education

MPUMALANGA PROVINCE

REPUBLIC OF SOUTH AFRICA

FURTHER EDUCATION AND TRAINING

GRADE 12

MATHEMATICS P2

AUGUST 2024 (PRE-TRIAL)

MARKS: 150

TIME: 3 HOURS

This question paper consists of 12 pages, 1 information sheet and an answer book.

INSTRUCTIONS AND INFORMATION

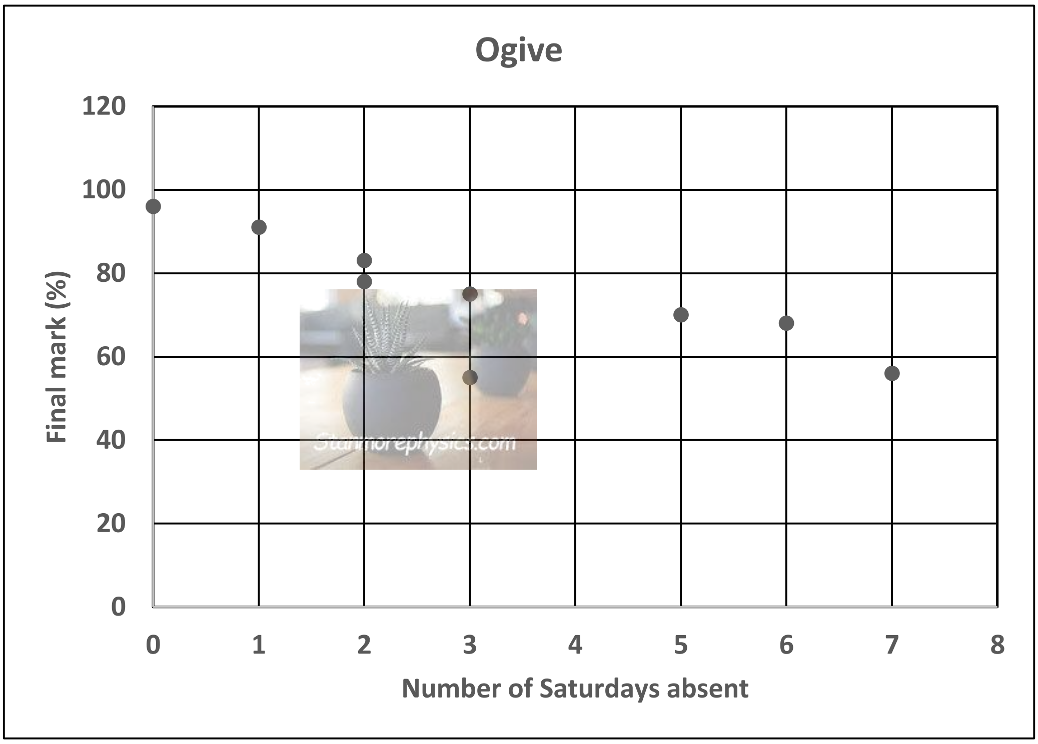
Read the following instructions carefully before answering the questions.

1. The question paper consists of 10 questions.
2. Answer ALL the questions in the special ANSWER BOOK.
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.

QUESTION 1

A group of 9 students attended a course in Statistics on Saturdays over a period of 10 months. The number of Saturdays on which a student was absent was recorded below and the scatterplot is drawn for the data.

Number of Saturdays absent	**0**	**1**	**2**	**2**	**3**	**3**	**5**	**6**	**7**
Final mark (%)	**96**	**91**	**78**	**83**	**75**	**55**	**70**	**68**	**56**



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

1.2 Draw the least squares regression line on the grid provided on the given ANSWER BOOK. (2)

1.3 Calculate the correlation coefficient. (1)

1.4 Comment on the strength of the correlation. (2)

1.5 If a student scored 52%, would it be accurate to predict that he or she was absent for 8 days? Motivate your answer. (3)

[11]

QUESTION 2

2.1 A chess team consisting of 10 players scored the following points during the year.

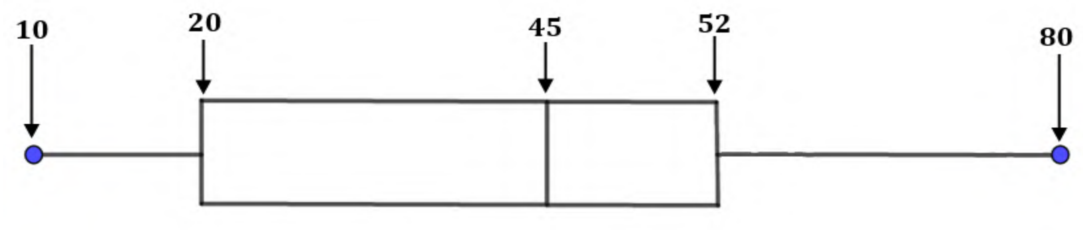
23 34 39 40 42 53 56 62 68 76

2.1.1 Calculate the average score of the data. (2)

2.1.2 Calculate the standard deviation of the data. (1)

2.1.3 How many players whose scores lie within ONE standard deviation from the mean? (3)

2.2 The data set contains a total of nine numbers. The second and third numbers of the data set are the same and the fourth number is 32. The seventh and eighth numbers are different. The eighth number is one more than the 75^{th} percentile. The mean for the data is 40.

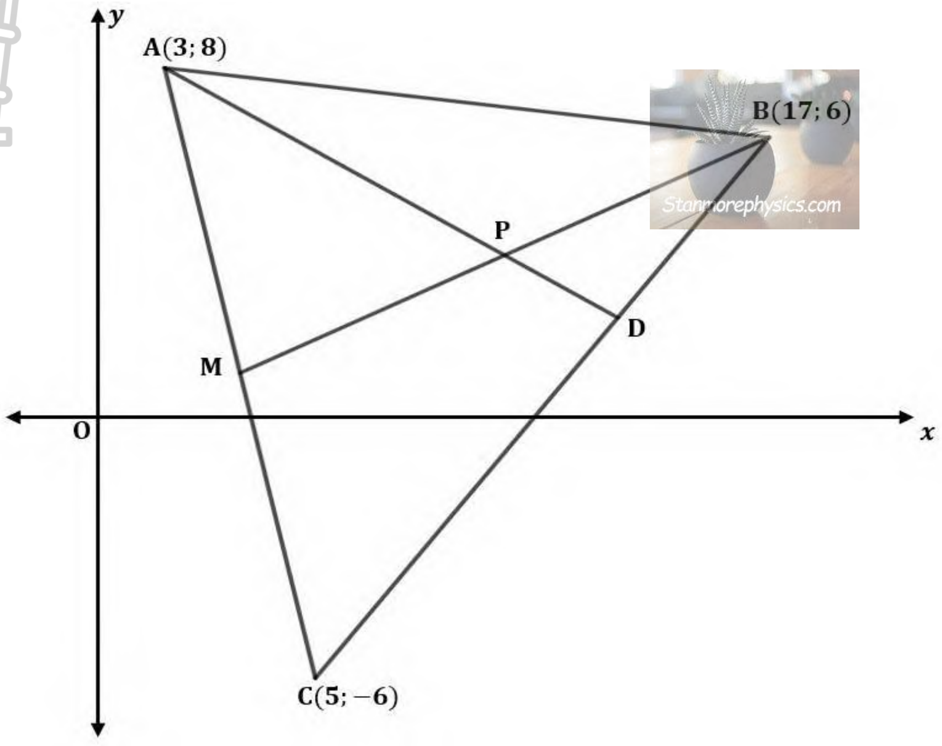


Write down a possible list of nine numbers which will result in the above box and whisker plot. (6)

[12]

QUESTION 3

The figure below represents ΔABC with $A(3;8), B(17;6) and\ C(5;-6)$. The altitude AD cuts the median BM at P.



