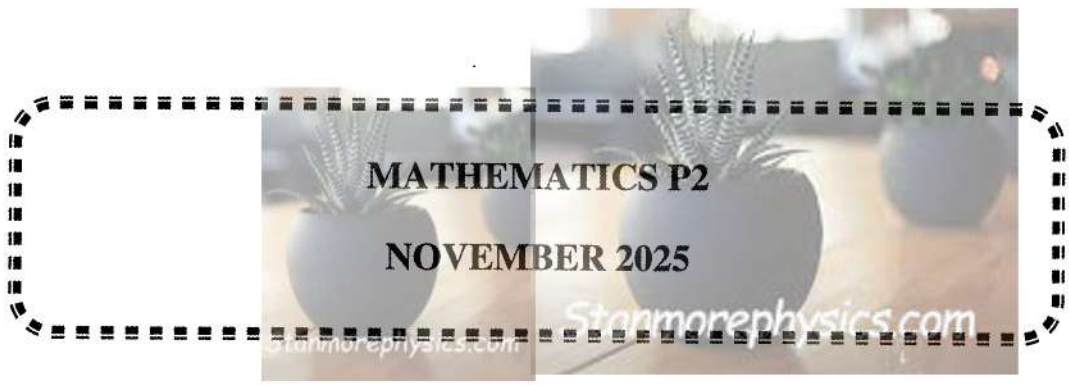
KWAZULU-NATAL PROVINCE

EDUCATION

REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11



MARKS: 150

TIME: 3 hours

This question paper consists of 13 pages and 1 information sheet.

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 11 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show numbering if additional space has been used to answer a question. If NOT, cross out all rough work done in the additional space.
4. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining your answers.
5. Answers only will NOT necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers correct to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. An information sheet with formulae is included at the end of the question paper.
10. Write neatly and legibly.

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QUESTION 1

Learners collected cans during "Operation Clean Up". The number of cans collected by 10 classes is shown in the table below.

250	259	265	276	290	290	294	310	315	330

1.1 Calculate the mean number of cans collected by these 10 classes. (2)

1.2 Write down the standard deviation of the above data. (1)

1.3 How many classes are within one standard deviation of the mean? (2)

1.4 Draw a box-and-whisker diagram of the data on the scaled line provided in the ANSWER BOOK. (2)

1.5 When another 10 classes added their cans to the original number of cans collected, the new mean is 250.

1.5.1 Calculate how many cans were collected by the 10 classes that were added. (2)

1.5.2 What effect does adding the cans of these 10 classes have on the original standard deviation? (1)

[10]

QUESTION 2

Learners were asked the time (to the nearest minute) that they usually take to get from home to school each morning. The results are shown in the table below:

Time in minutes	Number of learners
$5 < t \leq 10$	160
$10 < t \leq 15$	150
$15 < t \leq 20$	110
$20 < t \leq 25$	60
$25 < t \leq 30$	45
$30 < t \leq 35$	15

