



HILTON COLLEGE

TRIAL EXAMINATION
AUGUST 2016

CORE MATHEMATICS PAPER 2

Time: 3 hours

150 marks

PLEASE READ THE FOLLOWING GENERAL INSTRUCTIONS CAREFULLY.

1. This question paper consists of 24 pages. There is also a **separate** yellow information sheet. Please check that your paper is complete.
2. Read the questions carefully.
3. This question paper consists of 13 questions. Answer all questions.
4. You may use an approved non-programmable and non-graphical calculator, unless a specific question prohibits the use of a calculator.
5. Round off your answers to **one decimal digit** where necessary, unless otherwise stated.
6. All necessary working details must be shown.
7. It is in your own interest to write legibly and to present your work neatly.
8. Please note that the diagrams are **NOT** necessarily drawn to scale.
9. Please ensure that your calculator is in DEGREE mode.

Please do not turn over this page until you are asked to do so

EXAMINATION NUMBER:

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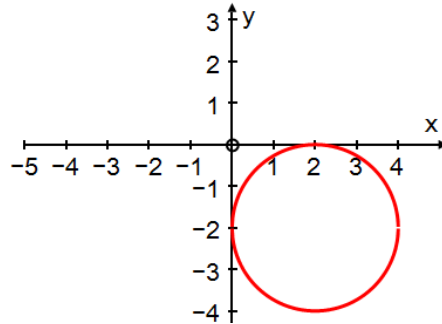
*I pledge that I have neither given nor received help with this assessment.***Date:** _____**Signed:** _____

Question	1	2	3	4	5	6	7	8	9	10	11	12	13
Mark													
Total	8	6	5	15	21	12	8	9	6	27	5	22	6
Marker	MAW			PI	TJM	LFJ			TJM	CEP	PI	PDEW	

SECTION A

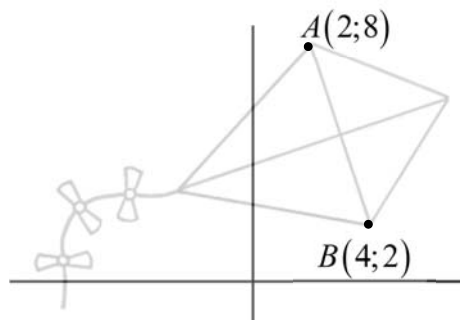
QUESTION 1

- (a) Give the equation of the circle shown below: (2)



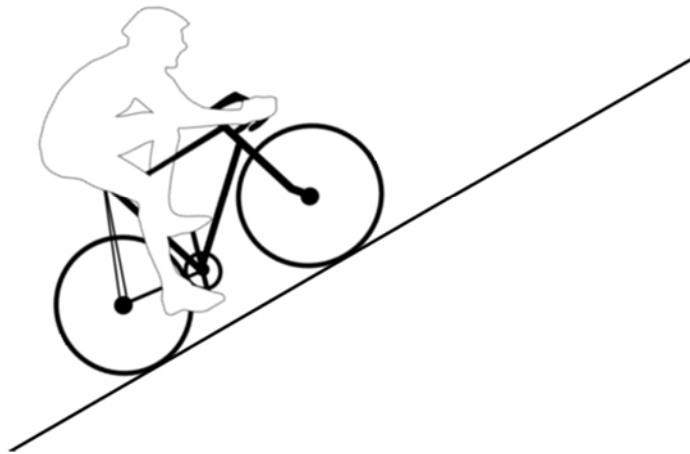
- (b) Give the equation of the line which has an angle of inclination of 45° and passes through the point $(0; -3)$. (2)

- (c) “The longer diagonal of a kite bisects the shorter diagonal at 90° ”
 Use the above statement to find the equation of the longer diagonal. (4)



QUESTION 2

Consider the sketch of Guy cycling up a hill. The equation of the straight line representing the road is $y = \frac{x}{\sqrt{3}}$ and the equation of the circle representing the rear wheel is $x^2 - 8x + y^2 - 4y = 1004$



