



Northern Cape
Department of Education



LAST PUSH

TRIAL PAPERS-2022

PAPER 2-

PER TOPIC



GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA



education
Department of
Education
FREE STATE PROVINCE



education
Department:
Education
PROVINCE OF KWAZULU-NATAL



education
Lefapha la Thuto
Onderwys Departement
Department of Education
NORTH WEST PROVINCE



LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION



education
DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE



Province of the
EASTERN CAPE
EDUCATION



Northern Cape
Department of Education



Western Cape
Government
Education

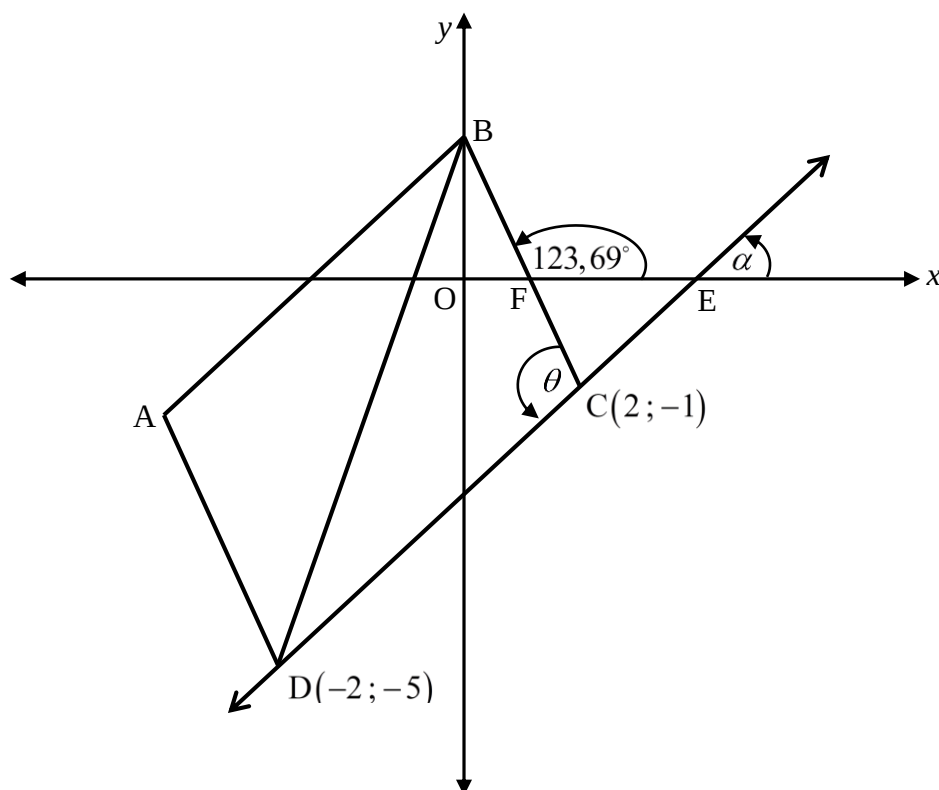
ANALITICAL GEOMETRY_NC SEPT EXAM P2 GR12 2022 - ENG _____	2
ANALITICAL GEOMETRY_Sept 2022 FS Maths P2 (Eng) _____	4
ANALYTICAL GEOMETRY_Maths P2 ENG _____	6
ANALYTICAL GEOMETRY_NW MATHEMATICS P2 ENG SEPT 2022 _____	8
ANALYTICAL GEOMETRY_Sept 2022 Lim Maths P2 (Eng) _____	10
ANALYTICAL GEOMETRY_Sept 2022 Metro South Maths P2 (Eng) _____	12
GEOMETRY_Maths P2 ENG _____	14
GEOMETRY_NC SEPT EXAM P2 GR12 2022 -ENG _____	19
GEOMETRY_NW MATHEMATICS P2 ENG SEPT 2022 _____	23
GEOMETRY_Sept 2022 FS Maths P2 (Eng) _____	27
GEOMETRY_Sept 2022 Lim Maths P2 (Eng) _____	32
GEOMETRY_Sept 2022 Metro South Maths P2 (Eng) _____	37
STATISTICS_Maths P2 ENG _____	40
STATISTICS_NC SEPT EXAM P2 GR12 2022 -ENG _____	42
STATISTICS_NW MATHEMATICS P2 ENG SEPT 2022 _____	44
STATISTICS_Sept 2022 FS Maths P2 (Eng) _____	47
STATISTICS_Sept 2022 Lim Maths P2 (Eng) _____	49
STATISTICS_Sept 2022 Metro South Maths P2 (Eng) _____	51
TRIGONOMETRY_Maths P2 ENG _____	53
TRIGONOMETRY_NC SEPT EXAM P2 GR12 2022 -ENG _____	56
TRIGONOMETRY_NW MATHEMATICS P2 ENG SEPT 2022 _____	58
TRIGONOMETRY_Sept 2022 FS Maths P2 (Eng) _____	61
TRIGONOMETRY_Sept 2022 Lim Maths P2 (Eng) _____	64
TRIGONOMETRY_Sept 2022 Metro South Maths P2 (Eng) _____	67

QUESTION 2

In the diagram below. A, B, C(2;-1) and D(-2;-5) are the vertices of a parallelogram.

BC cuts the x -axis in F. DC produced cuts the x -axis in E. Diagonal BD is drawn.

$\hat{BFE} = 123,69^\circ$ and $\hat{BCD} = \theta$. The inclination of line DE is α .

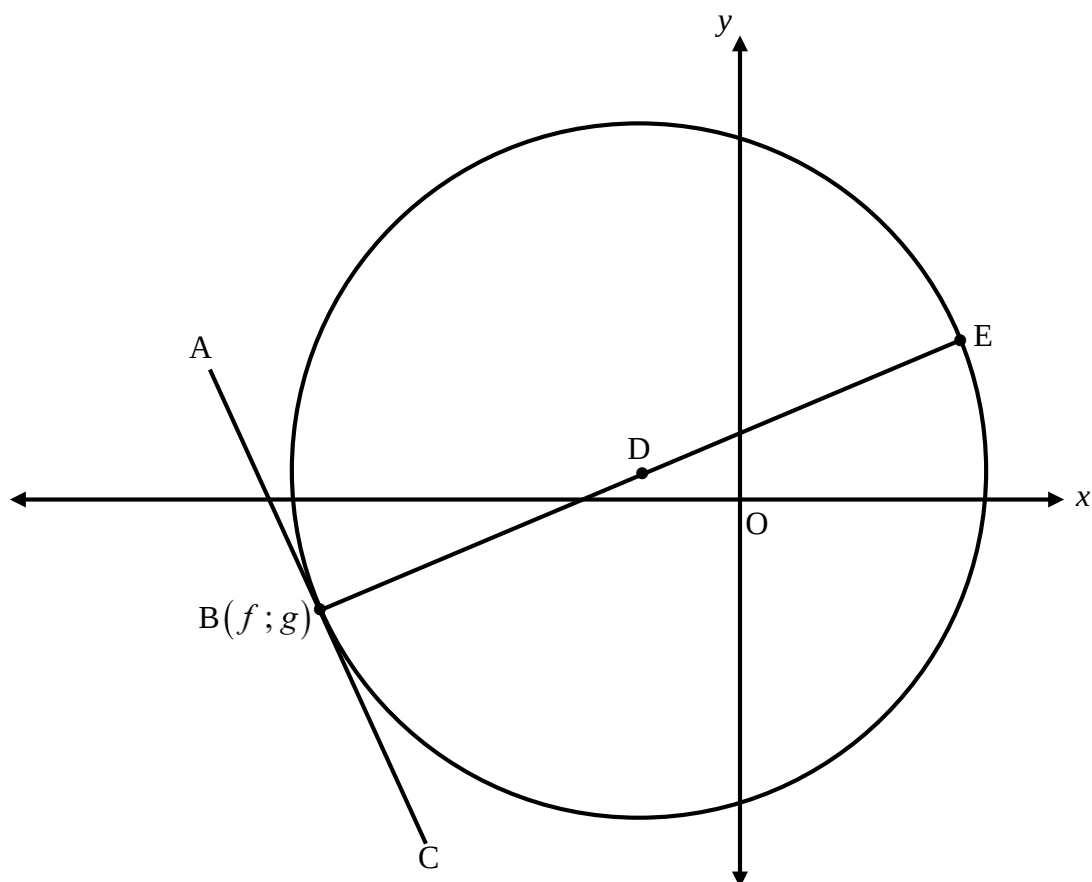


Calculate the:

- | | | |
|-----|---|-------------|
| 2.1 | length of DC (leave your answer in simplest surd form). | (2) |
| 2.2 | gradient of DC. | (2) |
| 2.3 | size of α . | (2) |
| 2.4 | size of θ . | (3) |
| 2.5 | coordinates of B. | (4) |
| 2.6 | coordinates of A. | (3) |
| 2.7 | area of $\triangle CDK$, if it is given that K (not shown on the diagram) is a point on BA produced and $BC = \sqrt{13}$. | (4) |
| | | [20] |

QUESTION 3

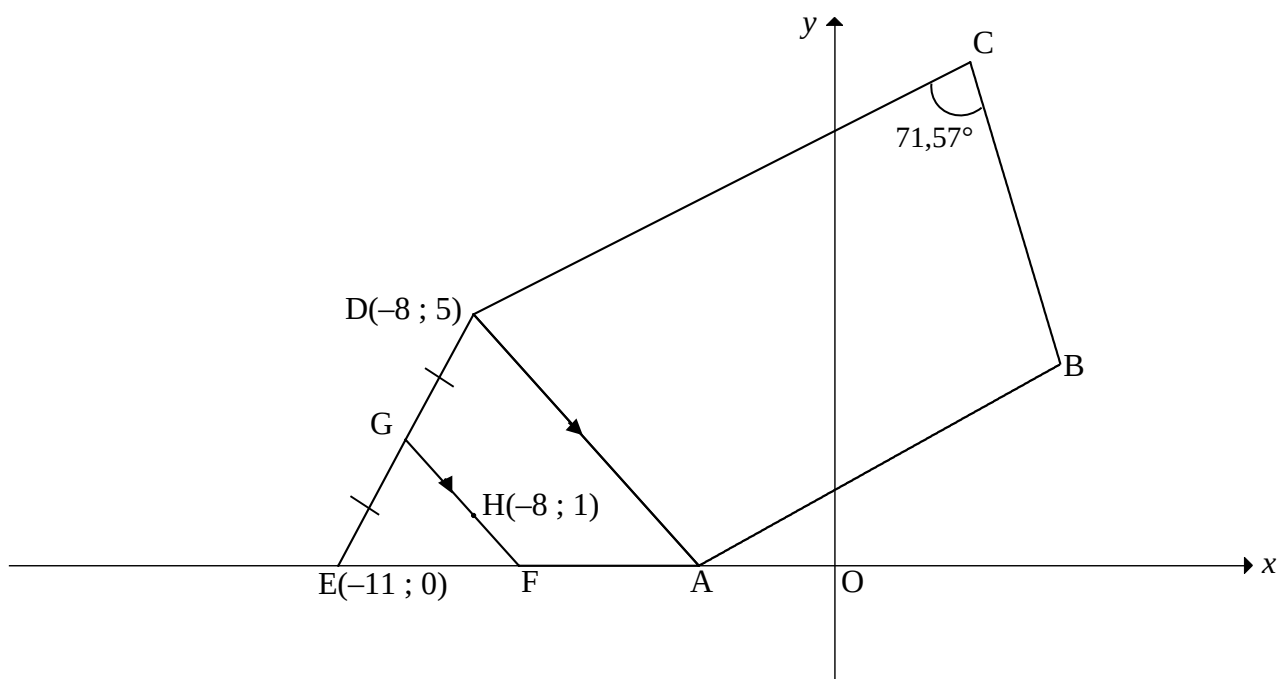
In the diagram below, D is the centre of the circle having equation $x^2 + 4x + y^2 - 2y - 175 = 0$. BE, a diameter of the circle, has the equation $2y - x = 4$. ABC is a tangent to the circle at B(f ; g). B lies in the 3rd quadrant.



- 3.1 Show that the coordinates of B are $(-14; -5)$. (6)
- 3.2 Determine the equation of the tangent ABC. (4)
- 3.3 Determine the equation of the circle in the form $(x-a)^2 + (y-b)^2 = r^2$. (3)
- 3.4 Write down the coordinates of D. (2)
- 3.5 A new circle is obtained by shifting the given circle 5 units vertically downwards and 3 units horizontally to the right and the radius is doubled. Determine the equation of the new circle in the form $Ax^2 + Bx + Cy^2 + Dy + E = 0$. (5)
- [20]**

QUESTION 3

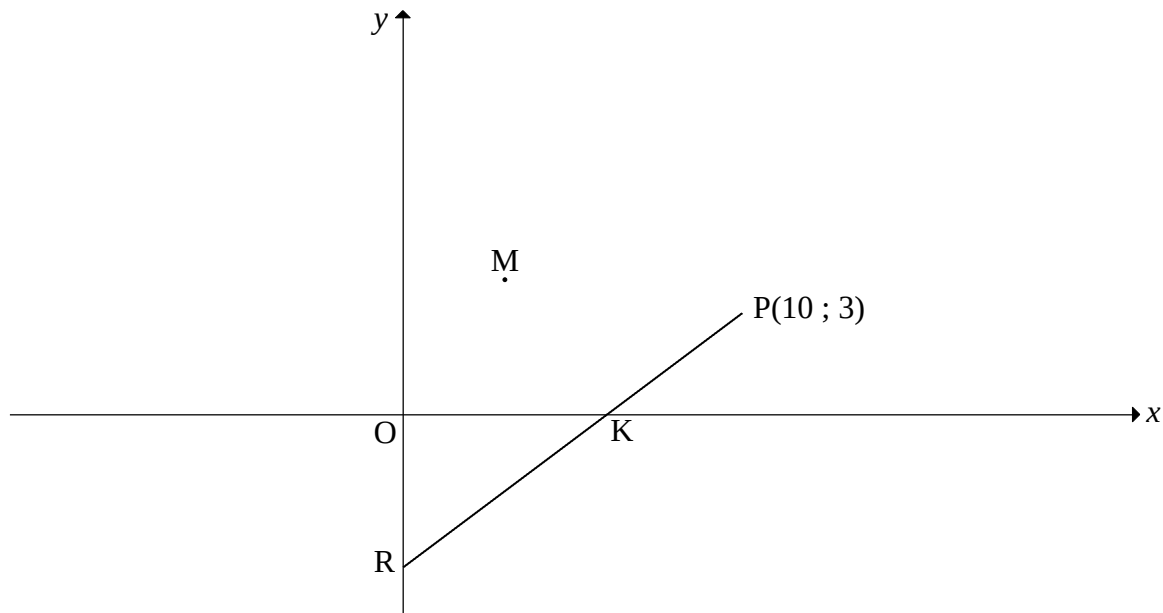
In the diagram, A, B, C and D $(-8; 5)$ are vertices of a cyclic quadrilateral. ED is drawn with E $(-11; 0)$. G and F are points on ED and EA respectively such that $GF \parallel DA$. H $(-8; 1)$ is a point on GF. $EG = GD$ and $\hat{DCB} = 71,57^\circ$.



- 3.1 Calculate the:
 - 3.1.1 Coordinates of G. (2)
 - 3.1.2 Gradient of GF. (2)
 - 3.2 Determine the equation of AD in the form $y = mx + c$. (3)
 - 3.3 Calculate the:
 - 3.3.1 Length of AE. (2)
 - 3.3.2 Area of trapezium ADGF. (4)
 - 3.3.3 Gradient of AB. (6)
- [19]**

QUESTION 4

In the diagram, a circle centred at M is drawn. The equation of the circle is given as $(x - 3)^2 + (y - 4)^2 = 25$. The circle cuts the x-axis at O and K. A tangent PR is drawn from P(10; 3) to touch the circle at K and the y-axis at R.

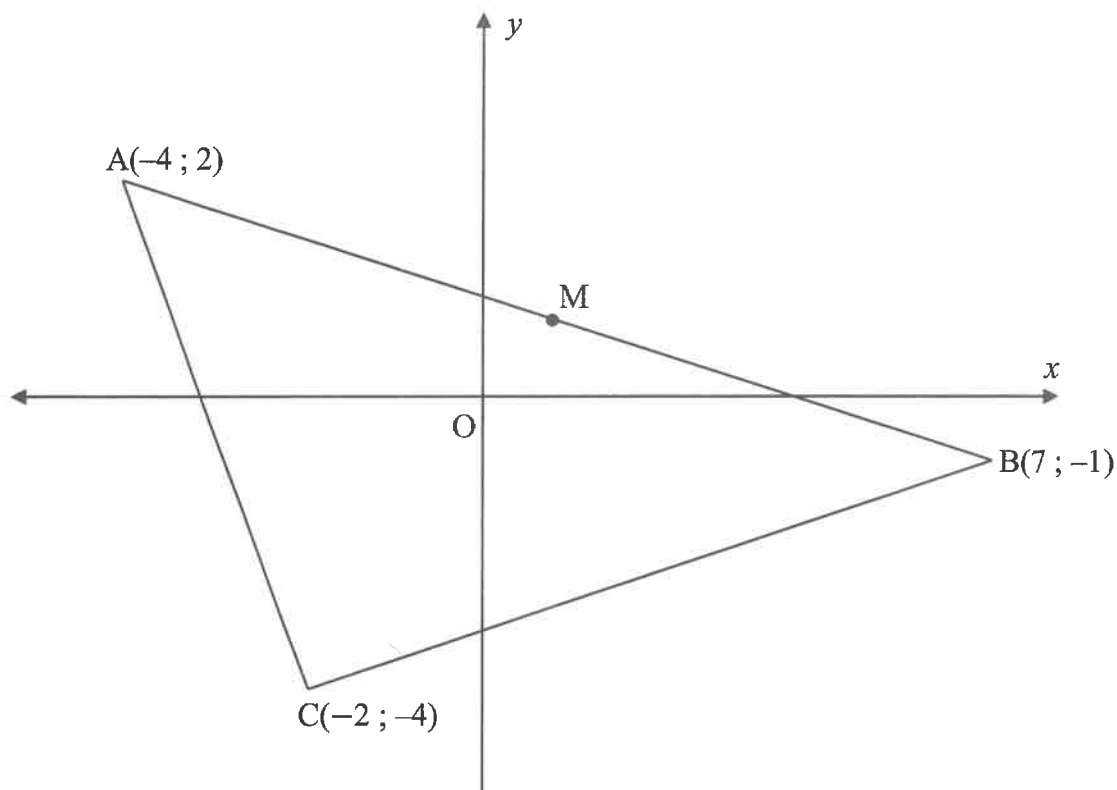


- 4.1 Write down the coordinates of M. (2)
- 4.2 Calculate the:
 - 4.2.1 Coordinates of K. (4)
 - 4.2.2 Gradient of MK. (2)
- 4.3 Determine the equation of tangent PR in the form $y = mx + c$. (3)
- 4.4 From R another tangent is drawn to the circle to touch the circle at T. Calculate the length of RT. (3)
- 4.5 Another circle, centred at N, is drawn to touch the circle, centred at M, externally at K. If it is given that $MN = 10$ units:
 - 4.5.1 Calculate the coordinates of N. (3)
 - 4.5.2 Determine the equation of the circle, centred at N, in the form $x^2 + y^2 + fx + gy + c = 0$. (4)

[21]

QUESTION 3

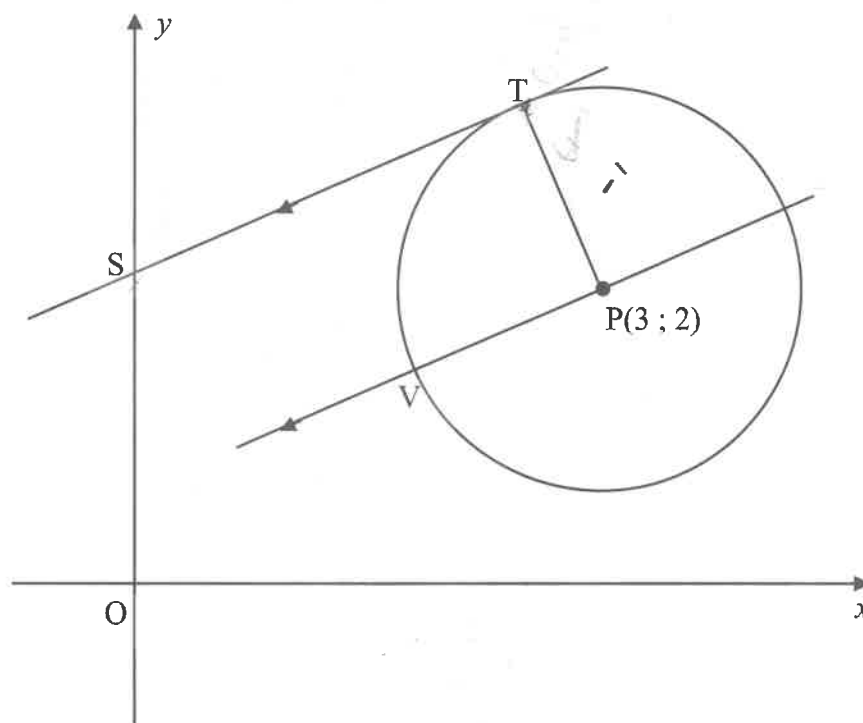
In the figure, $A(-4 ; 2)$, $B(7 ; -1)$ and $C(-2 ; -4)$ are the vertices of a triangle. M is the midpoint of AB .



