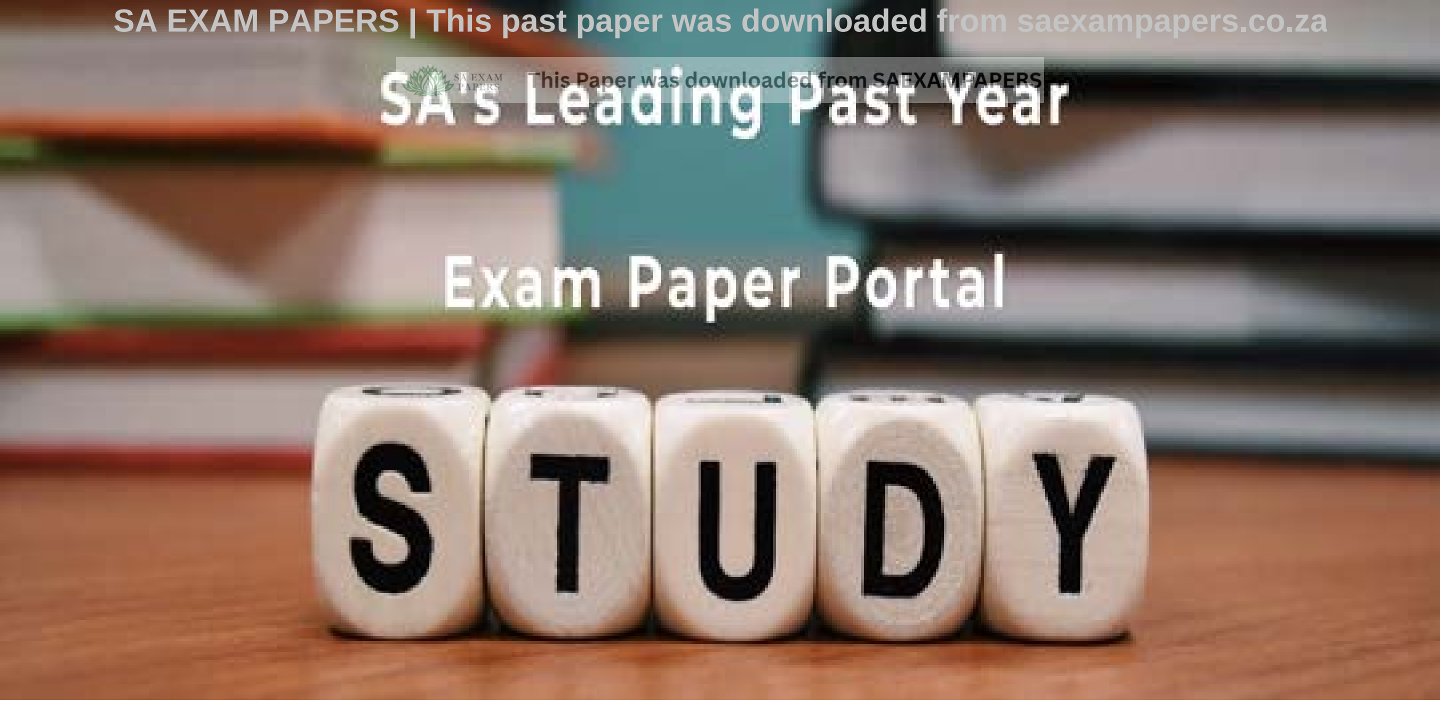

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PROVINSIALE EKSAMEN

PROVINCIAL EXAMINATION

GRAAD 12/GRADE 12

WISKUNDE/MATHEMATICS

VRAESTEL 2/PAPER 2

JUNIE/JUNE 2025

PUNTE/MARKS: 150

TYD/TIME: 3 uur/hours

Hierdie vraestel bestaan uit 13 bladsye, 1 inligtingsblad en 'n antwoordeboek van 23 bladsye./
This question paper consists of 13 pages, 1 information sheet and an answer book of 23 pages.

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 ALL calculations, diagrams, graphs, etc. which you have used in determining your 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. An information sheet with formulae is included at the end of this question paper.
9. Write neatly and legibly.