- (a) Determine the angle the road makes with the horizontal. (2)

<http://cliparting.com/free-bike-clip-art-11887/>

- (b) Assuming that units are in cm, determine the **diameter** of the rear wheel, in cm. (4)

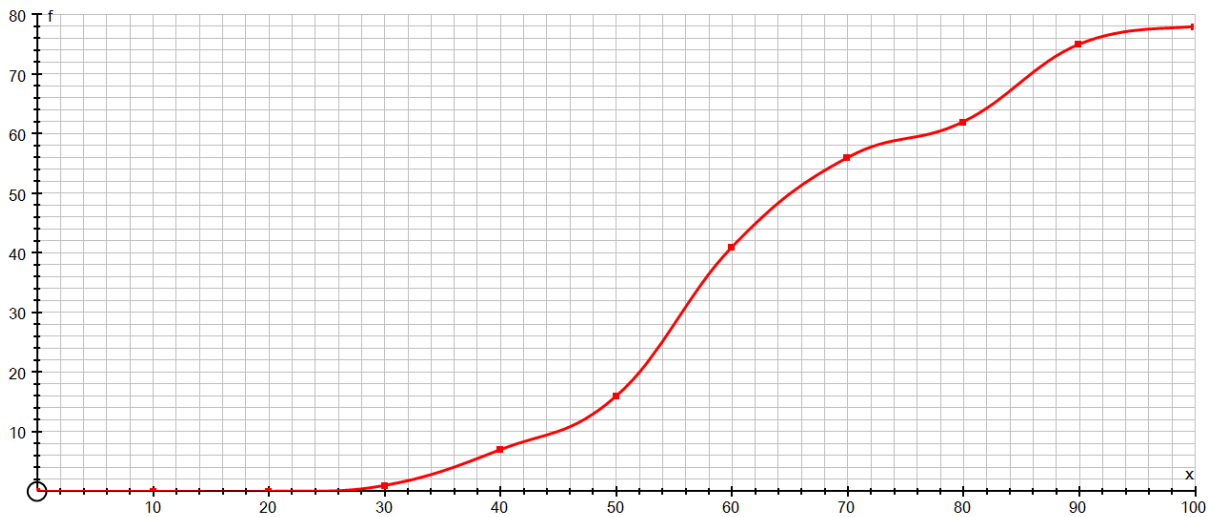
QUESTION 3

Determine the possible value(s) of k if the point $D(3;k)$ is a distance of 10 units from the point $A(9;3)$.

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QUESTION 4

(a) The Grade 12 Core Maths Marks for Term 2 are depicted in the cumulative frequency curve shown below:



(i) How many matrices do Core Maths? (1)

- (ii) Determine the inter-quartile range of the marks. Show by means of dotted lines where you have read off any values you have used in your calculation. (3)

- (iii) What percentage of pupils achieved a distinction (80% or more)? (2)

- (iv) Give a value for k if 40% of candidates achieved a mark of less than k ? (2)

- (b) Ten Grade 11 boys achieved the following marks in Science and Mathematics in the June 2016 Examinations.)

Science (x)	Maths (y)
90	93
74	61
49	60
87	88
77	82
72	62
77	90
62	43
64	77
89	80

- (i) Determine the equation of the line of best fit, the least squares regression line. Give both parameters to 3 decimal places. (2)

- (ii) Use your answer to (b) (i) to predict the Maths mark for a boy who achieves a mark of 80% for Science. (2)

- (iii) Calculate, to 2 decimal places, the correlation coefficient and comment on what it means for the relationship between the Science and Mathematics marks given. (3)

