Mathematics Paper 2 June 2016

FORM 4

| **Examiner:**	A Gunning	**Moderators:**	P Denissen, C Mundy
Time:	2½ hours	**Marks:**	125

NAME:

Ques No	1	2	3	4	5	6	7	8	TOTAL	%
Out of	16	14	40	10	10	6	20	9	125	100
Mark										

- All questions are to be answered in this booklet.

- This question paper consists of 17 pages. Included in this, is a list of useful formulae. Please check that your question paper is complete.

- Read and answer all questions carefully.

- It is in your own interest to write legibly and to present your work neatly.

- **All necessary working which you have used in determining your answers must be clearly shown.**

- Approved non-programmable calculators may be used except where otherwise stated. Where necessary give answers **correct to 2 decimal places**.

- Diagrams have not necessarily been drawn to scale.

Question 1
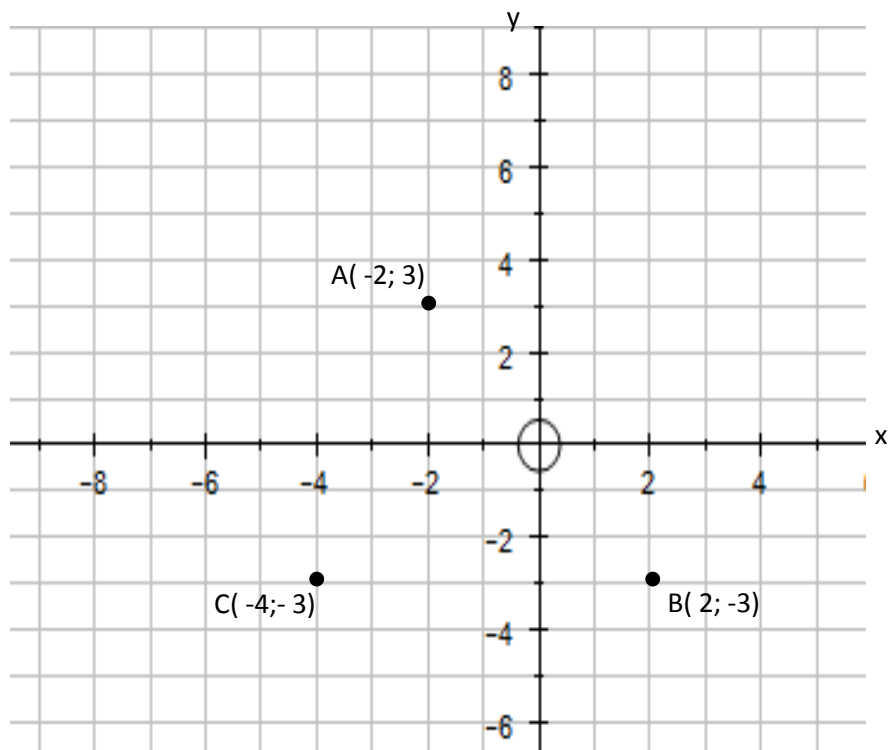
$A(-2; 3)$, $B(2; -3)$ and $C(-4; -3)$ are the vertices of a triangle.

(a) Calculate the gradients of AC and BC   (3)

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(b) Calculate the inclination of the lines AC and BC   (3)

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(c) Find the coordinates of the midpoint of AC. Label this point M. (2)

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(d) Find the equation of the line which is perpendicular to AC and which passes through M.

(4)

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(e) Write down the coordinates of the x and y intercepts of the line found in (d) (2)

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(f) Find the area of triangle ABC. (2)