2.1 Write down the modal class of the data. (1)

2.2 Complete the cumulative frequency column in the table provided in the ANSWER BOOK. (1)

2.3 Draw the ogive of this data on the grid provided in the ANSWER BOOK. (3)

2.4 Estimate the percentage of learners who take more than 25 minutes to get to school. (2)

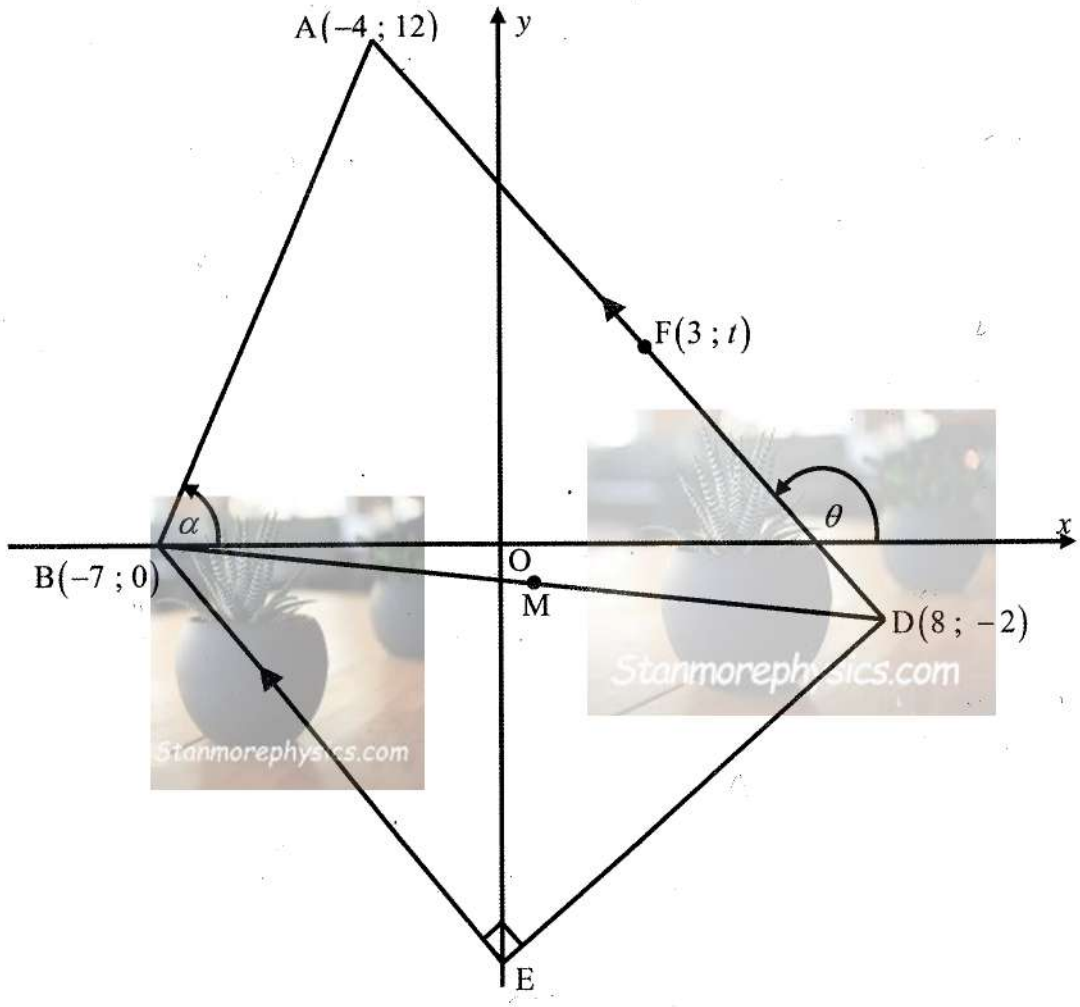
2.5 Estimate the mean time that these learners take to get to school in the morning. (3)

[10]

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QUESTION 3

In the diagram below, $A(-4\,;12)$, $B(-7\,;0)$, E and $D(8\,;-2)$ are the vertices of a trapezium. E lies on the y axis such that BE is perpendicular to DE. The equation of AB is $y=4x+28$. The angles of inclination of AB and AD are α and θ respectively. M is the midpoint of BD. $F(3\,;t)$ is a point on AD.