QUESTION 5

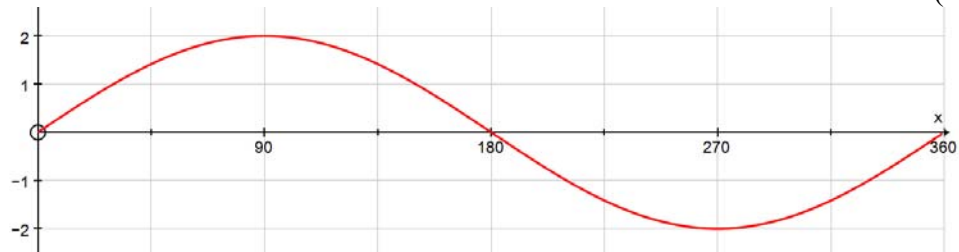
(a) In each case simply give the quadrant(s) in which θ must lie if:

(i) $\cos \theta > 0$ and $\tan \theta < 0$ (1)

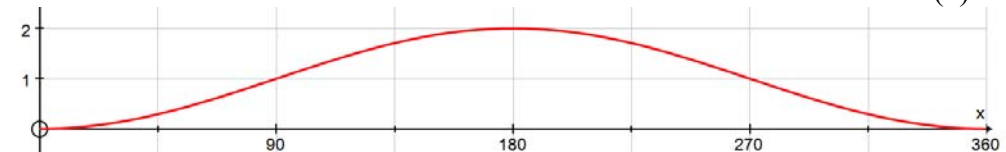
(ii) $\sin \theta = -\frac{3}{5}$ and $\tan \theta = \frac{3}{4}$ (1)

(b) Give the equations for each of the following graphs:

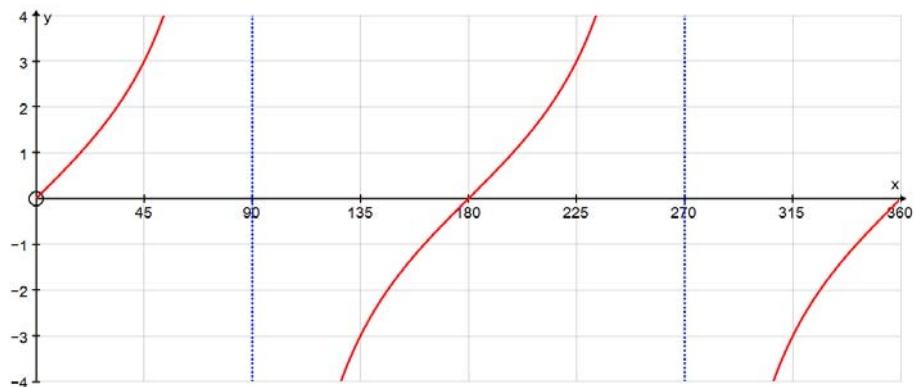
(i) (2)



(ii) (2)



(iii) (2)



(c) If $\sin 20^\circ = p$ then determine the following in terms of p :

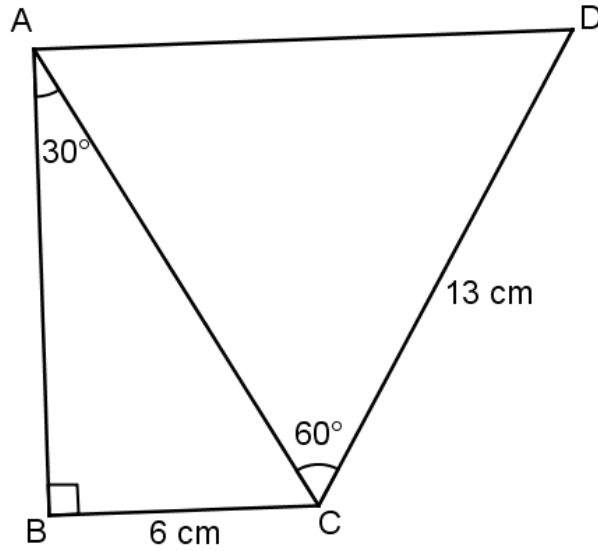
(i) $\cos 20^\circ$ (2)

(ii) $\sin(-200^\circ)$ (2)

(iii) $\cos 250^\circ$ (2)

(iv) $\cos 140^\circ$ (2)

(d) Consider the diagram with lengths and angles as marked:



(i) Determine the length of AC. (2)

