



Mathematics Paper 2 June 2017

FORM 4

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|------------------|-----------|-------------------|------------|
| Examiner: | A Gunning | Moderator: | P Denissen |
| Time: | 2½ hours | Marks: | 125 |

NAME:

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|---------|----|----|----|----|----|-------|----|-----|
| Ques No | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Out of | 11 | 11 | 6 | 8 | 5 | 19 | 14 | 10 |
| Mark | | | | | | | | |
| Ques No | 9 | 10 | 11 | 12 | 13 | TOTAL | | % |
| Out of | 5 | 8 | 9 | 8 | 11 | 125 | | 100 |
| Mark | | | | | | | | |

- All questions are to be answered in this booklet.
- This question paper consists of 20 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

Given points $R(1; 3)$, $S(3; 7)$ and $T(-1; -1)$

(a) Determine the gradient of RS. (2)

(b) The length of ST is $w\sqrt{5}$. Find the value of w . Show all relevant working detail. (3)

(c) Determine the equation of the line through T parallel to RS, giving your answer in standard form. (2)

(d) Determine the equation of a line which is perpendicular to RS AND which bisects RS. (4)

[11]

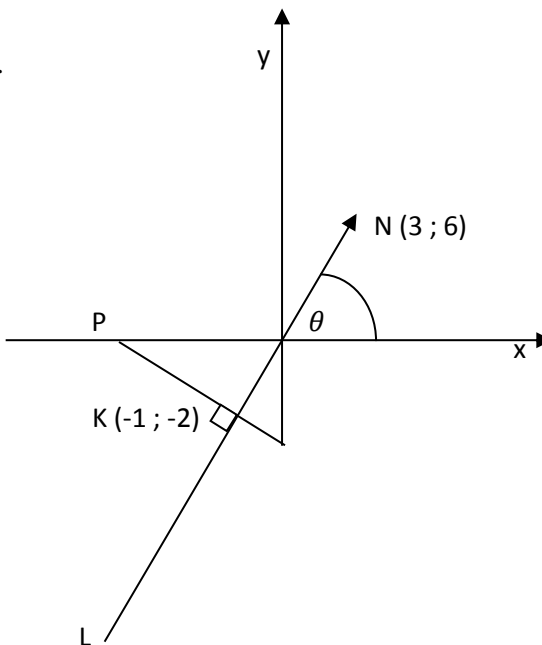
Question 2

This diagram has not been drawn to scale.

In the diagram, $K(-1; -2)$ is the midpoint of LN with $N(3; 6)$.

$PK \perp LN$ with P on the x -axis.

The angle of inclination of NL is θ .



Determine

- (a) the gradient of LN (2)

- (b) the size of θ , correct to 1 decimal place (2)

(c) the co-ordinates of L (4)

(d) the length of NK, leaving your answer in the simplest surd form. (3)

[11]

Question 3

The points $A(3; 1)$, $B(2; -2)$ and $C(2; 3)$ are given.

(a) If CD is perpendicular to AB with $D(-3; t + 1)$, determine the value of t . (3)

(b) If A , B and E are collinear, given $E(r; 4)$, evaluate r . (3)

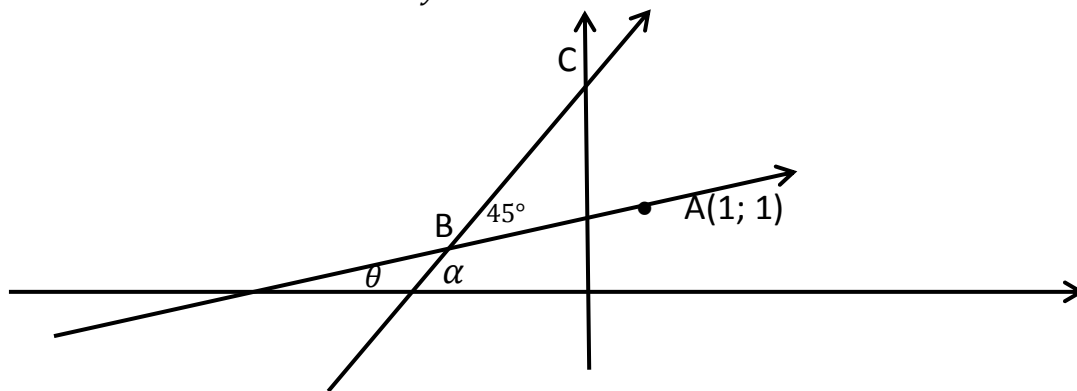
[6]

Question 4

In the given sketch (not drawn to scale) $A(1; 1)$ is a point on the line AB . And $\widehat{ABC} = 45^\circ$

The line BC makes an angle α with the x -axis and the line AB makes an angle θ with the x -axis.