Determine:

3.1 the coordinates of M, the midpoint of AC. (2)

3.2 the length of MB. (2)

3.3 the equation of the median, BM. (4)

3.4 If CE is drawn parallel to AB such that ABEC is a parallelogram and E is in the 4th quadrant, determine the $x-$coordinate of E. (2)

3.5 the equation of the altitude AD. (3)

3.6 the coordinates of P. (4)

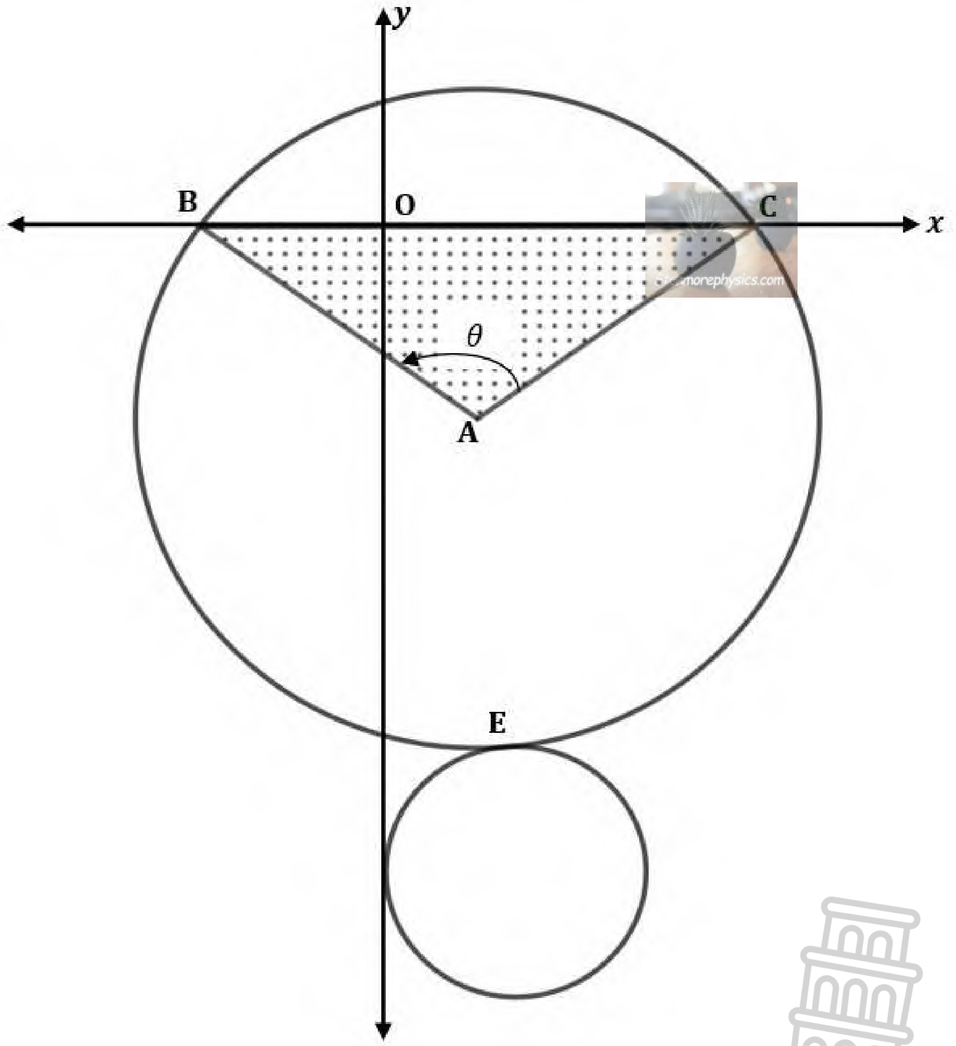
[17]

QUESTION 4

In the diagram below, the large circle with centre A, has the equation $x^2 - 2x + y^2 + 6y = 15$.

A smaller circle with the equation $(x-1)^2 + (y-b)^2 = 1$, touches the larger circle at E.

The larger circle cuts the x-axis at B and C. The area of the triangle ΔABC is shaded.



4.1 Determine the coordinates of the centre A, and the radius of the circle. (5)

4.2 Determine the coordinates of B and C. (4)

4.3 Determine the equation of the tangent to the larger circle at C. (4)

4.4 Determine the value of b. (2)

4.5 Determine the size of θ rounded off to one decimal place. Assume that θ is an obtuse angle. (4)

4.6 Determine the area of the unshaded part of the larger circle. (4)

[23]

QUESTION 5

5.1 If $\sin\theta = -\frac{5}{13}$ *and* $\cos\theta < 0$, calculate without using a calculator and with the aid of a diagram the value of:

5.1.1 $\sin 2\theta$ (5)

5.1.2 $\cos(\theta + 30°)$ (4)

5.2 Evaluate without using a calculator:

$$\frac{\sin 35° \cos 35°}{\tan 225° \cos 200°}$$ (5)

5.3 Given that: $\frac{1 - \tan A}{1 + \tan A} = \frac{\cos 2A}{1 + \sin 2A}$

5.3.1 Prove the identity. (4)

5.3.2 Hence, without using a calculator, determine the value of:

$$\frac{1 - \tan 22{,}5°}{1 + \tan 22{,}5°}$$ (3)

5.4 Given: $P = \sqrt{\sin x \, . \cos x}$

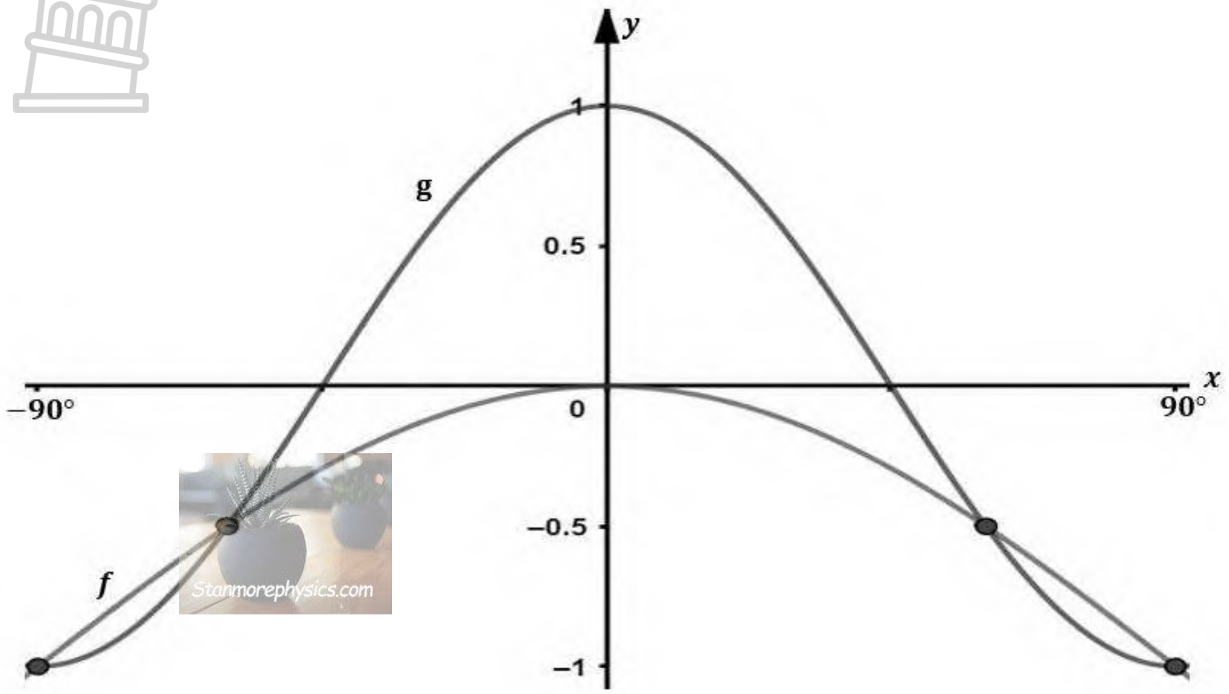
5.4.1 Determine the maximum value of P. (2)

