60°$, calculate the size of y. (2)

[8]

QUESTION 7

A pilot is flying in a helicopter. At point A, which is h metres directly above point D on the ground, he notices a strange object at point B. The pilot determines that the angle of depression from A to B is 30°. He also determines that the control room at point C is $3h$ metres from A and $B\hat{A}C = 2x$. Points B, C and D are in the same horizontal plane. This scenario is shown in the diagram below.



7.1 Determine the distance AB in terms of h. (2)

7.2 Show that the distance between the strange object at point B and the control room at point C is given by $BC = h\sqrt{25 - 24\cos^2 x}$. (4)

[6]

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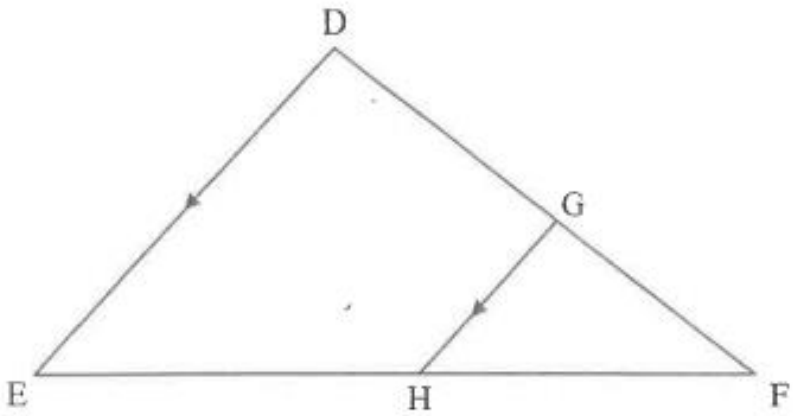
6	**Euclid Geometry – Grade 10 – 12 textbook riders** • Properties of Parallelogram • Mid-point theorem • Congruency • Triangles – sum, exterior angles, isosceles triangle • Lines (Parallel lines) • Circle Geometry- proves and riders. ✓ Use the given information to analyse the related diagram. ✓ Use different colours pencils on the diagram to identify triangles and angles	**20**
7	**Euclid Geometry – Grade 12 textbook** • Proportionality numerical exercises • Proportionality and similarity riders • Ratio of Areas of triangles • **Proves** and riders. ✓ Use the given information to analyse the related diagram. • Use different colours pencils on the diagram to identify triangles and angles	**17**
8	**Euclid Geometry** • Mixed Geometry- riders	**08**
	TOTAL	**150**

QUESTION 9

9.1 In the diagram, ΔDEF is drawn. Line GH intersects DF and EF at G and H respectively such that $GH \parallel DE$ and $\frac{GF}{DG} = \frac{2}{5}$.



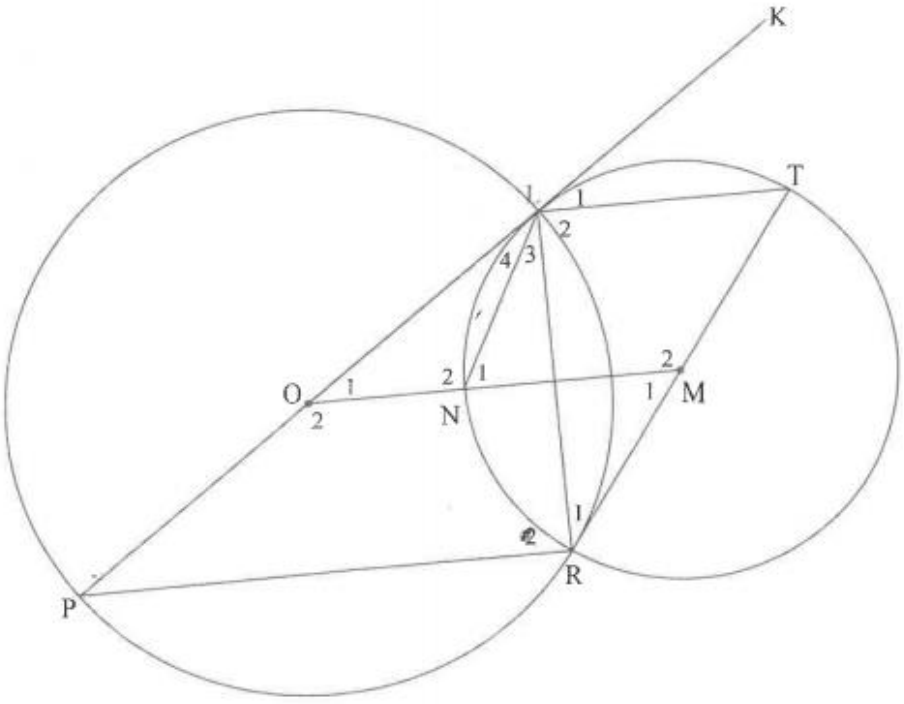
9.1.1 Write down, with a reason, the value of $\frac{HF}{EH}$. (2)

