

Write your name here

Surname

Dongbei

Other names

Laowai

**Pearson Edexcel  
International GCSE**

Centre Number

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Candidate Number

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# Mathematics A

Paper 4HR



**Higher Tier**

Tuesday 19 January 2016 – Morning

**Time: 2 hours**

Paper Reference

**4MA0/4HR**

**You must have:**

Ruler graduated in centimetres and millimetres, protractor, compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

--

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- **Calculators may be used.**
- You must **NOT** write anything on the formulae page.  
Anything you write on the formulae page will gain **NO** credit.

## Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*

## Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.

Turn over ►

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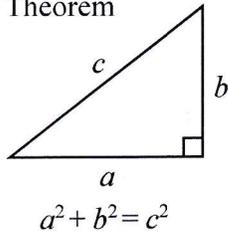
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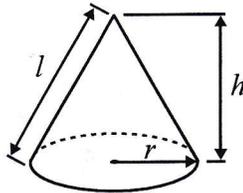
**International GCSE MATHEMATICS  
FORMULAE SHEET – HIGHER TIER**

Pythagoras' Theorem



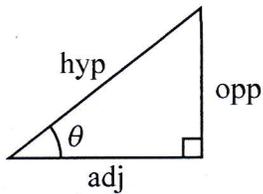
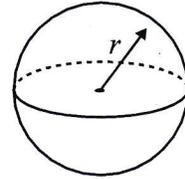
Volume of cone =  $\frac{1}{3} \pi r^2 h$

Curved surface area of cone =  $\pi r l$



Volume of sphere =  $\frac{4}{3} \pi r^3$

Surface area of sphere =  $4 \pi r^2$



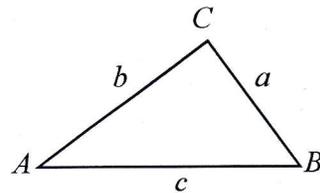
adj = hyp  $\times$  cos  $\theta$   
opp = hyp  $\times$  sin  $\theta$   
opp = adj  $\times$  tan  $\theta$

or  $\sin \theta = \frac{\text{opp}}{\text{hyp}}$

$\cos \theta = \frac{\text{adj}}{\text{hyp}}$

$\tan \theta = \frac{\text{opp}}{\text{adj}}$

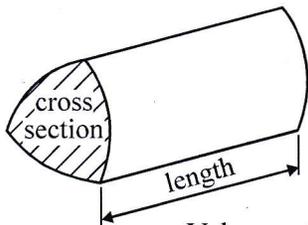
In any triangle ABC



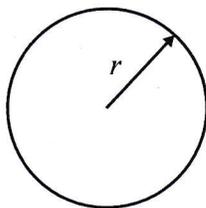
Sine rule:  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule:  $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle =  $\frac{1}{2} ab \sin C$



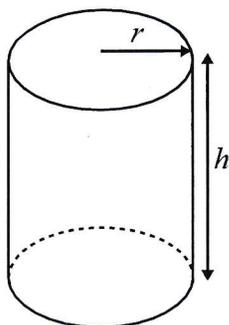
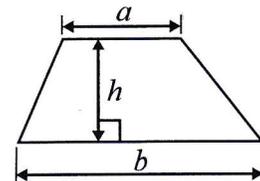
Volume of prism = area of cross section  $\times$  length



Circumference of circle =  $2 \pi r$

Area of circle =  $\pi r^2$

Area of a trapezium =  $\frac{1}{2}(a + b)h$



Volume of cylinder =  $\pi r^2 h$

Curved surface area of cylinder =  $2 \pi r h$

The Quadratic Equation

The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

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

DO NOT WRITE IN THIS AREA

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Answer ALL TWENTY FOUR questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Here is a list of ingredients needed to make 16 cookies.

Ingredients for 16 cookies
120 g butter
150 g sugar
240 g flour
170 g chocolate
1 egg

Max wants to make 40 cookies.

$$y = \frac{240 \times 40}{16}$$

(a) How much flour does Max need?

$$16 \text{ Cookies} \rightarrow 240 \text{ g}$$

$$40 \text{ Cookies} \rightarrow y$$

600

(2)

Abby made cookies to sell at a school fair.  
She used 600 g of butter.

(b) How many cookies did she make?

$$120 \text{ g butter} \rightarrow 16 \text{ cookies}$$

$$600 \text{ g butter} \rightarrow x$$

$$x = \frac{600 \times 16}{120} = 80$$

80

(2)

(c) Find the ratio of the weight of sugar to the weight of flour in the list of ingredients.  
Give your answer in the form 1: n

Sugar : Flour

150 : 240

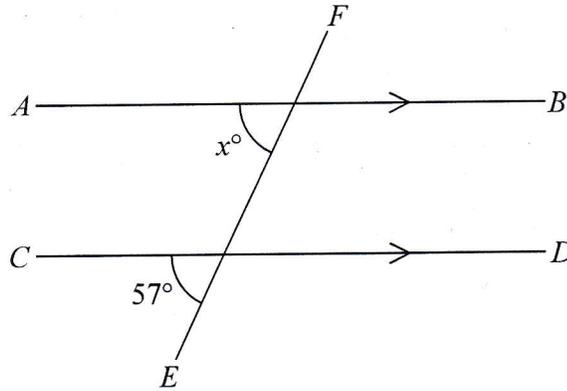
1 : 1.6

1 : 1.6

(2)

(Total for Question 1 is 6 marks)

2

Diagram NOT  
accurately drawn

$AB$  is parallel to  $CD$   
 $EF$  is a straight line.

