education

MPUMALANGA PROVINCE

REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

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MATHEMATICS P2

SEPTEMBER 2025

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MARKS: 150

TIME: 3 hours

This question paper consists of 15 pages and 1 information sheet, and an answer book is provided.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. The question paper consists of 10 questions.

2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.

3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining the answers.

4. Answers only will NOT necessarily be awarded full marks.

5. You may use an approved scientific calculator (non-programmable and non-graphical) unless stated otherwise.

6. If necessary, round off answers to TWO decimal places, unless stated otherwise.

7. Diagrams are NOT necessarily drawn to scale.

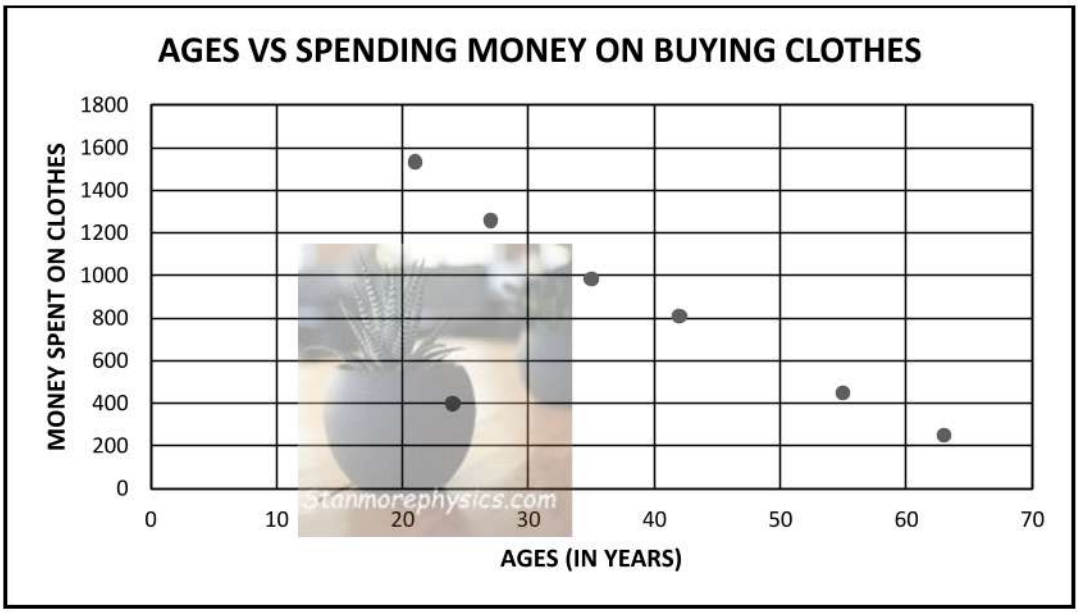
8. Write neatly and legibly.

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QUESTION 1

The relationship between age and spending money on buying clothes per month has been studied for years. Research has shown the following results:

Ages (in years)	21	24	27	35	42	55	63
Spending money on buying clothes (in rands)	1534	400	1260	986	810	450	250