(ii) Hence, or otherwise, determine the length of AD. (3)

QUESTION 6

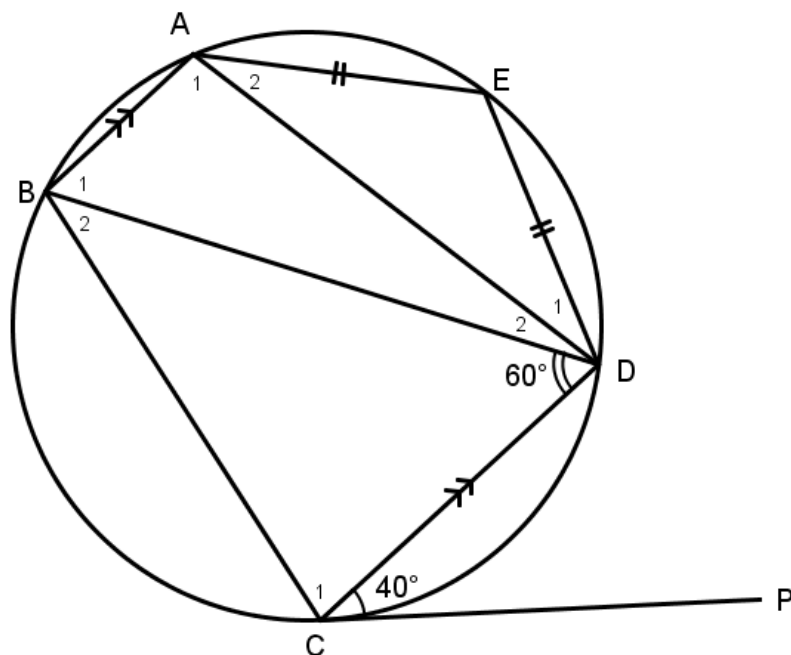
(a) Complete the following statements:

(i) If a line cuts two sides of a triangle in the same proportions then.... (1)

(ii) The exterior angle of a cyclic quadrilateral is (1)

(iii) If two triangles have corresponding sides in the same proportion then (1)

(b) In the diagram below CP is a tangent to the circle at C. $AB \parallel CD$. $AE = ED$.
 $\hat{PCD} = 40^\circ$ and $\hat{BDC} = 60^\circ$



Calculate, giving reasons, the sizes of:

(i) \hat{B}_2 (2)

(ii) \hat{B}_1 (1)

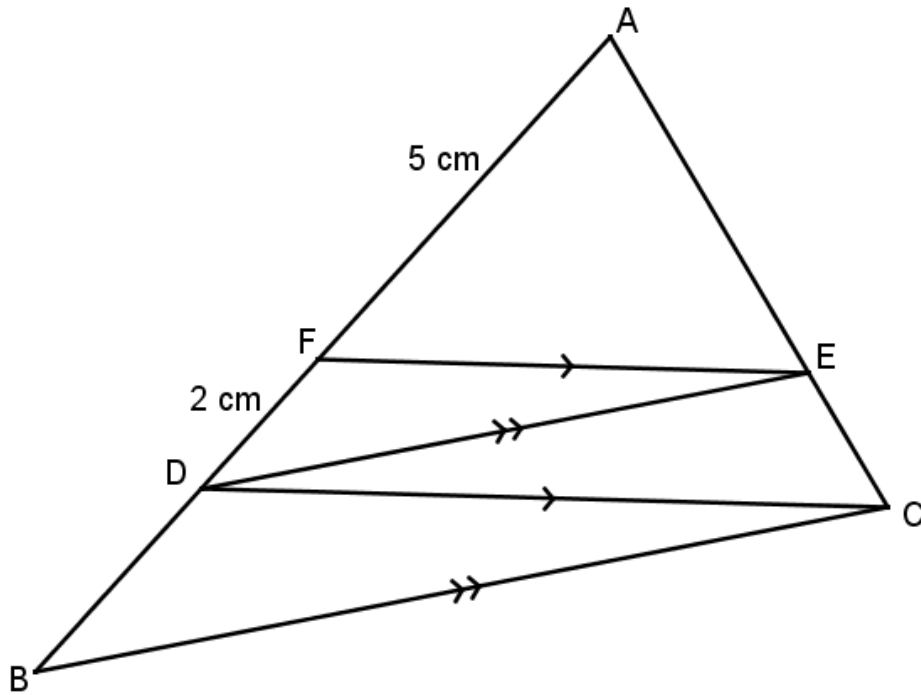
(iii) \hat{E} (2)