5.4.2 Determine the general solution of $\sin x \cos x = -0{,}24$ (5)

[28]

QUESTION 6

The graphs of $f(x) = \cos x + q$ and $g(x) = \cos bx$ are sketched below for $x \in [-90°; 90°]$:



6.1 Determine:

6.1.1 the value of q if f touches the x-axis at the origin. (1)

6.1.2 the amplitude of f. (1)

6.1.3 the value of b if the period of g is half the period of f. (1)

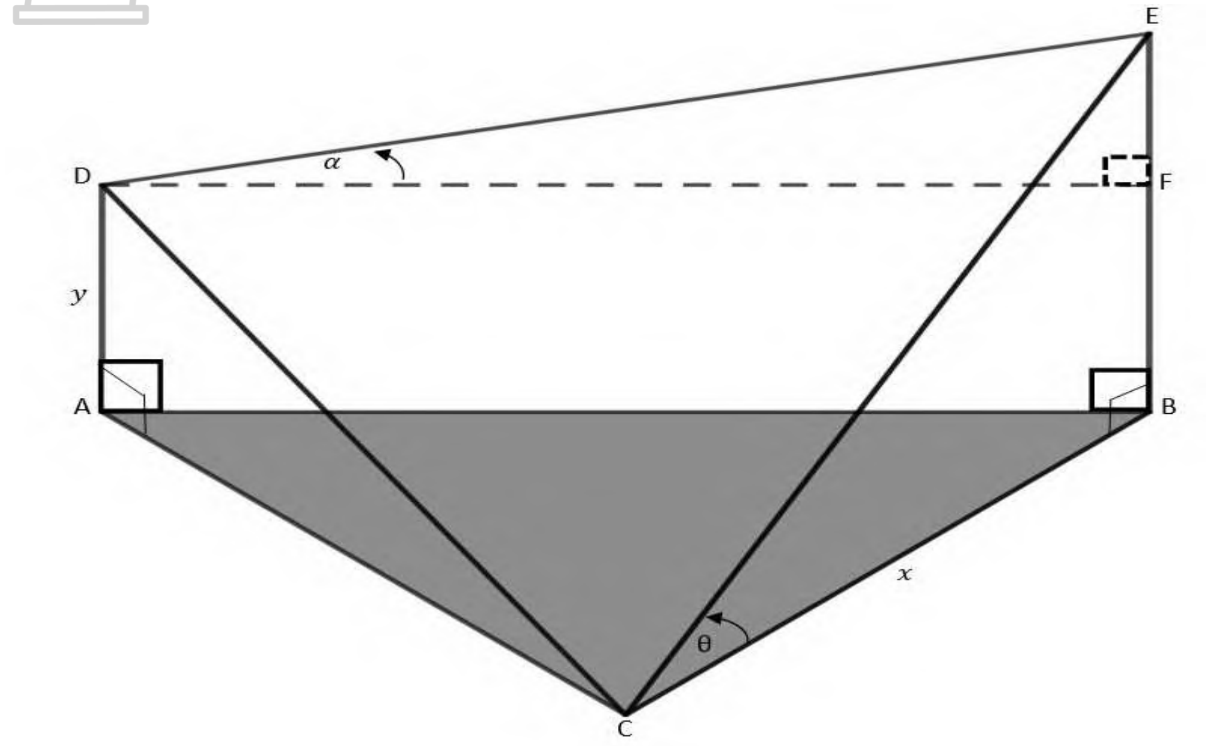
6.1.4 the coordinates of the x-intercept of g. (2)

6.2 Use the graphs to determine the values of x in the interval $x \in [-90°; 90°]$ for which:
$x.f'(x) < 0$. (3)

[8]

QUESTION 7

A telephone cable is to be created between 2 cliff sides AD and BE. An engineer stands at point C in the same horizontal plane as the foot of the cliffs. He measures the angle of E from C and D to be θ and α respectively. Cliff DA is y metres and x metres from the foot of cliff BE.



7.1 Show that the length of the telephone cable is given by:

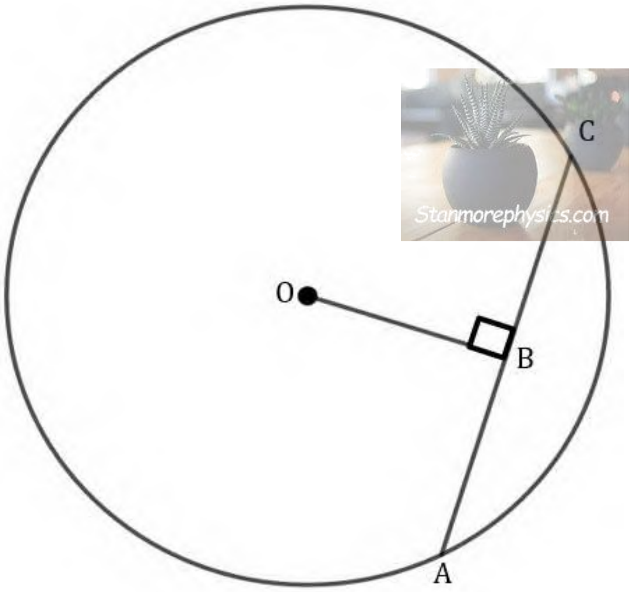
$$DE = \frac{xtan\theta - y}{sin\ \alpha}$$ (5)

7.2 If $x = 1000m, y = 250m\ and\ \theta = \alpha = 45°$. Calculate the distance between the cliffs? (3)

[8]

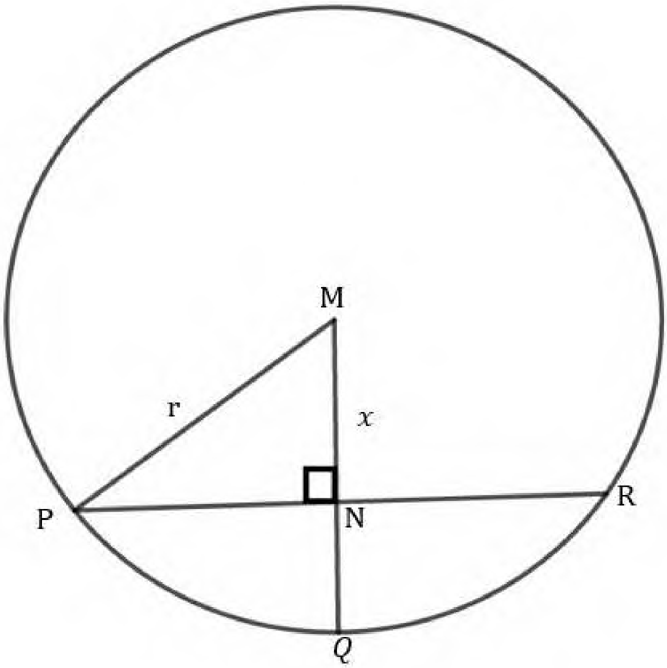
QUESTION 8

8.1 In the diagram below, O, is the centre of the circle and ABC is chord. OB ⊥ ABC.



Prove the theorem which states that $AB = BC$. (5)

8.2 PR is a chord of a circle with centre M and radius r. The perpendicular line from M on PR intersects PR at N and the circle at Q. PR $= 120mm$, MN $= x$ and QN $= 20mm$.