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

1.2 Draw the least squares regression line on the answer book. (2)

1.3 Determine the correlation coefficient. (1)

1.4 Predict the money spend by a 50-year-old person on buying clothes. (2)

1.5 Is the answer calculated in QUESTION 1.4 reliable? Justify your answer. (2)

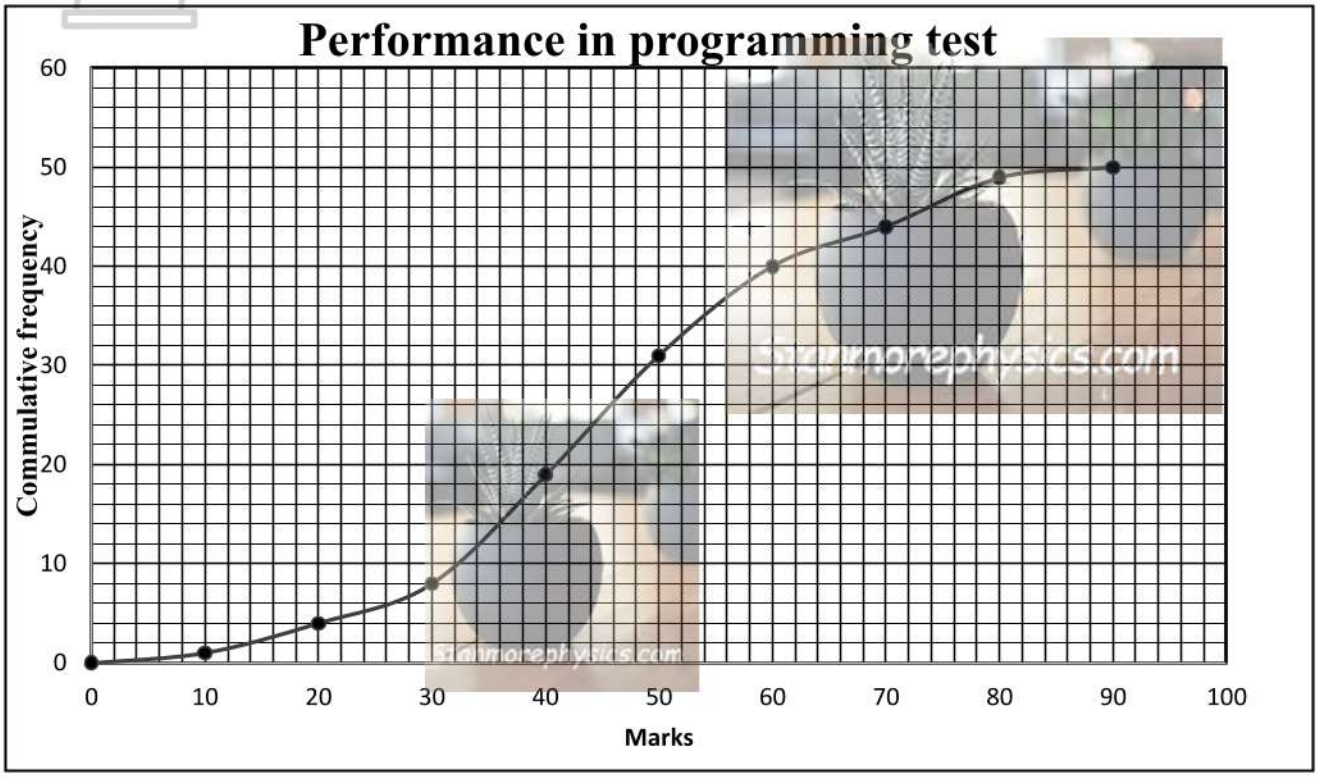
1.6 Explain the effect on the gradient of the regression line if the point $(24; 400)$ is removed. (1)

[11]

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QUESTION 2

2.1 The ogive (cumulative frequency graph) shows the performance of the students who took a test in basics programming skills. The test had a maximum of 100 marks.



2.1.1 How many students took the test? (1)

2.1.2 Only the top 25% of the students are allowed to do an advanced course in programming. Determine the cut-off mark for the top 25%. (2)

2.1.3 Complete a frequency table on the ANSWER BOOK provided. (2)

2.1.4 Calculate the mean estimate of the data. (3)

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2.2 The average time to deliver a pizza ordered telephonically is 25 minutes. The standard deviation of the delivery time allowed, is 6 minutes. The delivery times in a day is summarised below.

Delivery times (minutes)
32
28
20
38
15
24

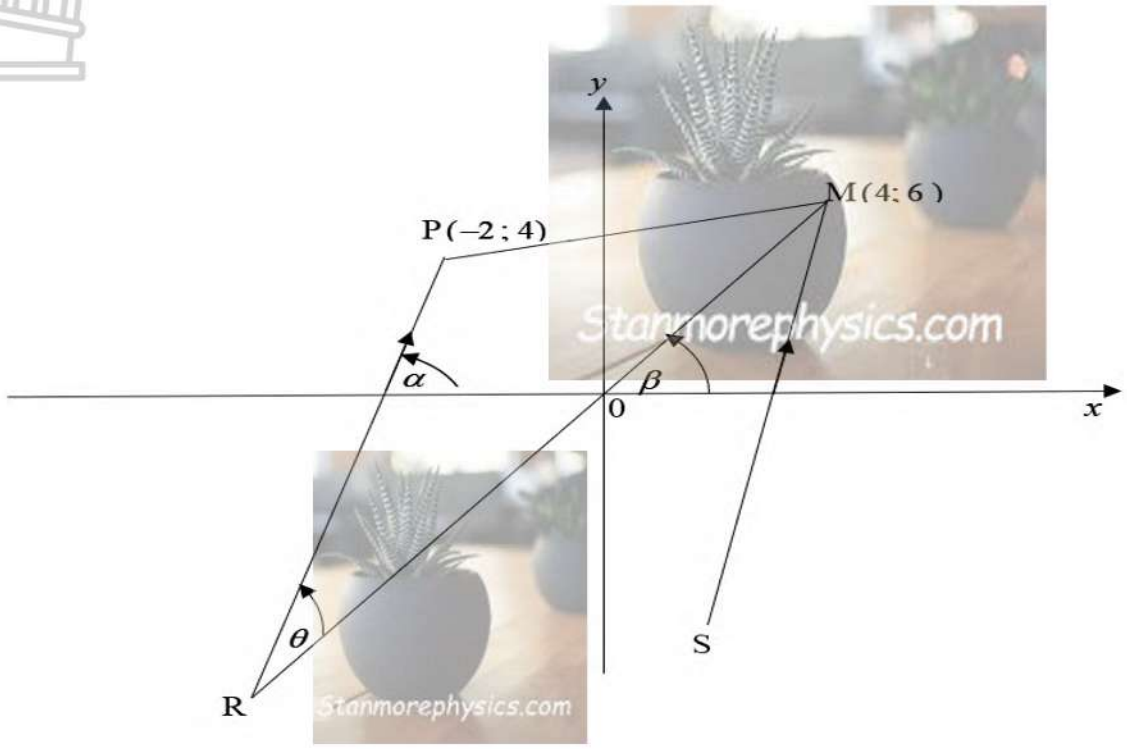
If the policy of the company is that you will receive the pizza free of charge when the delivery time is more than one standard deviation from the mean, determine the number of free pizzas for the day. Show all supporting calculations. (3)