9.1.2 If $EF = 21$ cm, calculate the length of EH. (2)

9.1.3 Write down a triangle which is similar to ΔFGH. (1)

9.1.4 Hence, calculate the value of $\frac{GH}{DE}$. (2)

9.2 In the diagram, POL is a diameter of the larger circle with centre O. TMR is a diameter of the smaller circle with centre M. The two circles intersect at L and R. PLK is a tangent to the smaller circle at L and TR is a tangent to the larger circle at R. OM intersects the smaller circle at N. Straight lines LT, LR, LN and PR are drawn.



Prove, giving reasons, that:

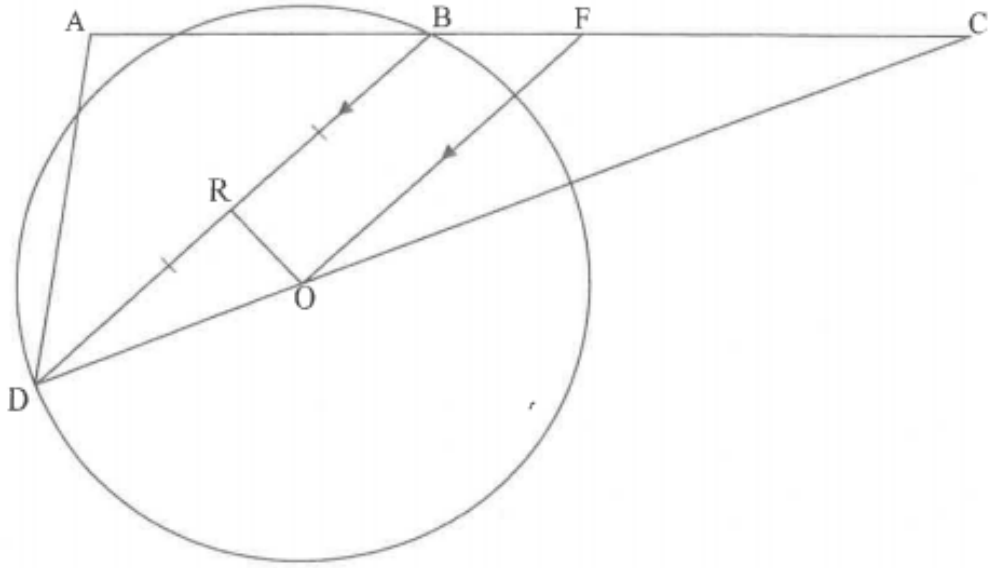
9.2.1 LT || PR (4)

9.2.2 LORM is a cyclic quadrilateral, if it is also given that LT || OM (5)

9.2.3 LN bisects $O\hat{L}R$ (4)

[20]

10.2 In the diagram, O is the centre of the circle. Points D and B lie on the circle. Points A and C lie outside the circle such that side AC of ΔADC passes through B. F is a point on BC such that FO ∥ BD. DR = RB and RO is drawn.