Points B and C lie on the line $y = 3x + 2$



(a) Determine the inclination of the line BC . (2)

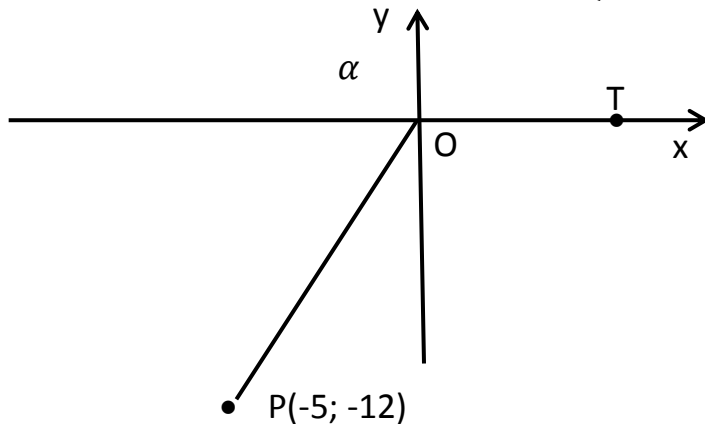
(b) Determine the value of θ , the inclination of the line AB . (2)

(c) Determine the equation of the line AB . (4)

[8]

Question 5

In the diagram below, reflex $T\hat{O}P = \alpha$ and P has coordinates $(-5; -12)$



Determine the value of each of the following, WITHOUT USING A CALCULATOR.

(a) $\cos \alpha$ (3)

(b) $\tan(180^\circ - \alpha)$ (2)

[5]

Question 6

Without the use of a calculator, simplify each of the following.

(a) $\frac{\sin 100^\circ}{\cos(350^\circ)}$ (2)

(b) $\sin^2(-20^\circ) + \cos^2(200^\circ)$ (4)

(c) $\frac{\cos 130^\circ - \sin(90^\circ - \theta)}{\sin 400^\circ + \cos(-\theta)}$ (5)

(d) $\frac{\cos 140^\circ \cdot \tan(-320^\circ)}{\sin 220^\circ}$ (4)

(e) Evaluate $\sqrt{4 \sin 150^\circ \cdot 2^3 \tan 135^\circ}$ without the use of a calculator. (4)

[19]

Question 7

(a) If $\cos 62^\circ = k$, determine the value of each of the following in terms of k .

(i) $\sin 28^\circ$ (2)

(ii) $\cos 242^\circ$ (2)

(b) Simplify to a single ratio

$$\frac{\tan(360^\circ - x) \cdot \sin(90^\circ + x)}{\sin(-x)} \quad (5)$$

(c) Consider $4\sin^2x - 3 = 0$ for $0^\circ \leq x \leq 270^\circ$,

(i) In how many quadrants will there be solutions for this equation? (1)

(ii) Without the use of a calculator, solve for x , giving all possible values of x (4).

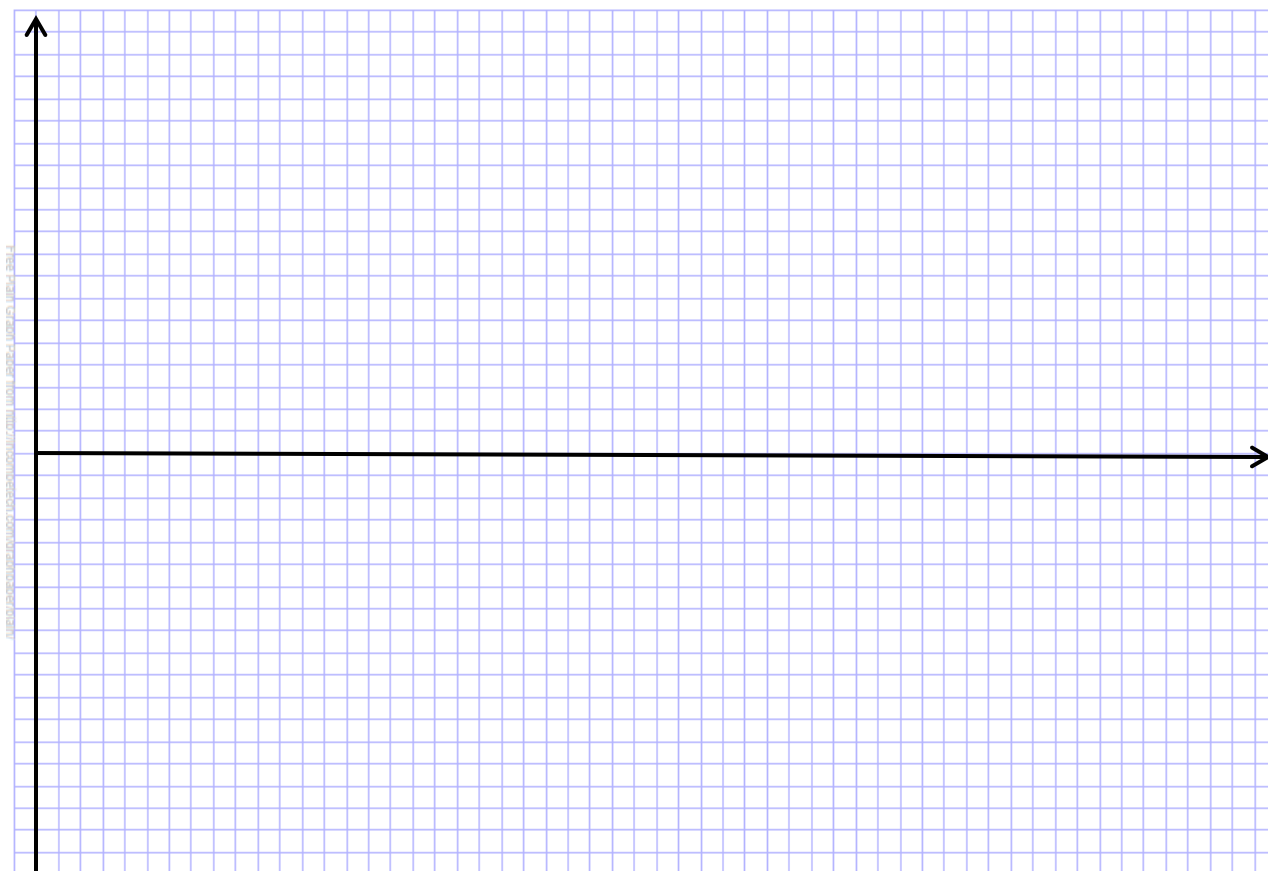
[14]