QUESTION 1

The number of WhatsApp messages sent by 11 learners on a particular day, are as follows:

14	25	31	36	37	41	51	52	55	79	112

1.1 Calculate the mean number of messages sent. (2)

1.2 Calculate the standard deviation. (1)

1.3 Determine the number of learners who sent the messages that are within one standard deviation of the mean. (3)

1.4 Calculate the interquartile range. (3)

1.5 Identify an outlier . (1)

[10]

QUESTION 2

A traffic department set up a camera to record the speed of cars travelling into the town.
The findings are shown in the table below.

Speed (km/h)	Frequency
$60 \le x < 70$	43
$70 \le x < 80$	69
$80 \le x < 90$	110
$90 \le x < 100$	49
$100 \le x < 110$	20
$110 \le x < 120$	9

2.1 How many cars were recorded by the camera? (1)

2.2 Complete the cumulative frequency column in the ANSWER BOOK. (2)

2.3 Draw the cumulative frequency curve (ogive) in the ANSWER BOOK. (3)

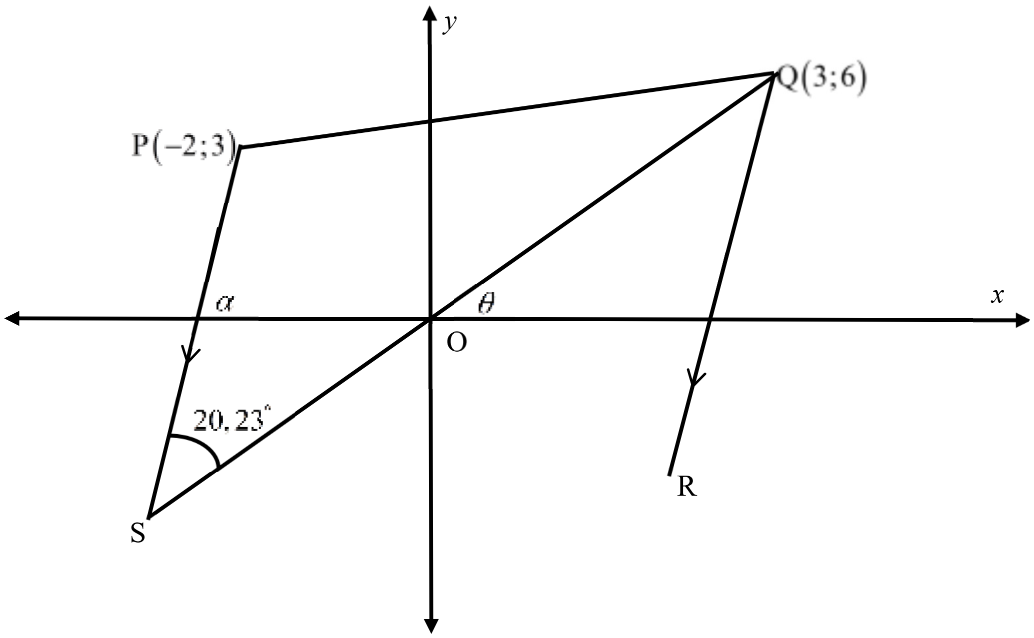
2.4 Use the ogive to estimate the semi-interquartile range. (3)

2.5 If the speed limit of the zone where the camera is installed is 80 km/h, how many cars drove above and equal to the speed limit? (2)

[11]