10.2.1 Prove, with reasons, that $\Delta CFO \;|||\; \Delta CBD$. (3)

10.2.2 If it is given that $R\hat{D}O = F\hat{C}O$, show, with reasons, that OF.CD = CO.BC (2)

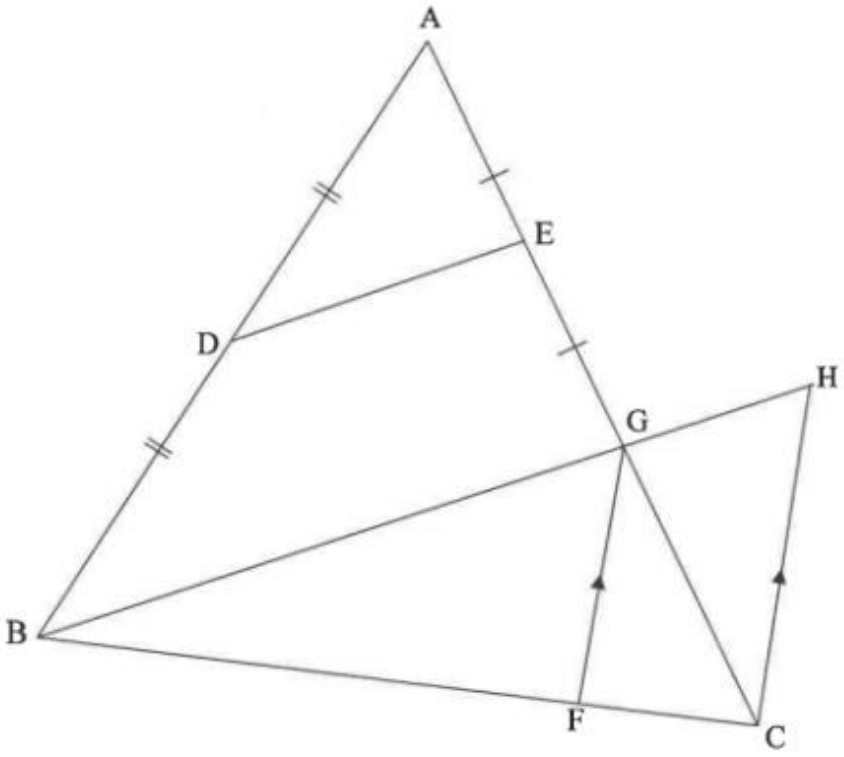
10.2.3 It is further given that DC = 19,2 units, BD = 12 units and $\frac{RO}{RD} = \frac{3}{4}$

Prove, with reasons, that $BF = \frac{75}{16}$ (6)

10.2.4 Calculate the size of $A\hat{B}D$. (3)

[20]

8.2 In the diagram, ΔABG is drawn. D and E are midpoints of AB and AG respectively. AG and BG are produced to C and H respectively. F is a point on BC such that $FG \parallel CH$.

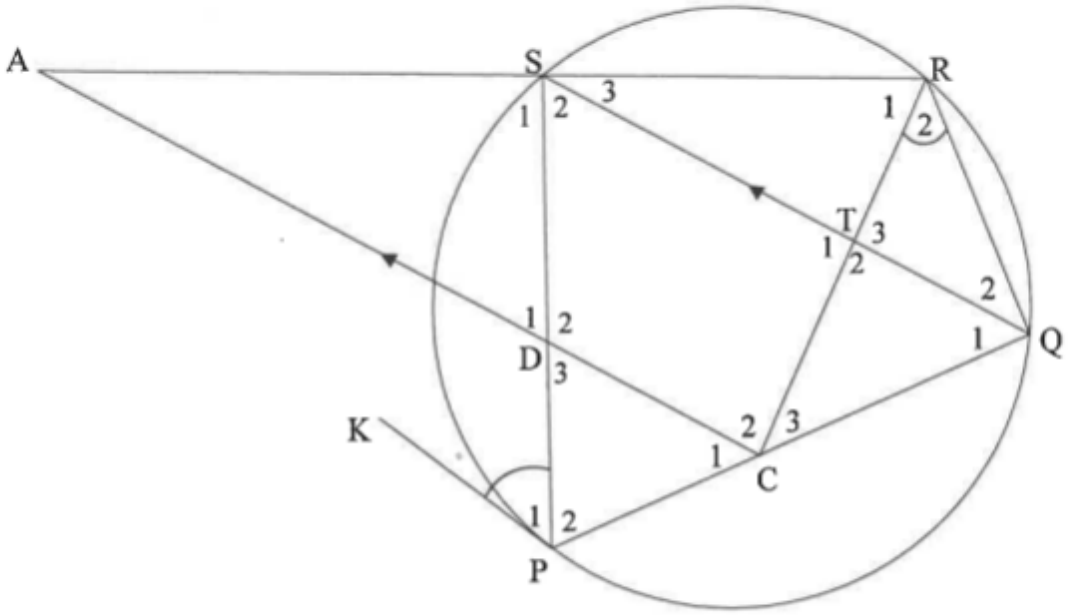


8.2.1 Give a reason why $DE \parallel BH$. (1)

8.2.2 If it is further given that $\frac{FC}{BF} = \frac{1}{4}$, $DE = 3x - 1$ and $GH = x + 1$, calculate, giving reasons, the value of x. (6)

QUESTION 10

In the diagram, PQRS is a cyclic quadrilateral. KP is a tangent to the circle at P. C and D are points on chords PQ and PS respectively and CD produced meets RS produced at A. CA ∥ QS. RC is drawn. $\hat{P}_1 = \hat{R}_2$.



Prove, giving reasons, that:

10.1 $\hat{S}_1 = \hat{T}_2$ (4)

10.2 $\frac{AD}{AR} = \frac{AS}{AC}$ (5)

10.3 $AC \times SD = AR \times TC$ (4)