- 3.1 Calculate the gradient of BC. (2)
- 3.2 Calculate the coordinates of M, the midpoint of AB. (2)
- 3.3 Determine the equation of the line passing through M, which is parallel to BC. Write down your answer in the form $y = mx + c$. (3)
- 3.4 Calculate the angle of inclination of AC. (3)
- 3.5 Calculate the area of $\triangle ABC$. (6)
- [16]**

QUESTION 4

- 4.1 In the sketch below, $P(3 ; 2)$ is the centre of the circle. ST is a tangent to the circle at T . The equation of ST is $x - 2y + 3 = 0$. V is a point on the circle such that PV is parallel to ST . TP is drawn.

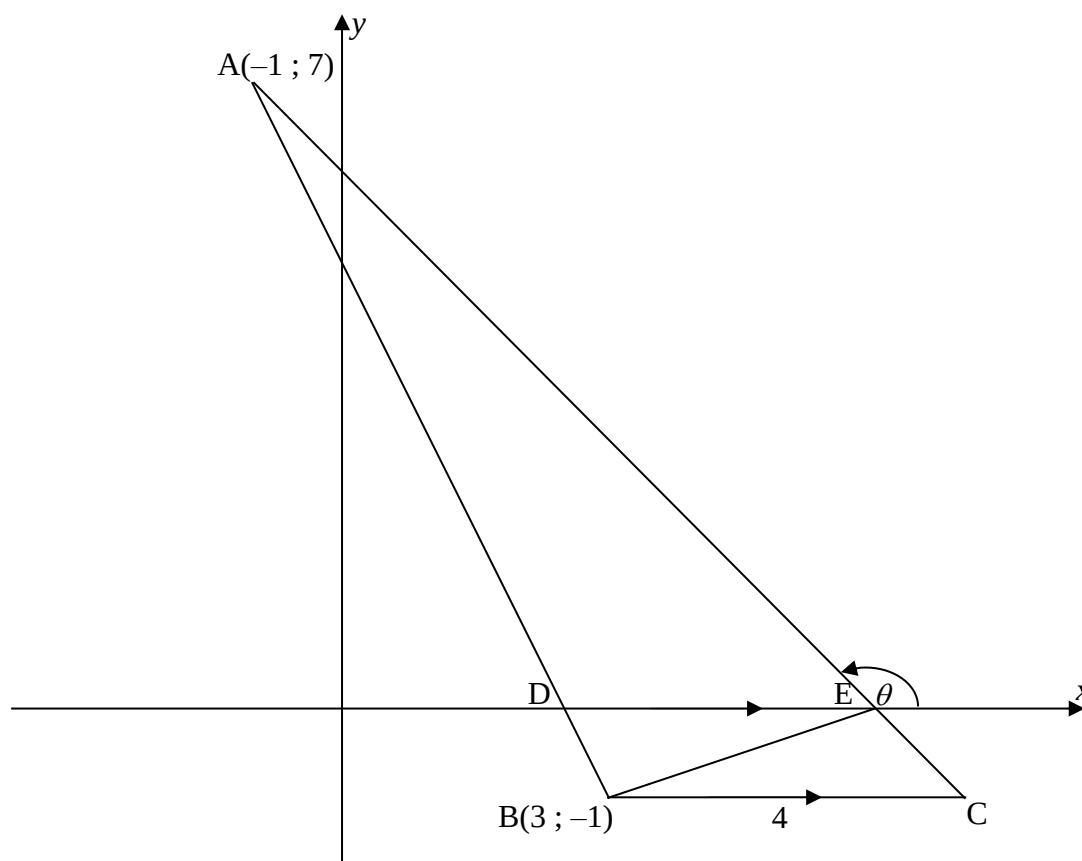


- 4.1.1 Write down the gradient of ST . (2)
- 4.1.2 Determine the equation of TP in the form $y = mx + c$. (3)
- 4.1.3 Calculate the perpendicular distance between the parallel lines. (5)
- 4.1.4 Determine the equation of the circle with centre P in the form $(x-a)^2 + (y-b)^2 = r^2$. (2)
- 4.1.5 The tangent ST is translated up so that point S now lies at $(0 ; 3)$. A new circle having centre at P is drawn so that the new position of T lies on the new circle. Determine the equation of the new circle in the form $(x-a)^2 + (y-b)^2 = r^2$. (5)
- 4.2 Given circle A having equation $x^2 + y^2 = 9$ and circle B having equation $(x-4)^2 + (y-1)^2 = 16$. Determine whether circles A and B intersect, touch each other or do not intersect at all. Show all calculations to support your answer. (5)

[22]

QUESTION 3

In the diagram below, $A(-1 ; 7)$, $B(3 ; -1)$ and C are the vertices of $\triangle ABC$. The angle of inclination of AC is θ . $BC \parallel x$ -axis and $BC = 4$ units. D and E are the x -intercepts of the lines AB and AC respectively. B and E are joined.

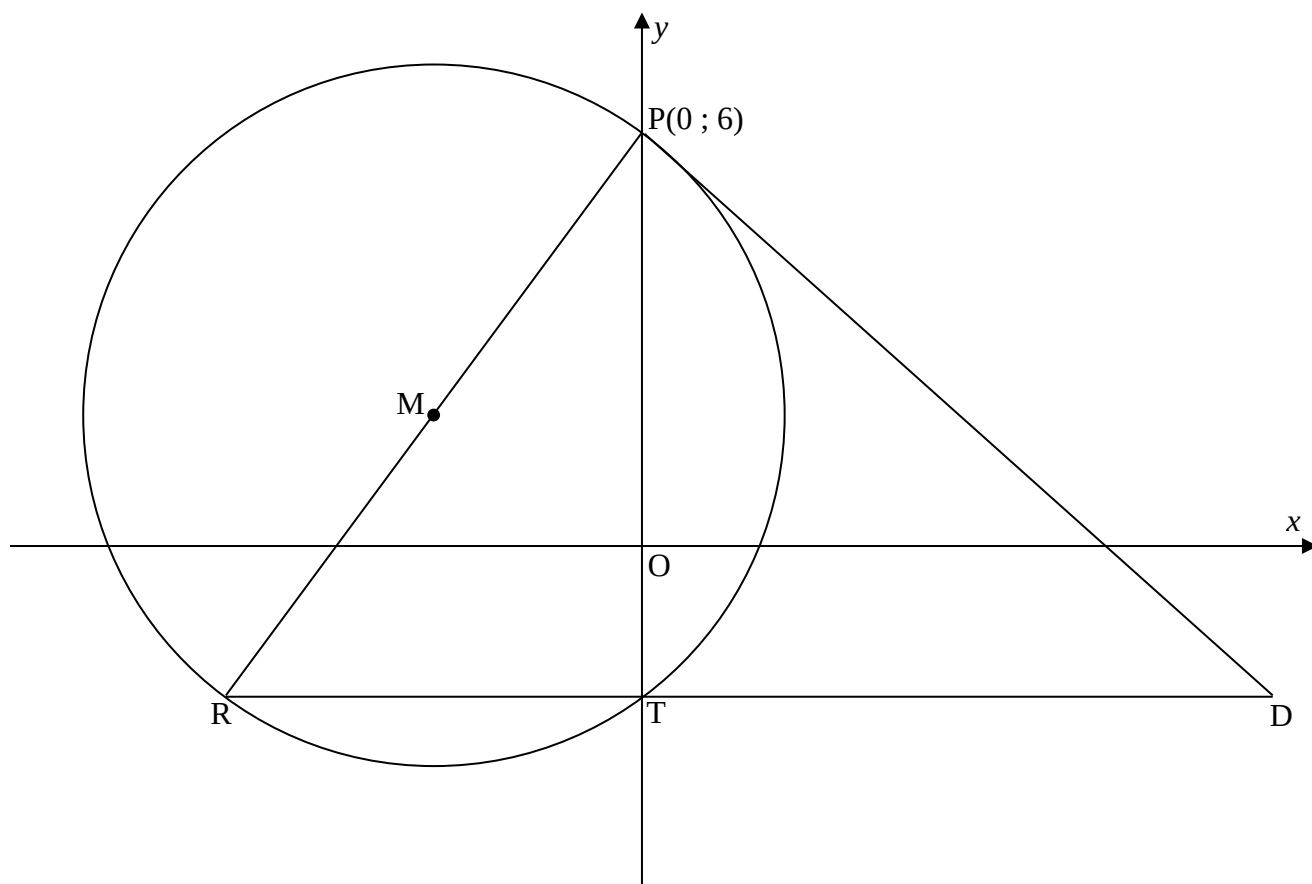


- 3.1 Write down the equation of the line BC . (1)
 - 3.2 Write down the x -coordinate of C . (1)
 - 3.3 Determine the equation of the line AC . (4)
 - 3.4 Calculate the size of $\hat{ACB}$. (4)
 - 3.5 If point K is the reflection of E in the line BC :
 - 3.5.1 Write down the coordinates of K . (3)
 - 3.5.2 Calculate the area of quadrilateral $BECK$. (3)
 - 3.6 F is a point in the first quadrant, such that it forms an equilateral $\triangle BFC$. Calculate the coordinates of F . (5)
- [21]**

QUESTION 4

In the diagram below, a circle with centre M and a tangent PD to the circle at P(0 ; 6) are drawn. The equation of the circle is given as $x^2 + 6x + y^2 - 4y - 12 = 0$.

PR is a diameter, T is a y-intercept and chord RT is produced to D. $RTD \parallel x$ -axis.

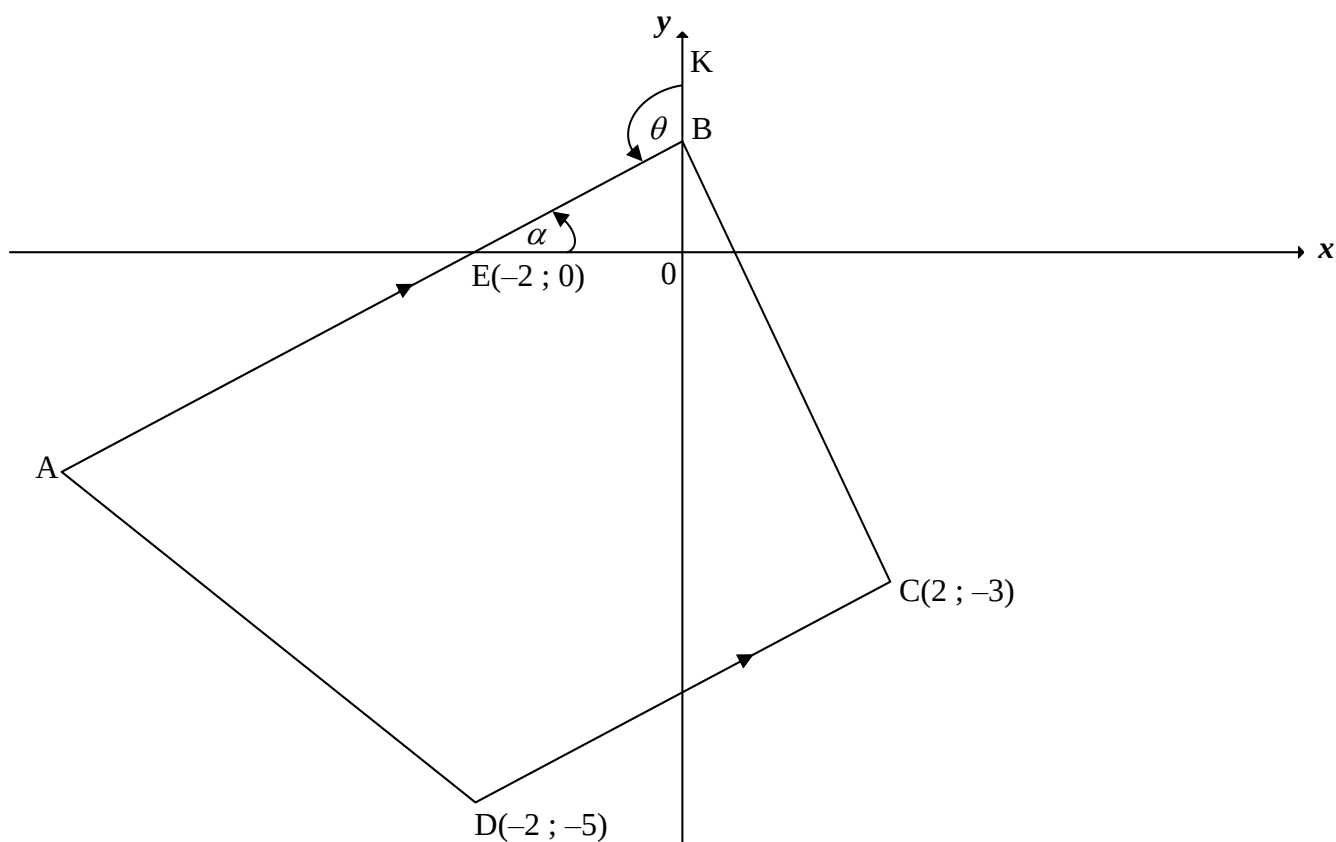


- 4.1 Determine the coordinates of M. (3)
- 4.2 Determine the length of PR. (2)
- 4.3 Determine the equation of the tangent PD. (3)
- 4.4 Determine the coordinates of D. (4)
- 4.5 The circle, having centre M, is translated to the right such that the point D lies on the translated circle. Determine the coordinates of the possible centres of the translated circle. (4)

[16]

QUESTION 3

In the diagram, A, B, C(2 ; -3) and D(-2 ; -5) are vertices of a trapezium with $AB \parallel DC$. E(-2 ; 0) is the x-intercept of AB. The inclination of AB is α . K lies on the y-axis and $\hat{KBE} = \theta$.



3.1 Determine:

3.1.1 The midpoint of EC (2)

3.1.2 The gradient of DC (2)

3.1.3 The equation of AB in the form $y = mx + c$ (3)

3.1.4 The size of θ (3)

3.2 Prove that $AB \perp BC$. (3)

3.3 The points E, B and C lie on the circumference of a circle. Determine:

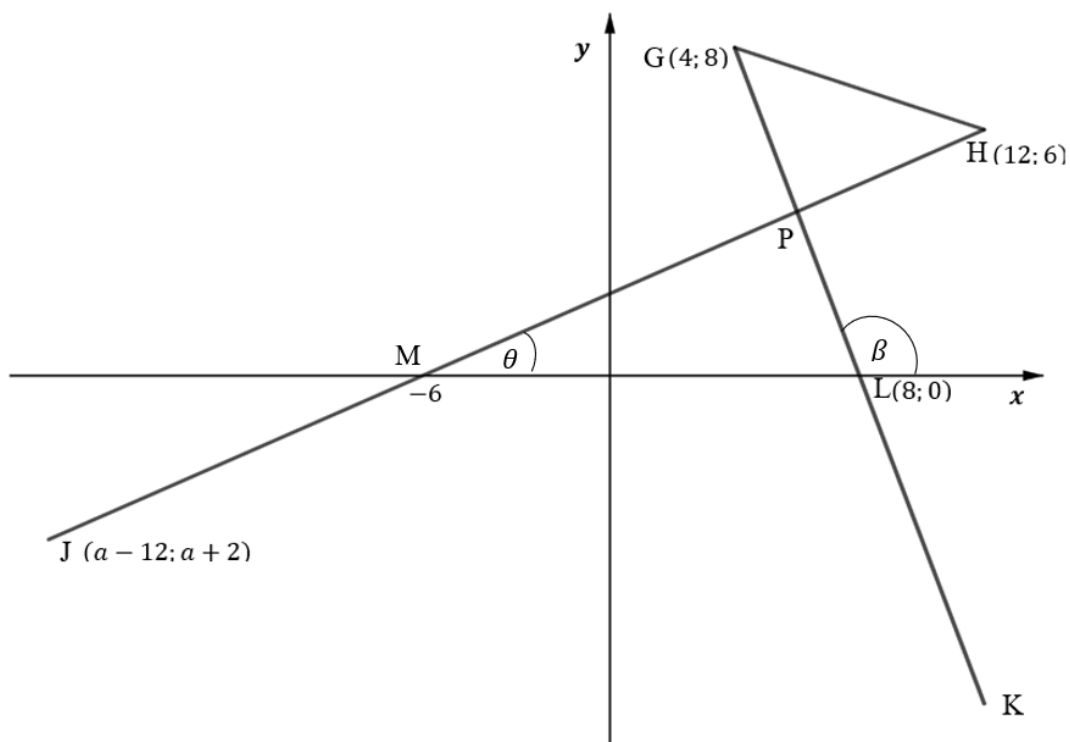
3.3.1 The centre of the circle (1)

3.3.2 The equation of the circle in the form $(x-a)^2 + (y-b)^2 = r^2$ (4)

[18]

QUESTION 3

In the following figure, the lines GK and HJ cut each other at point P. The angle of inclination of GK is β and $\widehat{PML} = \theta$.

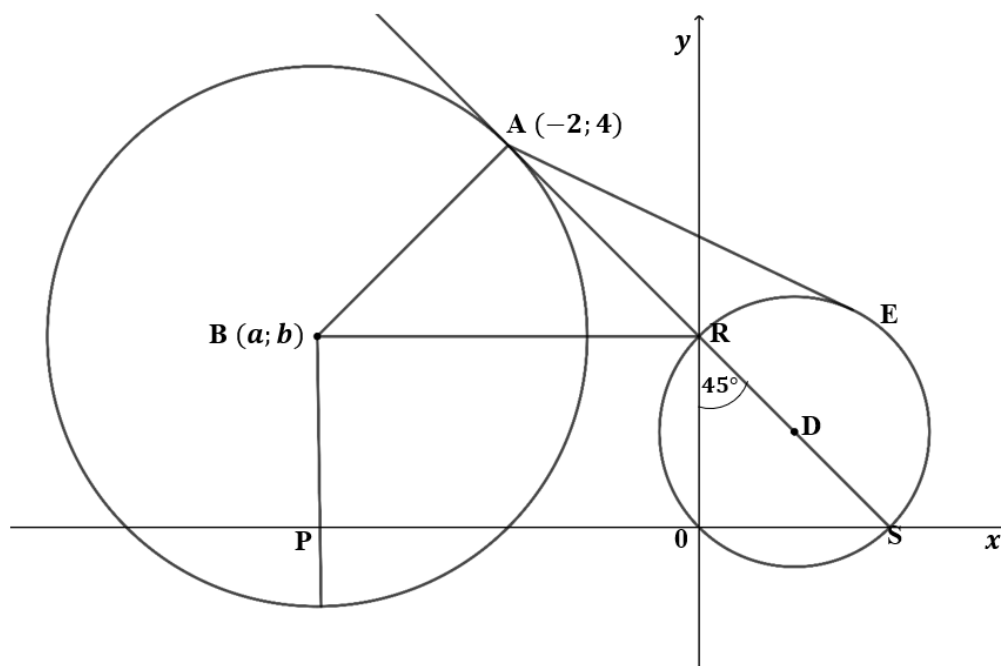


- 3.1 Determine the length of GH. (2)
- 3.2 Determine the gradient of JH. (2)
- 3.3 Hence, or otherwise, determine the value of a . (3)
- 3.4 Determine the coordinates of K, if $GL = KL$. (3)
- 3.5 Determine the equation of GK. (3)
- 3.6 Determine the coordinates of P. (4)
- 3.7 Determine the magnitude of $\widehat{GPH}$. (4)

[21]

QUESTION 4

The diagram below shows a circle with centre $B(a; b)$. BP is parallel to the y -axis with P on the x -axis. AS is a tangent to circle B at $A(-2; 4)$ and intersects the x -axis at S and the y -axis at R . AE is a tangent to the smaller circle with centre D and touches the circle at E . $\angle ORS = 45^\circ$. BR is perpendicular to the y -axis.



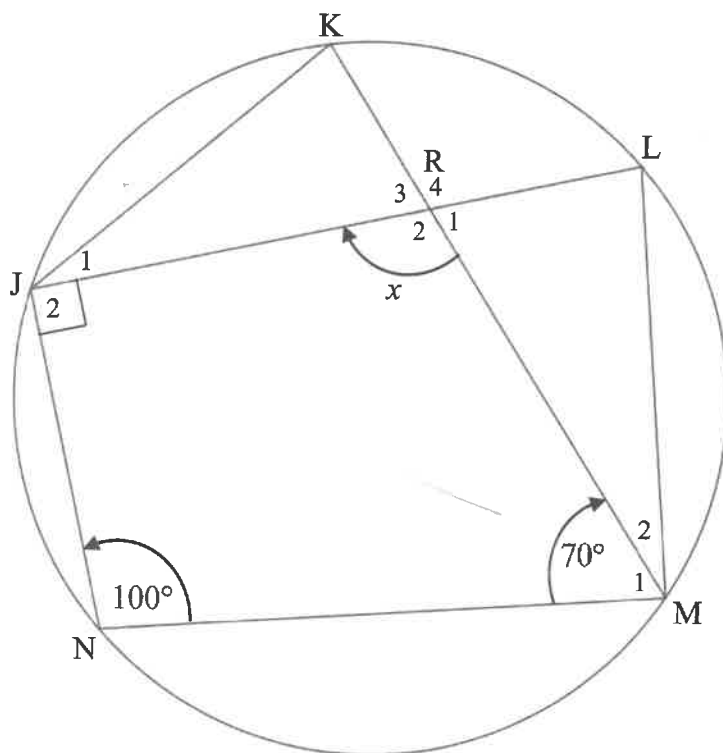
- 4.1 Show that the equation of the tangent AS is $y = -x + 2$. (4)
- 4.2 If $OP = 4$ units, determine the values of a and b , the centre of the larger circle. (2)
- 4.3 Determine the equation of the circle with centre B . (3)
- 4.4 The equation of the smaller circle with centre D is $x^2 - 2x + y^2 - 2y = 0$
Write this equation in the form $(x - a)^2 + (y - b)^2 = r^2$ (3)
- 4.5 Write down the coordinates of D , the centre of the smaller circle. (2)
- 4.6 Calculate the length of AE , the tangent to circle D at E . (6)

[20]

Provide reasons for your statements and calculations in QUESTIONS 8, 9 and 10.