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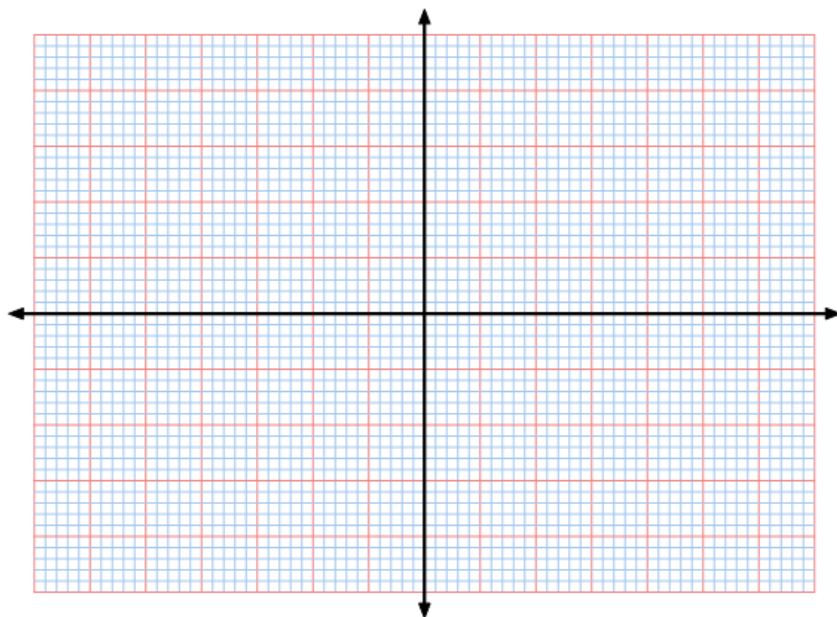_____

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[16]

Question 2

(a) Determine the equation of a straight line which passes through the points B(-2; 4) and C(2; 2)

(4)

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(b) You are given quadrilateral PQRS with coordinates $P(0; 4)$, $Q(3; 1)$, $R(-3; -5)$ and $S(-6; -2)$.

(i) Plot each of these points on the given set of axes. (2)

(ii) How would you prove that PQRS is a rectangle? (3)

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(iii) Using the method you specified, prove this. (5)

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[14]

Question 3

(a) If $5\,sin\theta = 3$ and $90° \le \theta \le 360°$, determine with the aid of a sketch, and without the use of a calculator,

(i) $\dfrac{1}{\tan\theta}$ (4)

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_____

_____

(ii) $\dfrac{5\cos\theta}{2}$ (2)

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(b) Using the special angle triangles, determine the value of each of the following, without using a calculator. Show all relevant steps needed to determine the answers.

   (i) $\sin 150° + \cos 120°$ (3)

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   (ii) $sin^2 225° - \tan 135°$ (3)

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(c) Simplify without the use of a calculator. Show all relevant steps needed to determine the answers.

   (i) $\dfrac{\sin(-20°)}{\cos 250°}$ (3)

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   (ii) $1 - sin^2\theta - cos^2\theta$ (2)

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_____

(iii) $\dfrac{\cos(360°-x).\cos(90°-x).\tan(180°-x)}{\cos(180°+x).\sin(360°-x)}$ (7)

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(iv) $\dfrac{\cos(90°-\alpha).\tan(180°+\alpha)}{\tan(180°-\alpha).\sin(180°+\alpha)} + \dfrac{\cos(90°+\alpha)}{\sin(360°-\alpha)}$ (7)

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(v) $\dfrac{\sin(-338°).\cos(300°)}{\cos 248°.\tan 135°}$ (6)

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(d) If $\sin 18° = p$ determine the following in terms of p.

  (i) $\sin 198°$ (1)

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  (ii) $\cos(-108°)$ (2)

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[40]

Question 4
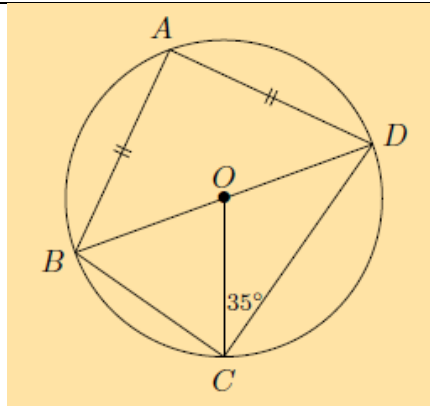
BOD is a diameter of the circle with centre O. AB = AD and $O\hat{C}D = 35°$,

Calculate the value of the following angles, giving all relevant reasons.

(a)$O\hat{D}C$ (2)	
(b) $C\hat{O}D$ (2)	
(c) $C\hat{B}D$ (2)	
(d) $B\hat{A}D$ (2)	
(e) $A\hat{D}B$ (2)	

[10]

Question 5

D, E, F and G are points on the circle with centre M.