QUESTION 3

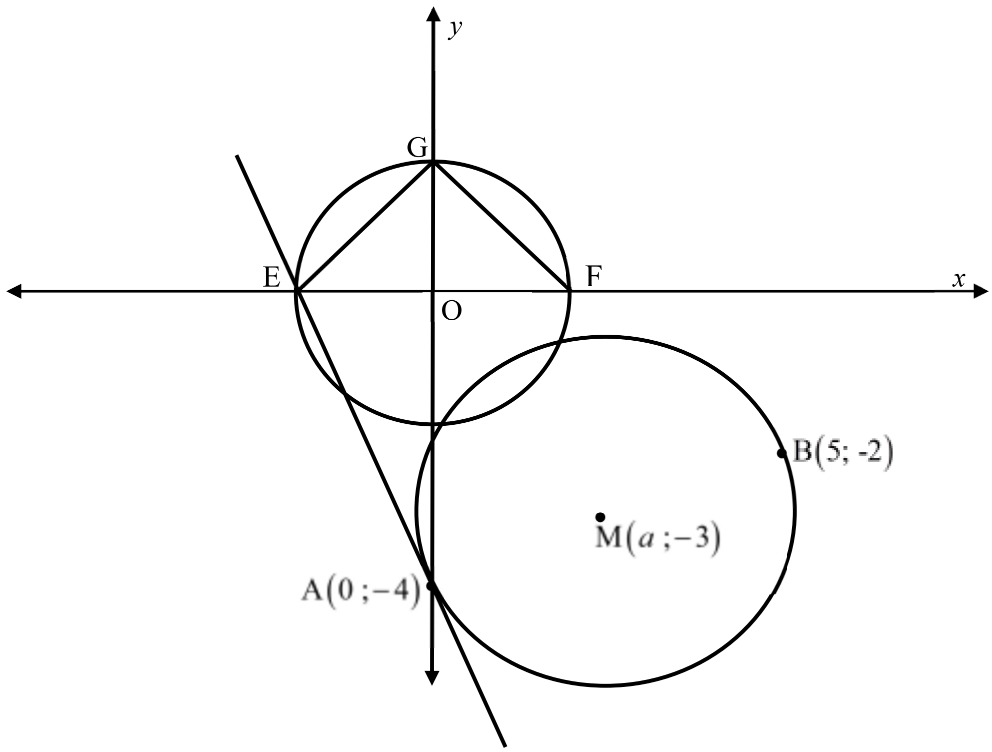
In the diagram below, ΔPQS is drawn with vertices $P(-2\,;3)$ and $Q(3;6)$ and S. Line QS passes through the origin at O. PR ∥ QR and $\hat{PSQ} = 20{,}23°$.



3.1	Calculate the gradient of QS.	(2)
3.2	Calculate the size of θ.	(2)
3.3	Determine the:	
	3.3.1 Gradient of PS, correct to the nearest integer	(3)
	3.3.2 Equation of PS in the form $y = mx + c$	(3)
3.4	If it is further given that the equation of QS is $y = 2x$, determine the coordinates of S.	(4)
3.5	If $S(-21\,;\,-42)$, determine the coordinates of M, the midpoint of SQ.	(2)
3.6	Write down the coordinates of R if PQRS is a parallelogram.	(3)
		[19]

QUESTION 4

In the diagram, the centre of the smaller circle is at the origin and the circle cuts the x-axis at E and F respectively. The centre of the larger circle is at $M(a\,;-3)$. The equation of tangent AE to the larger circle is given by $y = -\frac{5}{2}x - 4$.



4.1 Determine:

4.1.1 The coordinates of E (2)

4.1.2 The equation of the smaller circle (3)

4.2 Determine the equation of the radius AM in the form $y = mx + c$. (3)

4.3 Hence, calculate the value of a. (3)

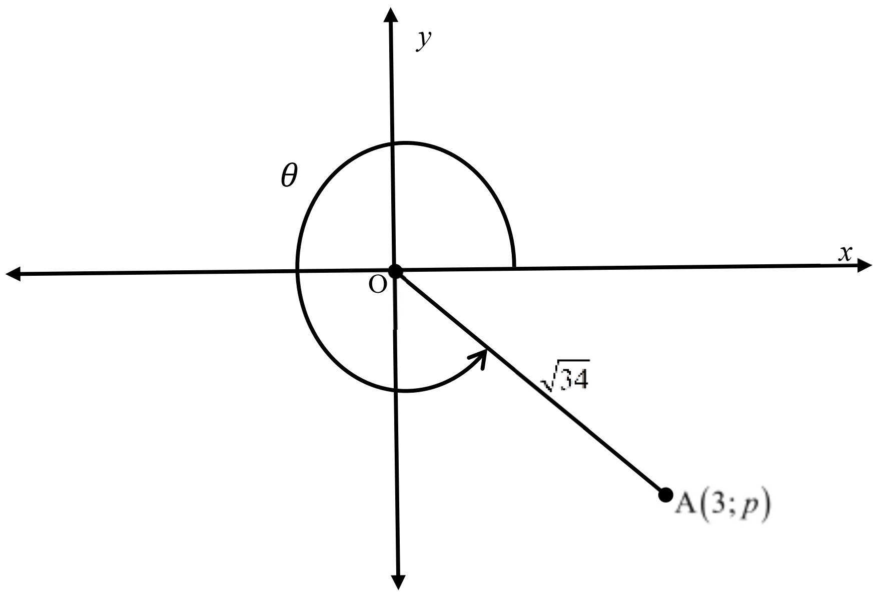
4.4 If $a = \frac{5}{2}$, determine the equation of the larger circle. (4)