QUESTION 8

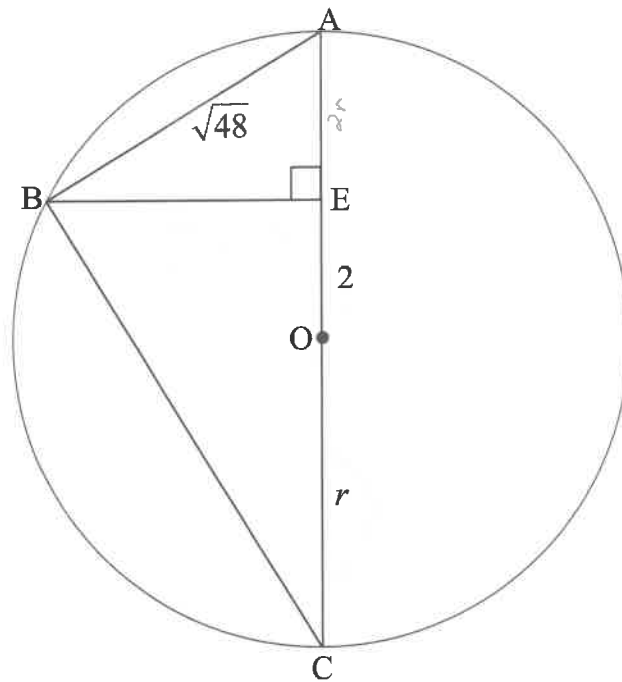
- 8.1 Two cyclic quadrilaterals, JNML and KJNM, are drawn below. The chords KM and JL intersect at R. $\hat{J}_2 = 90^\circ$, $\hat{N} = 100^\circ$, $\hat{M}_1 = 70^\circ$ and $\hat{R}_2 = x$.



Calculate:

- 8.1.1 the size of $\hat{K}$. (2)
- 8.1.2 the size of $\hat{J}_1$. (2)
- 8.1.3 the numerical value of x . (2)

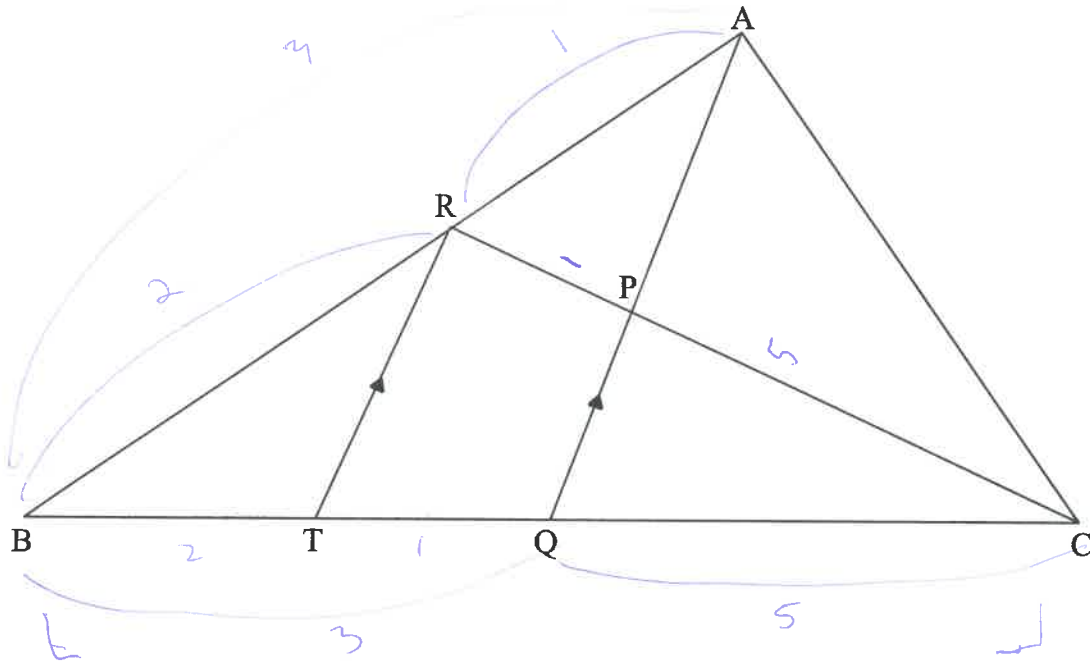
- 8.2 In the diagram, O is the centre of the circle. AC is a diameter. AB and BC are chords with $BE \perp AC$. $AB = \sqrt{48}$, $OE = 2$ units and $OC = r$ units



- 8.2.1 Prove, with reasons, that $\triangle BAE \sim \triangle CAB$. (4)
- 8.2.2 Write down the length of AE in terms of r . (1)
- 8.2.3 Show that: $AB^2 = AE \cdot AC$ (2)
- 8.2.4 Calculate the numerical value of r . (5)
- [18]**

QUESTION 9

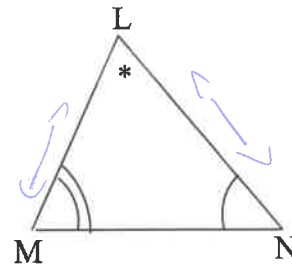
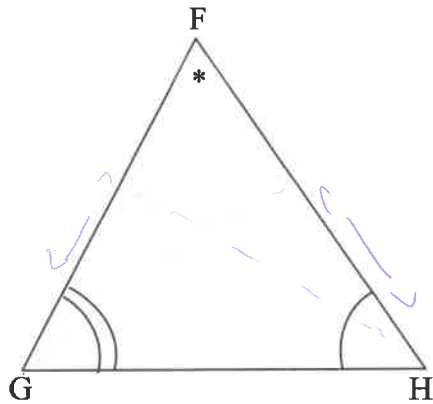
In the diagram below, Q is on BC such that $\frac{BQ}{QC} = \frac{3}{5}$ and R on BA such that $\frac{BR}{RA} = \frac{2}{1}$.
T is on BQ such that $AQ \parallel RT$.



- 9.1 Calculate the numerical value of $\frac{PC}{RP}$. (3)
- 9.2 Show that area of $\triangle ABC = 1,5 \times$ area of $\triangle BRC$ (3)
[6]

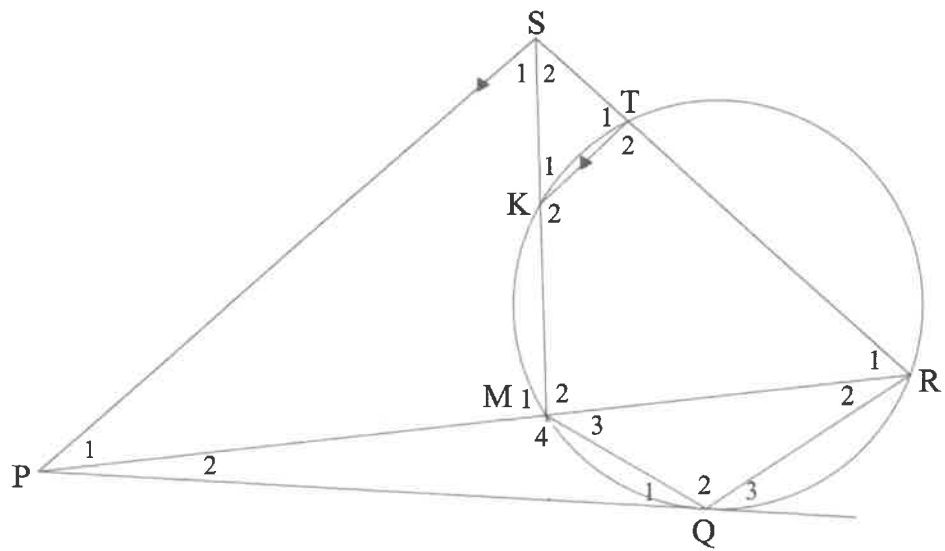
QUESTION 10

- 10.1 In the diagram below, $\triangle FGH$ and $\triangle LMN$ are drawn. It is given that $\hat{L} = \hat{F}$, $\hat{M} = \hat{G}$ and $\hat{N} = \hat{H}$.



Prove the theorem which states that $\frac{FG}{LM} = \frac{FH}{LN}$ (6)

- 10.2 In the diagram, PQ is a tangent to the circle at Q. R is a point on the circle and S is a point outside the circle. RS and RP cut the circle at T and M respectively. SM cuts the circle at K. $KT \parallel PS$. QM and QR are drawn.



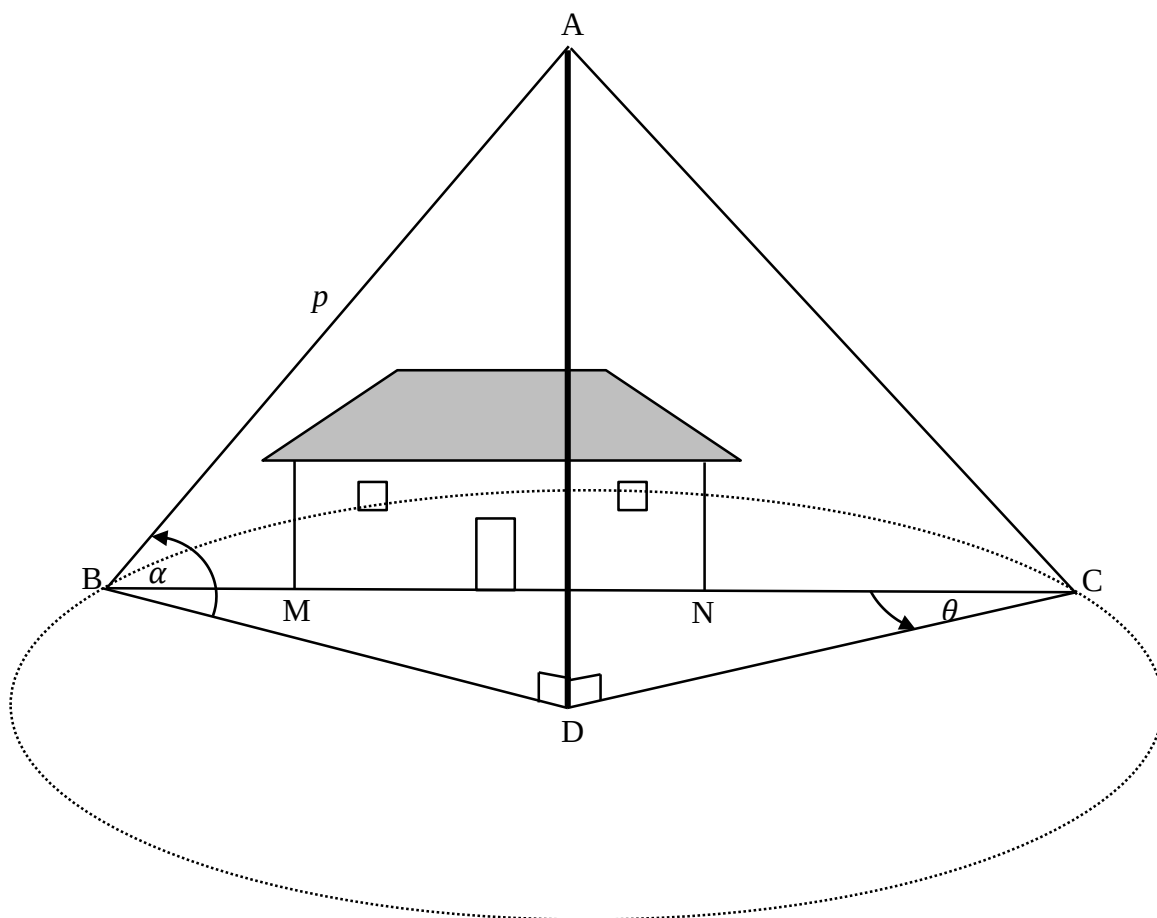
- 10.2.1 Prove: $\triangle PMQ \parallel \triangle PQR$ (4)
- 10.2.2 Show that $PQ^2 = PR \cdot PM$ (1)
- 10.2.3 Prove that $\hat{M}_1 = \hat{P}\hat{S}\hat{R}$ (3)
- 10.2.4 Show that $PQ = PS$ (6)
- [20]

TOTAL: 150

$$\frac{\sin \theta}{\cos \theta} = \frac{\sin \theta}{1}$$
$$\sin \theta \cdot \cos \theta = \sin \theta$$
$$=$$

QUESTION 6

Building regulations require the provision of lightning protection for thatched roof structures. In the diagram below, AD represents a vertical lightning mast constructed on the same horizontal plane as a house. B and C are two points on the ground which are in line with the front side MN of the house. B and C lie on the circle of lightning protection provided by the lightning mast. $\hat{DBA} = \alpha$ is the angle of elevation from B to the top of the mast at A. $\hat{DCB} = \theta$ and $AB = p$.

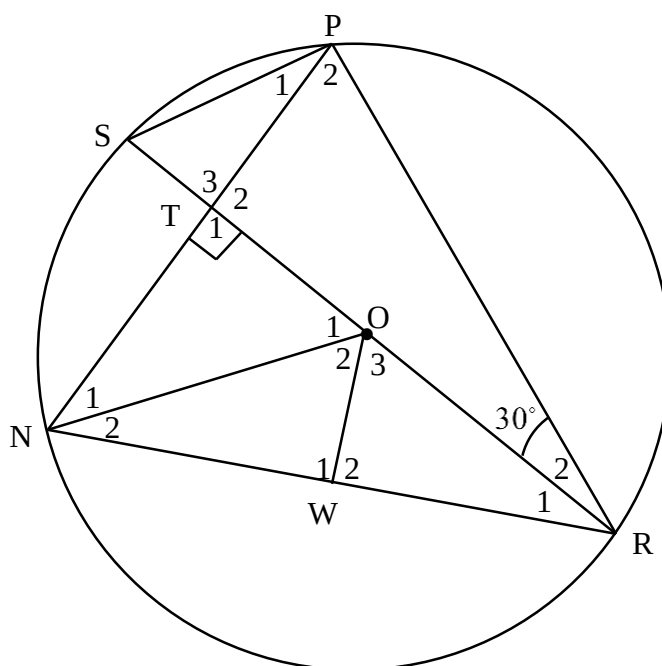


- 6.1 Express BD, the radius of protection, in terms of p and α . (2)
- 6.2 Hence, show that $BC = 2p \cdot \cos \alpha \cdot \cos \theta$. (4)
- 6.3 If $BC = 29,5\text{m}$, $p = 21,2\text{m}$ and $\alpha = 45^\circ$. Determine the size of θ . (3)
- 6.4 Hence, determine to the nearest metre, the shortest distance between D and the front of the house. (5)
- [14]**

GIVE REASONS FOR YOUR STATEMENTS AND CALCULATIONS IN QUESTIONS 7 TO 9.

QUESTION 7

- 7.1 An angle at the ... of a circle equals ... an angle at the circumference subtended by the same arc. (2)
- 7.2 In the diagram below. The vertices of $\triangle PNR$ lie on the circle with centre O. Diameter SR and chord NP intersect at right angles in T. Point W lies on NR. SP, ON and OW are drawn. $\hat{R}_2 = 30^\circ$.

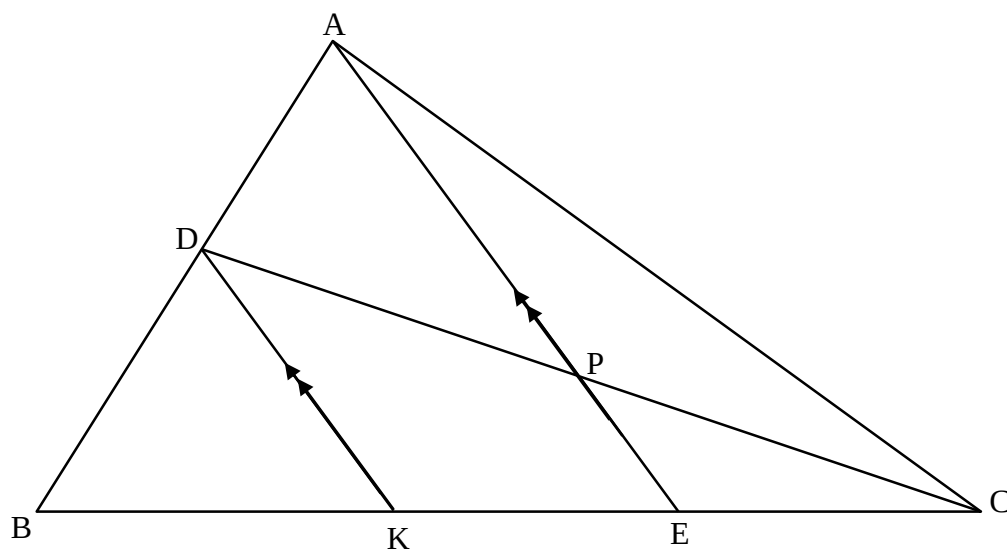


Determine, with reasons, the size of:

- 7.2.1 $\hat{S}PR$ (2)
- 7.2.2 $\hat{P}SR$ (1)
- 7.2.3 $\hat{P}NR$ (2)
- 7.2.4 $\hat{R}_1$ (1)
- 7.2.5 $\hat{N}_1$ (3)
- [11]**

QUESTION 8

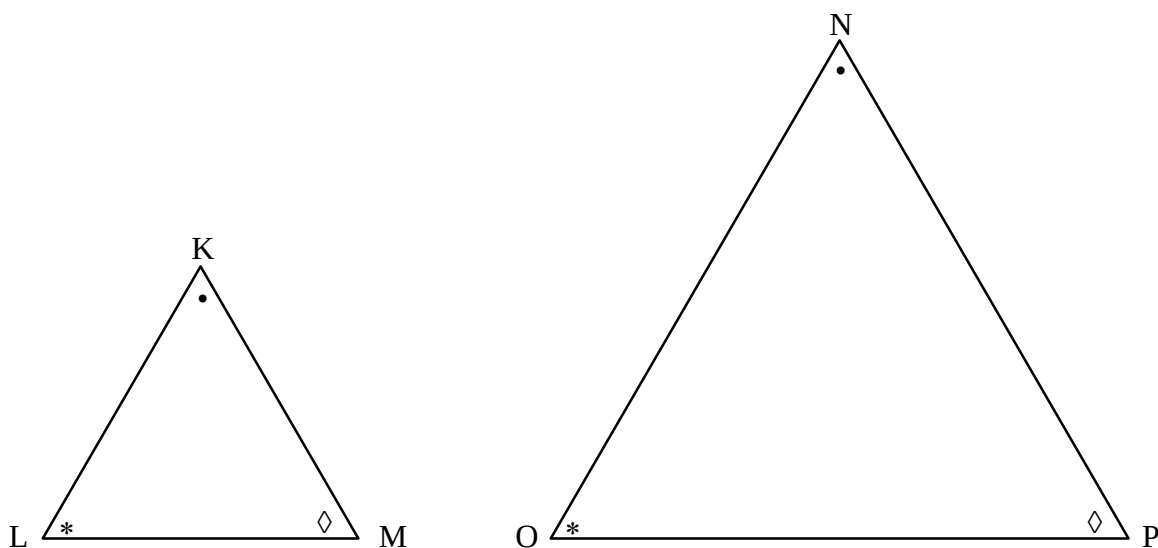
In the diagram below, D lies on side AB of $\triangle ABC$ such that $AD:BD = 2:3$. E lies on side BC such that $BE:EC = 4:3$. K lies on BE such that $DK \parallel AE$. DC and AE intersect in P.



- 8.1 Determine the value of $\frac{BK}{KE}$. (2)
- 8.2 If $CE = 3\text{ m}$, determine the length of BK in terms of m . (3)
- 8.3 Determine $CP:PD$. (4)
- [9]**

QUESTION 9

9.1 Given: $\triangle KLM$ and $\triangle NOP$ having $\hat{K} = \hat{N}$; $\hat{L} = \hat{O}$ and $\hat{M} = \hat{P}$.



Use the above diagrams to prove the theorem which states that:

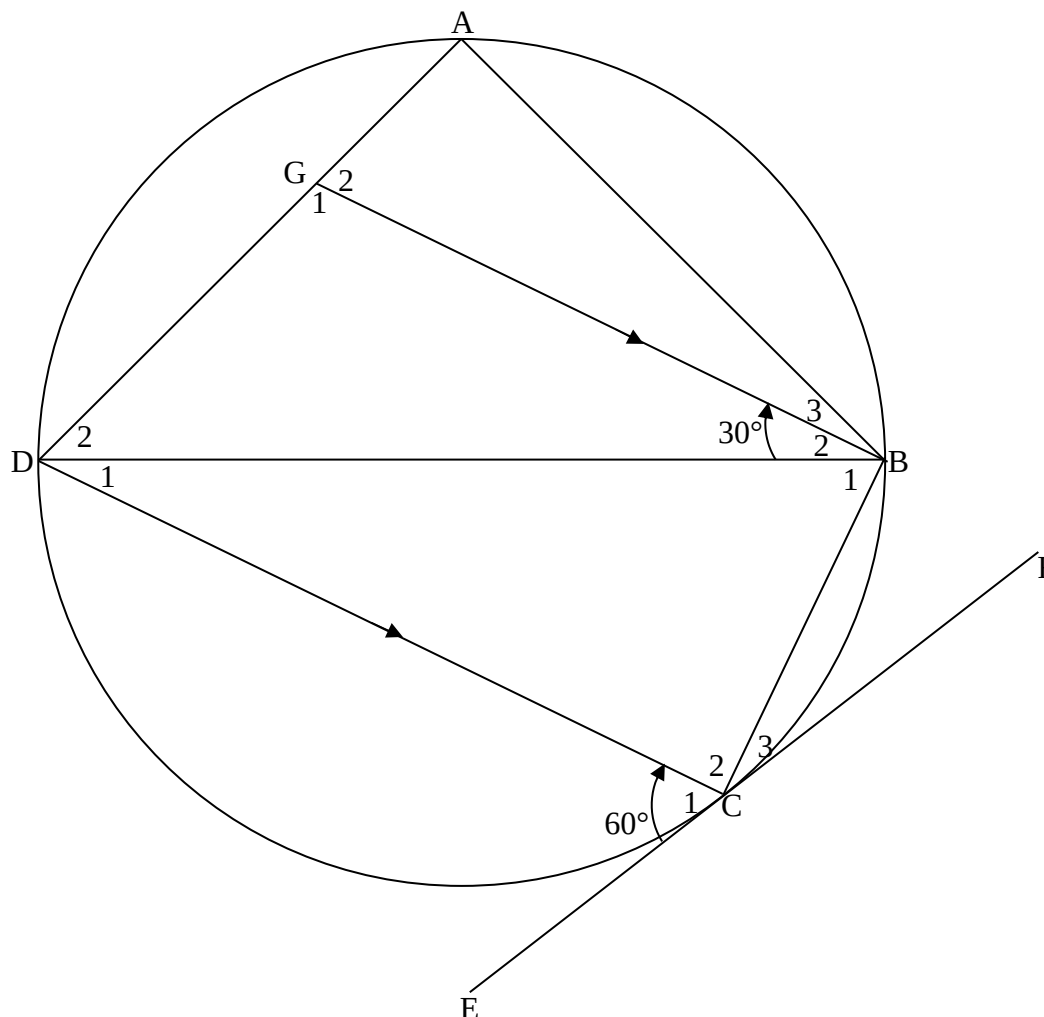
$$\frac{KL}{NO} = \frac{KM}{NP}. \quad (6)$$

Give reasons for your statements in QUESTIONS 8, 9 and 10.