3.1 Calculate the length of AD. (2)

3.2 Calculate the coordinates of M, the midpoint of BD. (2)

3.3 Calculate the gradient of BE. (3)

3.4 Determine the equation of DE. (3)

3.5 Calculate the value of t, the y-coordinate of F. (3)

3.6 Calculate the coordinates of C, if ABCD, in that order, is a parallelogram. (2)

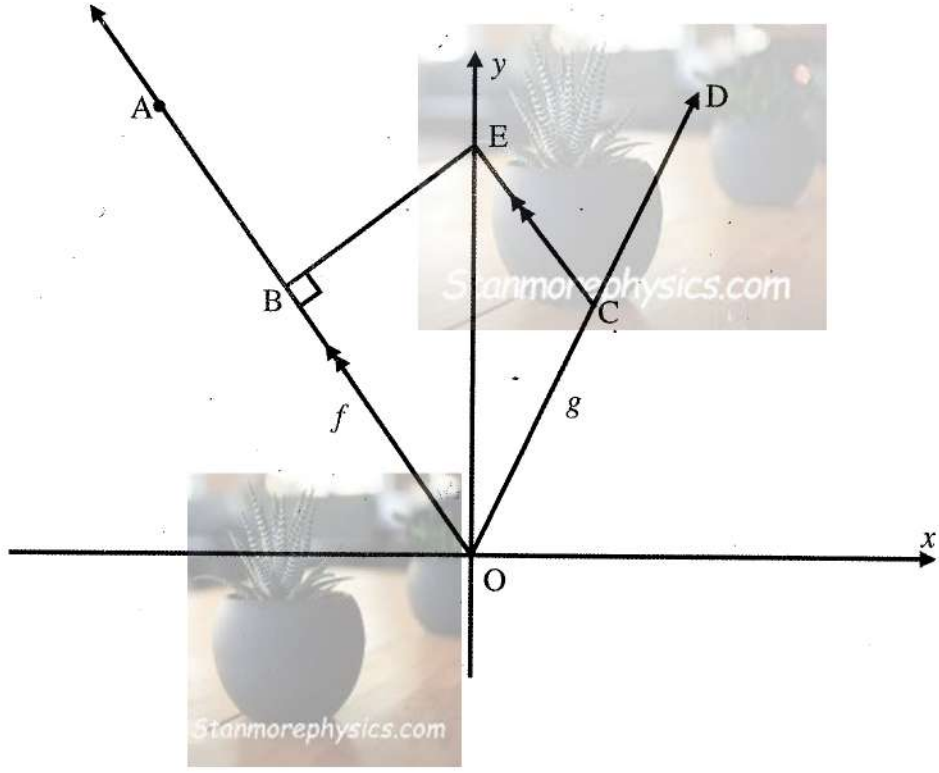
3.7 Calculate the size of $B\hat{C}D$, correct to the nearest degree. (5)

[20]

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QUESTION 4

In the diagram below, A is a point on the line with equation $y+2x=0$. B is a point on OA such that $OB=5\sqrt{5}$ units. E is a point on the y axis such that EB is perpendicular to OA. The equation of OD is $y=2x$ and CE // OA.



Determine the following:

4.1 The coordinates of B. (4)

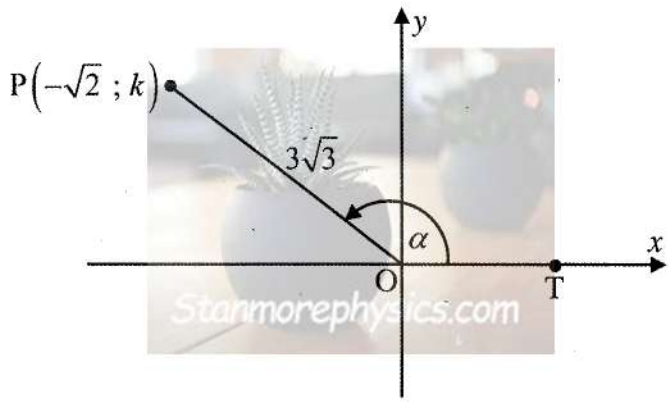
4.2 The area of the trapezium OBEC correct to the nearest square unit. (8)

[12]

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QUESTION 5

5.1 In the diagram below, P is the point $\left(-\sqrt{2}\ ;k\right)$ such that $OP=3\sqrt{3}$ units. $T\hat{O}P=\alpha$ is an obtuse angle.



WITHOUT using a calculator, determine the value of the following:

5.1.1 k. (2)

5.1.2 $\tan\left(\alpha-180°\right)$ (2)

5.1.3 $\cos\beta$, if it is further given that $\alpha+\beta=180°$. (2)

5.2 If $\sin 34°=p$, determine, in terms of p, the value of $\tan 484°$ **WITHOUT using a calculator.** (4)

5.3 Simplify the following **WITHOUT the use of a calculator:**

$$\frac{\tan 205°.\cos 315°.\sin\left(-45°\right)}{\sin 210°.\cos 150°.\tan 25°}$$ (5)

5.4 Simplify the following to a single trigonometric term:

$$\sin\left(180°+x\right).\cos\left(x-90°\right)-\frac{\sin x}{\sin\left(90°-x\right).\tan\left(180-x\right)}$$ (6)