4.5 Calculate the area of ΔEFG. (5)

[20]

QUESTION 5

5.1 In the diagram, $A(3\,;p)$ is a point in the Cartesian plane in the fourth quadrant. $OA = \sqrt{34}$ and θ is the reflex angle.



Determine, **without using a calculator,** the value of:

5.1.1 p (2)

5.1.2 $\cos(450° - 2\theta)$ (3)

5.1.3 $\cos(30° - \theta)$ (3)

5.2 Simplify $\dfrac{2\cos(90°+x).\cos(180°+x)}{\cos(60°+x).\sin x + \sin(60°+x).\cos x}$ to a single trigonometric function. (6)

5.3 Given: $f(x) = \cos(x + 45°)\,.\cos(45° - x)$ and $g(x) = 1 - 2\sin x$

5.3.1 Prove that $f(x) = \frac{1}{2}\cos 2x$ (4)

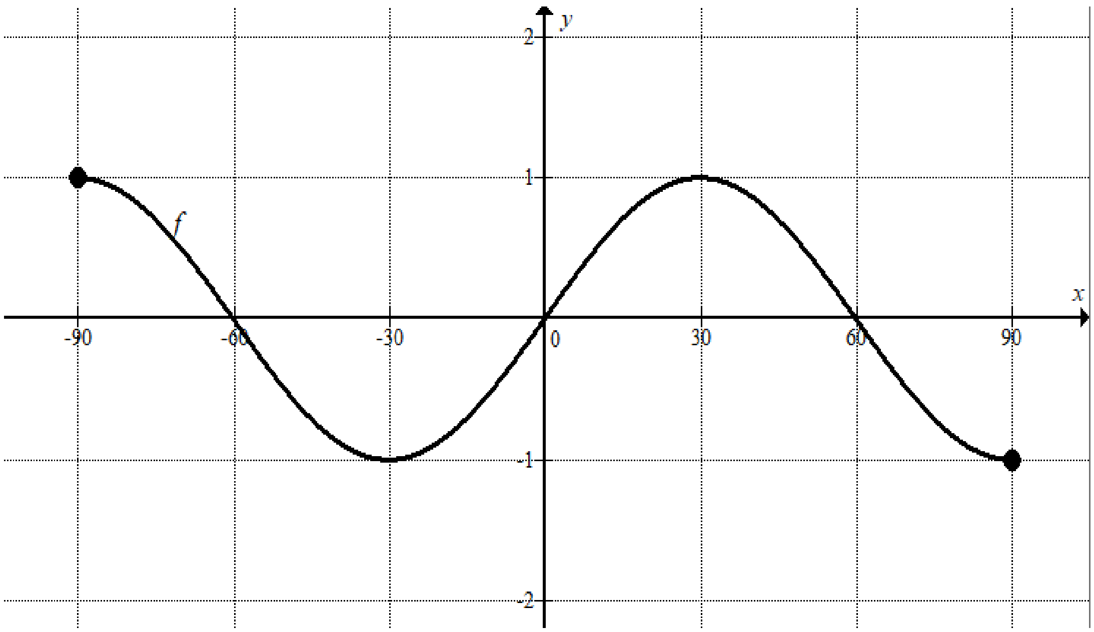
5.3.2 If $f(x) = g(x)$, determine the general solution. (6)

5.4 If $\cos\theta = 2m$ and $\cos 2\theta = 7m$, determine the value(s) of m. (5)

[29]

QUESTION 6

In the diagram below, the graph of $f(x) = \sin 3x$ is drawn for the interval $x \in [-90°\,;90°]$.