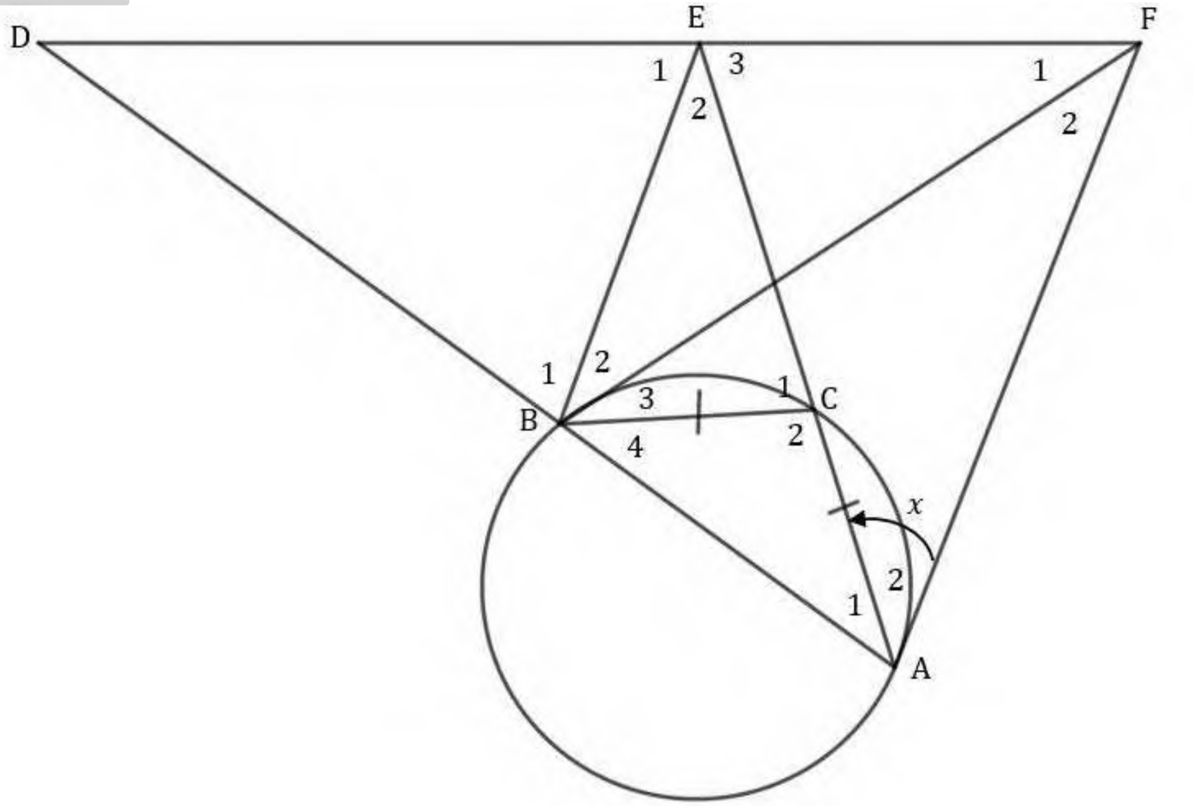
8.2.1 Write down r in terms of x. (1)

8.2.2 Hence calculate the numerical value of r, the radius of the circle. (6)

[12]

QUESTION 9

FA and FB are tangents to the circle ABC with $BC = AC$. $FD \parallel CB$ and $C\hat{A}F = x$. Chord AB is produced to D and chord AC is produced to meet DF at E. BC is joined.



9.1 Write down FIVE other angles equal to x. (9)

9.2 Hence deduce that:

9.2.1 ABEF is a cyclic quadrilateral. (2)

9.2.2 $AF = BD$ (2)

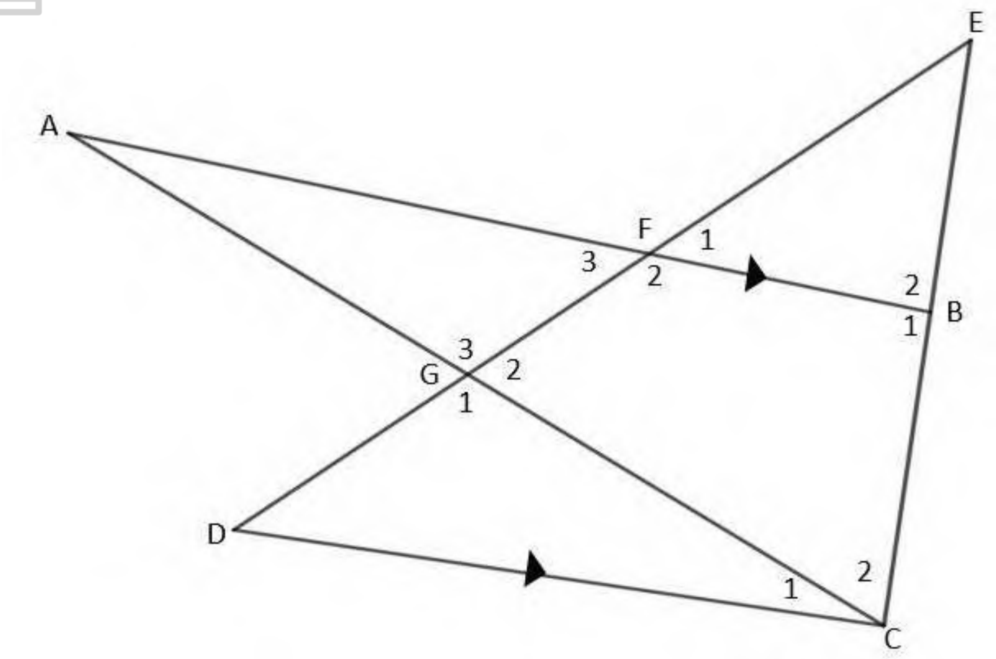
9.3 Prove that $AF : FB = DE : AE$ (6)

[19]

QUESTION 10

In the diagram below, F lies on lines ED and AB and G lies on lines ED and AC. DGFE is a straight line and:

BFA ||DC , AB = 40cm , BC = 20cm , EF = 16cm , EB = 10cm and FB = 12cm



10.1 With reasons, determine the value of $\frac{EF}{ED}$. (2)

10.2 Determine the length of ED. (2)

10.3 Without any reasons complete: $\Delta EFB ||| \Delta$ ... (1)

10.4 Hence, with reasons, determine the length of DC. (2)

10.5 Show that $\frac{3\ Area\ of\ \Delta EFB}{16\ Area\ of\ \Delta DGC} = \frac{1}{DG}$ (5)

[12]

TOTAL: 150

INFORMATION SHEET

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$= 1 - 2sin^2\alpha$

$= 2cos^2\alpha - 1$

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

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

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

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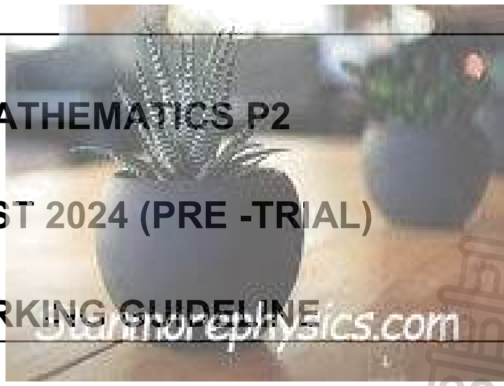
MARKING GUIDELINE