5.5 Given the identity: $\frac{1+\sin x}{\cos x}+\frac{\cos x}{1+\sin x}=\frac{2}{\cos x}$

5.5.1 Prove the identity. (4)

5.5.2 For which values of x in the interval $0°\le x\le 360°$ will the above identity be undefined? (2)

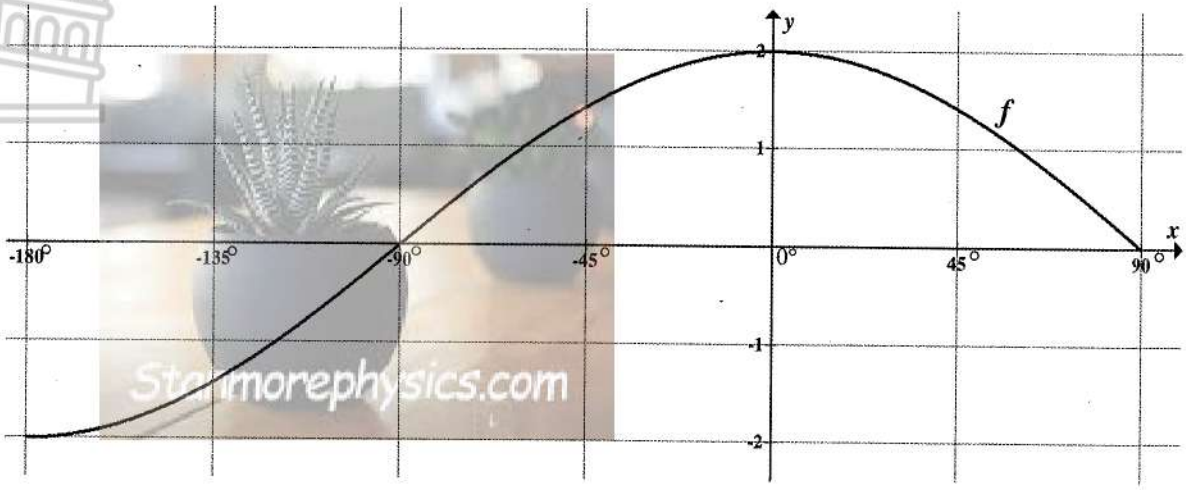
5.6 Determine the general solution of the equation: $\tan x.\sin x=\frac{3}{\sin x}-\cos x$ (6)

[33]

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QUESTION 6

Below is a sketch of the graph of $f(x) = a\cos x$ for $x \in [-180° ; 90°]$.



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6.1 Write down the value of a. (1)

6.2 Write down the period of $g(x) = -\cos 2x$. (1)

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6.3 Sketch the graph of $g(x) = -\cos 2x$ for $x \in [-180° ; 90°]$ on the set of axes provided in the ANSWER BOOK. (3)

6.4 Use the graphs to write down the value of x for which $f(x) - 1 = g(x) + 2$. (2)

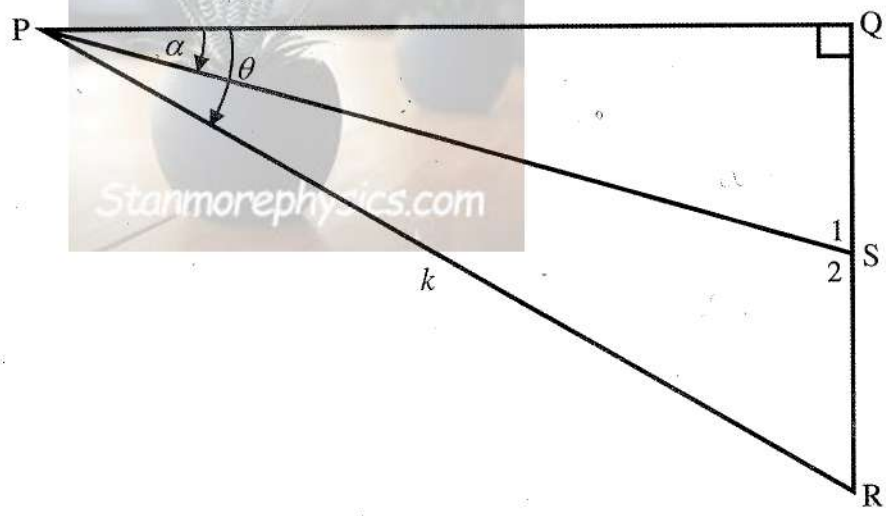
6.5 Determine minimum value of $1 - 2[\sin(90° - x)]$. (3)

[10]

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QUESTION 7

In the diagram below, $PQ \perp QR$. $Q\hat{P}S = \alpha$ and $Q\hat{P}R = \theta$ and $PR = k$ units.