[11]

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QUESTION 3

In the diagram below, ΔPMR is drawn with vertices $P(-2;4), M(4;6)$ and R in the Cartesian plane. Line MR passes through the origin at O. $P\hat{R}M = \theta$ and PR||MS.The equation of MS is given by $y - 5x + 14 = 0$.



3.1 Calculate the length of MR, in simplified surd form. (2)

3.2 Determine the equation of MR (3)

3.3 Determine the equation of PR. (3)

3.4 Determine the coordinates of R. (3)

3.5 Calculate the size of θ , rounded off to TWO decimal places. (4)

3.6 Calculate the area of PMSR if it is further given that PMSR is a parallelogram. (4)

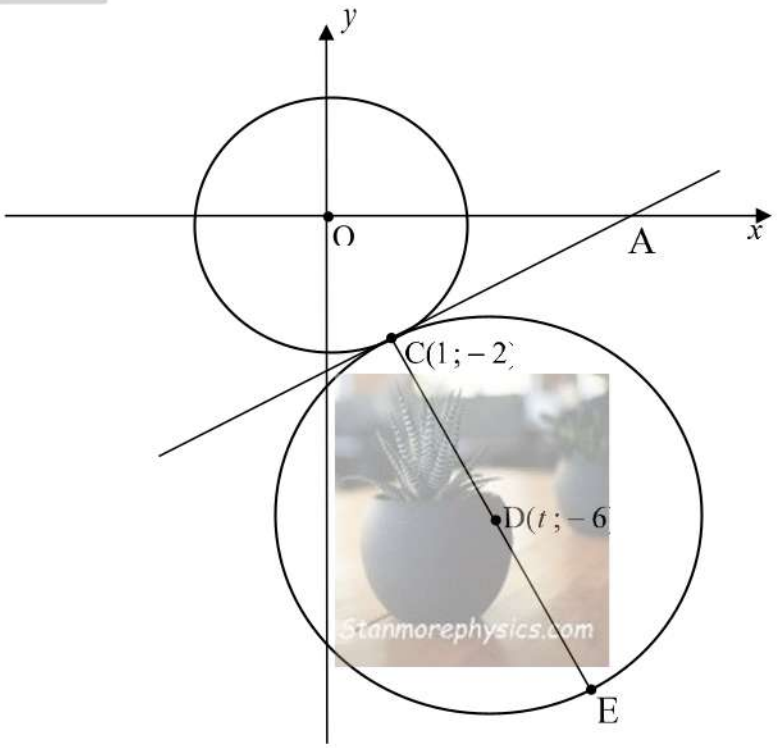
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QUESTION 4

The diagram below consists of two circles, which touch each other externally at C (1; –2).
The smaller circle has its centre O at the origin. The other circle has centre $D(t;-6)$ .CA is a common tangent which intersects the x-axis at A. CDE is the diameter of the larger circle.



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4.1 Give a reason why the points O, C and D lie on a straight line. . (2)

4.2 Calculate the gradient of OC (2)

4.3 Hence, show that the value of $t = 3$. (2)

4.4 Determine the equation of the tangent AC in the form $y = mx + c$. (3)

4.5 Calculate the coordinates of E. (2)

4.6 Determine the equation of a circle passing through the points A (5 ; 0), C and E in the form $(x-a)^2 + (y-b)^2 = r^2$. (5)

4.7 If a circle with centre D and equation $(x-3)^2 + (y+6)^2 = r^2$ has to cut the circle with centre O twice, give all possible values of *r*. (4)

[20]

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QUESTION 5

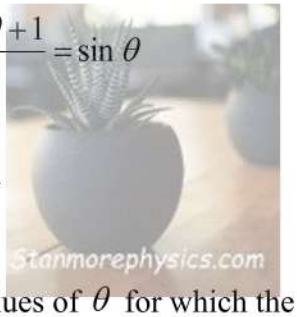
5.1 If $\tan A = \frac{5}{12}$ *and* $A \in (180°; 360°)$, determine without using a calculator and with an aid of a diagram the value of:

5.5.1 $\cos A$ (3)

5.5.2 $\sin 2A$ (3)

5.2 Determine the value of : $\dfrac{1}{\cos(360^\circ - \theta).\sin(90^\circ - \theta)} - \tan^2(180^\circ + \theta)$ (6)

5.3 Given: $\dfrac{\sin(-2\theta) - \cos^2\theta + 1}{\sin\theta - 2\cos\theta} = \sin\theta$



5.3.1 Prove the identity (5)

5.3.2 Determine the values of θ for which the identity will be undefined if $\theta \in [-180°; 180°]$ (4)

5.4 Determine the general solution of the following equation:

$$\sin(2x + 40^\circ)\cos(x + 30^\circ) - \cos(2x + 40^\circ)\sin(x + 30^\circ) = \cos(2x - 20^\circ)$$ (6)

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

Determine the maximum value of $f(x)$ (3)

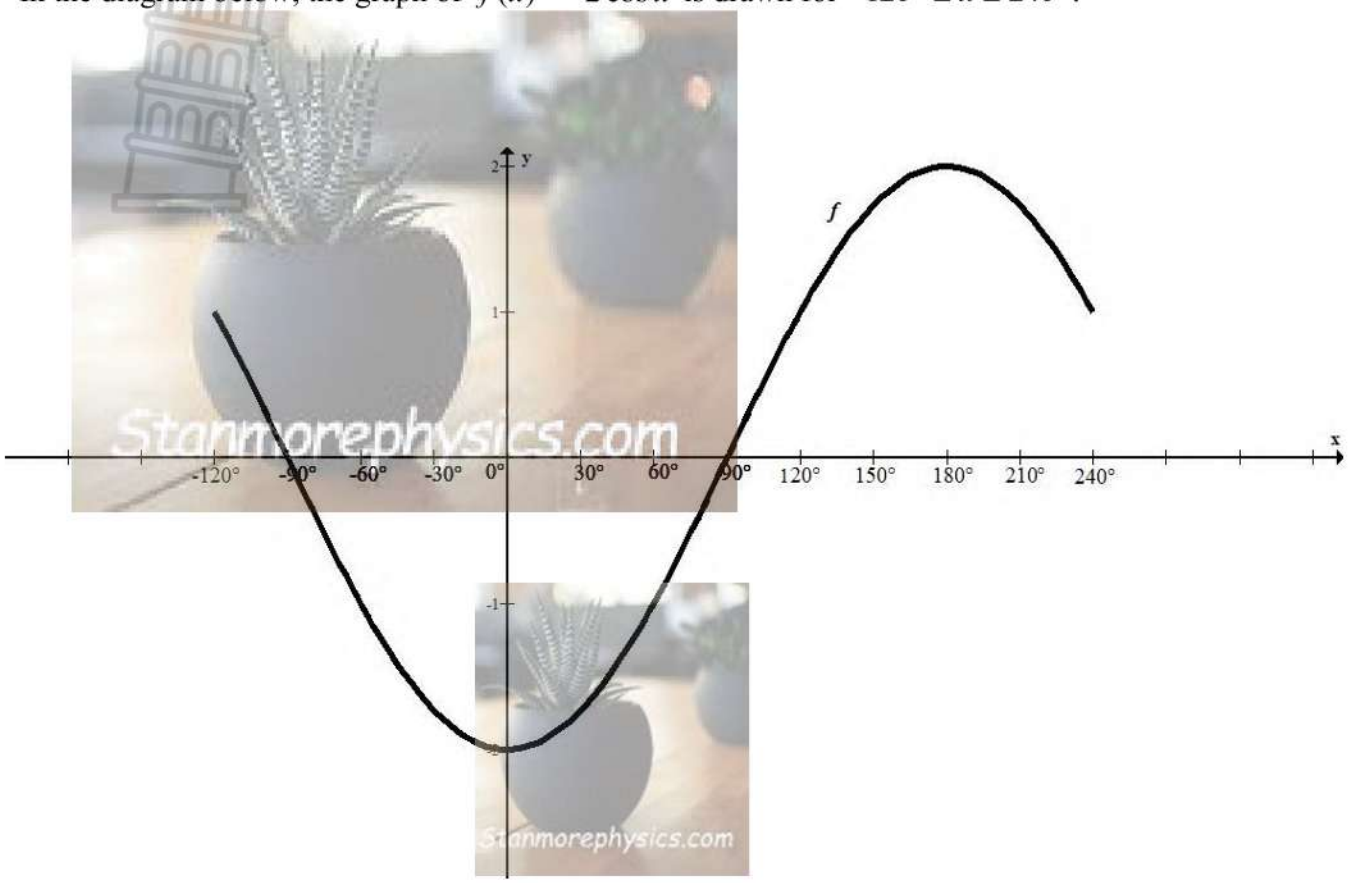
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QUESTION 6