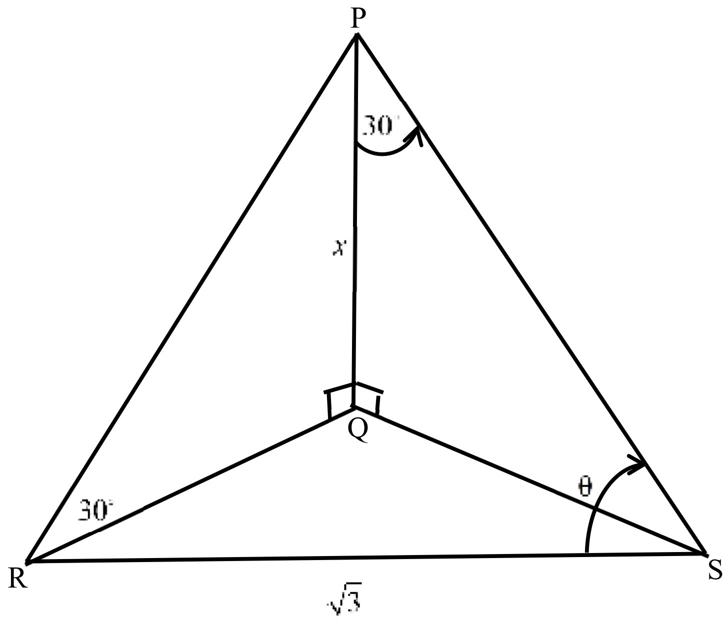


6.1	Write down the period of f.	(1)
6.2	On the grid given in the ANSWER BOOK, draw the graph of $g(x) = 2\cos(x - 30°)$ on the same set of axes.	(3)
6.3	Use the graphs and write down the value(s) of x for which:	
	6.3.1 $f(x) > g(x)$	(2)
	6.3.2 $f(x).g(x) < 0$	(3)
	6.3.3 $f(x) - g(x) = 1$	(1)
6.4	Graph h is obtained when g is translated 60° to the right. Determine the equation of h. Write you answer in its simplest form.	(2)

[12]

QUESTION 7

In the diagram, PQ is a vertical line with length x units. RS $= \sqrt{3}$ units, $P\hat{S}R = \theta$ and $P\hat{R}Q = S\hat{P}Q = 30°$.



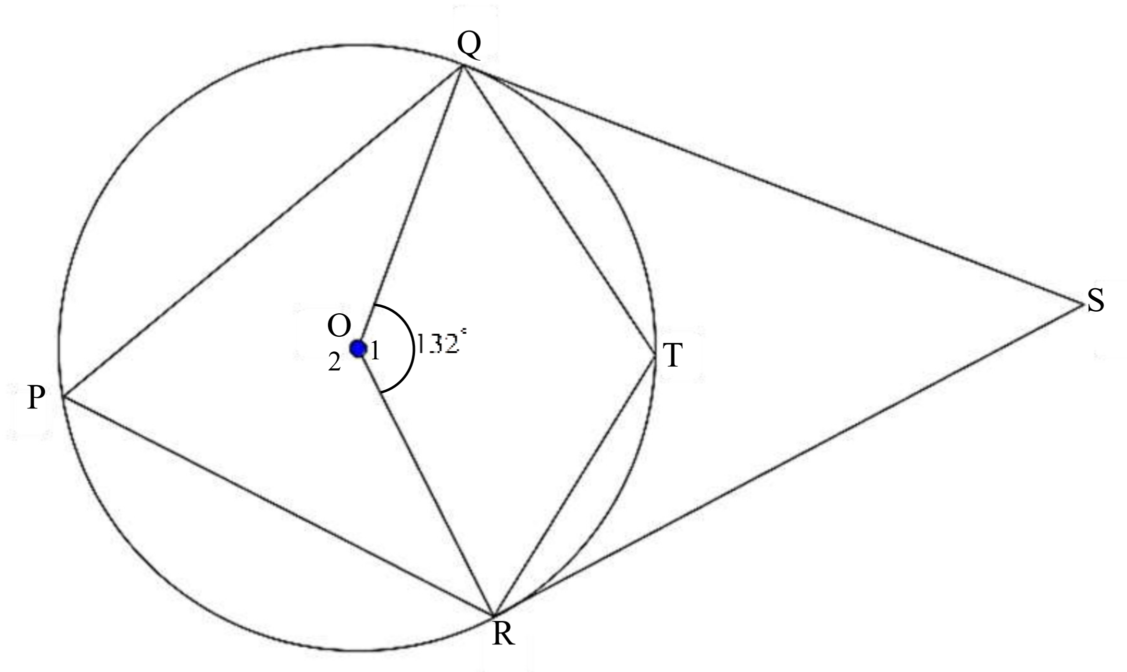
7.1 Show that $\cos\theta = \frac{9-8x^2}{12x}$ (6)