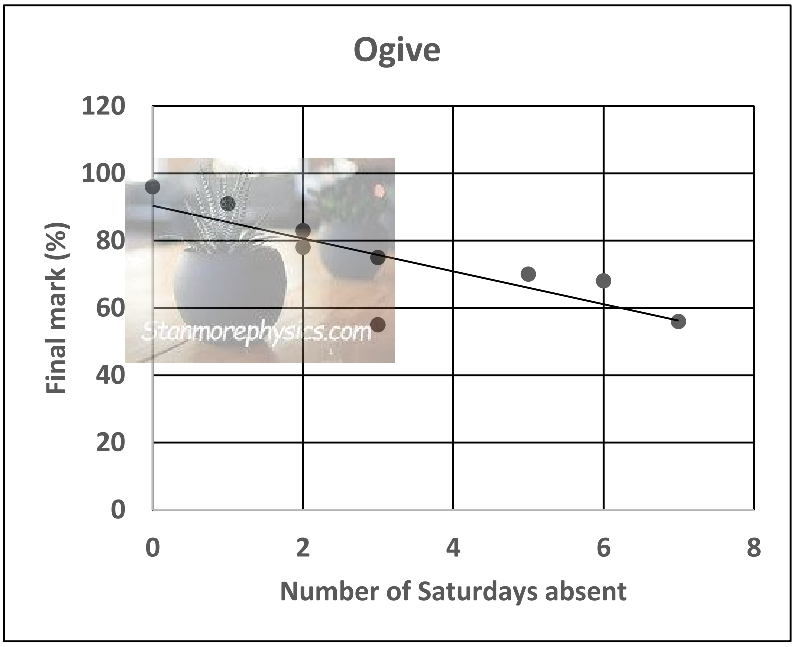


MARKS: 150

This question paper consists of 13 pages.

NOTE:

- If a candidate answered a question TWICE, mark only the FIRST attempt.
- If a candidate crossed out an answer and did not redo it, mark the crossed-out answer.
- Consistent accuracy applies to ALL aspects of the marking guidelines.
- Assuming values/ answers to solve a problem is unacceptable.

QUESTION 1		
1.1	$A = 90{,}375$ $B = -4{,}875$ $\hat{y} = 90{,}38 - 4{,}88x$	✓ *value of A* ✓ *value of B* ✓ *equation* (3)
1.2		✓ y-intercept ✓ *passing through mean pt* (3,2; 74,67)) (2)
1.3	$r = -0{,}80$	✓ *answer* (1)
1.4	Negative strong correlation	✓ *negative* ✓ *strong* (2)
1.5	$52 = 90{,}38 - 4{,}88x$ $x = 7{,}86$ It is accurate since 7, 86 is closer to 8. OR	✓ $52 = 90{,}38 - 4{,}88x$ ✓ $x = 7{,}86$ ✓ *conclusion* (3)

	$y = 90{,}38 - 4{,}88(8)$ $= 51{,}34\%$ Which is closest to 52%	✓ $y = 90{,}38 - 4{,}88(8)$ ✓ $y = 51{,}34\%$ ✓ *conclusion* (3)
		[11]

QUESTION 2		
2.1.1	$\bar{x} = \dfrac{493}{10}$ $= 49{,}3$	✓ $\frac{493}{10}$ ✓ *answer* (2) AO: Full Marks
2.1.2	$\sigma_x = 15{,}67$	✓ *answer* (1)
2.1.3	$(\bar{x} - \sigma_x;\ \bar{x} + \sigma_x)$ $= (49{,}3 - 15{,}67\ ;49{,}3 + 15{,}67)$ $= (33{,}67\ ;64{,}97)$ 7 *players*	✓ *substitution* ✓ *interval* ✓ 3 (3)
2.2	$10 \quad x \quad x \quad 32 \quad 45 \quad y \quad 51 \quad 53 \quad 80$ $x = 20$ $\dfrac{y + 312}{9} = 40$ $312 + y = 360$ $y = 49$	✓ $x = 20$ ✓ 51 ✓ 53 ✓ 312 ✓ $\frac{y+312}{9} = 40$ ✓ $y = 49$ (6)
		[12]

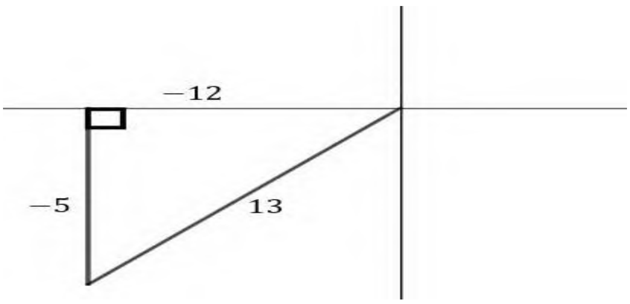
QUESTION 3		
3.1	$M\left(\frac{3+5}{2};\frac{8-6}{2}\right)$ $= M(4;1)$	✓ $x = 4$ ✓ $y = 1$ (2)
3.2	$MB = \sqrt{(17-4)^2 + (6-1)^2}$ $= \sqrt{194} \approx 13{,}93$	✓ *substitution* ✓ *answer* (2)
3.3	$m_{MB} = \frac{6-1}{17-4} = \frac{5}{13}$ $1 = \dfrac{5}{13}(4) + c$	✓ *subst* ✓ *gradient* ✓ *subst* $M(4;1)$*or* $B(17;6)$ ✓ *equation*

	$c = -\frac{7}{13}$ $y = \frac{5}{13}x - \frac{7}{13}$ **OR** $m_{MB} = \frac{6-1}{17-4} = \frac{5}{13}$ $y - 6 = \frac{5}{13}(x - 17)$ $y = \frac{5}{13}x - \frac{7}{13}$	(4) **OR** ✓ *subst* ✓ *gradient* ✓ *subst* $M(4;1)$ *or* $B(17;6)$ ✓ *equation* (4)
3.4	$\frac{5+17}{2} = 11$ $11 = \frac{3+x_2}{2}$ $x_2 = 19$ $\therefore x = 19$	✓ *subst* ✓ *answer* (2)
3.5	$m_{AD} = -1$ $y = -x + c$ $8 = -3 + c$ $c = 11$ $\therefore y = -x + 11$ **OR** $m_{AD} = -1$ $y - 8 = -(x - 3)$ $\therefore y = -x + 11$	✓ $m_{AD} = -1$ ✓ *subst grad and* $(3;8)$ ✓ *equation* (3) **OR** ✓ $m_{AD} = -1$ ✓ *subst grad and* $(3;8)$ ✓ *equation* (3)
3.6	$\frac{5}{13}x - \frac{7}{13} = -x + 11$ $5x - 7 = -13x + 143$ $18x = 150$ $x = \frac{25}{3}$ $y = \frac{8}{3}$ $\therefore P\left(\frac{25}{3}; \frac{8}{3}\right)$	✓ *equating* ✓ $18x = 150$ ✓ *value of x* ✓ *value of y* (4)
		[17]

QUESTION 4

4.1	$x^2 - 2x + 1 + y^2 + 6y + 9 = 15 + 1 + 9$ $(x-1)^2 + (y+3)^2 = 25$ $A(1;-3)$ $r = 5$	✓ $(x-1)^2 + (y+3)^2$ ✓ 25 ✓ $value\ of\ x$ ✓ $value\ of\ y$ ✓ $r = 5$ (5)
4.2	$let\ y = 0$ $x^2 - 2x = 15$ $x^2 - 2x - 15 = 0$ $(x+3)(x-5) = 0$ $x = -3\ or\ x = 5$ $B(-3;0)\ and\ C(5;0)$ **OR** $(x-1)^2 + (0+3)^2 = 25$ $(x-1)^2 = 16$ $x - 1 = \pm 4$ $x = -3\ or\ x = 5$ $B(-3;0)$ and $C(5;0)$	✓ $y = 0$ ✓ $standard\ form$ ✓ $B(-3;0)$ ✓ $C(5;0)$ (4) **OR** ✓ $y = 0$ ✓ $(x-1)^2 = 16$ ✓ $B(-3;0)$ ✓ $C(5;0)$ (4)
4.3	$m_{AC} = \dfrac{0-(-3)}{5-1}$ $= \dfrac{3}{4}$ $m_{tan} = -\dfrac{4}{3}$ $y - 0 = -\dfrac{4}{3}(x-5)$ $\therefore y = -\dfrac{4}{3}x + \dfrac{20}{3}$	✓ $m_{AC} = \frac{3}{4}$ ✓ $m_{tan} = -\frac{4}{3}$ ✓ $subst\ C(5;0)$ ✓ $y = -\frac{4}{3}x + \frac{20}{3}$ (4)
4.4	$r_1 + r_2 = 6$ $-3 - b = 6$ $b = -9$	✓ 6 ✓ $b = -9$ (2)
4.5	$BC = 8$ $(8)^2 = (5)^2 + (5)^2 - 2(5)(5)\cos\theta$ $\cos\theta = -\dfrac{7}{25}$ $\theta = 106{,}3°$ ***OR***	✓ $BC = 8$ ✓ $substitution$ ✓ $\cos\theta = -\frac{7}{25}$ ✓ $answer$ (4)