$\hat{F}_1 = 7°$ and $\hat{D}_2 = 51°$. Determine the value of each of the following angles. Give all relevant reasons.
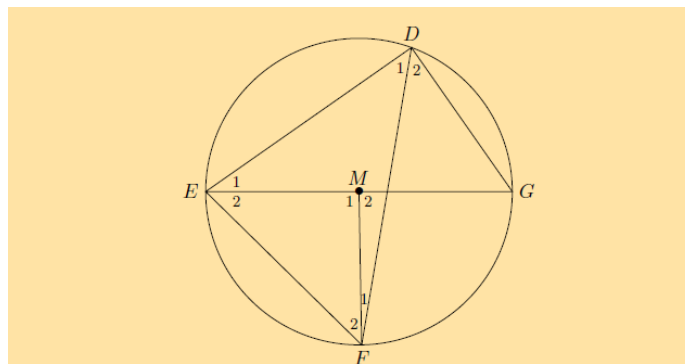
(a) $\hat{D}_1$ (2)

(b) $\hat{M}_1$ (2)

(c) $\hat{F}_2$ (2)

(d) $\hat{G}$ (2)

(e) $\hat{E}_1$ (2)

[10]

Question 6

O is the center of the circle and SPT is a tangent. Determine the values of a, b and c. Give all relevant reasons.
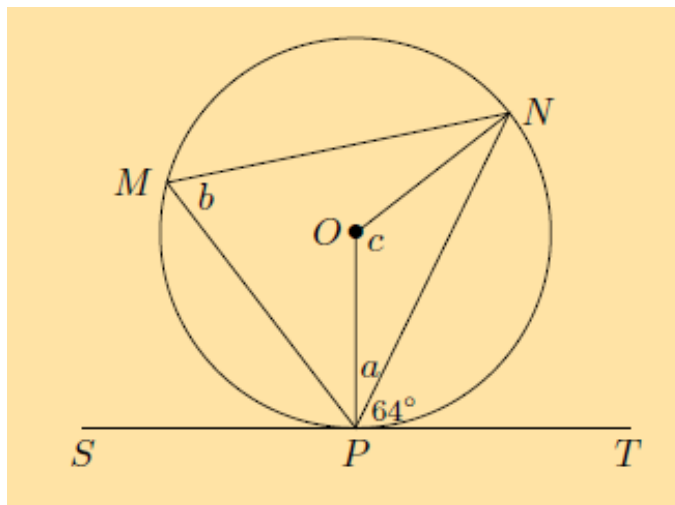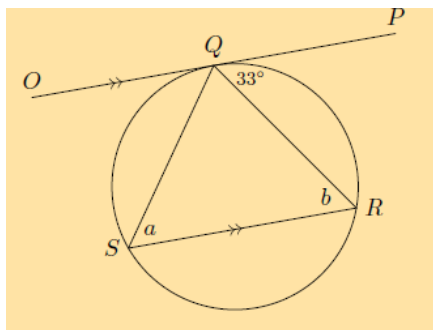

(a) Determine a (2)

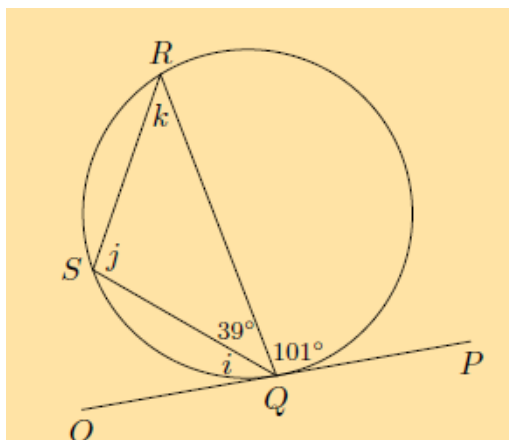(b) Determine b (2)

(c) Determine c (2)

[6]

Question 7

Determine, with all relevant reasons, the values of the unknown in each of the following.

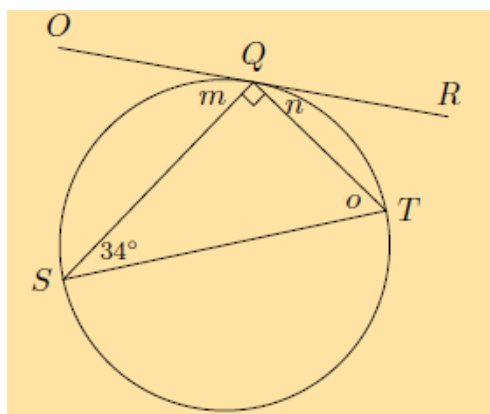(a) You are given that OQP is a tangent to the circle QRS, at Q.