7.2 If $x = 1$, show that the area of $\Delta PSR = \sin\theta$ units^2. (2)

[8]

QUESTION 8

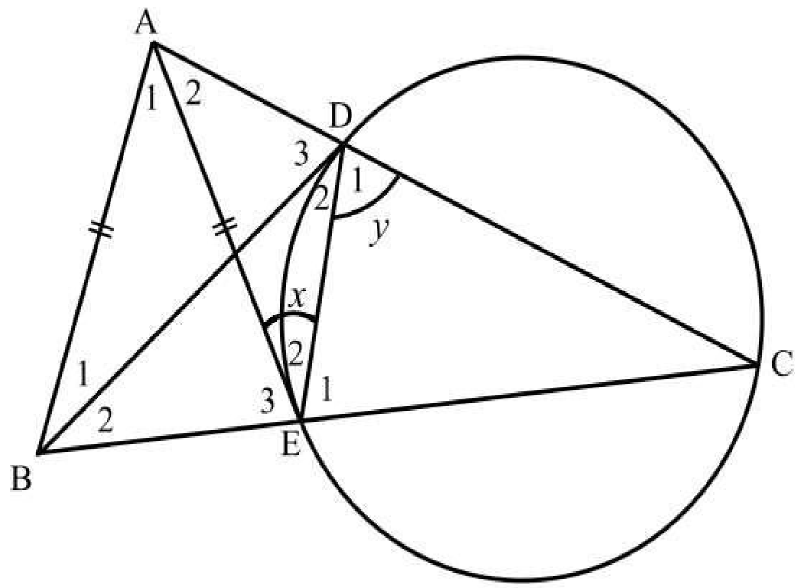
In the diagram, QS and RS are tangents to the circle at Q and R respectively. O is the centre of the circle. $Q\hat{O}R = 132°$.



8.1	Calculate, with a reason, the size of $Q\hat{T}R$.	(3)
8.2	Prove that QORS is a cyclic quadrilateral.	(3)
8.3	Hence, calculate the size of $Q\hat{S}R$.	(2)
		[8]

QUESTION 9

In the diagram below, chords CD and CE of the circle areproduced to A and B respectively. AE is a tangent to the circle and AB = AE. $E_2 = x$ and $\hat{D}_1 = y$.