QUESTION 8

In the diagram, ABCD is a cyclic quadrilateral. G is a point on AD such that $BG \parallel CD$. ECF is a tangent to the circle at C. BD is a chord of the circle.

$\hat{GBD} = 30^\circ$ and $\hat{DCE} = 60^\circ$.



8.1 Calculate, with reasons, the size of:

8.1.1 $\hat{D}_1$ (1)

8.1.2 $\hat{B}_1$ (2)

8.1.3 $\hat{C}_2$ (1)

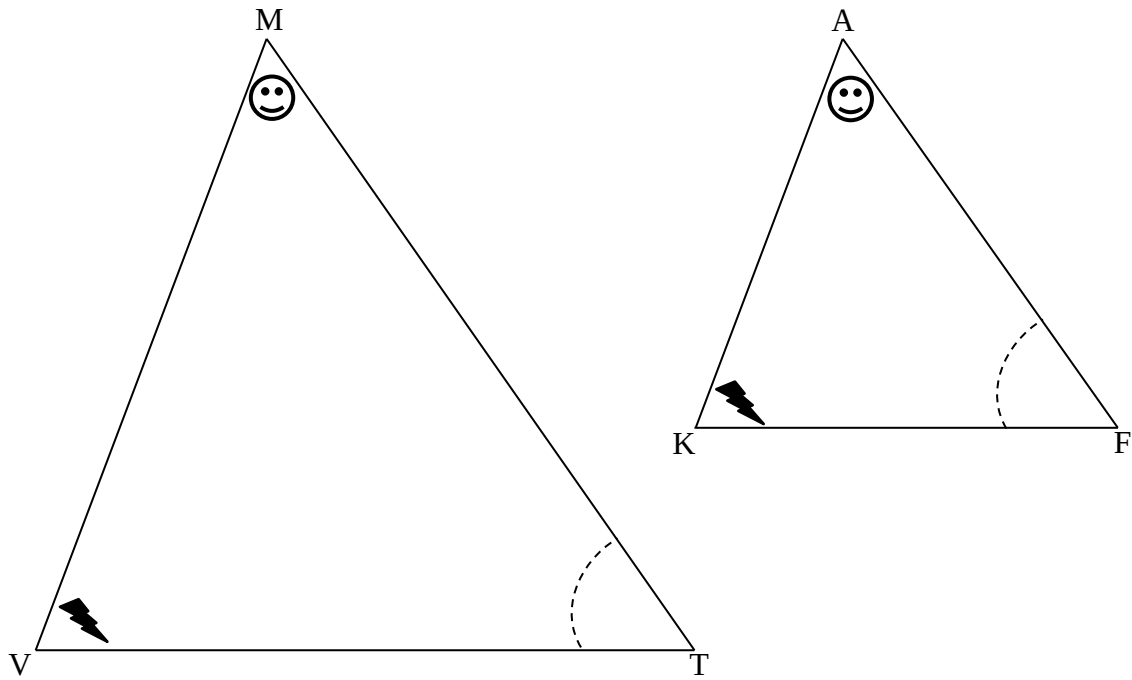
8.1.4 $\hat{DAB}$ (2)

8.2 Is BD a diameter of the circle? Motivate your answer. (2)

[8]

QUESTION 9

9.1 In the diagram below, $\triangle MVT$ and $\triangle AKF$ are drawn such that $\hat{M} = \hat{A}$, $\hat{V} = \hat{K}$ and $\hat{T} = \hat{F}$.

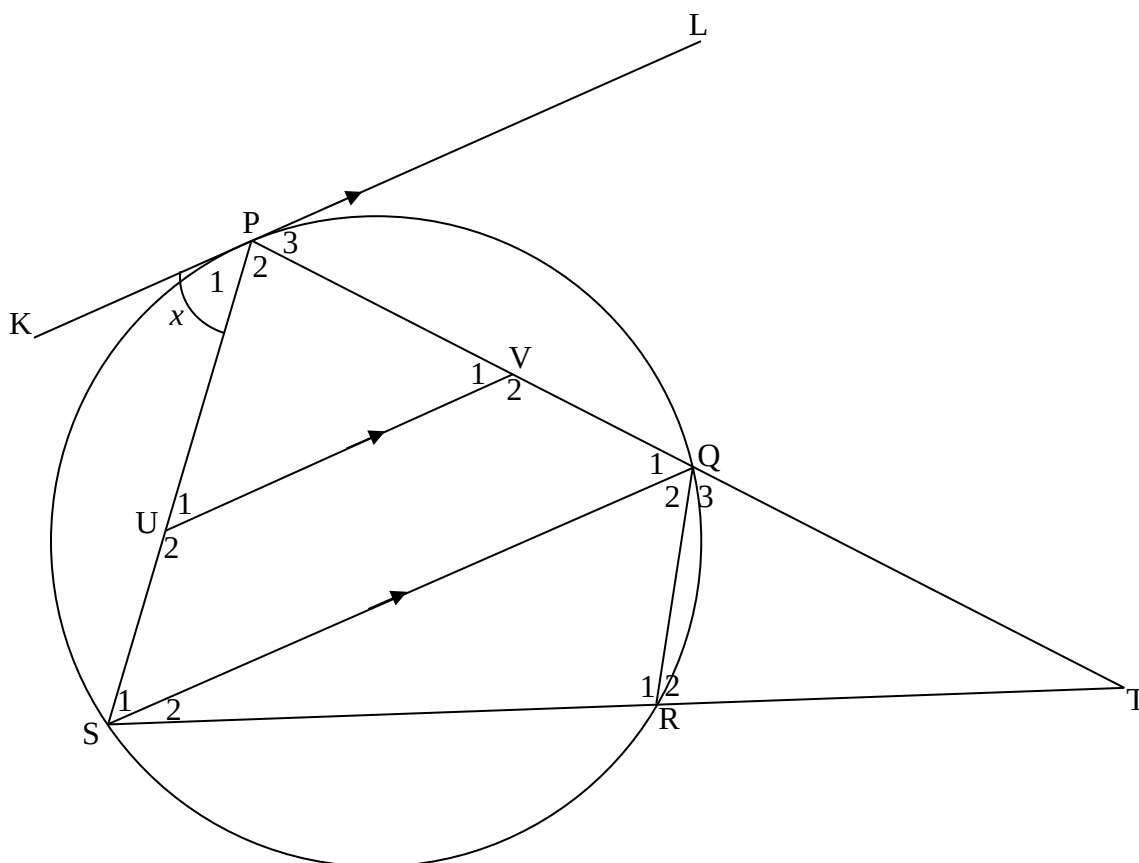


Use the diagram in the ANSWER BOOK to prove the theorem which states that if two triangles are equiangular, then the corresponding sides are in proportion,

that is $\frac{MV}{AK} = \frac{MT}{AF}$

(7)

- 9.2 In the diagram below, cyclic quadrilateral PQRS is drawn. Chord SR produced and chord PQ produced meet at T. KPL is a tangent to the circle at P. U and V are points on PS and PQ respectively such that $UV \parallel SQ \parallel KL$. Let $\hat{KPS} = x$



9.2.1 Write down, with reasons, FIVE other angles EACH equal to x . (5)

9.2.2 Prove that:

(a) $PQ = PS$ (1)

(b) KP is a tangent to the circle that passes through the points P, U and V, at P. (1)

9.2.3 Give a reason why $\frac{PU}{PS} = \frac{PV}{PQ}$ (1)

9.2.4 Prove that:

(a) $\triangle PTS \parallel \triangle RTQ$ (4)

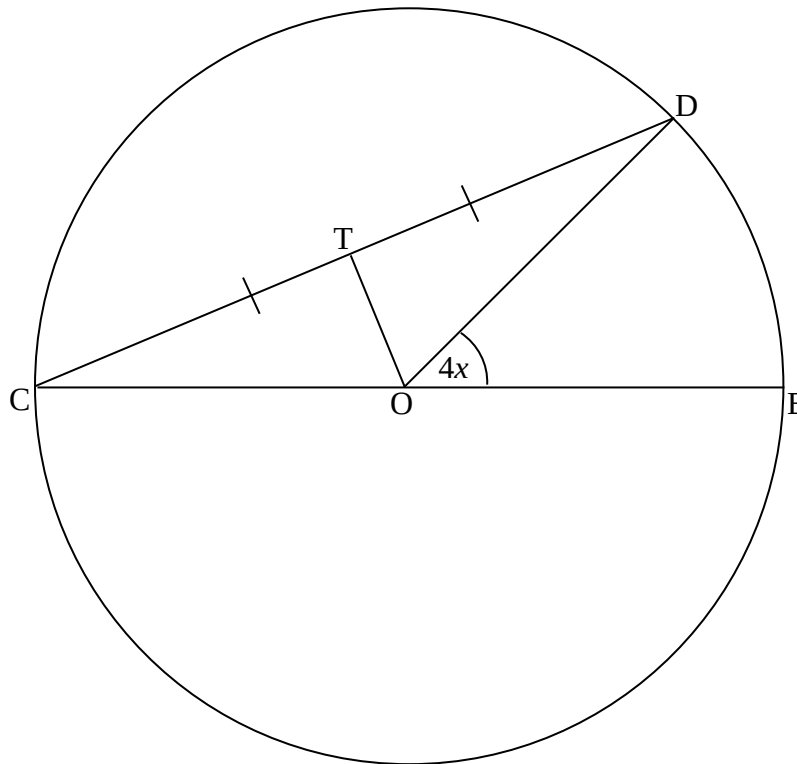
(b) $PT.RQ = PS.RT$ (2)

(c) $PQ = \sqrt{PS.PT - TS.RQ}$ (4)

[25]

QUESTION 10

In the diagram below, the circle with centre O, passes through the points C, D, and E.
OT bisects chord CD. $\angle DOE = 4x$



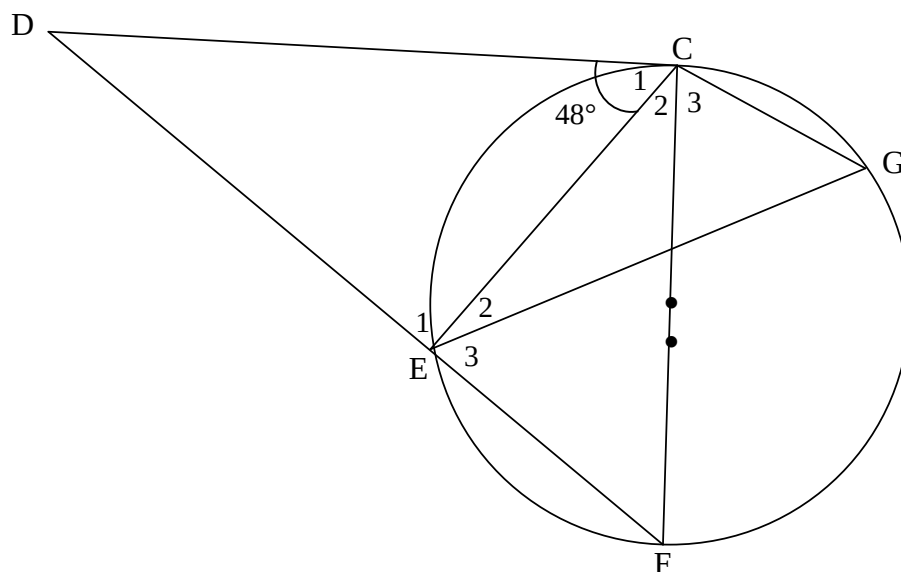
Prove, with reasons, that $\sin x \cdot \cos x = \frac{OT}{CE}$

[7]

TOTAL: 150

QUESTION 8

In the diagram, CF is a diameter of the circle. E, F, G and C are points on the circle. A tangent DC is drawn to the circle at C. FE is produced to meet the tangent at D. Chords EC, CG, and EG are drawn. $\hat{C}_1 = 48^\circ$



Determine, giving reasons, the size of each of the following angles:

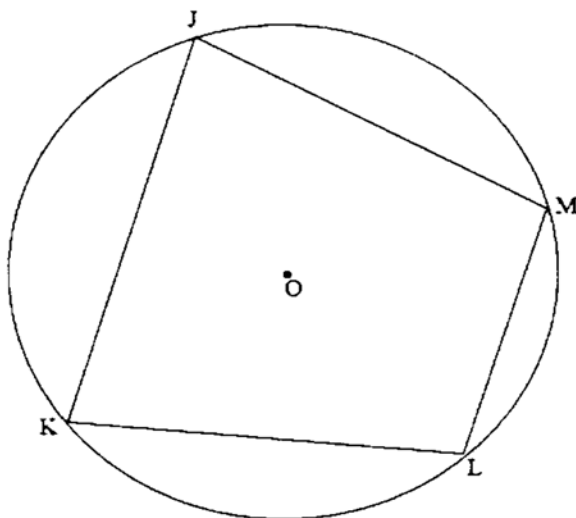
8.1 $\hat{G}$ (2)

8.2 $\hat{C}_2$ (3)

8.3 $\hat{D}$ (3)
[8]

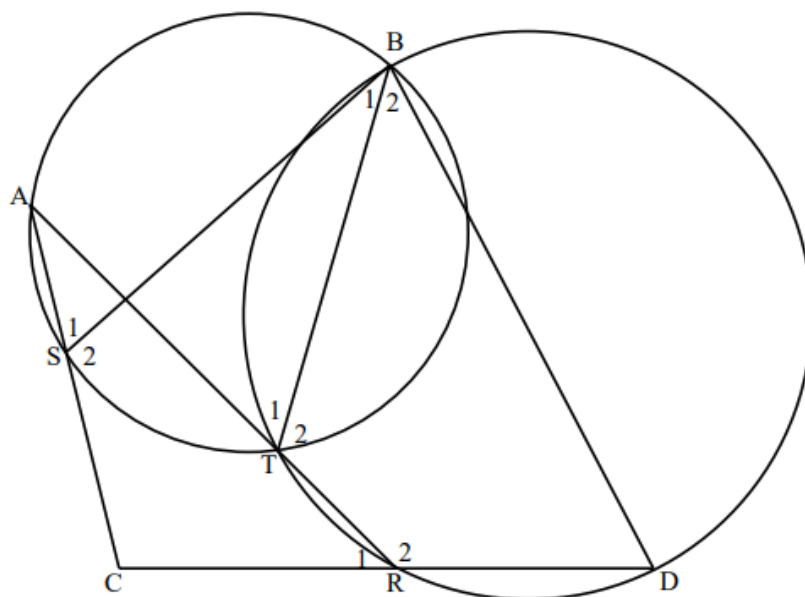
QUESTION 9

- 9.1 In the diagram, JKLM is a cyclic quadrilateral in the circle centred O. Prove the theorem that states that the opposite angles of a cyclic quadrilateral are supplementary i.e. $\hat{J} + \hat{L} = 180^\circ$.



(5)

- 9.2 In the diagram, A, B, T and S are points on the smaller circle and TBDR is a cyclic quadrilateral in the larger circle. BT is a common chord of the two circles. Chord AS and chord DR are produced to meet at C. ATR is a straight line.



Prove, giving reasons, that:

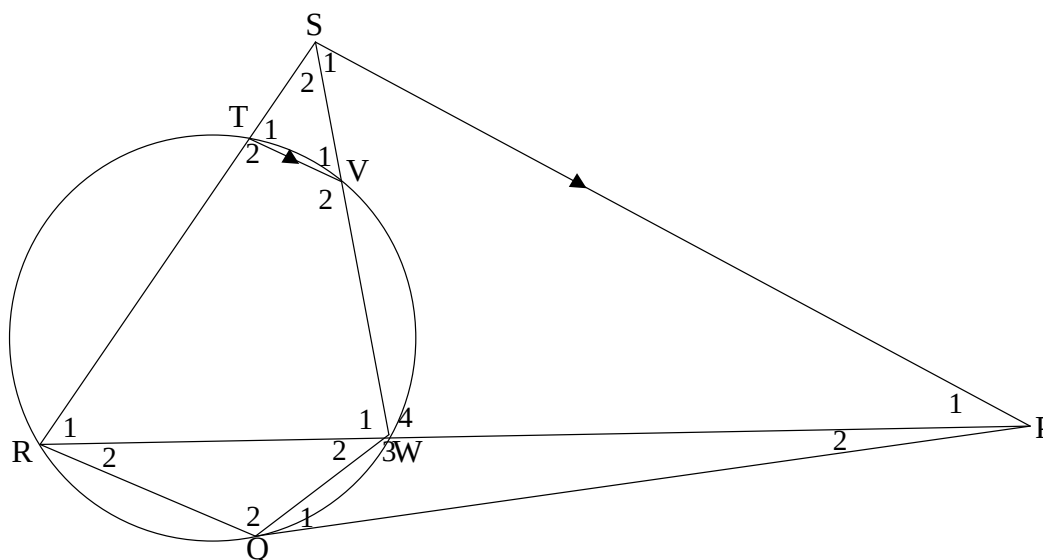
9.2.1 SCDB is a cyclic quadrilateral. (5)

9.2.2 $\hat{SBD} = \hat{A} + \hat{R}_1$ (2)

[12]

QUESTION 10

In the diagram, V, W, Q, R and T are points on a circle. PQ is a tangent to circle at Q. Chord RW is produced to meet the tangent at P. S is a point outside the circle such that $PS \parallel VT$. Chords RT and WV are produced to meet at S. RQ and QW are drawn.



10.1 Prove, giving reasons, that:

10.1.1 $\hat{S}_1 = \hat{R}_1$ (3)

10.1.2 $PQ^2 = PW \cdot PR$ (4)

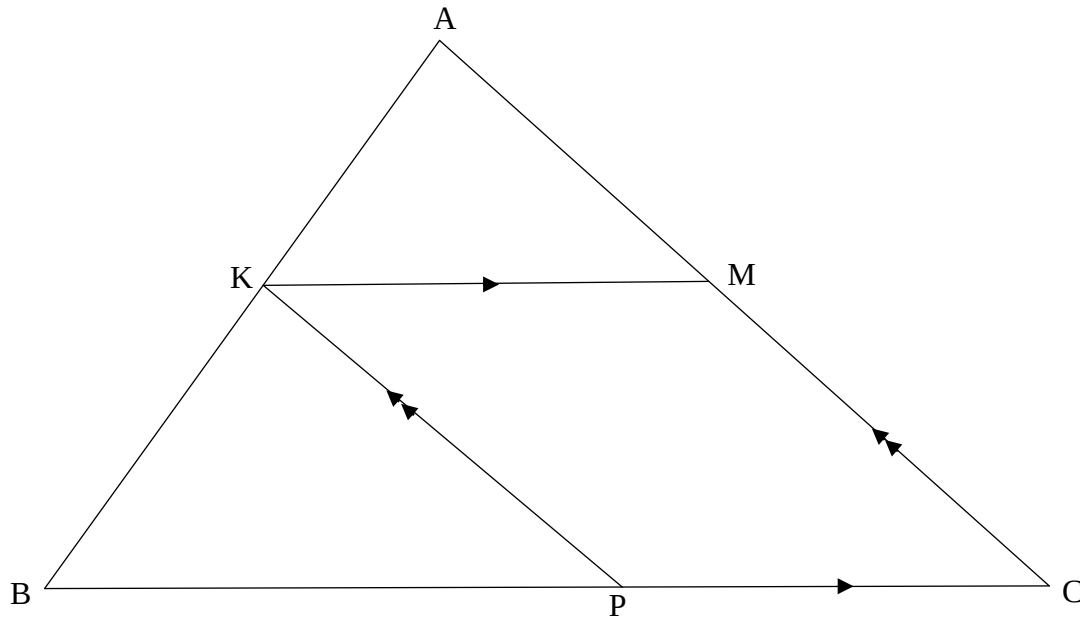
10.2 Write down a triangle similar to $\triangle PSR$. (1)

10.3 Hence, prove that $PQ = PS$. (3)

[11]

QUESTION 11

In the diagram, $\triangle ABC$ is drawn. K, M and P are points on sides AB, AC and BC respectively. $KP \parallel AC$ and $KM \parallel BC$. $BP:PC = 4:3$.