	$m_{AB} = \frac{-3-0}{1-(-3)}$ $= -\frac{3}{4}$ $\tan\alpha = -\frac{3}{4}$ $\alpha = 143{,}13°$ $\tan\beta = \frac{3}{4}$ $\beta = 36{,}87°$ $\theta = 106{,}3°$ **OR** $\tan\beta = \frac{3}{4}$ $\beta = 36{,}87°$ $\therefore B\hat{C}A = 36{,}87°$ $A\hat{B}C = 36{,}87°$ $\mid <s\ opp = sides$ $\therefore \theta = 106{,}3°$ $\mid sum\ of <s\ of\ \Delta ABC$	**OR** ✓ $\tan\alpha = -\frac{3}{4}$ ✓ $143{,}13°$ ✓ $\tan\beta = \frac{3}{4}$ ✓ *answer* (4) **OR** ✓ $\tan\beta = \frac{3}{4}$ ✓ $\therefore B\hat{C}A = 36{,}87°$ ✓ $A\hat{B}C = 36{,}87°$ ✓ *answer* (4)
4.6	$\text{area}\Delta ABC = \frac{1}{2}(8)(3)$ $= 12$ $\text{area of circle} = \pi(5)^2 = 25\pi$ $\text{area unshaded} = 25\pi - 12$ $= 66{,}54 \text{ units}^2$ **OR** $\text{area}\Delta ABC = \frac{1}{2}(5)(5)\sin 106{,}3°$ $= 12{,}00$ $\text{area of circle} = \pi(5)^2 = 25\pi$ $\text{area unshaded area} = 25\pi - 12$ $= 66{,}54 \text{ units}^2$	✓ *substitution* ✓ 12 ✓ 25π ✓ *answer* (4) **OR** ✓ *substitution* ✓ 12 ✓ 25π ✓ *answer* (4)
		[23]

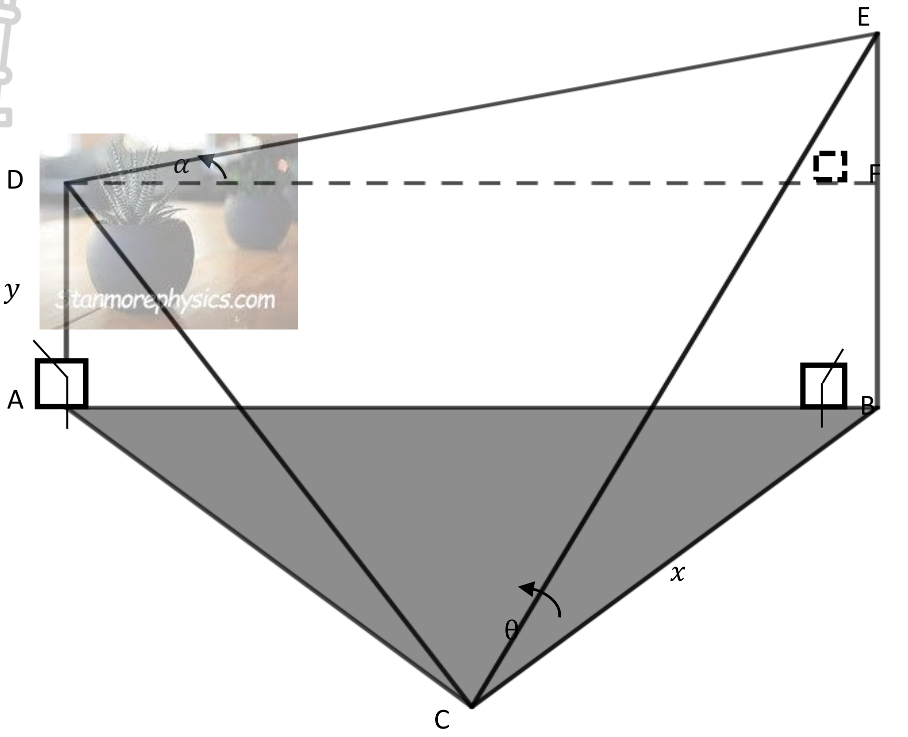
QUESTION 5		
5.1.1	$x^2 + (-5)^2 = (13)^2$ $x^2 = 144$ $x = -12$  $\sin 2\theta = 2\sin\theta\cos\theta$ $= 2\left(\frac{-5}{13}\right)\left(\frac{-12}{13}\right)$ $= \frac{120}{169}$	✓ *3rd quad* ✓ $x = -12$ ✓ $2\sin\theta\cos\theta$ ✓ Substution ✓ Answer (5)
5.1.2	$\cos(\theta + 30°) = \cos\theta\cos 30° - \sin\theta\sin 30°$ $= \left(-\frac{12}{13}\right)\left(\frac{\sqrt{3}}{2}\right) - \left(-\frac{5}{13}\right)\left(\frac{1}{2}\right)$ $= \frac{-12\sqrt{3}+5}{26}$	✓ *expansion* ✓ *subst* $-\frac{12}{13}$ *and* $-\frac{5}{13}$ ✓ *subst* $\frac{\sqrt{3}}{2}$ *and* $\frac{1}{2}$ ✓ *answer* (4)
5.2	$\frac{\sin 35° \cos 35°}{\tan 225° \cos 200°}$ $= \frac{\sin 35° \cos 35°}{\tan 45°(-\sin 70°)}$ $= \frac{\sin 35° \cos 35°}{(-1)\sin 70°)}$ $= \frac{\sin 35° \cos 35°}{(-1)2\sin 35° \cos 35°}$ $= -\frac{1}{2}$ **OR** $\frac{\sin 35° \cos 35°}{\tan 45°(-\cos 20°)} \times \frac{2}{2}$ $= \frac{\sin 70°}{2(-1)\cos 20°}$ $= \frac{\sin 70°}{-2\sin 70°}$	✓ $\tan 45°$ ✓ $-\sin 70°$ ✓ -1 ✓ $2\sin 35° \cos 35°$ ✓ $-\frac{1}{2}$ (5) **OR** ✓ $\tan 45°$ ✓ $-\cos 20°$ ✓ -1 ✓ $\sin 70°$ *in numerator* ✓ $\sin 70°$ *in denominato* (5)