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



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6.1 Write down the amplitude of f. (1)

6.2 Write down the range of $f(x) + 3$ (2)

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

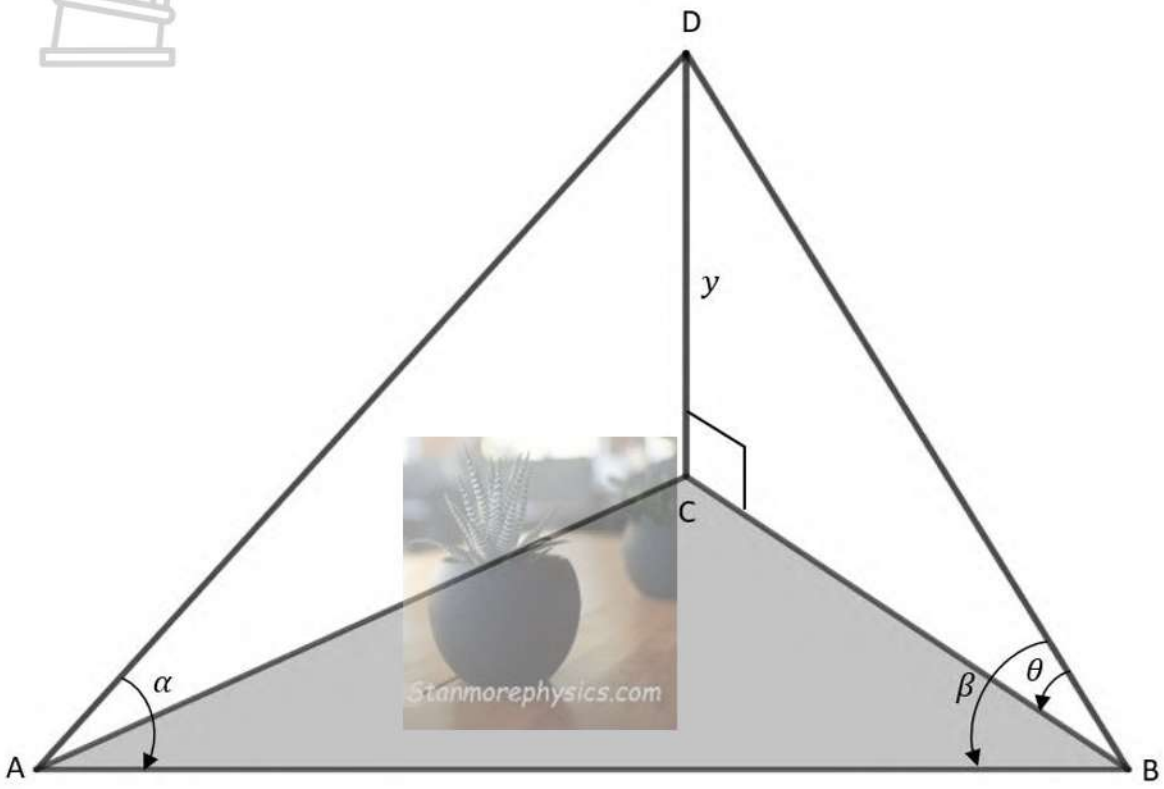
6.4 For which values of k will $f(x) = k$ have no real roots? (2)

6.5 Determine the values of x in the interval $-120^\circ \leq x \leq 240^\circ$ for which $x.g'(x) < 0$. (3)

[11]

QUESTION 7

In the diagram alongside, D is a point vertically above C. DC is y metres in length. The angle of elevation of D from B is θ. $D\hat{A}B = \alpha$ and $D\hat{B}A = \beta$.