Determine, giving reasons, the ratio:

11.1 $\frac{KM}{BC}$ (3)

11.2 $\frac{AC}{AM}$ (3)

11.3 $\frac{\text{Area of } \triangle KBP}{\text{Area of } \triangle ABC}$ (4)

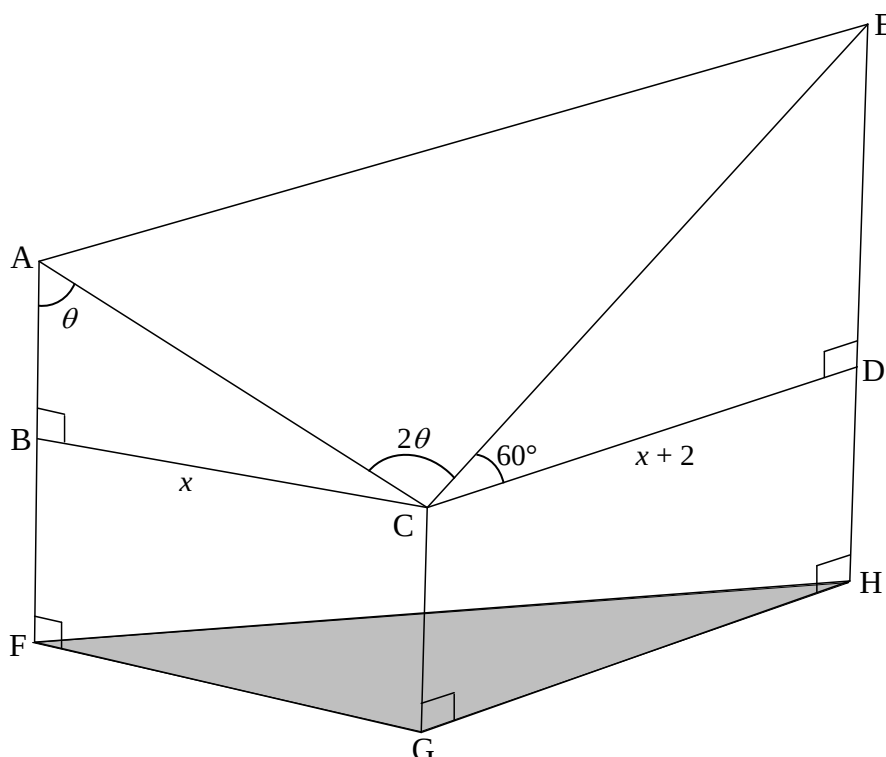
[10]

TOTAL: 150

QUESTION 7

In the diagram below, CGFB and CGHD are fixed walls that are rectangular in shape and vertical to the horizontal plane FGH. Steel poles erected along FB and HD extend to A and E respectively. $\triangle ACE$ forms the roof of an entertainment centre.

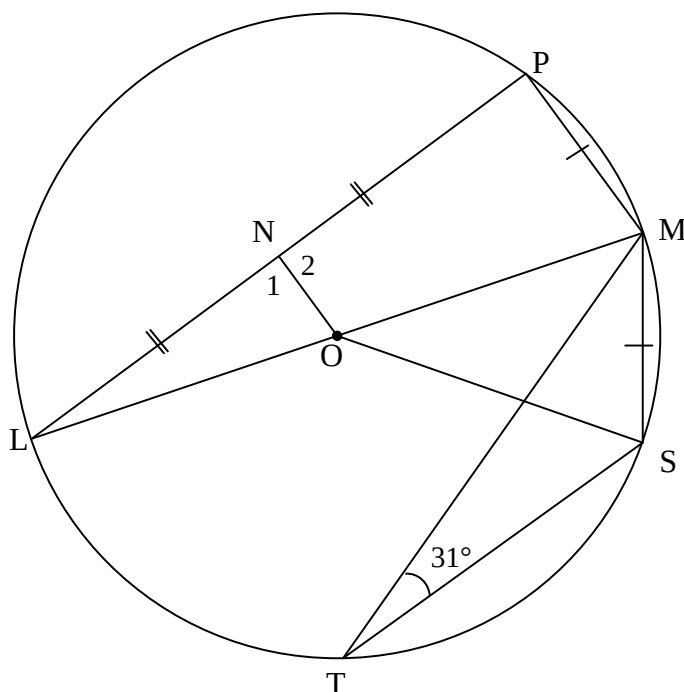
$BC = x$, $CD = x + 2$, $\hat{BAC} = \theta$, $\hat{ACE} = 2\theta$ and $\hat{ECD} = 60^\circ$



- 7.1 Calculate the length of:
- 7.1.1 AC in terms of x and θ (2)
- 7.1.2 CE in terms of x (2)
- 7.2 Show that the area of the roof $\triangle ACE$ is given by $2x(x+2)\cos\theta$. (3)
- 7.3 If $\theta = 55^\circ$ and $BC = 12$ metres, calculate the length of AE. (4)
- [11]**

QUESTION 8

- 8.1 In the diagram, O is the centre of the circle and LOM is a diameter of the circle. ON bisects chord LP at N. T and S are points on the circle on the other side of LM with respect to P. Chords PM, MS, MT and ST are drawn. $PM = MS$ and $\hat{MTS} = 31^\circ$



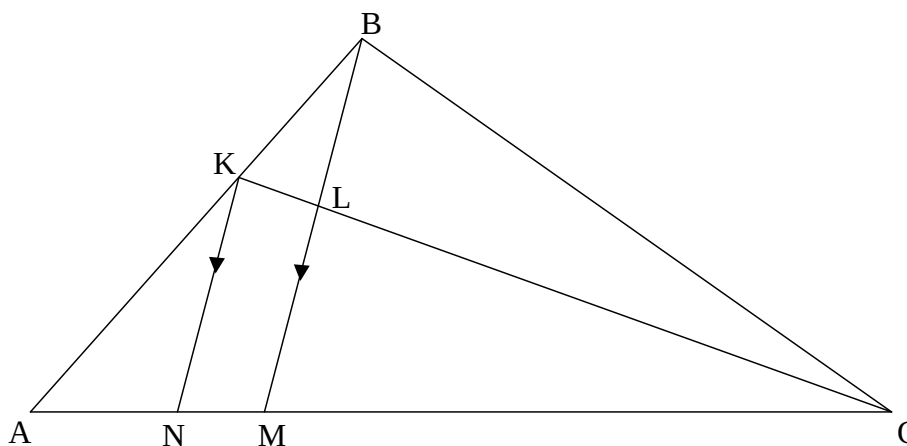
- 8.1.1 Determine, with reasons, the size of each of the following angles:

(a) $\hat{MOS}$ (2)

(b) $\hat{L}$ (2)

- 8.1.2 Prove that $ON = \frac{1}{2} MS$. (4)

- 8.2 In $\triangle ABC$ in the diagram, K is a point on AB such that $AK : KB = 3 : 2$. N
 and M are points on AC such that $KN \parallel BM$. BM intersects KC at L . AM
 $AM : MC = 10 : 23$.



Determine, with reasons, the ratio of:

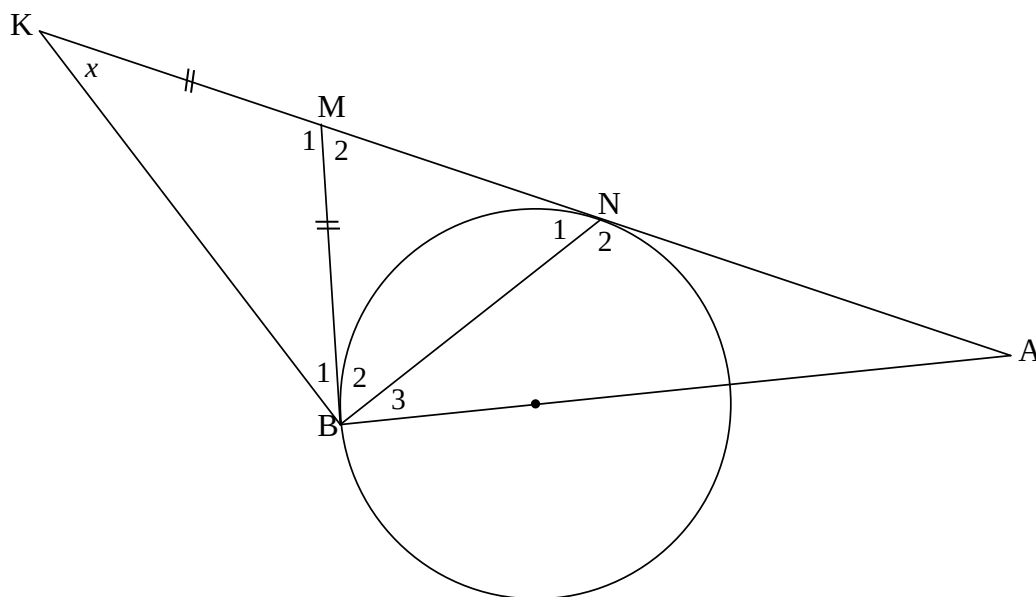
8.2.1 $\frac{AN}{AM}$ (2)

8.2.2 $\frac{CL}{LK}$ (3)

[13]

QUESTION 9

In the diagram, tangents are drawn from point M outside the circle, to touch the circle at B and N . The straight line from B passing through the centre of the circle meets MN produced in A . NM is produced to K such that $BM = MK$. BK and BN are drawn. Let $\hat{K} = x$.



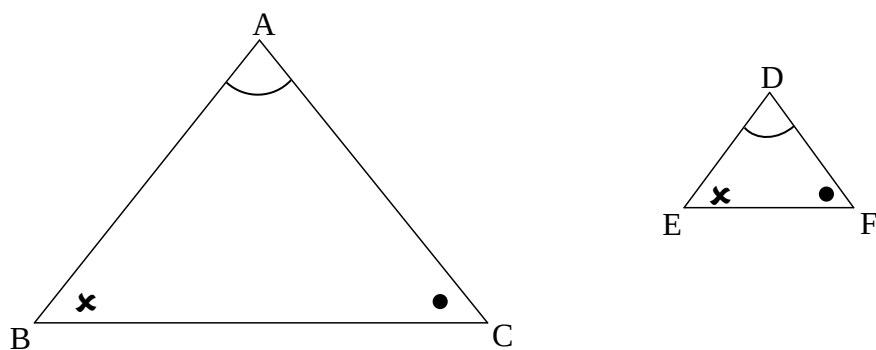
9.1 Determine, with reasons, the size of $\hat{N}_1$ in terms of x . (6)

9.2 Prove that BA is a tangent to the circle passing through K , B and N . (5)

[11]

QUESTION 10

10.1 In the diagram, $\triangle ABC$ and $\triangle DEF$ are drawn such that $\hat{A} = \hat{D}$, $\hat{B} = \hat{E}$ and $\hat{C} = \hat{F}$.



Use the diagram in the ANSWER BOOK to prove the theorem which states that if two triangles are equiangular, then the corresponding sides are in proportion,

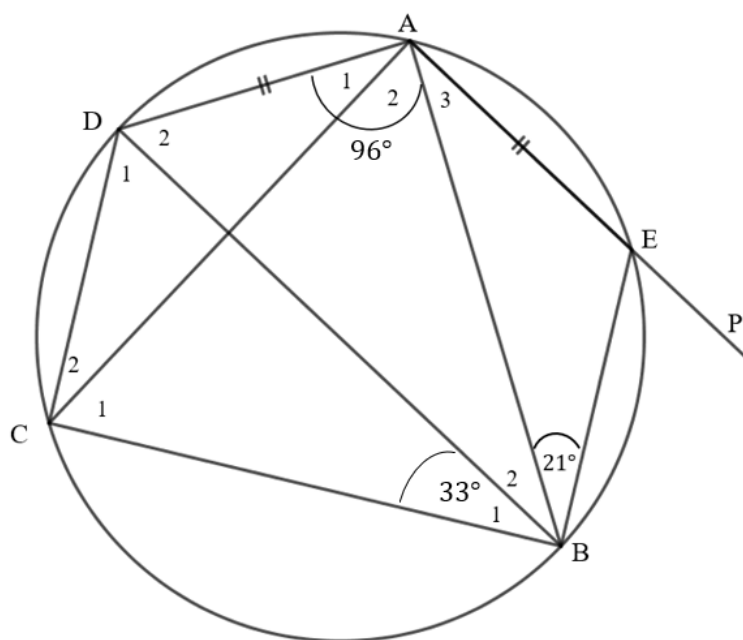
that is $\frac{AB}{DE} = \frac{AC}{DF}$.

(6)

- 10.2 In the diagram, O is the centre of the circle and CG is a tangent to the circle at G. The straight line from C passing through O cuts the circle at A and B. Diameter DOE is perpendicular to CA. GE and CA intersect at F. Chords DG, BG and AG are drawn.

QUESTION 9

In the figure below $ABCD$ is a cyclic quadrilateral with $\widehat{BAD} = 96^\circ$ and $\widehat{B}_1 = 33^\circ$. The diagonals AC and BD are drawn. E is a point on the circle and AE is produced to P . $\widehat{ABE} = 21^\circ$ and $AD = AE$.

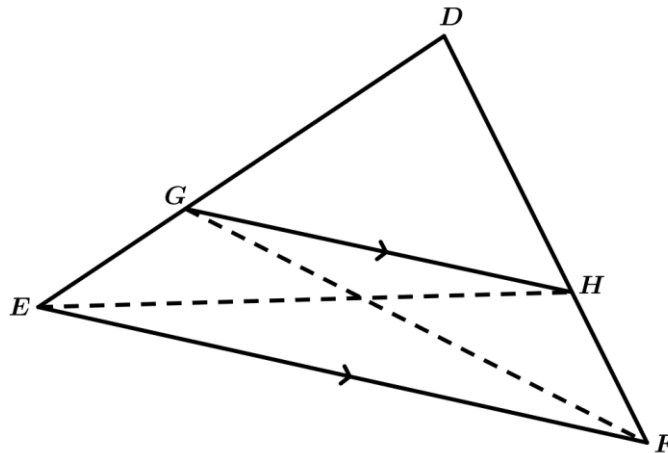


- 9.1 Write down, stating reasons, TWO other angles, each equal to 21° . (3)
- 9.2 Determine the size of $\widehat{C}_1$. (2)
- 9.3 The size of $\widehat{BEP}$. (2)
- 9.4 Prove that $CB = AB$. (3)

[10]

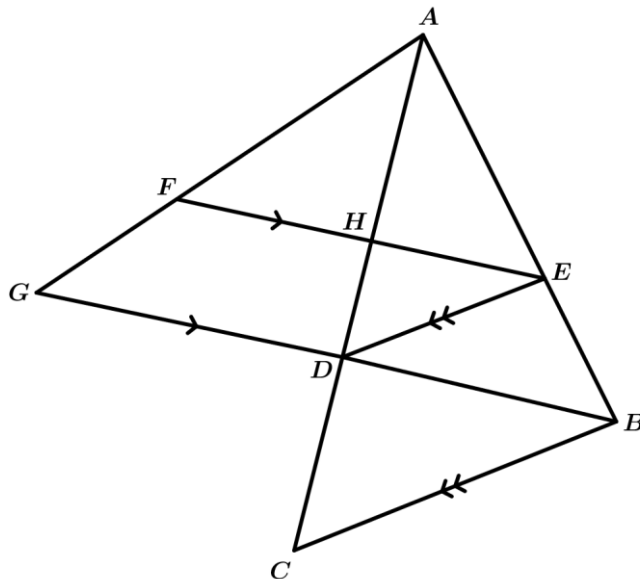
QUESTION 10

- 10.1 In $\triangle DEF$, G is a point on DE and H is a point on DF. GH is drawn such that $GH \parallel EF$. EH and FG are drawn.



Prove the theorem which states that $\frac{DG}{GE} = \frac{DH}{HF}$. (5)

- 10.2 In the diagram below, $DE \parallel CB$ and $FE \parallel GB$. $\frac{AF}{FG} = 3$.



- 10.2.1 Calculate with reasons:

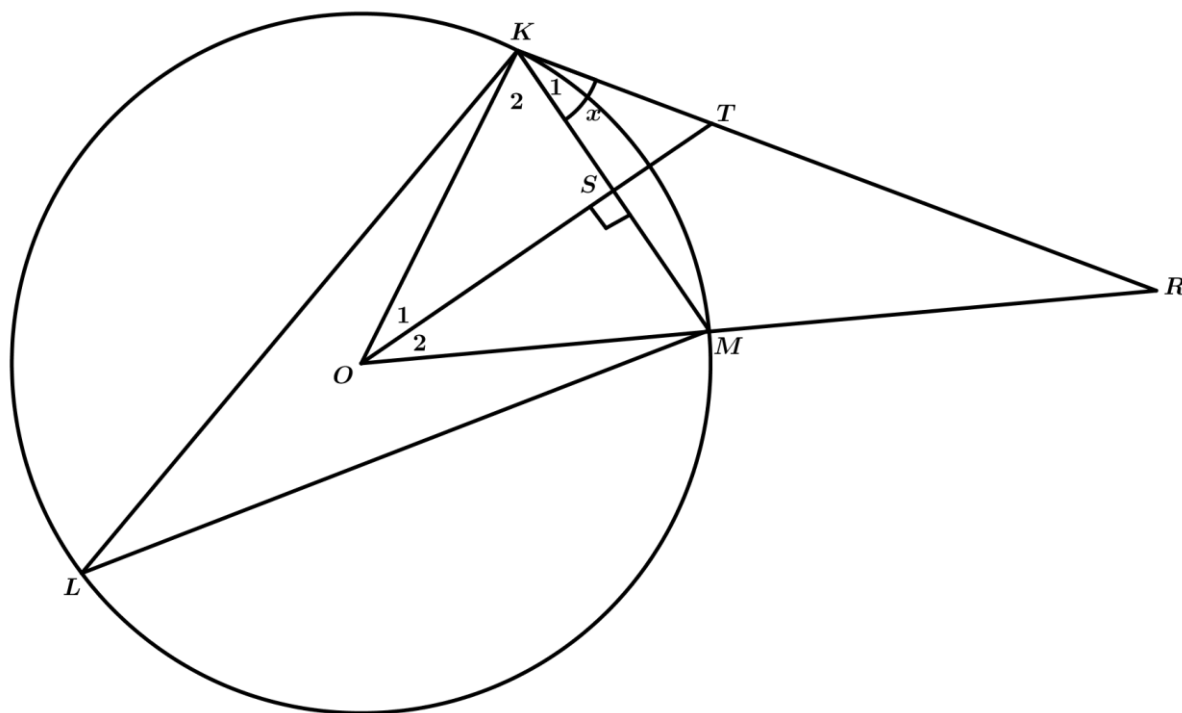
- (a) $\frac{AC}{CD}$ (4)
 (b) $AH : CD$ (3)

- 10.2.2 If $HD = 3$ cm, calculate the length of AC. (3)

[15]

QUESTION 11

In the diagram below, KR is a tangent to circle with centre O . OS is perpendicular to KM and is produced to T . OT bisects $\widehat{KOM}$. $\widehat{K}_1 = x$.



11.1 Determine the size of $\widehat{O}_1$ in terms of x . (3)

11.2 Prove that KOMT is a cyclic quadrilateral. (2)

11.3 Prove that $\triangle RKM \parallel \triangle ROT$ (3)

11.4 If $KR = 8$ cm and $KO = 6$ cm, calculate the lengths of:

11.4.1 MR (3)

11.4.2 KT (3)

11.5 Prove that $\frac{KS}{OT} = \frac{2}{5}$ (4)

[18]

TOTAL: 150

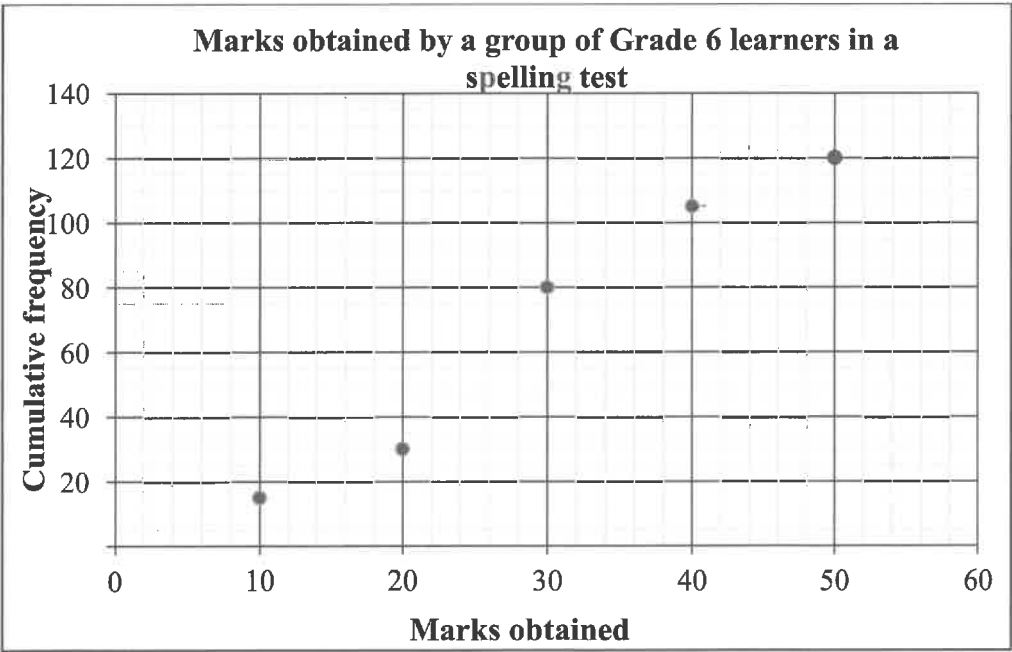
QUESTION 1

1.1 Ten athletes were training for the next marathon. The number of hours that they spent training in the last week is given in the table below.