Question 8

(a) On the same set of axes below, draw sketch graphs of each of

$$f(x) = -2\sin x \quad \text{and} \quad g(x) = \cos 2x \quad \text{for the domain } x \in [0^\circ; 360^\circ].$$

You must show clearly any intercepts with the axes as well as the coordinates of the maximum and minimum values for each graph. (6)



(b) Without doing any working, write down the period of the graph $k(x) = \sin 3x$ (1)

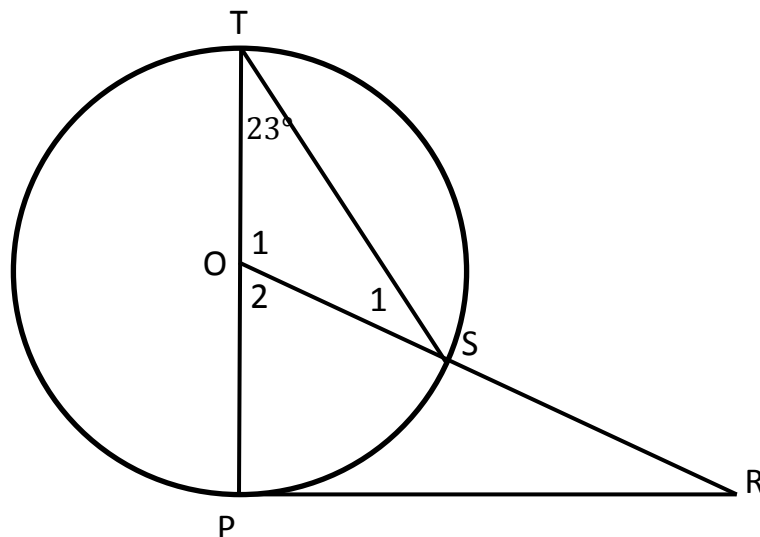
(c) State the amplitude of the graph $f(x) + 1$ (1)

(d) What is the range of $g(x) = \cos 2x$? (1)

(e) If $f(x)$ has been shifted 30° to the right, write down the equation of the new graph. (1)

[10]

Question 9



O is the center of the circle.

TOP is the diameter and PR is a tangent.

If $\hat{T} = 23^\circ$, to determine the size of \hat{R} , the following steps have been given. For each of the statements below, fill in the relevant reason.

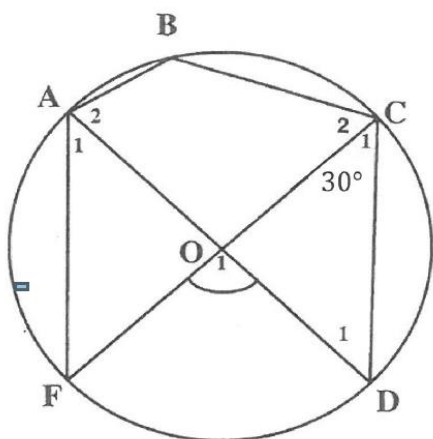
(Remember, you are building a logically sequenced proof.)

| STATEMENTS | REASONS |
|------------------------|---------|
| $TO = OS$ | |
| $\hat{S}_1 = 23^\circ$ | |
| $\hat{O}_2 = 46^\circ$ | |
| $\hat{P} = 90^\circ$ | |
| $\hat{R} = 44^\circ$ | |

[5]

Question 10

In the given diagram, O is the centre of the circle. $\widehat{C_1} = 30^\circ$



- (a) Name with reasons, three other angles each equal to 30° (4)

- (b) Calculate, with reasons, the following angles.