(iv) \hat{D}_1 (2)

(v) \hat{A}_1 (2)

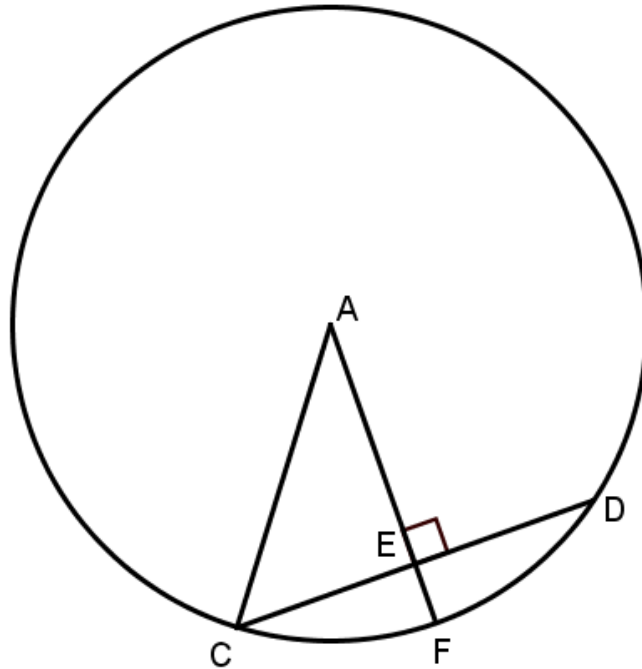
QUESTION 7

- (a) In the diagram below, $FE \parallel DC$ and $DE \parallel BC$. $AF = 5 \text{ cm}$ and $FD = 2 \text{ cm}$.



Calculate, with reasons, the length of DB to one decimal place. (5)

- (b) In the diagram below A is the centre of the circle. $CD = 6$ cm and $EF = 1$ cm. Calculate, giving reasons, the length of the radius. Hint: let the radius be x . (3)



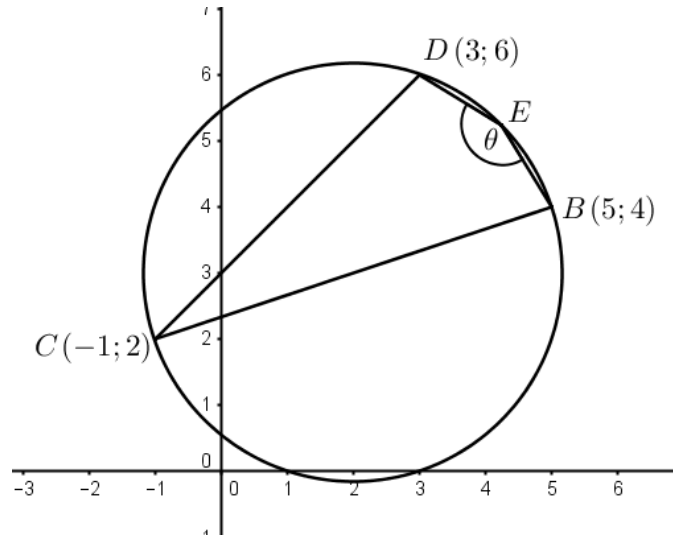
8

TOTAL FOR SECTION A: 75 MARKS

SECTION B

QUESTION 8

Consider the diagram:

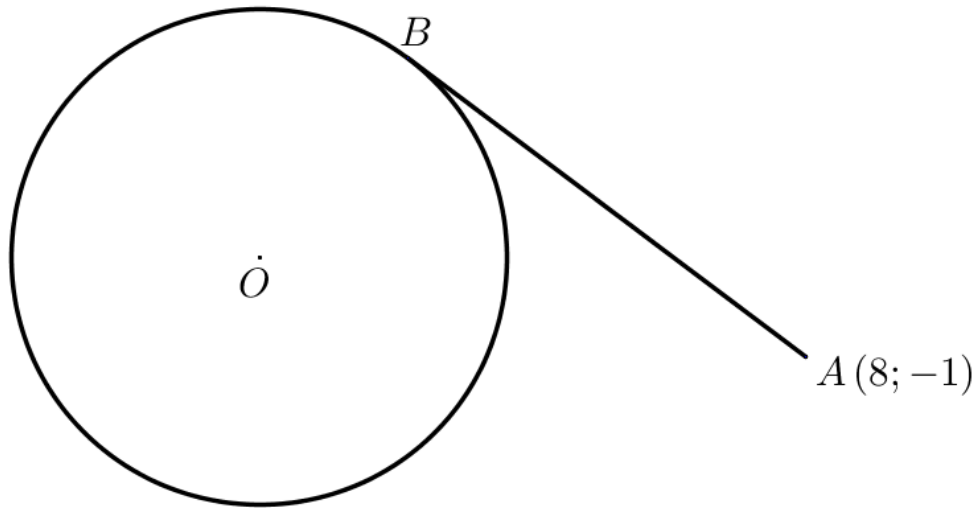


- (a) Determine θ to 1 decimal place, giving reasons where necessary. (5)

- (b) If it is further given that BC is a diameter of the circle then find the equation of the circle. (4)

QUESTION 9

Consider the diagram below, showing the circle with equation $x^2 + y^2 + 6x - 2y - 15 = 0$



Determine, to 1 decimal place, the length of the tangent (AB) to the circle from the point $A(8; -1)$, to the point of contact B , giving reasons where necessary.

QUESTION 10

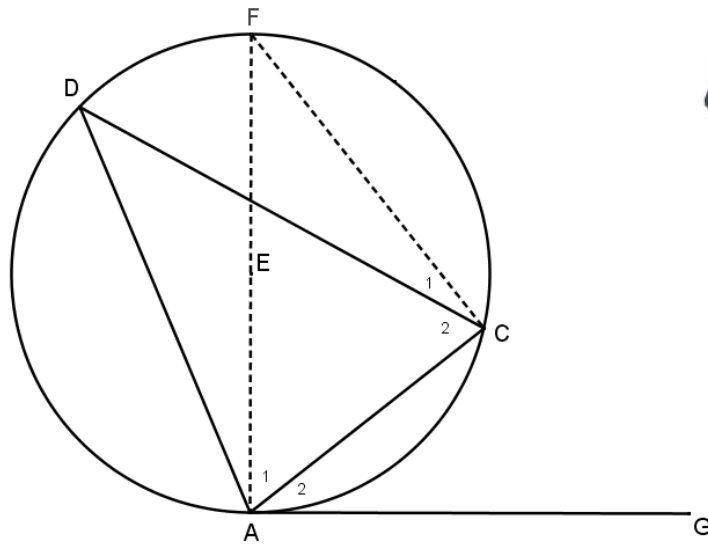
- (a) John was asked to prove the ***tan-chord*** theorem, viz. that “*the angle between a tangent and a chord is equal to any angle subtended by that chord in the alternate segment*”.

He knows that he needs to prove that $\hat{A}_2 = \hat{D}$ and he has remembered that he needs to construct the diameter and to join FC.