5	7	24	32	10	11	15	14	8	12
---	---	----	----	----	----	----	----	---	----

- 1.1.1 Calculate the mean number of hours that the athletes spent training in the last week. (2)
- 1.1.2 Write down the standard deviation for the data. (1)
- 1.1.3 Athletes who trained for less than one standard deviation below the mean in the last week are not allowed to take part in the next marathon. How many athletes will not take part in the next marathon? (2)

1.2 A group of grade 6 learners wrote a spelling test that had a maximum of 50 marks. Their marks are summarised in the partially completed cumulative frequency graph below. The data points shown are plotted at the upper limit of each class interval.



- 1.2.1 How many learners wrote the test? (1)
- 1.2.2 Write down the modal class of the data. (1)
- 1.2.3 Complete the cumulative frequency graph (ogive) on the grid provided in the ANSWER BOOK. (2)
- 1.2.4 Use the cumulative frequency graph (ogive) to determine the upper quartile for the data. (2)
- 1.2.5 How many learners obtained more than 45 marks in the test? (2)

[13]

QUESTION 2

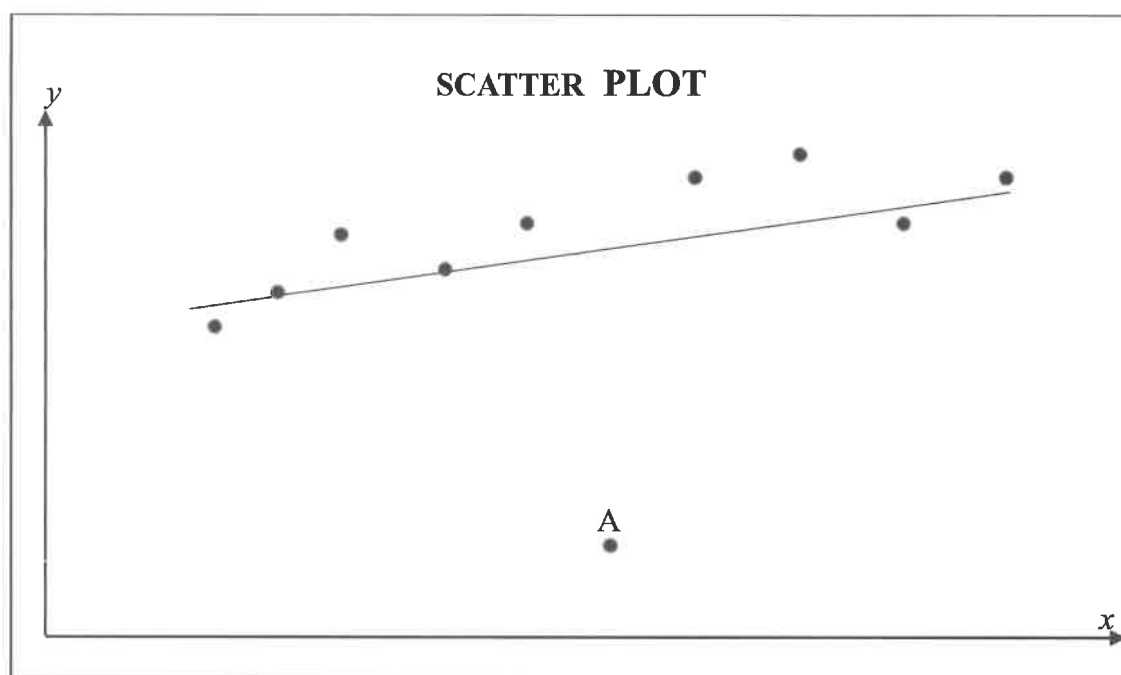
- 2.1 A supermarket is located at a shopping centre. The manager of the supermarket observed the number of cars parked in the parking lot between 7:00 pm and 8:00 pm over 7 days and the number of customers inside the supermarket at the same time. The data is given in the table below.

Number of cars parked in the parking lot	125	568	874	321	184	364	612
Number of customers inside the supermarket	100	62	410	54	122	51	76

- 2.1.1 Determine the equation of the least squares regression line for this data. (3)

- 2.1.2 Use the equation of the least squares regression line to predict the number of customers in the supermarket if there were 400 cars parked in the parking lot between 7:00 pm and 8:00 pm on a certain day. (2)

- 2.2 The diagram below shows a scatter plot. The least squares regression line for the data is drawn. Point A is an outlier.



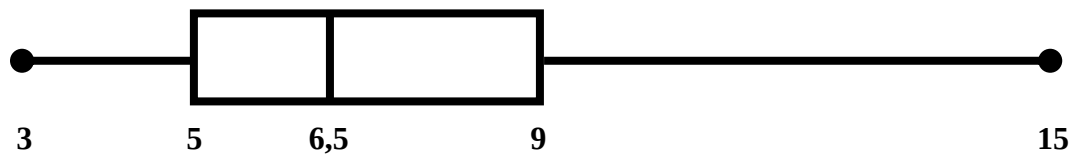
State whether the following statements about the above scatter plot are **True** or **False**. In each case, give a reason for your answer

- 2.2.1 The mean of y will increase if Point A is removed from the set of data. (2)
- 2.2.2 The correlation coefficient is a positive value. (2)

[9]

QUESTION 1

1.1 The following box-and-whisker diagram was drawn for a certain set of data.



1.1.1 Describe the skewness of the data. (1)

1.1.2 If the values of 5 and 6,5 appear only once in the data set, what percentage of data lies between 5 and 6,5? (1)

1.1.3 Write down the semi-interquartile range of the data set. (1)

1.2 The table below shows the number of hours that a professional nurse spent with nine patients as well as the value of medication given (in thousands of rands) to each patient over a period of three months.

Number of hours	15	25	50	60	75	95	110	120	130
Value of medication (in thousands of rands)	2,70	2,75	5,00	4,20	6,20	1,50	8,00	8,50	8,20

1.2.1 Consider the number of hours that the nurse spent with these patients.

a) Calculate the average number of hours that the nurse spent on these patients. (2)

b) Write down the standard deviation for the number of hours spent. (1)

c) With how many patients did the nurse spend outside one standard deviation of the mean time? (3)

1.2.2 Identify the outlier in the data above. (1)

1.2.3 Describe the trend in the data. (1)

1.2.4 Determine the equation of the least squares regression line for the data. (3)

1.2.5 If the nurse spent 80 hours with the patient, predict to the nearest rand, the value of medication given to the patient. (2)

- 1.2.6 Comment on the strength of the correlation between time spent with a patient and the value of the medication given to the patient. Justify your answer with relevant statistical values. (2)
- 1.2.7 If a patient was treated between 15 and 130 hours, what is the expected increase in the value of medication given to the patient for each additional hour that the nurse spent with the patient? (2)
- [20]**

QUESTION 1

A study was conducted among eight (8) employees in a company to understand the relationship between the additional number of rest days given in a year and the productivity of each employee.

The results are shown in the table below.

Additional number of rest days	5	2	9	1	3	10	4	6
Productivity of the employee (in %)	85	63	90	56	70	88	72	62

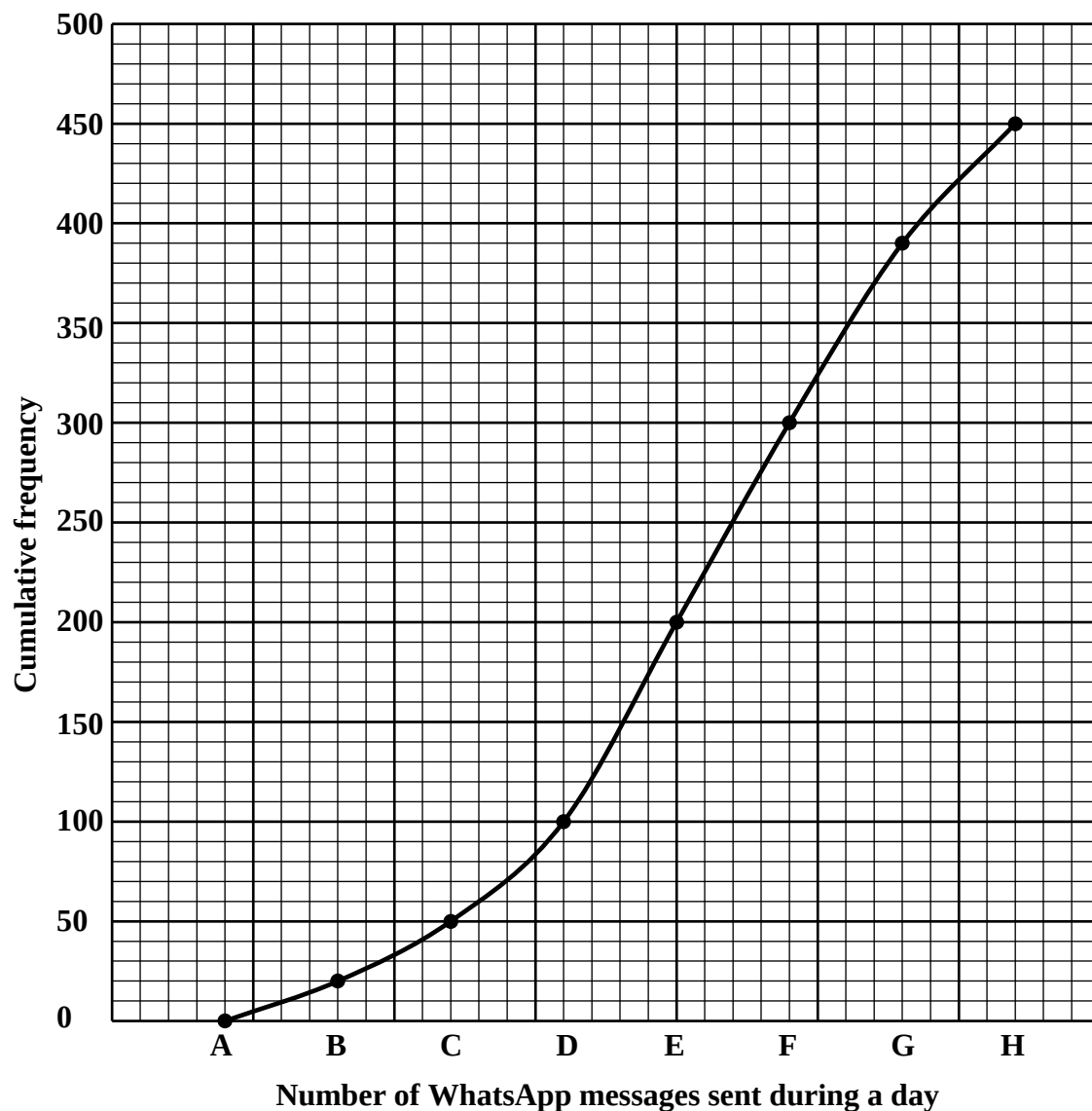
- 1.1 Calculate the correlation coefficient of the data. (1)
- 1.2 Consider the correlation coefficient calculated in QUESTION 1.1 and the four phrases below. Only write down the letter of the phrase that best describes the relationship between the variables in the given data.
- A. Fairly strong, negative correlation
- B. Very weak, positive correlation
- C. Fairly strong, positive correlation
- D. Perfect, positive correlation (1)
- 1.3 Determine the equation of the least squares regression line of the data. (3)
- 1.4 Use the equation obtained in QUESTION 1.3 to predict an employee's productivity if he/she was given eight (8) additional rest days. (2)
- 1.5 Should the regression line in QUESTION 1.3 be used to predict the productivity of an employee if he/she was given thirty (30) additional rest days in the year? Explain your answer. (2)
- [9]**

QUESTION 2

A survey was conducted among a number of learners who were using the same cellphone company to establish the number of WhatsApp messages that they sent during a day. The results were summarised in the partially completed cumulative frequency graph (ogive) below.



Cumulative Frequency Graph (Ogive)



The data shown in the cumulative frequency graph is also summarised in the partially completed frequency table below.

WhatsApp messages sent	Frequency
$40 \leq x < 80$	20
$80 \leq x < 120$	30
$120 \leq x < 160$	Q
$160 \leq x < 200$	R
$200 \leq x < 240$	100
$240 \leq x < 280$	90
$280 \leq x < 320$	60

- 2.1 Write down the value of A, a tick mark on the horizontal axis of the cumulative frequency curve. (1)
- 2.2 How many learners participated in this survey? (1)
- 2.3 Calculate the values of Q and R, the frequencies in the frequency table above. (3)
- 2.4 Estimate the mean number of WhatsApp messages sent per day. (2)
- 2.5 Calculate the interquartile range. (3)
- 2.6 The cellphone company wants to introduce a new rule where you are not allowed to send more than 200 WhatsApp messages per day. If this rule is applied to this group of learners on the existing data, how would the standard deviation for the data be affected? Motivate your answer. (2)
- [12]**

QUESTION 1

The table below shows the distances (in cm) of the best attempts of 11 long jump athletes during an athletics event.

287	328	374	486	492	501	522	583	601	619	685
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

- 1.1 Calculate the:
- 1.1.1 Range of the data (1)
- 1.1.2 Mean distance of the athletes' best attempts. (2)
- 1.1.3 Standard deviation of the above data. (1)
- 1.2 Determine how many distances lie outside one standard deviation from the mean best attempt. Show ALL your calculations. (3)
- 1.3 Unfortunately, the official incorrectly measured the distances of the long jump athletes; he measured y cm short from the correct measuring mark. Hence, all distances measured were y cm shorter than what it was supposed to be. This scenario is shown in the diagram below.



A= The correct mark from where the distance should have been measured.
 B= The incorrect mark from where the distances were measured.
 C= The mark up to where the distances were measured.

When the correction is made to the distances, the sum of the athletes' best jumps is now 5555 cm, i.e.:

$$\sum_{n=1}^{11} k_n = 5555$$

After the corrections were made, write down the:

- 1.3.1 Standard deviation of the new data. (1)
- 1.3.2 Median of the new data. (3)

[11]

QUESTION 2

Eight netball goal-shooters were practising their shots during the training in the week. During the tournament the number of goals scored was recorded as a percentage of the total number of shots they made. This is referred to as a successful goal shoot.

The table below shows the number of goal shots practised and the successful goal-shoot average during the tournament.

Number of shots practised:	280	400	540	595	375	430	500	650
Successful goal-shoot-average (%)	73	75	83	89	80	76	82	91

- 2.1 Determine the equation of the least squares regression line. (3)
 - 2.2 Calculate the correlation coefficient for the data. (1)
 - 2.3 A player practised 465 goal shots. What is her expected successful goal-shot average for the next tournament? (2)
 - 2.4 Comment on the correlation between the number of goal shots practised and the successful goal-shoot average. (2)
- [8]**

QUESTION 1

Each child in a group of four-year-old children was given the same puzzle to complete. The time taken (in minutes) by each child to complete the puzzle is shown in the table below.

TIME TAKEN (t) (IN MINUTES)	NUMBER OF CHILDREN
$2 < t \leq 6$	2
$6 < t \leq 10$	10
$10 < t \leq 14$	9
$14 < t \leq 18$	7
$18 < t \leq 22$	8
$22 < t \leq 26$	7
$26 < t \leq 30$	2

- 1.1 How many children completed the puzzle? (1)
- 1.2 Calculate the estimated mean time taken to complete the puzzle. (2)
- 1.3 Complete the cumulative frequency column in the table given in the ANSWER BOOK. (2)
- 1.4 Draw a cumulative frequency graph (ogive) to represent the data on the grid provided in the ANSWER BOOK. (3)
- 1.5 Use the graph to determine the median time taken to complete the puzzle. (2)

[10]

QUESTION 2

Learners who scored a mark below 50% in a Mathematics test were selected to use a computer-based programme as part of an intervention strategy. On completing the programme, these learners wrote a second test to determine the effectiveness of the intervention strategy. The mark (as a percentage) scored by 15 of these learners in both tests is given in the table below.

LEARNER	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15
TEST 1 (%)	10	18	23	24	27	34	34	36	37	39	40	44	45	48	49
TEST 2 (%)	33	21	32	20	58	43	49	48	41	55	50	45	62	68	60

2.1 Determine the equation of the least squares regression line. (3)

2.2 A learner's mark in the first test was 15 out of a maximum of 50 marks.

2.2.1 Write down the learner's mark for this test as a percentage. (1)

2.2.2 Predict the learner's mark for the second test. Give your answer to the nearest integer. (2)

2.3 For the 15 learners above, the mean mark of the second test is 45,67% and the standard deviation is 13,88%. The teacher discovered that he forgot to add the marks of the last question to the total mark of each of these learners. All the learners scored full marks in the last question. When the marks of the last question are added, the new mean mark is 50,67%.

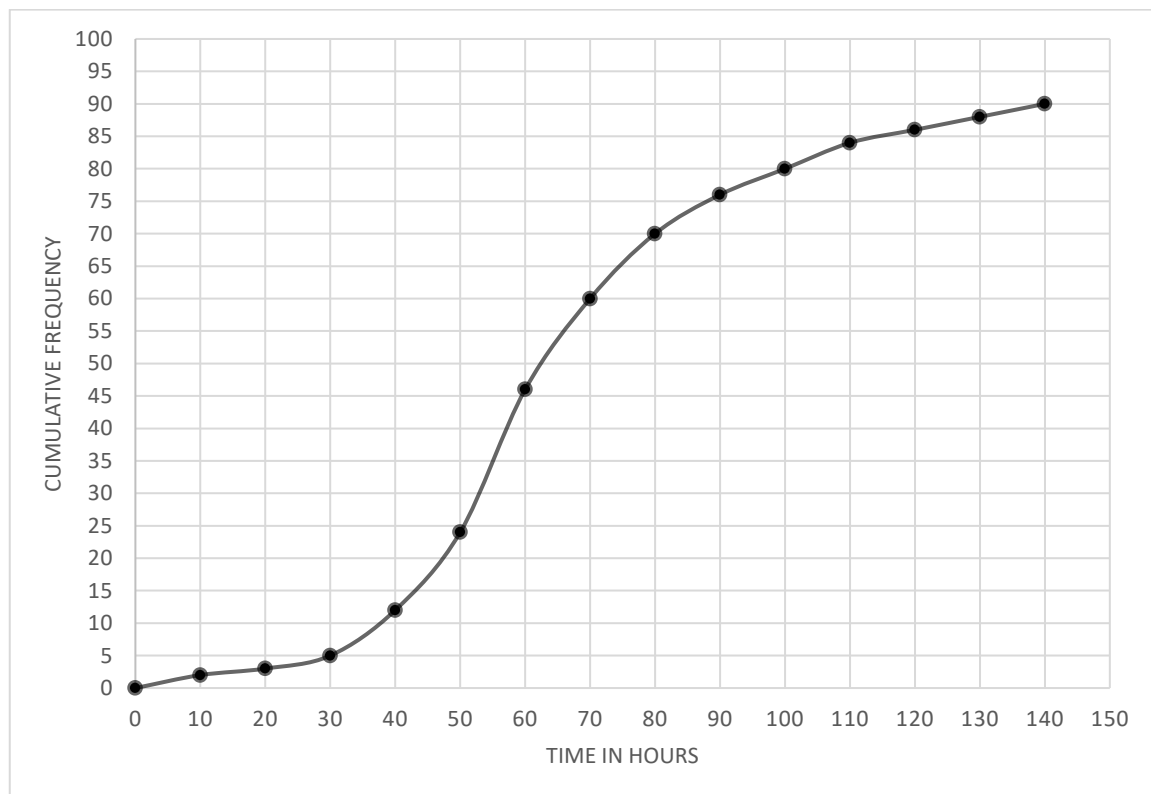
2.3.1 What is the standard deviation after the marks for the last question are added to each learner's total? (2)

2.3.2 What is the total mark of the last question? (2)

[10]

QUESTION 1

South Africa is currently experiencing problems with power generation. A study to investigate the use of batteries as an alternative during loadshedding was done by a group of students. The ogive (cumulative frequency graph) below shows the life span (in hours) of the batteries.