(4)

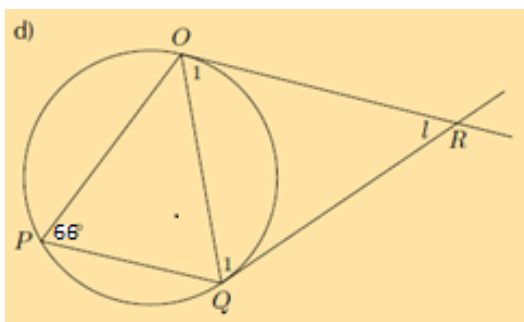(b) You are given that OQP is a tangent to the circle QRS, at Q
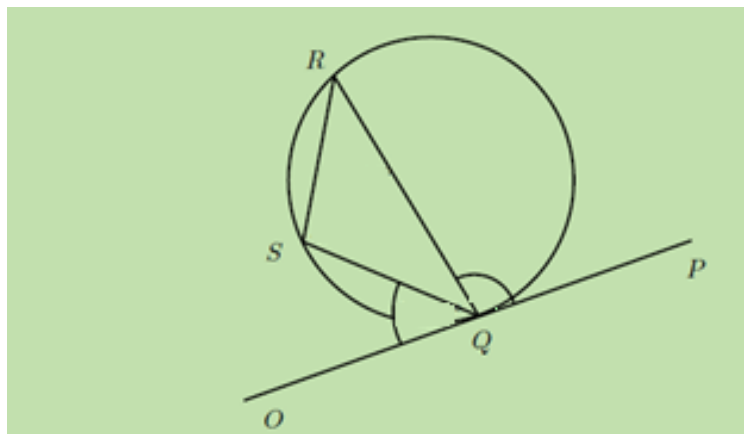

(3)

(c) OQR is a tangent to circle QST.

(3)

(d) OR and QR are tangents to circle OPQ. Find the value of l.

(5)

(e) OQP is a tangent to circle RSQ. $\hat{R} = 4m - 70°$, $R\hat{Q}P = s$, $O\hat{Q}S = m + 20°$, $\hat{S} = 4m$

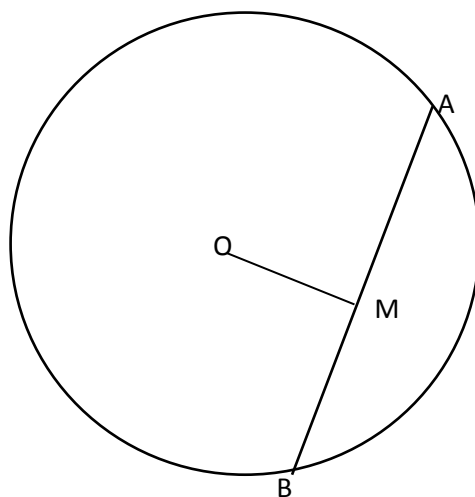Find the values, with reasons, of m and s.

(5)

[20]

Question 8

(a)In the diagram below, you are given a circle center O. A line is drawn from O perpendicular to a chord AB. Complete the statements below to prove the theorem which states that this line will bisect the chord AB. (4)

Given: *OM is perpindicular to AB*

Required to prove: …………………...

Proof:

Join ……………………………………

In ΔOMB and ΔOMA

1…………………………………..	…………………………..
2…………………………………..	……………………………..
3…………………………………..	…………………………..
$\therefore \Delta OMB \equiv \Delta OMA$	………………………….
………………………………………….	………………………….

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(b) Two circles with centers A and B, as shown below, have radii of 7 cm and 10 cm respectively. AB is perpendicular to PQ. The diagram has NOT been drawn to scale.

If the length of the common chord PQ is 8 cm, what is the length of AB?

Remember to show all relevant working and state all reasons. (5)
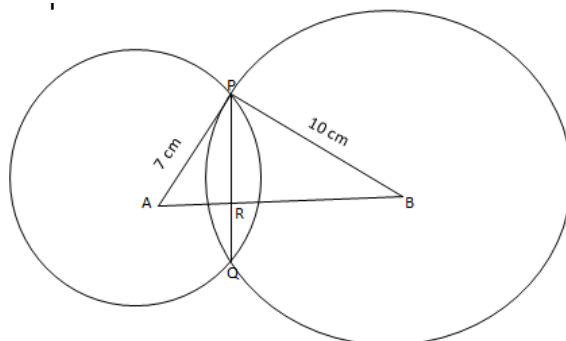
[9]

Useful formulae

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2} ; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan\theta$$