	$= -\frac{1}{2}$	
5.3.1	$LHS: \frac{1-\tan A}{1+\tan A}$ $= \frac{1-\frac{\sin A}{\cos A}}{1+\frac{\sin A}{\cos A}}$ $= \frac{\cos A - \sin A}{\cos A + \sin A} \times \frac{\cos A + \sin A}{\cos A - \sin A}$ $= \frac{\cos^2 A - \sin^2 A}{\cos^2 A + 2\cos A \sin A + \sin^2 A}$ $= \frac{\cos 2A}{1+\sin 2A} = \text{RHS}$ **OR** $\frac{1-\tan A}{1+\tan A}$ $= \frac{1-\frac{\sin A}{\cos A}}{1+\frac{\sin A}{\cos A}}$ $= \frac{\cos A - \sin A}{\cos A + \sin A}$ $RHS: \frac{\cos 2A}{1+\sin 2A}$ $= \frac{\cos^2 A - \sin^2 A}{1+2\sin A\cos A}$ $= \frac{\cos^2 A - \sin^2 A}{\sin^2 A + \cos^2 A + 2\sin A \cos A}$ $= \frac{(\cos A - \sin A)(\cos A + \sin A)}{(\sin A + \cos A)(\sin A + \cos A)}$ $= \frac{\cos A - \sin A}{\cos A + \sin A}$ $\text{LHS} = \text{RHS}$	✓ $\frac{\sin A}{\cos A}$ ✓ $\frac{\cos A - \sin A}{\cos A + \sin A}$ ✓ $\cos^2 A - \sin^2 A$ ✓ $\cos^2 A + 2\cos A \sin A + \sin^2 A$ (4) OR ✓ $\frac{\sin A}{\cos A}$ ✓ $\frac{\cos A - \sin A}{\cos A + \sin A}$ ✓ $\frac{\cos^2 A - \sin^2 A}{1+2\sin A\cos A}$ ✓ $\frac{(\cos A - \sin A)(\cos A + \sin A)}{(\sin A + \cos A)(\sin A + \cos A)}$ (4)
5.3.2	$\frac{1-\tan 22{,}5°}{1+\tan 22{,}5°}$ $= \frac{\cos 45°}{1+\sin 45°}$ $= \frac{\frac{\sqrt{2}}{2}}{1+\frac{\sqrt{2}}{2}}$ $= \frac{\sqrt{2}}{2+\sqrt{2}}$ or $-1+\sqrt{2}$	✓ $\frac{\cos 45°}{1+\sin 45°}$ ✓ $\frac{\frac{\sqrt{2}}{2}}{1+\frac{\sqrt{2}}{2}}$ ✓ *answer* (3)
5.4.1	$P = \sqrt{\frac{2\sin x \cos x}{2}}$ $= \sqrt{\frac{1}{2}\sin 2x}$	✓ $P = \sqrt{\frac{2\sin x \cos x}{2}}$ ✓ Answer (2)

	$\therefore maximum \{\sqrt{\sin x \cdot \cos x}\} = \frac{1}{\sqrt{2}}$	
5.4.2	$\sin x \cos x = -0{,}24$ $\sin 2x = -0{,}48$ Ref <: $2x = 28{,}69°$ $2x = 208{,}69° + k360°; k \in Z$ $x = 104{,}35° + k180°$ Or $2x = 331{,}31° + k360°$ $x = 165{,}66° + k180°$ **OR** $\sin 2x = -0{,}48$ $2x = -28{,}69° + k360°; k \in Z$ $x = -14{,}35° + k180°$ or $2x = -151{,}31° + k360°$ $x = -75{,}66° + k180°$	✓ $\sin 2x = -0{,}48$ ✓ $2x = 208{,}69° + k360°$ ✓ $x = 104{,}35° + k180°$ ✓ $x = 104{,}35° + k180°$ ✓ $k \in Z$ (5) **OR** ✓ $\sin 2x = -0{,}48$ ✓ $2x = -28{,}69° + k360°$ ✓ $x = -14{,}35° + k180°$ ✓ $x = -75{,}66° + k180°$ ✓ $k \in Z$ (5)
		[28]

QUESTION 6		
6.1.1	$y = -1$	✓ *answer* (1)
6.1.2	$amplitude = 1$	✓ *answer* (1)
6.1.3	$b = 2$	✓ *answer* (1)
6.1.4	$(-45°; 0)$ *and* $(45°; 0)$	✓ $(-45°; 0)$ ✓ $(45°; 0)$ (2)
6.2	$-90° \leq x < 0$ *or* $0° < x \leq 90°$	✓✓ $-90° \leq x < 0$ ✓ $0° < x \leq 90°$ (3)
		[8]

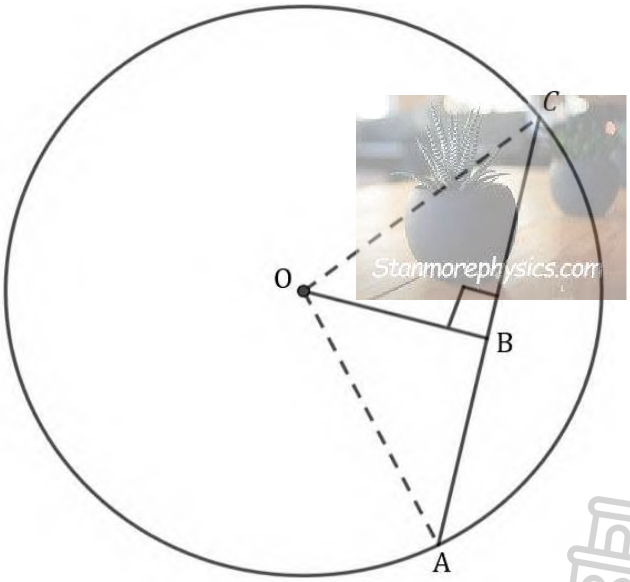
QUESTION 7



7.1	*In* ΔBCE: $\tan\theta = \frac{EB}{x}$ $EB = x\tan\theta$ *In* ΔDEF: $\sin\alpha = \frac{EF}{DE}$ $DE = \frac{EF}{\sin\alpha}$ $BF = AD = y$ ∣ *sides of rectangles* $EF = EB - y$ $= x\tan\theta - y$ $DE = \frac{x\tan\theta - y}{\sin\alpha}$ Q.E.D	✓ $\tan\theta = \frac{EB}{x}$ ✓ $EB = x\tan\theta$ ✓ $DE = \frac{EF}{\sin\alpha}$ ✓ $BF = y$ ✓ $EF = EB - y$ (5)
7.2	$DF^2 = DE^2 - EF^2$ ∣ *Pythagoras* $DF^2 = \left(\frac{x\tan\theta - y}{\sin\alpha}\right)^2 - (x\tan\theta - y)^2$ $= \left(\frac{1000\tan 45° - 250}{\sin 45°}\right)^2 - (1000\tan 45° - 250)^2$	✓ *subst given info* ✓ *subst into Pythagoras* ✓ *answer* (3)

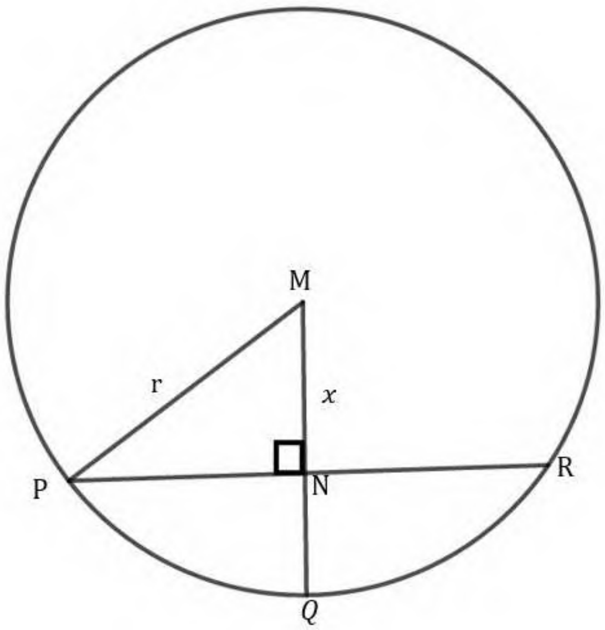
	$\therefore DF = 750m$ **OR** $\tan\alpha = \frac{EF}{DF}$ $DF = \frac{EF}{\tan\alpha}$ $DF = \frac{x\tan\alpha - y}{\tan\alpha}$ or $\cos\alpha = \frac{DF}{DE}$ $DF = DE\cos\alpha$ $= \frac{1000\tan 45° - 250}{\tan 45°}$ $\therefore DF = 750m$	**OR** ✓ $\tan\alpha = \frac{EF}{DF}$ ✓ *substitution* ✓ *answer* (3)
		[8]