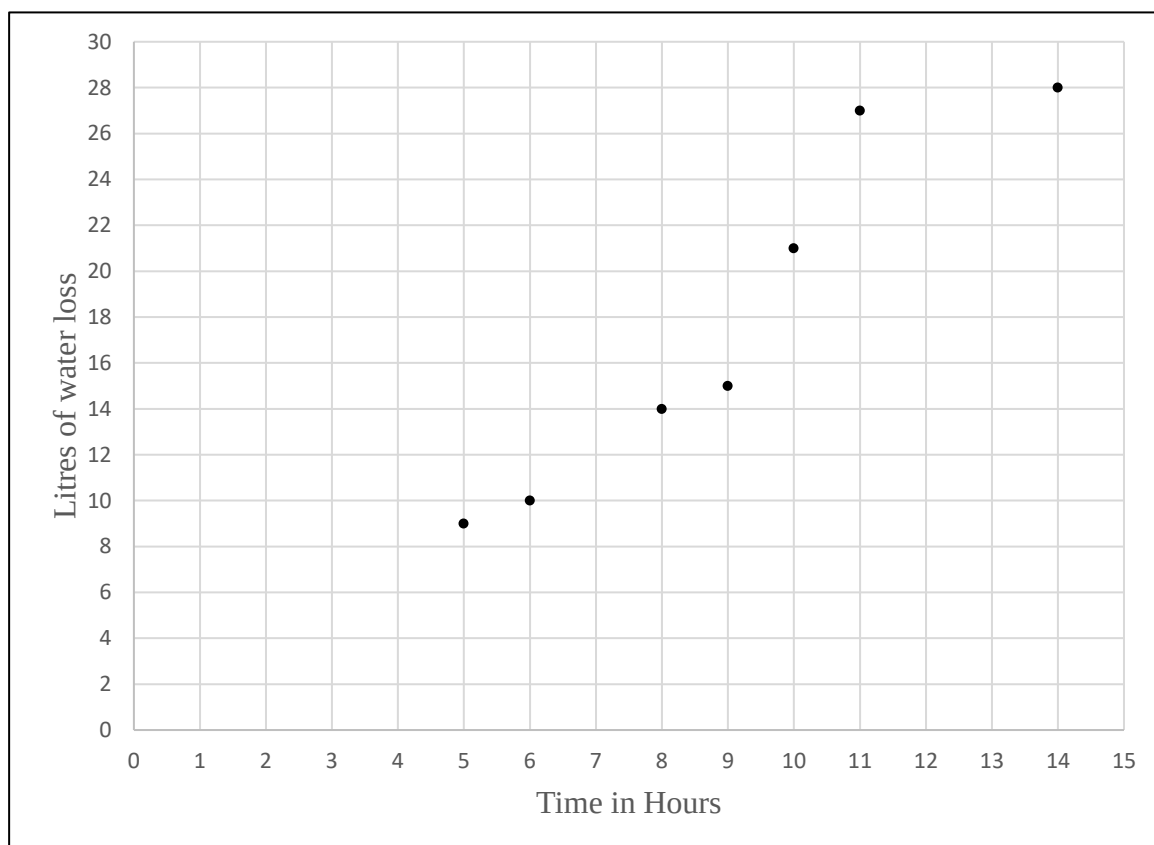


- 1.1 Write down the total number of batteries used in the experiment. (1)
 - 1.2 Use the graph to estimate the median time for the life span (in hours) of a battery. (1)
 - 1.3 What percentage of the batteries have a lifespan of at least 75 hours? (3)
 - 1.4 Write down the modal class. (2)
- [7]**

QUESTION 2

With the water shortage in KZN, the municipality decided to measure the amount of water loss of a few houses in a street. The following data which is represented on the accompanying scatter plot was recorded.

Time in hours (x)	5	6	8	9	10	11	14
Litres of water loss (y)	9	10	14	15	21	27	28



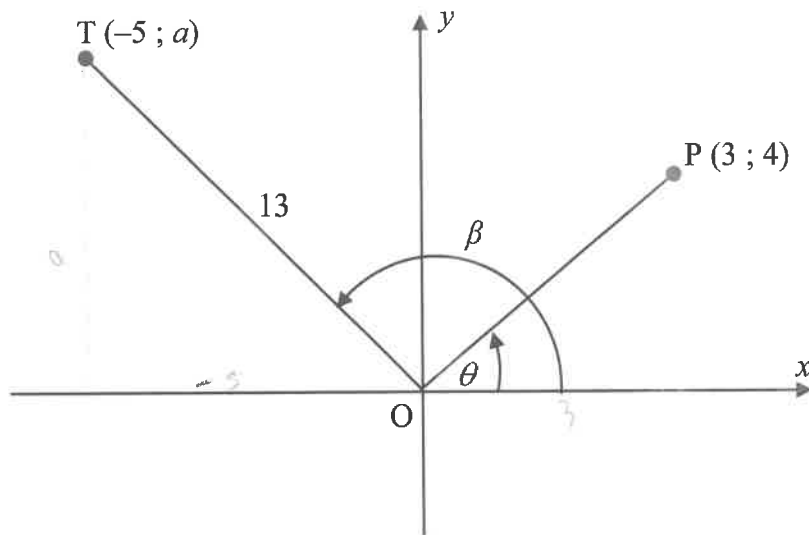
- 2.1 Determine the equation of the least squares regression line for the data. (3)
- 2.2 Draw the line of least squares regression on the scatter plot. (3)
- 2.3 Determine the correlation coefficient. (1)
- 2.4 Comment on the strength of the relationship of the water loss. (1)
- 2.5 Determine the standard deviation of the water loss. (1)
- 2.6 Predict the water loss (in litres) for a day. (2)

[11]

QUESTION 5

5.1 Use the identity: $\cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$ to derive a formula for $\sin(\alpha + \beta)$ (2)

5.2 In the diagram, OP and OT are drawn with endpoints at P(3 ; 4) and T(-5 ; a).
 OT = 13 units
 OP makes an angle of θ with the positive x-axis.
 OT makes an angle β with the positive x-axis.



Determine, without using a calculator, the following:

5.2.1 The value of a . (2)

5.2.2 The length OP. (1)

5.2.3 $\sin(\beta - \theta)$ (4)

5.2.4 $\cos 2\theta$ (3)

5.3 Solve for x : $4\sin^2 x - 3\sin x - 1 = 0$ for $x \in [0^\circ; 360^\circ]$ (6)

5.4 Given: $\tan \alpha = \frac{2 \tan \alpha - \sin 2\alpha}{2 \sin^2 \alpha}$

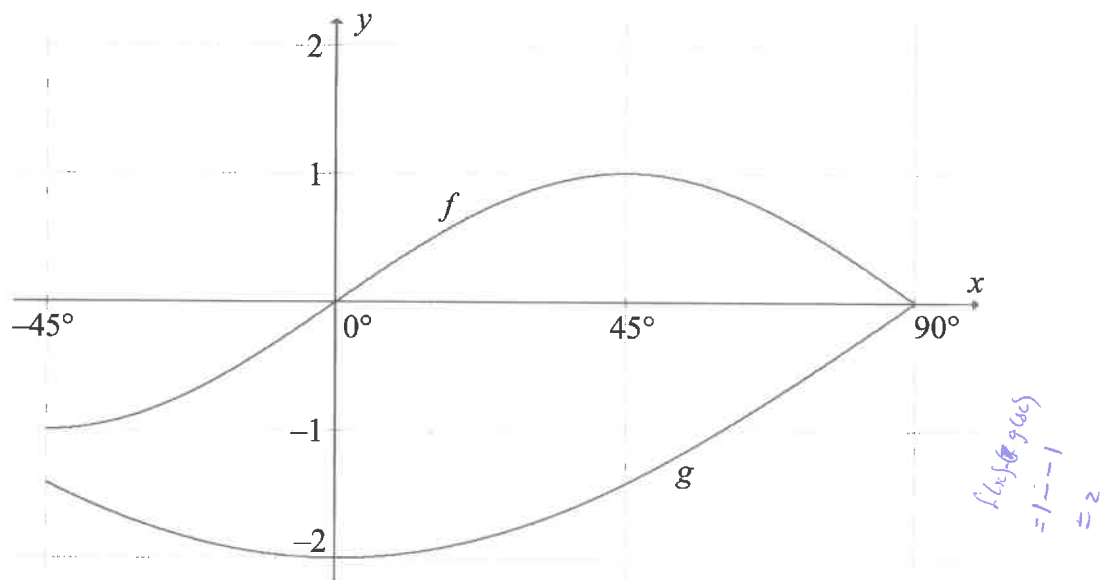
5.4.1 Determine the general solution for which the identity is undefined. (4)

5.4.2 Prove the given identity. (5)

5.5 The numerical value of $\cos 195^\circ$ can be written in the form $a(b+1)$.
Determine, without the use of a calculator, the value of a and b in surd form. (6)
[33]

QUESTION 6

The graphs of the functions $f(x) = \sin 2x$ and $g(x) = -2 \cos x$ are drawn for the interval $x \in [-45^\circ; 90^\circ]$.



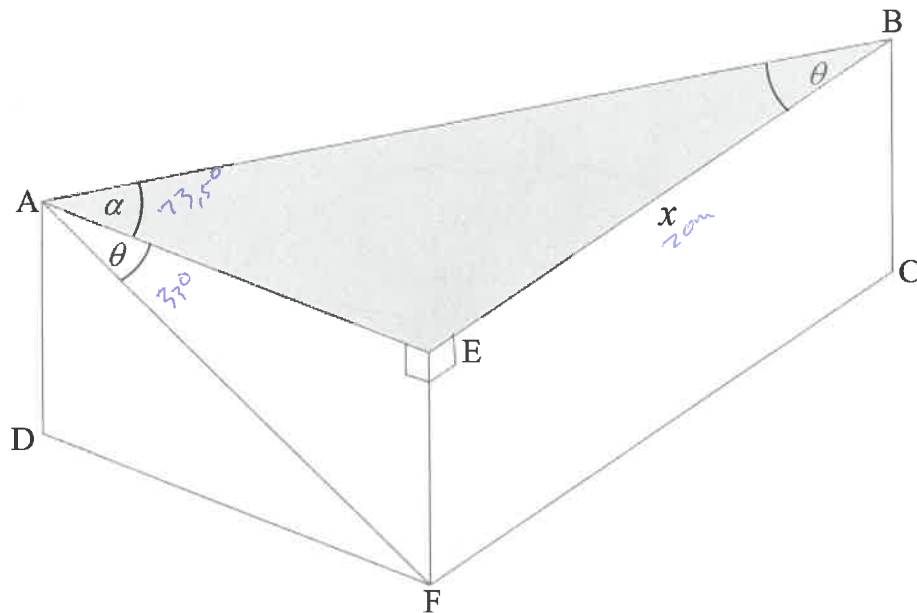
6.1 Write down the range of g for the interval $x \in [-45^\circ; 90^\circ]$. (2)

6.2 Write down ONE value of x for which $f(x) - g(x) = 2$ in the interval $x \in [-45^\circ; 90^\circ]$. (1)

6.3 For which values of x is $-4 \sin x \cdot \cos^2 x < 0$ for the interval $x \in [-45^\circ; 90^\circ]$? (3)
[6]

QUESTION 7

A triangular prism is drawn below. The top surface, $\triangle ABE$, has $EB = x$, $\hat{EAB} = \alpha$ and $\hat{ABE} = \theta$. Rectangles $EBCF$ and $AEFD$ are two sides of the prism. AF is drawn and $\hat{EAF} = \theta$.



7.1 Show that $AF = \frac{x \tan \theta}{\sin \alpha}$ (5)

7.2 Calculate the length of AF if $x = 20 \text{ m}$, $\theta = 33^\circ$ and $\alpha = 73,5^\circ$. (2)
[7]

QUESTION 4

4.1 If $\sin 20^\circ = k$. Determine the following in terms of k .

4.1.1 $\cos 20^\circ$ (2)

4.1.2 $\cos 110^\circ$ (2)

4.1.3 $\sin 40^\circ$ (2)

4.2 Simplify the following:
 $[\sin(x - 540^\circ) - \cos(-x)]^2$ (5)

4.3 Determine the general solution of: $3\cos 2x = 1 + 5\cos x$ (7)

4.4 Given: $\cos(x + y) = 0$ and $\tan(x - y) = \sqrt{3}$ where x and y are both acute angles.
Determine, WITHOUT the use of a calculator, the numerical value(s) of x and y . (4)

4.5 Bepaal, SONDER die gebruik van 'n sakrekenaar, die waarde van:
 $\sin 40^\circ \cdot \tan 20^\circ + \cos 40^\circ$. (5)
[27]

QUESTION 5

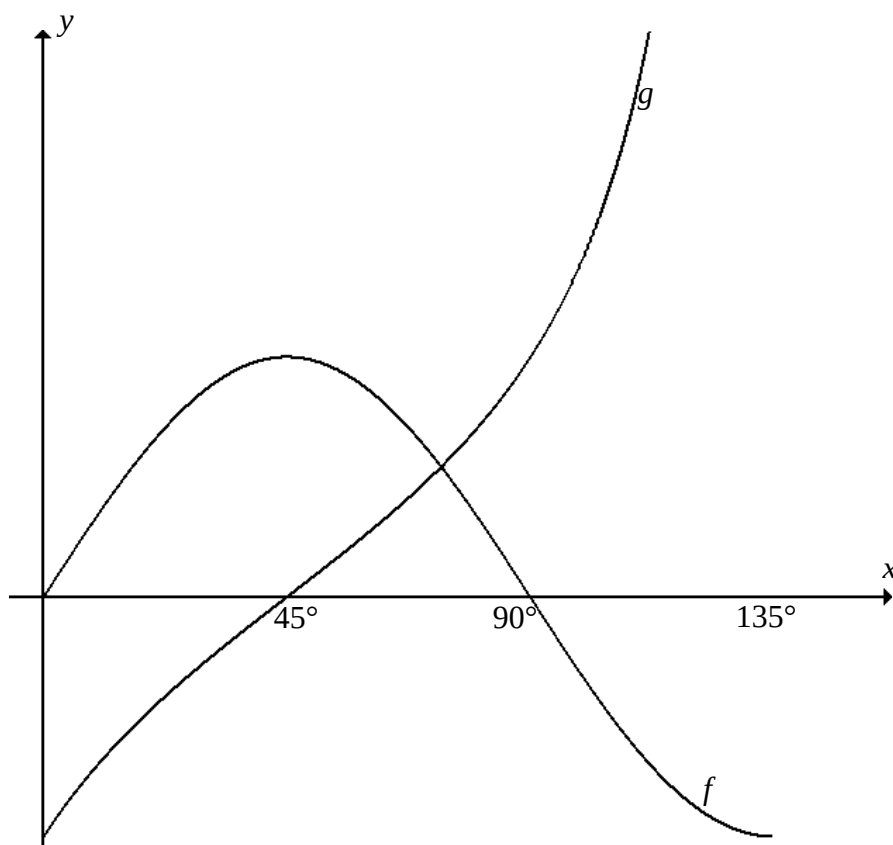
Given: $f(x) = -3\cos 2x$

- 5.1 Write down the period of f . (2)
- 5.2 Write down the range of f . (2)
- 5.3 On the given set of axes in your ANSWER BOOKLET, sketch the graph of $f(x) = -3\cos 2x$ for $x \in [-180^\circ; 180^\circ]$. (3)
- 5.4 Hence, solve for x , if $f(x) < -1,5$ for $x \in [-180^\circ; 180^\circ]$. (3)

[10]

QUESTION 5

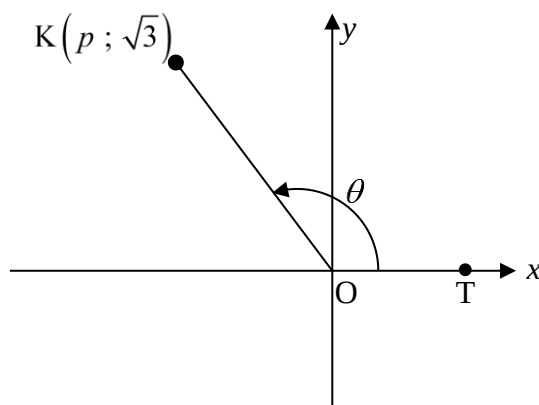
In the diagram below, $f(x) = \sin ax$ and an incomplete $g(x) = \tan(x + b)$ are drawn for the interval $x \in [0^\circ; 135^\circ]$.



- 5.1 Write down the values of a and b . (2)
 - 5.2 Write down the range of f . (2)
 - 5.3 Write down the period of g . (1)
 - 5.4 Write down the equation of the asymptote of g for the given interval. (1)
 - 5.5 Write down TWO values of x , in the given interval, where $f(x) = 1 - g(x)$ (2)
 - 5.6 For which value(s) of x , in the given interval, is $f'(x) \cdot g'(x) > 0$? (2)
- [10]**

QUESTION 6

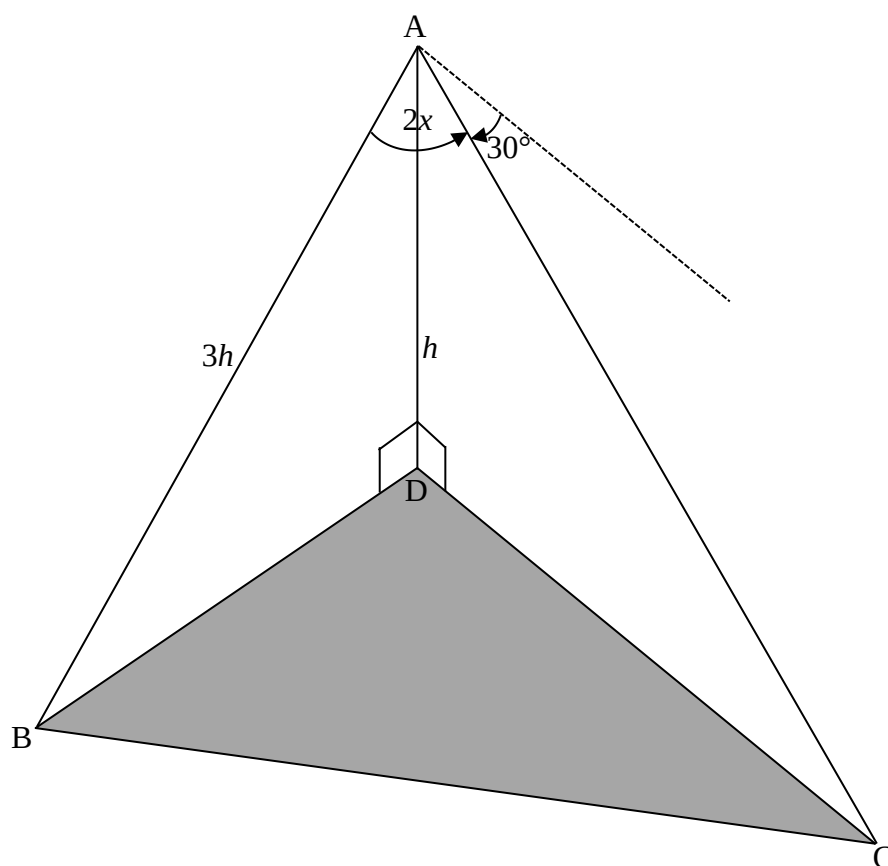
- 6.1 In the diagram, $K(p; \sqrt{3})$ is a point in the 2nd quadrant. T is a point on the positive x-axis and obtuse $\widehat{KOT} = \theta$.



- 6.1.1 Write down the value of $\tan \theta$ in terms of p . (1)
- 6.1.2 If $\theta = 120^\circ$, **WITHOUT using a calculator**, calculate the value of p . (3)
- 6.2 If $\cos 42^\circ = t$, **WITHOUT using a calculator**, write the following expressions in terms of t :
- 6.2.1 $\sin 48^\circ$ (2)
- 6.2.2 $\cos 84^\circ$ (3)
- 6.2.3 $\cos 72^\circ$ (5)
- 6.3 Simplify the following expression to ONE trigonometric ratio:
- $$\frac{\sin x}{\sin 2x} + \frac{\sin(180^\circ - x)}{\cos x} - \frac{\sin^2 x + \cos^2 x}{2 \sin(90^\circ + x)} \quad (6)$$
- 6.4 Consider $f(x) = \sin(2\theta - 15^\circ) \cdot \cos(\theta - 30^\circ) + \cos(2\theta - 15^\circ) \cdot \sin(\theta - 30^\circ)$
Determine the general solution of $f(x) = 0,8$ (7)
- 6.5 It is given that $4^{\sin x} = 6$, $6^{\cos x} = 8$ and $8 = 32^{1 - 2\sin^2 x}$
WITHOUT solving for x , determine the value of $\tan 2x$. (5)
[32]

QUESTION 7

In the diagram below, AD is a vertical pole having height h metres. B, D and C are three points in the same horizontal plane. AB and AC are cables and the angle of depression from A to C is 30° . $AB = 3h$ and $\hat{BAC} = 2x$.