7.1 Determine the length of DB in terms of y and θ. (3)

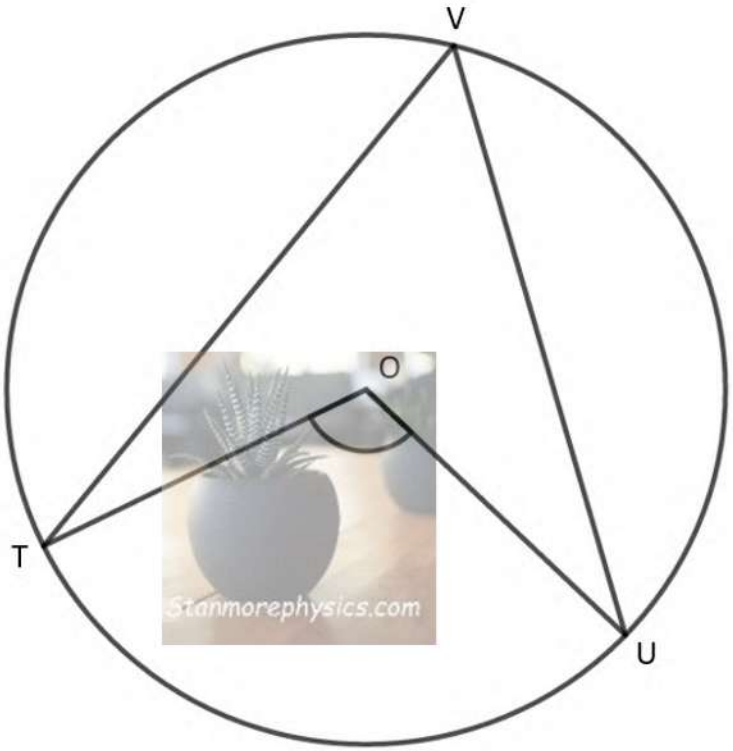
7.2 Show that $AB = \dfrac{y \sin(\alpha + \beta)}{\sin\theta \sin\alpha}$ (4)

[7]

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

QUESTION 8

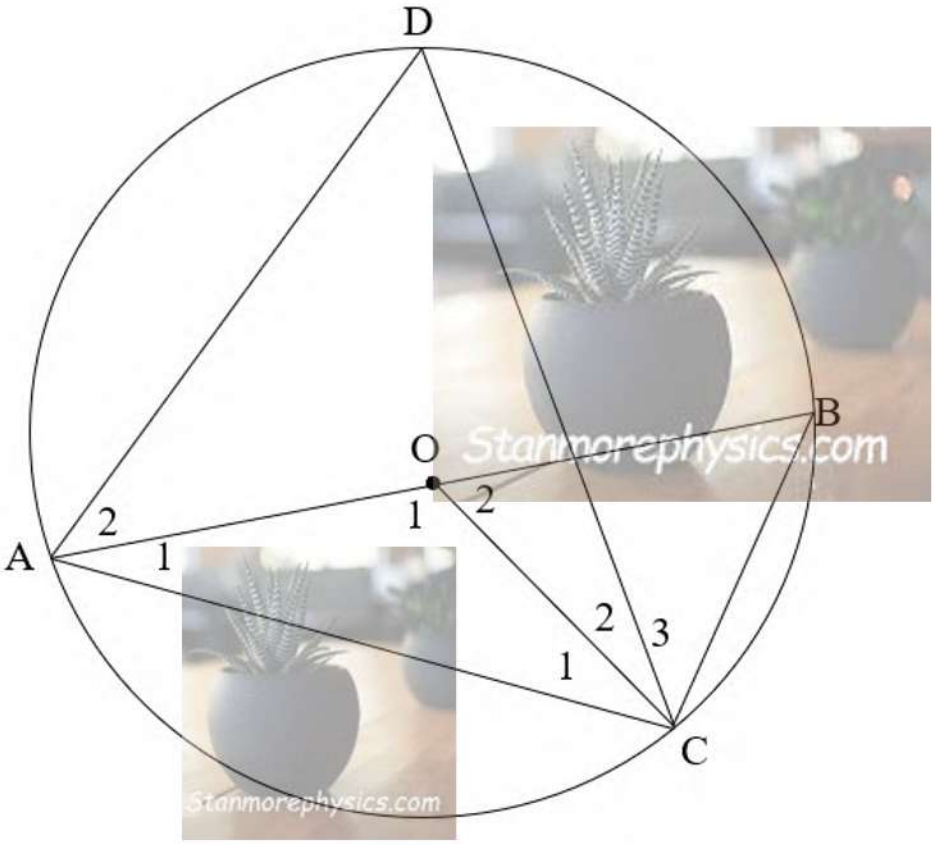
8.1 In the diagram below, O is the centre of circle TUV.



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Use the diagram on the ANSWER BOOK to prove the theorem which states that $T\hat{O}U = 2T\hat{V}U$ (6)

8.2 O is the centre of the circle. AB is a diameter. $A\hat{O}C = 104^\circ$ and $D\hat{A}B = 32^\circ$.



Calculate the size of:

8.2.1 $\hat{D}$ (2)