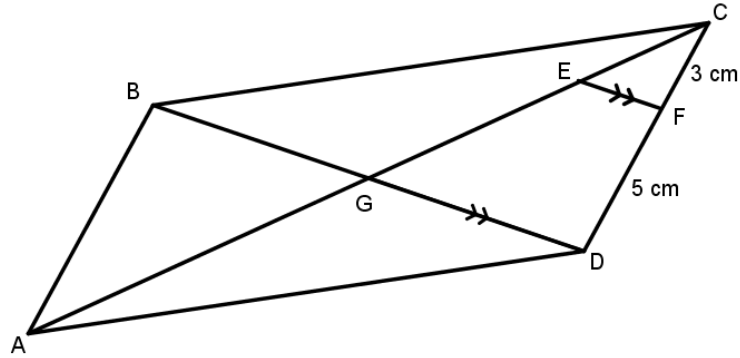
He has made the constructions correctly with dotted lines but now he is stuck!

Complete the proof for John.

(6)



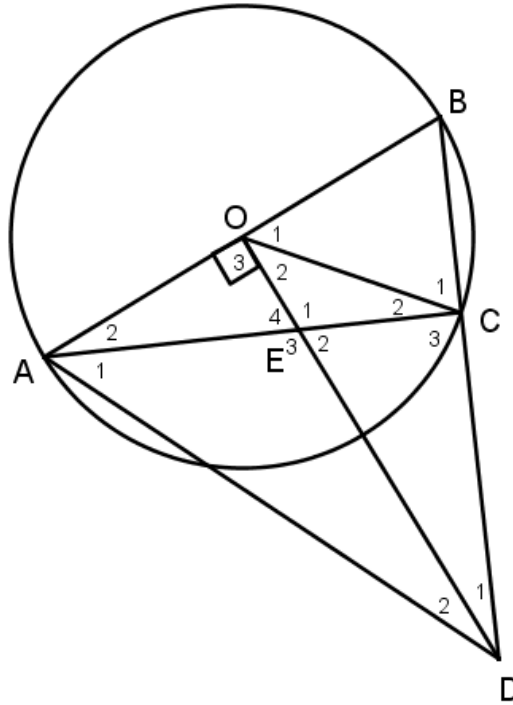
- (b) Consider the diagram below showing parallelogram ABCD with diagonals AC and BD drawn, intersecting at G. EF || BD, CF = 3 cm and FD = 5 cm



- (i) Determine the ratio $\frac{CE}{EA}$ giving reasons. (4)

- (ii) Determine $\frac{\text{Area } \triangle CEF}{\text{Area } ABCD}$ giving reasons. (4)

- (c) In the diagram below, AB is a diameter of circle ABC with centre O. Chord BC is produced to D. $OD \perp AB$ and OD cuts AC at E.



Prove, giving reasons:

- (i) That AOCD is a cyclic quadrilateral. (4)

- (i) $\hat{C}_2 = \hat{D}_1$ (3)

(iii) $\triangle OCE \parallel \triangle ODC$ (4)

(iv) $OE \cdot OD = OC^2$ (2)

QUESTION 11

The marks of a class of 23 boys have a mean of 73% and a standard deviation of 10.

Angus and Gavin have marks of 79% and 67% respectively.

Calculate, to 2 decimal places, the standard deviation of the remaining boys if Angus and Gavin leave the class.