- 7.1 Write down the size of $\hat{ACD}$. (1)
- 7.2 Determine the distance AC in terms of h . (2)
- 7.3 Calculate the size of $\hat{ABD}$. (2)
- 7.4 Calculate the size of x if $BC = \sqrt{7}h$. (5)
- [10]**

QUESTION 5

5.1 Simplify the following expression to a single trigonometric ratio:

$$\frac{\cos(x-180^\circ) \cdot \tan(-x) \cdot \sin^2(90^\circ-x)}{\sin(180^\circ-x)} - 4\cos^2 x \quad (7)$$

5.2 Consider: $\cos(A-B) - \cos(A+B) = 2\sin A \sin B$

5.2.1 Prove the identity. (2)

5.2.2 Hence or otherwise calculate, **without using a calculator**, the value of $\cos 15^\circ - \cos 75^\circ$. (4)

5.3 **Without using a calculator**, determine the value of:

$$\frac{\cos 36^\circ}{\cos 12^\circ} - \frac{\sin 36^\circ}{\sin 12^\circ} \quad (4)$$

5.4 Consider: $\frac{2\sin^2 x + \sin 2x}{\cos 2x} = \frac{2\sin x}{\cos x - \sin x}$

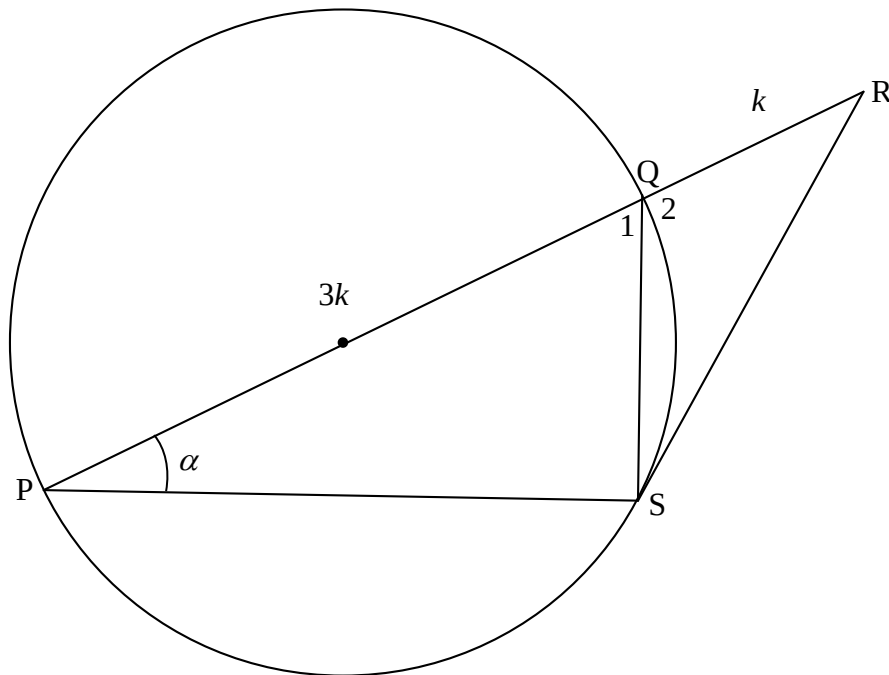
5.4.1 Prove the identity. (4)

5.4.2 For which value(s) of x in the interval $x \in [-90^\circ; 180^\circ]$ will the identity not be valid? (2)

5.5 A line is drawn from A $(\cos \theta; \sin \theta)$ to B $(6; 7)$. If $AB = \sqrt{86}$, determine the value of $\tan \theta$. (5)
[28]

QUESTION 6

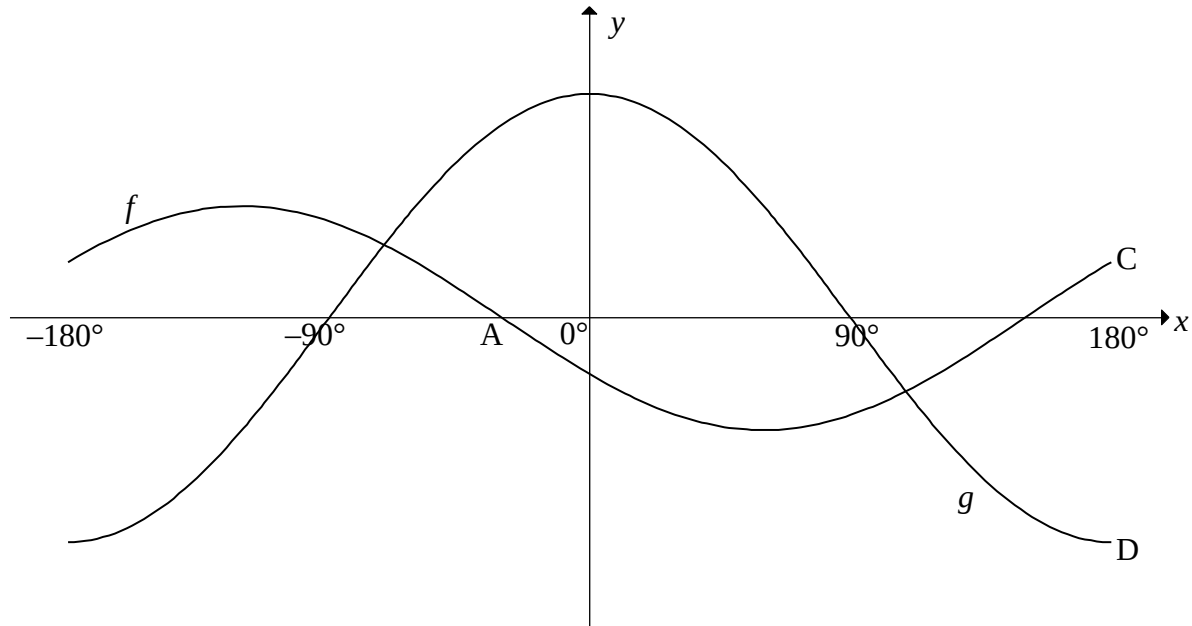
In the diagram below, PQ is a diameter of the circle and RS is a tangent to the circle at S. The tangent and diameter produced meet at R such that $PQ = 3k$ and $QR = k$. Chord PS is drawn. $\hat{P} = \alpha$.



- 6.1 Write $\hat{R}$ in terms of α . (1)
 - 6.2 Determine QS in terms of k and α . (2)
 - 6.3 Show that $PS = \frac{4k \cos 2\alpha}{\cos \alpha}$ (3)
 - 6.4 Show that $\tan \alpha = \frac{3}{8} \tan 2\alpha$ (3)
- [9]**

QUESTION 7

In the diagram below, the functions $f(x) = -\sin(x + 30^\circ)$ and $g(x) = 2 \cos x$ are drawn in the interval $x \in [-180^\circ; 180^\circ]$. A is an x -intercept of f and C and D are the endpoints of the graphs of f and g at 180° .

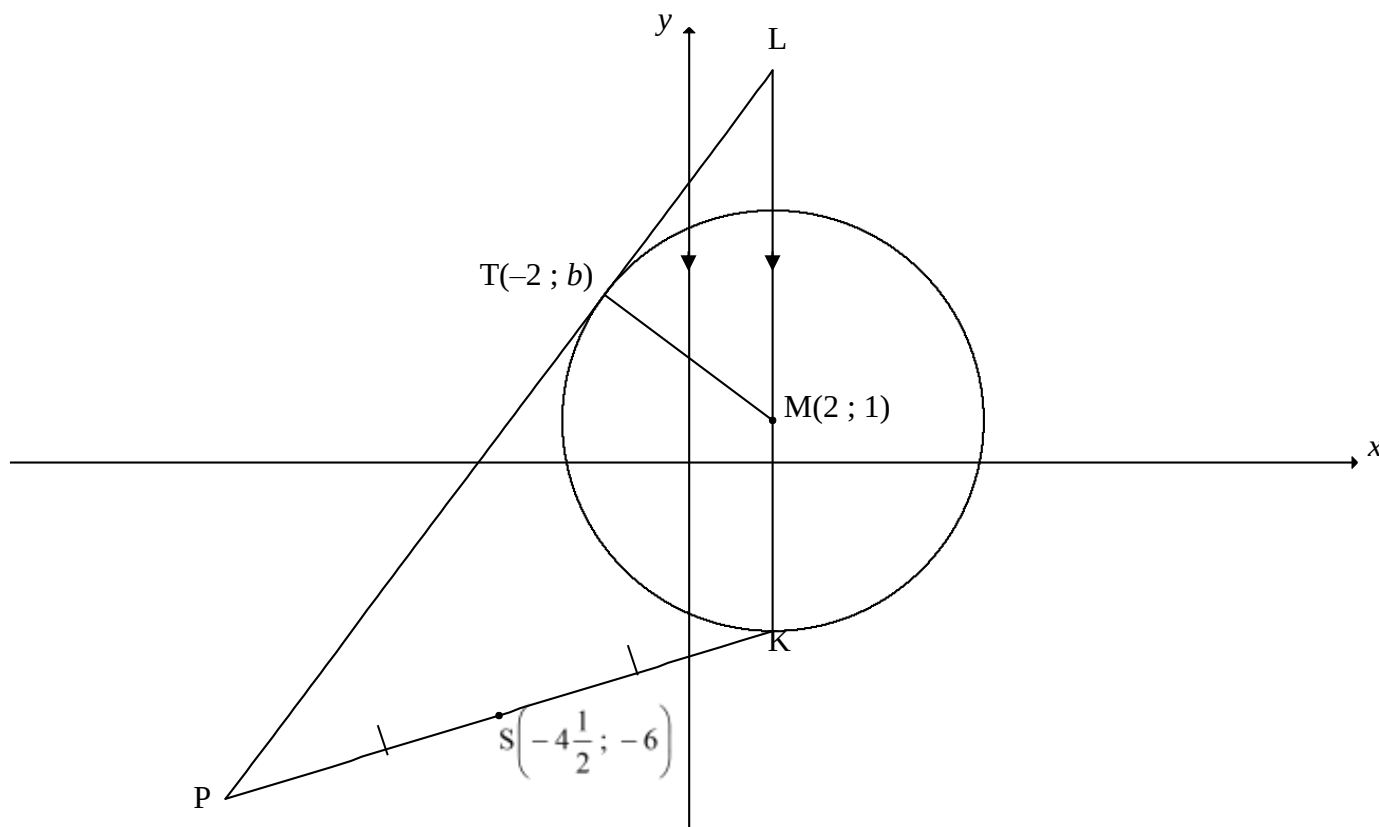


- 7.1 Calculate the:
- 7.1.1 Coordinates of A. (1)
- 7.1.2 Distance CD. (2)
- 7.2 Write down the period of g . (1)
- 7.3 Determine the general solution of the equation $2\cos x + \sin(x + 30^\circ) = 0$. (6)
- 7.4 For which values of x in the interval $x \in [-180^\circ; 180^\circ]$ will $2\cos(x + 20^\circ) + \sin(x + 50^\circ) > 0$? (3)
- [13]**

QUESTION 4

In the diagram, the circle is centred at $M(2; 1)$. Radius KM is produced to L , a point outside the circle, such that $KML \parallel y$ -axis. LTP is a tangent to the circle at $T(-2; b)$.

$S\left(-4\frac{1}{2}; -6\right)$ is the midpoint of PK .



4.1 Given that the radius of the circle is 5 units, show that $b = 4$. (4)

4.2 Determine:

4.2.1 The coordinates of K (2)

4.2.2 The equation of the tangent LTP in the form $y = mx + c$ (4)

4.2.3 The area of $\triangle LPK$ (7)

4.3 Another circle with equation $(x - 2)^2 + (y - n)^2 = 25$ is drawn. Determine, with an explanation, the value(s) of n for which the two circles will touch each other externally. (4)

[21]

QUESTION 5

5.1 **Without using a calculator**, write the following expressions in terms of $\sin 11^\circ$:

5.1.1 $\sin 191^\circ$ (1)

5.1.2 $\cos 22^\circ$ (1)

5.2 Simplify $\cos(x - 180^\circ) + \sqrt{2} \sin(x + 45^\circ)$ to a single trigonometric ratio. (5)

5.3 Given: $\sin P + \sin Q = \frac{7}{5}$ and $\hat{P} + \hat{Q} = 90^\circ$

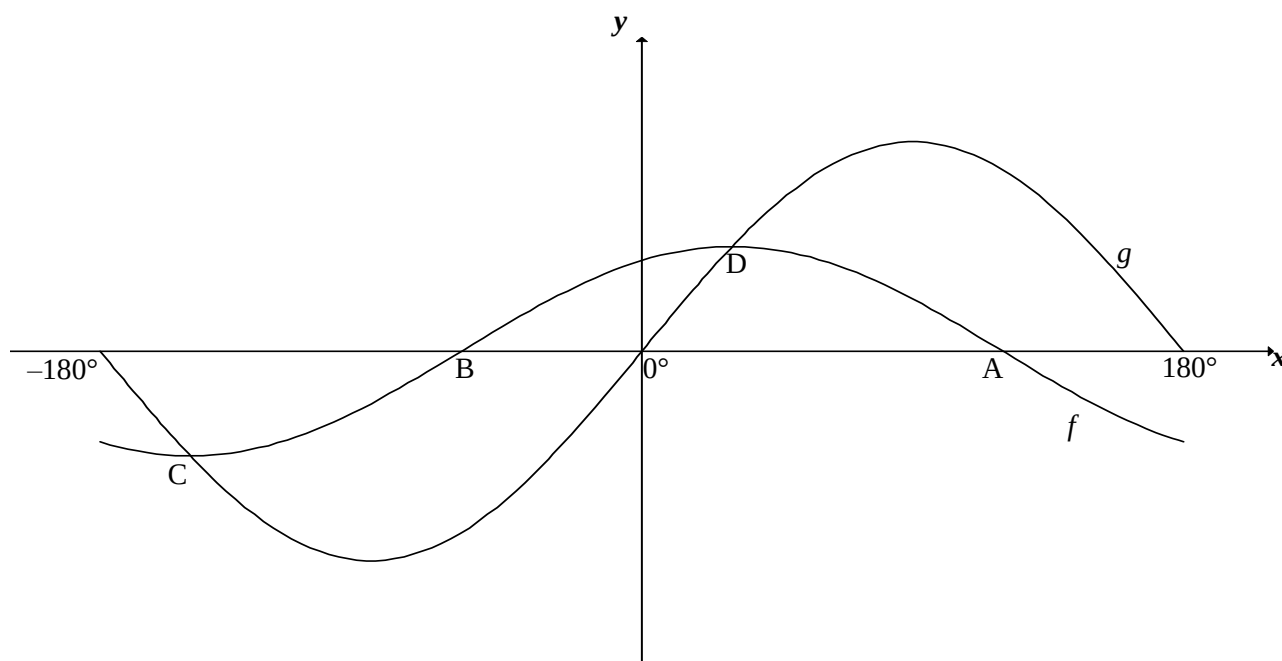
Without using a calculator, determine the value of $\sin 2P$. (5)

[12]

QUESTION 6

6.1 Determine the general solution of $\cos(x - 30^\circ) = 2 \sin x$. (6)

6.2 In the diagram, the graphs of $f(x) = \cos(x - 30^\circ)$ and $g(x) = 2 \sin x$ are drawn for the interval $x \in [-180^\circ; 180^\circ]$. A and B are the x -intercepts of f . The two graphs intersect at C and D, the minimum and maximum turning points respectively of f .



6.2.1 Write down the coordinates of:

(a) A (1)

(b) C (2)

6.2.2 Determine the values of x in the interval $x \in [-180^\circ; 180^\circ]$, for which:

(a) Both graphs are increasing (2)

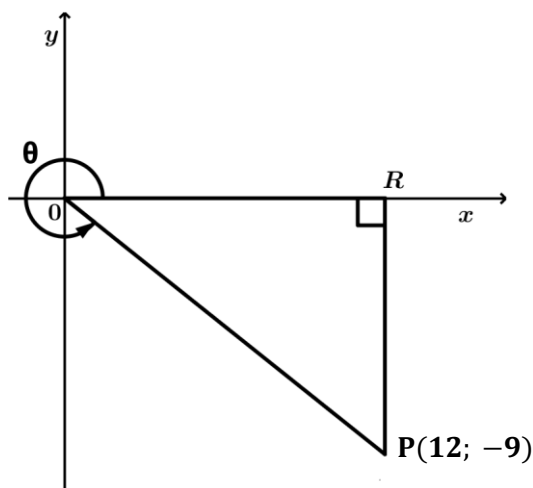
(b) $f(x + 10^\circ) > g(x + 10^\circ)$ (2)

6.2.3 Determine the range of $y = 2^{2 \sin x + 3}$ (5)

[18]

QUESTION 5

- 5.1 In the diagram below, $P(12; -9)$ is a point in the Cartesian plane. Reflex angle $\widehat{ROP}$ is equal to θ .



Calculate, **without using a calculator**, the:

5.1.1 Length of OP (1)

5.1.2 The value of:

(a) $\cos(90^\circ - \theta)$ (2)

(b) $\sin(\theta + 30^\circ)$ (5)

5.2 Determine the general solution of:

$$3 \sin 2x - 2 \cos 2x = 2 - 2 \cos^2 x \quad (6)$$

5.3 Prove the identity:

$$\frac{\tan^2 x + 1}{\tan x} = \frac{2}{\sin 2x} \quad (5)$$

[19]

QUESTION 6

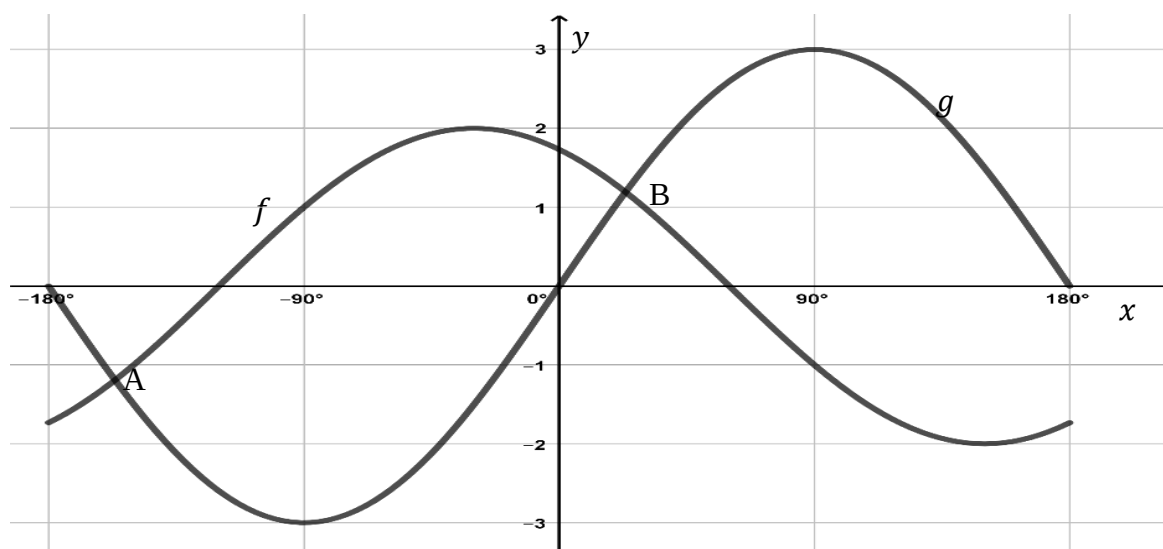
6.1 Reduce $\frac{\tan 43^\circ \cdot \sin 47^\circ \cdot 2 \cos 137^\circ}{2 \cos 317^\circ \cdot \sin 133^\circ - 1}$ to a single trigonometric ratio of one angle without the use of a calculator. (7)

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

6.2.2 Hence, or otherwise, solve for x if:
 $\sin 4x - \sin 2x = 0$ for $0^\circ \leq x \leq 90^\circ$ (5)

[14]**QUESTION 7**

The graph of $f(x) = 2 \cos(x + 30^\circ)$ and $g(x) = 3 \sin x$ for the interval $-180^\circ \leq x \leq 180^\circ$ are shown below.



7.1 What is the amplitude of $f(x)$? (1)

7.2 Determine the value of $f(-90^\circ) - g(-90^\circ)$ (1)

7.3 For which values of x is $g(x) < 0$? (2)

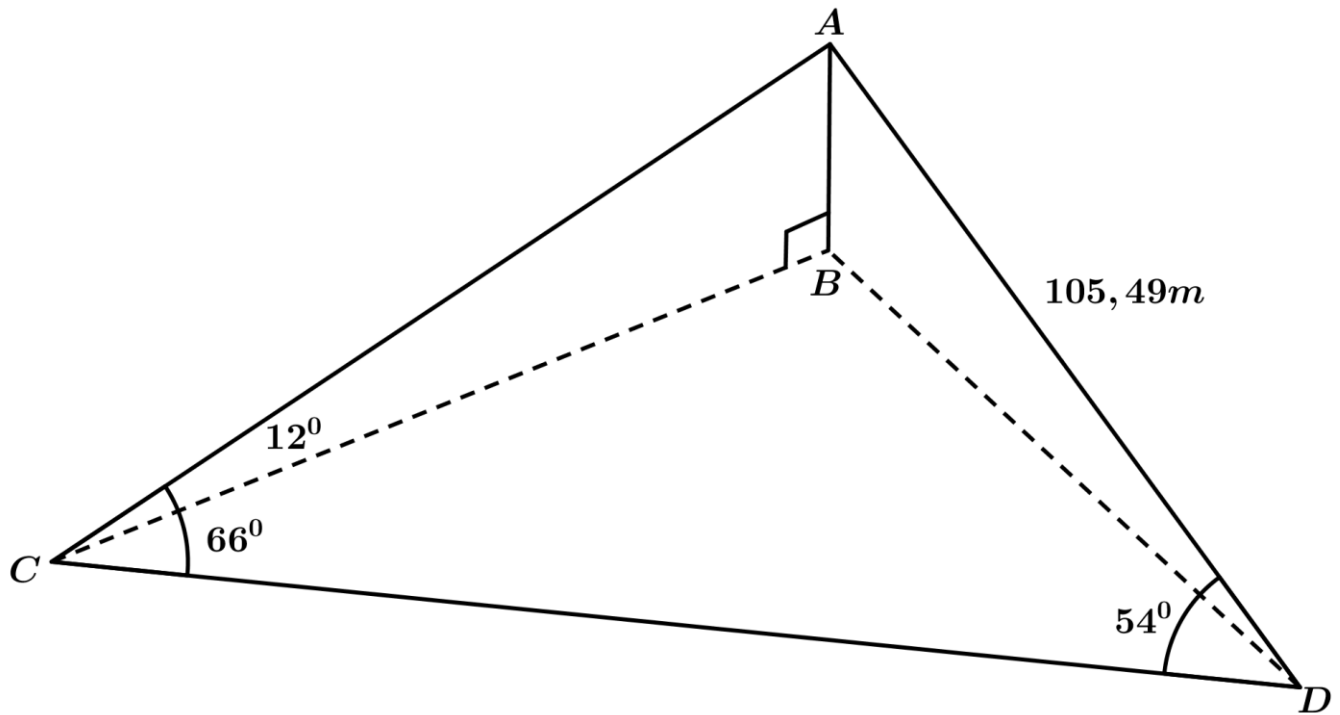
7.4 If the coordinates of B (the point of intersection of f and g) is $(23,41^\circ; 1,19)$, determine the coordinates of A. (2)

7.5 For which values of x is $f'(x) \cdot g'(x) > 0$ in the interval $-90^\circ < x < 90^\circ$? (2)

[8]

QUESTION 8

A vertical steel pole AB is shown in the diagram below. AC and AD are strong steel ropes. The length of AD is $105,49\text{m}$. The angle of elevation of A from C is 12° . $\widehat{ACD} = 66^\circ$ and $\widehat{ADC} = 54^\circ$.



- 8.1 Write down the size of $\widehat{CAD}$. (1)
- 8.2 Calculate the length of AC . (2)
- 8.3 Calculate the height of the pole AB . (2)
- 8.4 Calculate the area of the triangle $\triangle ACD$. (2)

[7]