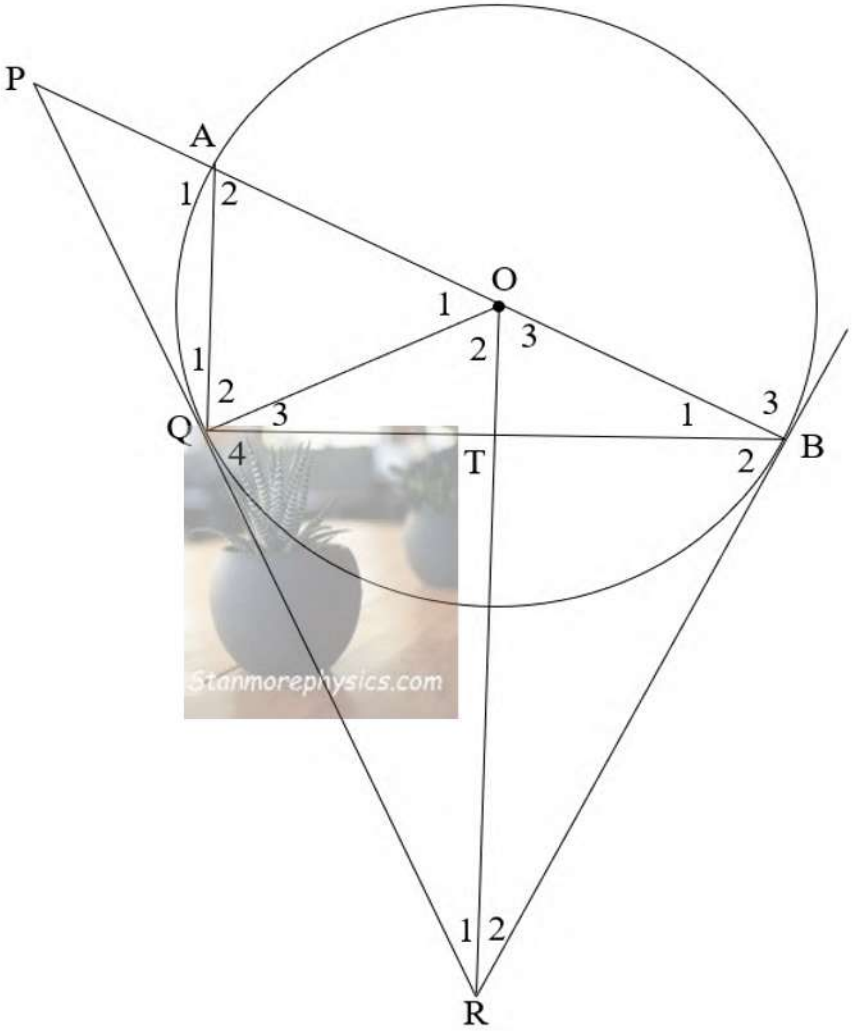
8.2.2 $\hat{C}_3$ (1)

8.2.3 $\hat{A}_1$ (3)

8.2.4 $\hat{C}_2$ (3)

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8.3 In the figure below, RQ and RB are tangents at the points Q and B respectively to the circle with centre O and $TQ = TB$. The radius BO produced meets the circle at A and RQ produced at P.



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8.3.1 Prove that RBOQ is a cyclic quadrilateral. (4)

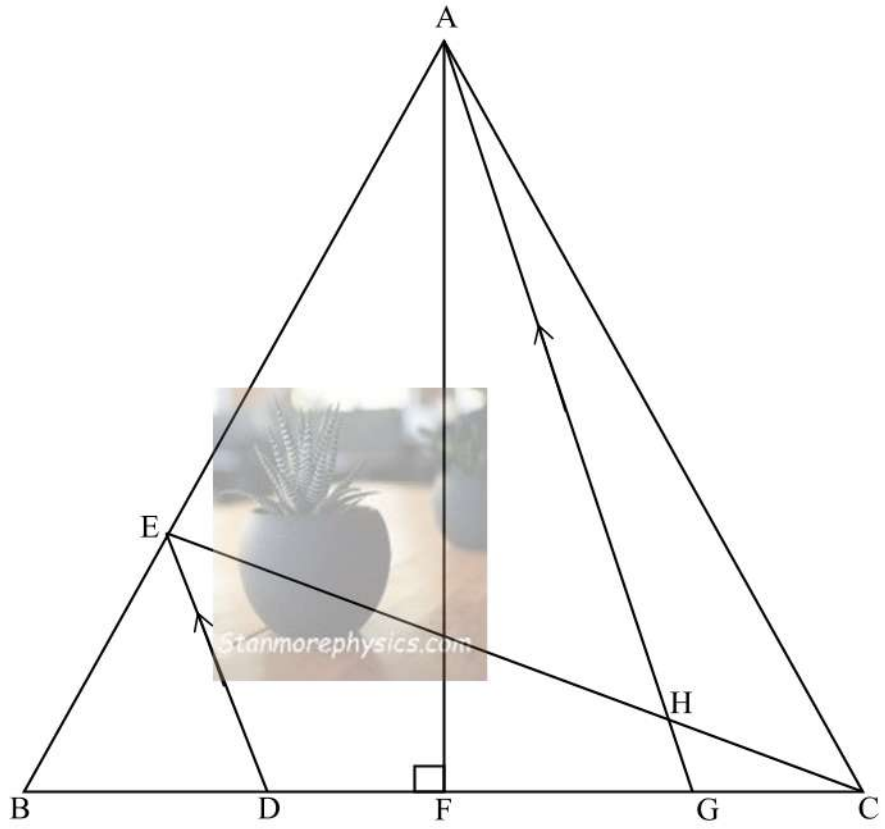
8.3.2 Prove that RB is a tangent to the circle passing through T, O and B. (4)

8.3.3 Express $\hat{P}$ in terms of $\hat{B}_1$. (3)

[26]

QUESTION 9

In the diagram below $\frac{DG}{GC} = \frac{3}{2}$; $\frac{BE}{EA} = \frac{1}{2}$ and AG ∥ DE.