- (i) \widehat{B} (2)

- (ii) $\widehat{O_1}$ (2)

[8]

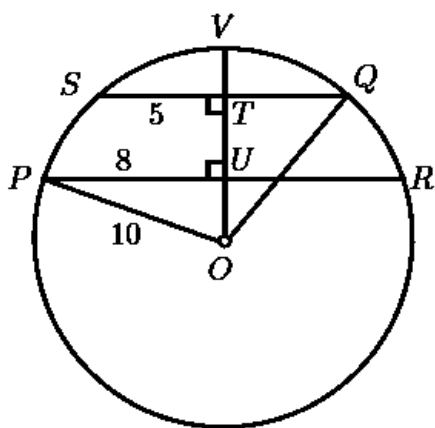
Question 11

(a) Complete the following statement: (1)

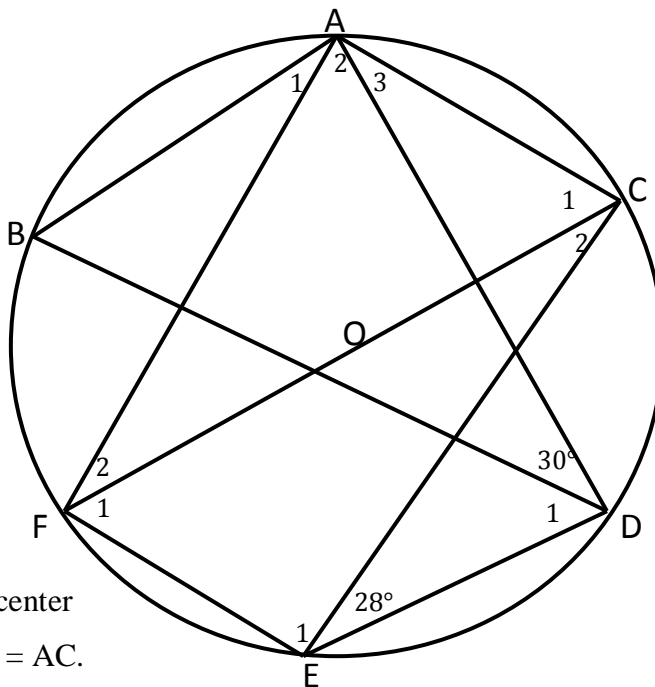
A line drawn from the center of a circle perpendicular to the chord _____

(b) In the circle with centre O , $OT \perp SQ$, $OT \perp PR$, $OP = 10$ units and $PU = 8$ units.

Determine TU . (8)



Question 12



In the diagram, O is the center of the circle. Chords $AB = AC$.

$\widehat{CED} = 28^\circ$ and $\widehat{ADB} = 30^\circ$.

Calculate with reasons, the sizes of each of the following angles.

- (a) \hat{E}_1 (2)

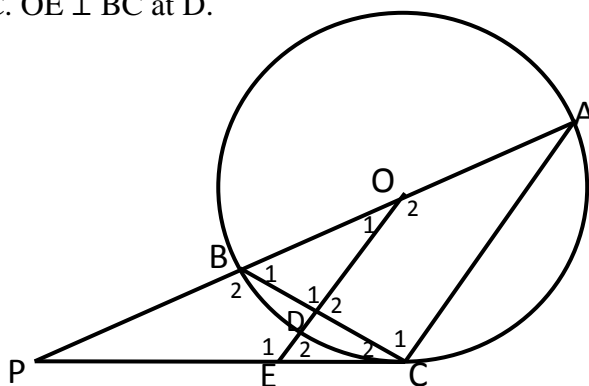
- (b) \hat{F}_2 (2)

- (c) \hat{A}_2 (4)

[8]

Question 13

In the diagram, AB is the diameter of the circle, center O . AB is produced to P . PC is a tangent to the circle at C . $OE \perp BC$ at D .



- (a) Prove with reasons that $EO \parallel CA$. (4)

- (b) If $\hat{C}_2 = x$, name with reasons, two other angles also equal to x . (4)

- (c) Calculate, with reasons, the size of \hat{P} in terms of x (3)

[11]

Useful formulae

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

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

$$y = mx + c$$

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

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

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

$$m = \tan \theta$$