QUESTION 8



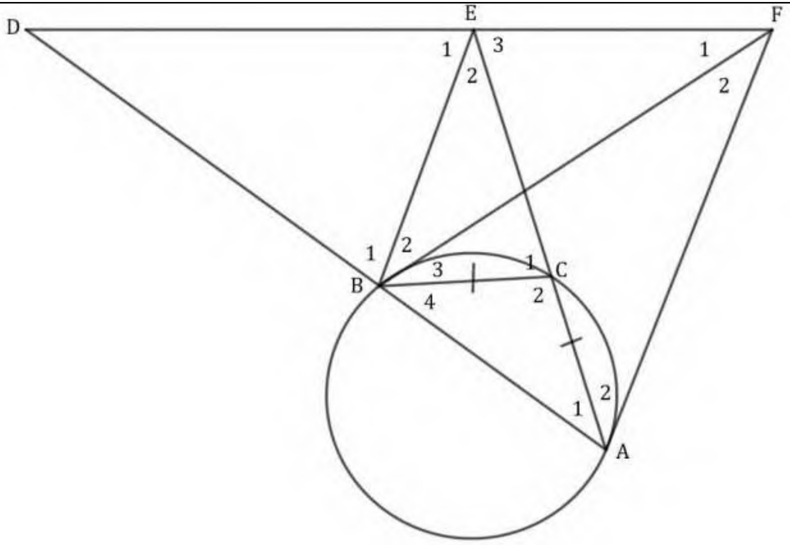
8.1	*In* ΔOBC *and* ΔOBA: $O\hat{B}C = O\hat{B}A$ [*both* = 90°] $OA = OC$ [*radii*] $OB = OB$ [*common*] $\therefore \Delta OBC \equiv \Delta OBA$ [*RHS*] $AB = BC$ [$\equiv \Delta s$]	✓ *construction* ✓ S/R ✓ S/R ✓ $\therefore \Delta OBC \equiv \Delta OBA$ [*RHS*] ✓ $AB = BC$ [$\equiv \Delta s$] (5)

8.2



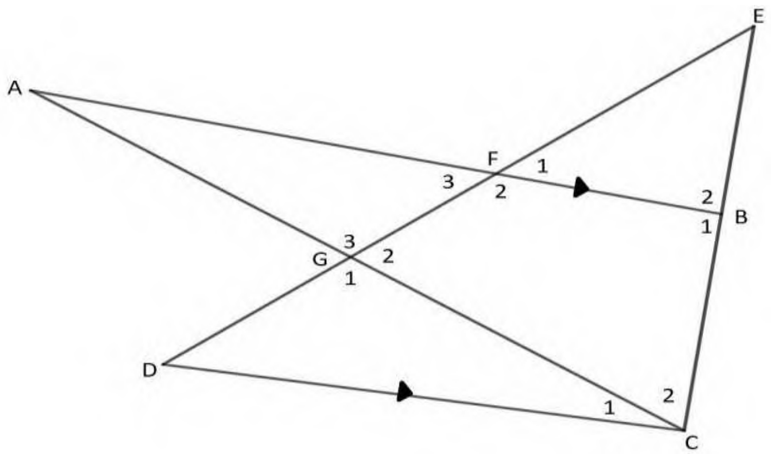
8.2.1	$r = x + 20$	✓ *answer* (1)
8.2.2	$PN = NR$ $= 60$ ׀ *line from centre* ⊥ *to chord* $PM^2 = PN^2 + NM^2$ ׀ *Pythagoras* $(x + 20)^2 = (60)^2 + x^2$ $x^2 + 40x + 400 = 3600 + x^2$ $40x = 3200$ $x = 80$ $r = 100mm$	✓ S ✓ R ✓ *subst into Pythagoras* ✓ $x^2 + 40x + 400$ ✓ $x = 80$ ✓ 100 (6)
		[12]

QUESTION 9



9.1	$\hat{B}_4 = \hat{A}_2 = x$ [tan chord theorem] $\hat{B}_4 = \hat{A}_1 = x$ [$\angle$ s opp = sides] $\hat{B}_3 = \hat{A}_1 = x$ [tan chord theorem] $\hat{D} = \hat{B}_4 = x$ [corresp $\angle$ s, BC‖DF] $\hat{F}_1 = \hat{B}_3 = x$ [alt $\angle$ s, BC‖DF]	✓ S ✓ R ✓ S ✓ R ✓ S ✓ R ✓ S|R ✓ S|R (8)
9.2.1	$\hat{F}_1 = \hat{A}_1 = x$ [proved] ABEF is a cyclic quad [converse $\angle$ s in the same seg]	✓ S ✓ R (2)
9.2.2	AF = BF [tans from common pt] BD = BF [$\angle$ s opp = sides] AF = BD [= BF]	✓ S|R ✓ S ✓R (3)
9.3	In ΔBDE and ΔFAE: $\hat{D} = \hat{A}_2 = x$ | proved $\hat{B}_1 = \hat{F}_1 + \hat{F}_2$ | ext < of cyclic quad $\hat{E}_1 = \hat{E}_3$ | int < s of Δs ∴ ΔBDE ||| △FAE |AAA $\frac{BD}{AF} = \frac{DE}{AE}$ | |||Δs but BD = AF and AF = BF $\therefore \frac{AF}{FB} = \frac{AF}{AE}$	✓ ΔBDE and ΔAEF ✓ S ✓ S|R ✓ AAA ✓ S ✓ R (6)
		[19]

QUESTION 10



10.1	$\frac{EF}{ED} = \frac{EB}{EC}$ [$prop\ theorem, FB \parallel DC$] $= \frac{10}{30} = \frac{1}{3}$	✓ $S \vert R$ ✓ $\frac{1}{3}$ (2)
10.2	$\frac{EF}{ED} = \frac{EB}{EC}$ [$proved$] $\frac{16}{ED} = \frac{1}{3}$ $\therefore ED = 48cm$	✓ $\frac{16}{ED} = \frac{1}{3}$ ✓ $answer$ (2)
10.3	$\Delta EFB \vert\vert\vert \Delta EDC$	✓ $answer$ (1)
10.4	$\frac{DC}{12} = \frac{30}{10}$ [$\vert\vert\vert \Delta s$] $\therefore DC = 36cm$	✓ $S \vert R$ ✓ $answer$ (2)
10.5	$\frac{area\Delta EFB}{area\Delta EDC} = \frac{\frac{1}{2}(16)(10)\sin E}{\frac{1}{2}(48)(30)\sin E}$ $= \frac{1}{9}$ $\frac{area\Delta EDC}{area\Delta DGC} = \frac{48}{DG}$ [$same\ height, common\ vertex$] $\frac{area\Delta EFB}{area\Delta EDC} \times \frac{area\Delta EDC}{area\Delta DGC} = \frac{1}{9} \times \frac{48}{DG} = \frac{16}{3DG}$ $\frac{area\Delta EFB}{area\Delta DGC} = \frac{16}{3DG}$ $\therefore \frac{3area\Delta EFB}{16area\Delta DGC} = \frac{1}{DG}$	✓ $\frac{area\Delta EFB}{area\Delta EDC} = \frac{\frac{1}{2}(16)(10)\sin E}{\frac{1}{2}(48)(30)\sin E}$ ✓ $\frac{1}{9}$ ✓ $\frac{area\Delta EDC}{area\Delta DGC} = \frac{48}{DG}$ ✓ $multiplying$ ✓ $\frac{area\Delta EFB}{area\Delta DGC} = \frac{16}{3DG}$ (5)
		[12]
		TOTAL: 150