Determine, with reasons, the value of:

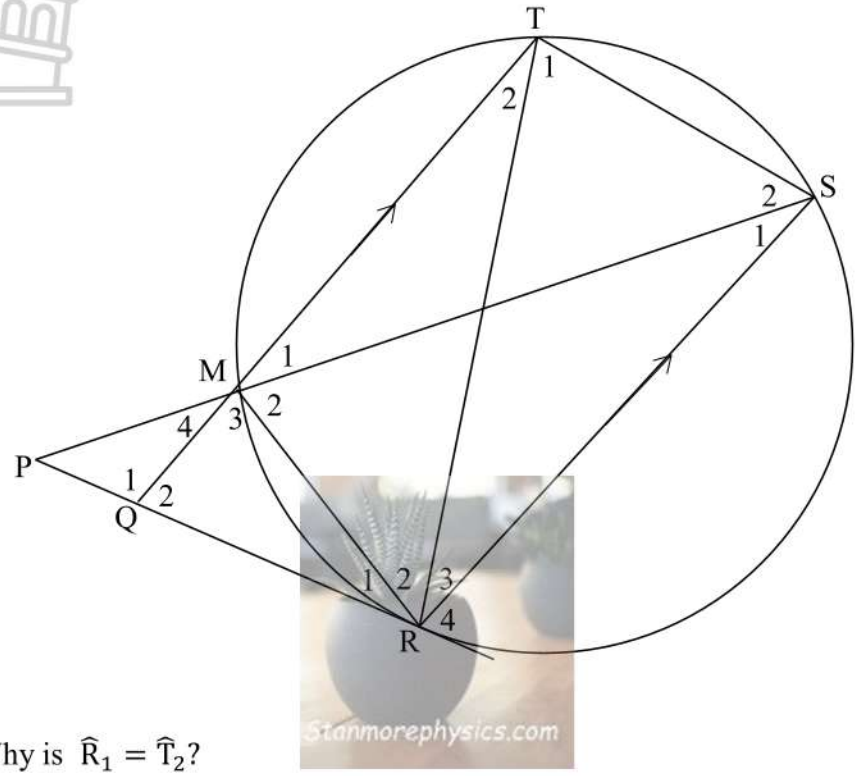
9.1 $\frac{EH}{HC}$. (2)

9.2 $\frac{\text{Area } \Delta BAG}{\text{Area } \Delta CAG}$. (3)

[5]

QUESTION 10

In the diagram alongside, RS∥QT and PR is a tangent to the circle at R. SMP is a straight line.



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10.1 Why is $\hat{R}_1 = \hat{T}_2$? (1)

10.2 Prove that $\Delta RTS ||| \Delta RQM$ (4)

10.3 Prove that $RQ \times TS = QM \times RT$ (1)

10.4 Calculate the numerical value of $\frac{PQ}{RT}$ if it is given that $\frac{PM}{ST} = \frac{2}{3}$ and $\frac{QM}{SM} = \frac{1}{2}$. (4)

[10]

TOTAL: 150

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

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

$T_n = a + (n-1)d$

$S_n = \frac{n}{2}[2a + (n-1)d]$

$T_n = ar^{n-1}$

$S_n = \frac{a(r^n - 1)}{r - 1}\ ; r \neq 1$

$S_\infty = \frac{a}{1 - r}\ ; -1 < r < 1$

$F = \frac{x[(1+i)^n - 1]}{i}$ $P = \frac{x[1 - (1+i)^{-n}]}{i}$

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

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

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

$(x-a)^2 + (y-b)^2 = r^2$

$In\ \triangle ABC$: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$a^2 = b^2 + c^2 - 2bc.\cos A$

$area\ \triangle ABC = \frac{1}{2}ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$ $\sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha\sin\beta$ $\cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha\sin\beta$

$\cos 2\alpha = cos^2\alpha - sin^2\alpha$ $\sin 2\alpha = 2\sin\alpha\cos\alpha$

$= 1 - 2sin^2\alpha$

$= 2cos^2\alpha - 1$

$\bar{x} = \frac{\sum fx}{n}$ $\sigma^2 = \frac{\sum_{i=1}^{n}(x_1 - x)^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)$

$\hat{y} = a + bx$ $b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$

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