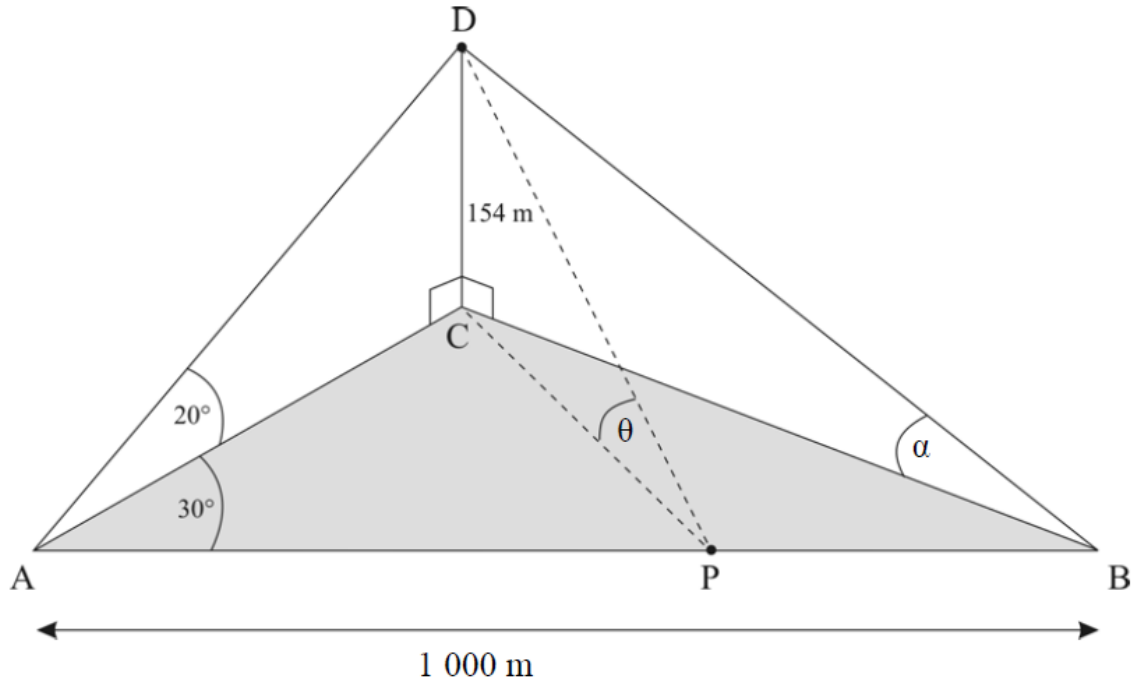
QUESTION 12

(a) Determine the general solution of the following equations:

(i) $\sin 2\theta \cos 20^\circ - \cos 2\theta \sin 20^\circ = -\frac{1}{2}$ (4)

(ii) $\sin \theta = \cos 3\theta$ (5)

- (b) In the diagram below, AB is a straight line 1000m long. P represents an object moving along AB . DC is a vertical tower with C , A and B points in the same horizontal plane. The angles of elevation of D from A and B are 20° and α respectively.



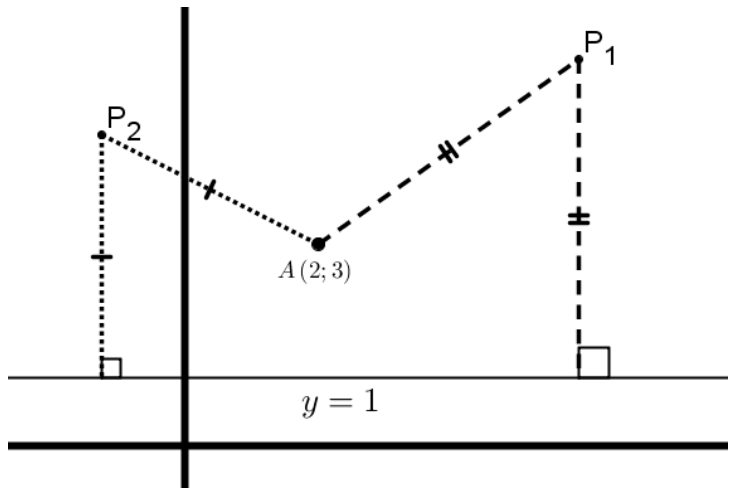
- (i) Find the length of AC rounded to 2 decimal places. (2)

- (ii) Find the value of α to the nearest degree. (6)

- (iii) Let θ be the angle of elevation of D from P. (5)
Determine the **maximum** value of θ to one decimal place.

QUESTION 13

A point P moves in the plane in such a way that its distance from the point $A(2;3)$ is always equal to its distance from the line $y=1$. Two possible positions for P are shown and labelled as P_1 and P_2 to aid your understanding.



By letting the point P be the point $P(x; y)$, determine, in standard form, the equation of the function on which P moves while satisfying the condition of being equidistant from the point $A(2;3)$ and the line $y=1$.

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TOTAL FOR SECTION B: 75 MARKS

TOTAL FOR PAPER: 150 MARKS