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7.1 Write down the size of $R\hat{P}S$ in terms of α and θ. (1)

7.2 Show that $RS = \dfrac{k.\sin(\theta - \alpha)}{\cos\alpha}$ (3)

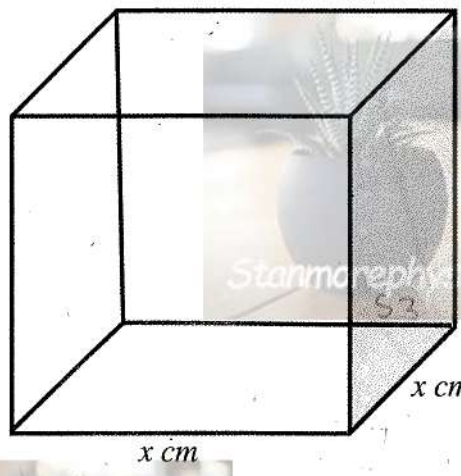
7.3 Calculate the length of RS if $k = 17$ units, $\theta = 58°$ and $\alpha = 23°$. (2)

7.4 Show that the area of $\Delta RSP = 48$ square units, correct to the nearest square unit. (2)

[8]

QUESTION 8

The diagram below represents an open tank with a square base (side dimensions of x *cm*) and a height of h *cm*. The tank has a volume of $490\ cm^3$.



8.1 Determine the height, h, of the tank in terms of x. (2)

8.2 Show that A, the external surface area of the tank is given by: $A = x^2 + \frac{1960}{x}\ cm^2$. (2)

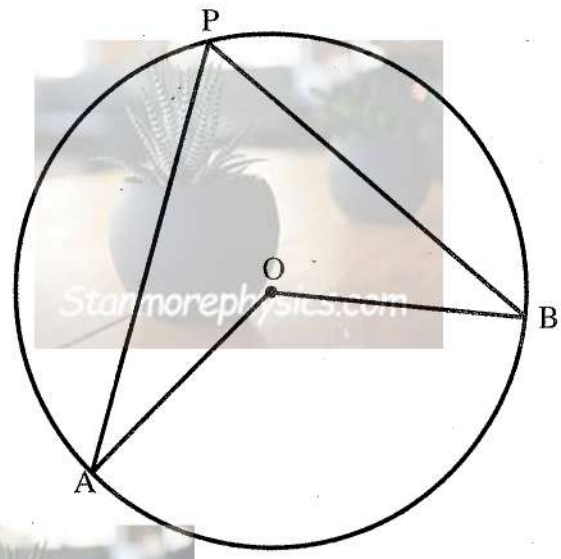
8.3 Calculate the external surface area of the tank if the height is 10 *cm*. (4)

[8]

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QUESTION 9

9.1 In the diagram below, A, B and P are points on the circle with centre O. PA, PB, AO and BO are joined.

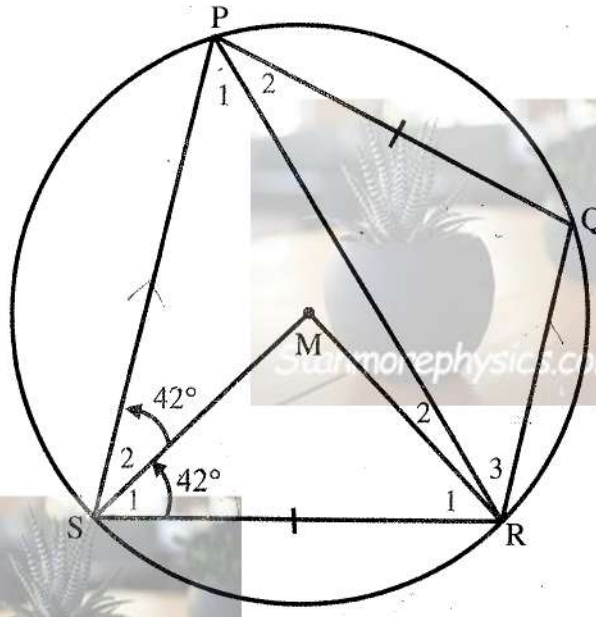


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Use the diagram in the ANSWER BOOK to prove the theorem which states that the angle subtended by an arc or chord at the centre of the circle is twice the angle subtended by the same arc or chord at the circumference, that is, prove that $A\hat{O}B = 2A\hat{P}B$.

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9.2 In the diagram below, PQRS is a cyclic quadrilateral. M is the centre of the circle. MS bisects $P\hat{S}R$ such that $\hat{S}_1 = \hat{S}_2 = 42°$ and $PQ = SR$.