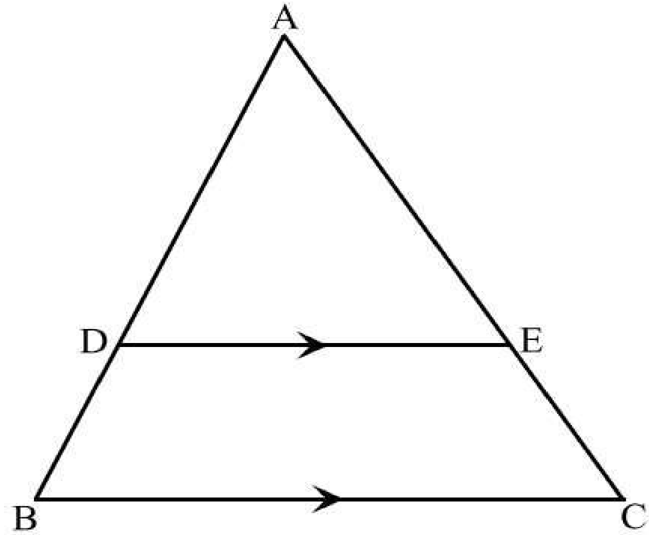


9.1 Prove that ABED is a cyclic quadrilateral. (6)

9.2 Prove that AB is a tangent to a circle passing through B, C and D. (3)
[9]

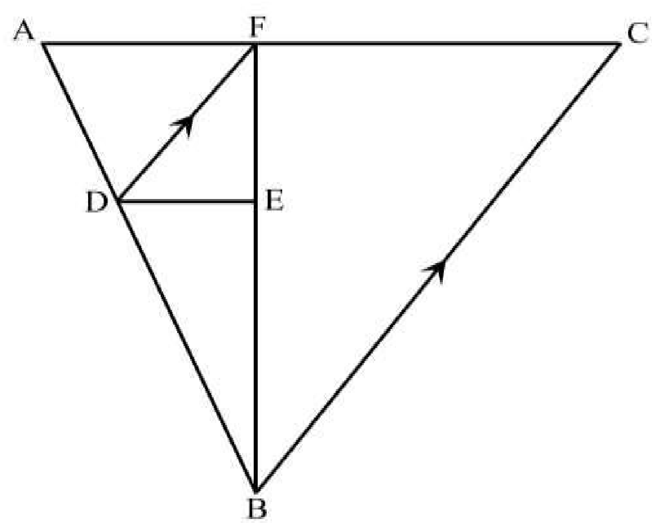
QUESTION 10

10.1 In the diagram, ΔABC is drawn. Line DE intersects AB and AC at D and E respectively such that DE ∥ BC.



Use the diagram and prove the theorem which states that a line drawn parallel to one side of a triangle divides the other two sides proportionally, i.e. $\frac{AD}{DB} = \frac{AE}{EC}$ (6)

10.2 In the diagram is ΔABC with DF∥BC and $\frac{AF}{FE} = \frac{FC}{EB}$.

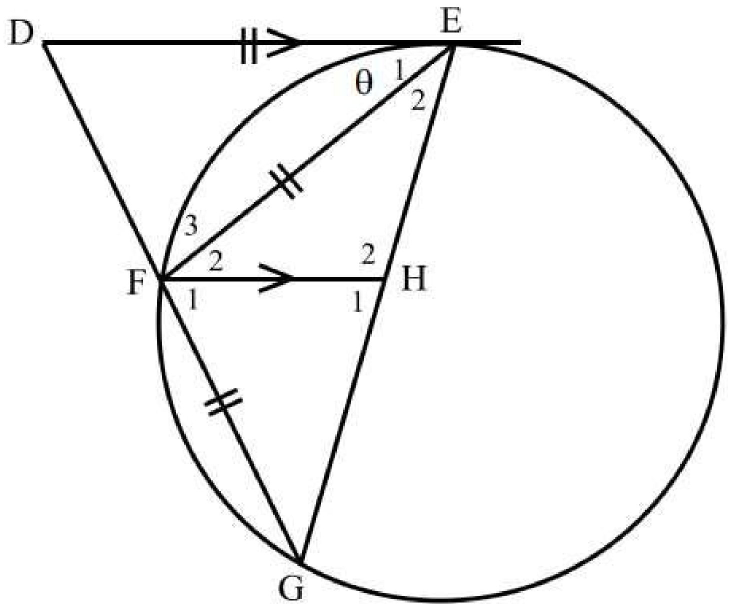


Prove, with reasons, that DE∥AF. (6)

[12]

QUESTION 11

In the diagram below, E, F and G are points on the circle. DE is to the circle at E. DFG is a secant such that DE=EF=FG. FH‖DE and $\hat{E}_1 = \theta$.



11.1	State, with reasons, THREE other angles each equal to θ.	(3)
11.2	Prove that $DE^2 = DF.DG$	(5)
11.3	Prove, with reasons, that $\frac{DF^2}{DE^2} + \frac{DF}{DE} = 1$	(4)
		[12]

TOTAL: 150

INFORMATION SHEET

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

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

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

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

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

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

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

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

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

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\quad a^2 = b^2 + c^2 - 2bc.\cos A$ $\quad$ area $\Delta ABC = \frac{1}{2}ab.\sin C$

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

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

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

$\bar{x} = \frac{\sum fx}{n}$ $\quad \sigma^2 = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n}$ $\quad \mathrm{P}(A) = \frac{n(\mathrm{A})}{n(\mathrm{S})}$

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