9.2.1 Name, giving a reason, another angle equal to $42°$. (2)

9.2.2 Calculate, giving reasons, the sizes of:

(a) $P\hat{Q}R$ (2)

(b) $\hat{P}_1$ (3)

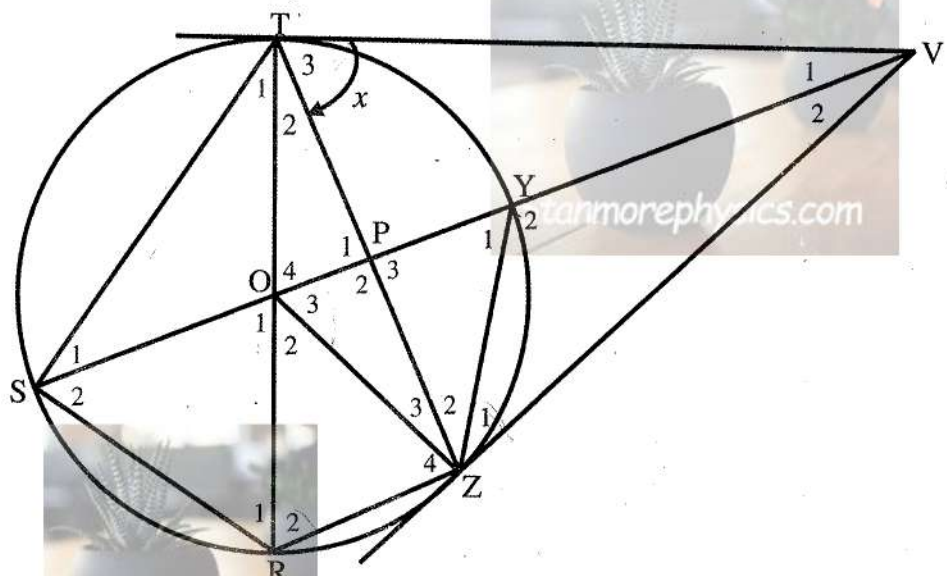
9.2.3 Prove that SP // QR. (3)

[15]

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QUESTION 10

In the diagram, VT and VZ are tangents to the circle with centre O at T and Z respectively. T, S, R, Z and Y are points on the circle such that TR is the diameter. P is the midpoint of chord TZ. $\hat{T}_3 = x$.



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Prove that:

10.1 TOZV is a cyclic quadrilateral.

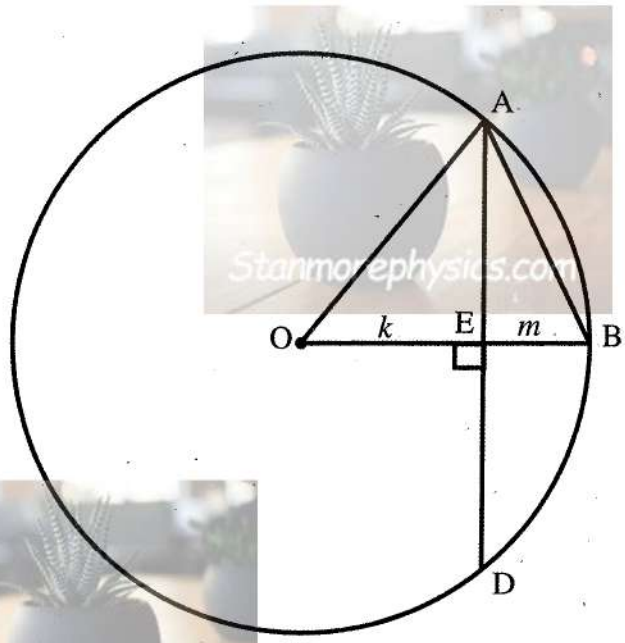
10.2 RZ // SY

10.3 $\hat{T}_1 = \frac{1}{2}x$

10.4 $\hat{Y}_2 = 90° + \hat{T}_1$

QUESTION 11

In the diagram below, AD is a chord of circle with centre O. OB is drawn perpendicular to AD and cuts AD at E. OE = k and EB = m. OA and AB are drawn.



11.1 Prove that $AB^2 = 2km + 2m^2$ (4)

11.2 Write down, giving a reason, the length of DE in terms of k and m. (2)

[6]

TOTAL: 150 MARKS

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INFORMATION SHEET

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

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

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

$T_n = ar^{n-1}$ $\quad S_n = \frac{a(r^n - 1)}{r-1}$; $r \neq 1$ $\quad S_\infty = \frac{a}{1-r}$; $-1 < r < 1$

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

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

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

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

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

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

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

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

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

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

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$$

$\sin 2\alpha = 2\sin\alpha.\cos\alpha$

$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$ $\quad \sigma^2 = \frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n}$

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

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

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