(a) (i) Find the value of  $x$ 

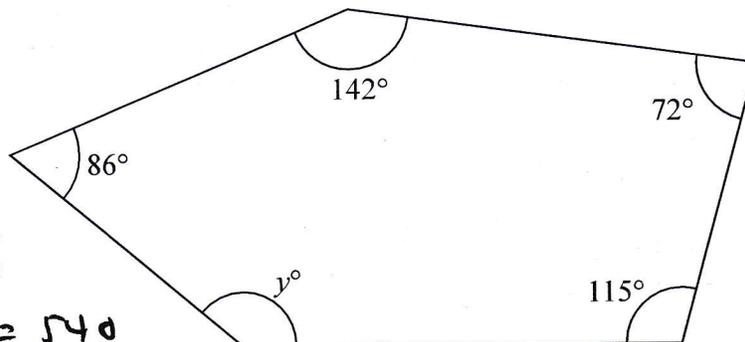
$$x = \underline{\underline{57}}$$

(ii) Give a reason for your answer.

Corresponding angles are equal.

(2)

Here is a pentagon.

Diagram NOT  
accurately drawn

Int angle:  
 $(n-2) \times 180$   
 $= (5-2) \times 180 = 540$

(b) Work out the value of  $y$ .

$$y = 540 - (86 + 142 + 115 + 72)$$

$$y = 540 - 415$$

$$y = \underline{\underline{125}}$$

$$y = \underline{\underline{125^\circ}}$$

(3)

(Total for Question 2 is 5 marks)

3 Show that  $\frac{3}{4} + \frac{4}{5} = 1\frac{11}{20}$

$$\frac{15}{20} + \frac{16}{20}$$

$$= \frac{31}{20}$$

$$= \underline{\underline{1\frac{11}{20}}}$$

(Total for Question 3 is 2 marks)

4  $\mathcal{E} = \{\text{whole numbers}\}$   
 $A = \{\text{factors of } 100\} \rightarrow 1, 2, 4, 5, 10, 20, 25, 50, 100$   
 $B = \{\text{multiples of } 5\} \rightarrow 5, 10, 15, 20, 25, \dots$   
List the members of the set  $A \cap B$

$$A \cap B = \{5, 10, 20, 25, 50, 100\}$$

(Total for Question 4 is 2 marks)

5 Here are a rectangle and a square.

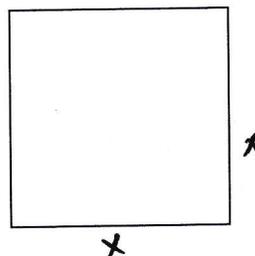
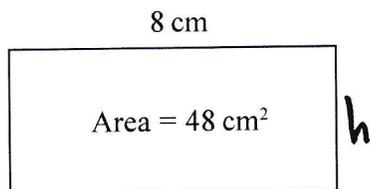


Diagram NOT accurately drawn

The rectangle has length 8 cm and area  $48 \text{ cm}^2$

The perimeter of the square is the same as the perimeter of the rectangle.

Calculate the area of the square.

Rectangle

$$A = 8 \times h$$

$$48 = 8 \times h$$

$$h = 6$$

Perimeter =

$$8 + 8 + 6 + 6$$

$$= 28$$

Square

$$4x = 28$$

$$x = 7 \text{ cm}$$

$$\text{Area} = x^2$$

$$= 7^2$$

$$= \underline{\underline{49}}$$

49

$\text{cm}^2$

(Total for Question 5 is 4 marks)

DO NOT WRITE IN THIS AREA

6 (a) Simplify  $x^7 \times x^2 = x^{7+2} = x^9$

$x^9$

(1)

(b) Simplify  $y^9 \div y^3 = y^{9-3} = y^6$

$y^6$

(1)

(c) Expand and simplify  $4(2d + 3) - 2(3d - 5)$

$8d + 12 - 6d + 10$   
 $2d + 22$

$2d + 22$

(2)

(d) Solve  $9y - 3 = 5y + 2$

$9y - 5y = 2 + 3$   
 $4y = 5$   
 $y = 5/4$

$y = 5/4$

(2)

(e) Solve  $\frac{7x - 1}{5} = x$

Show clear algebraic working.

$7x - 1 = 5x$   
 $2x = 1$   
 $x = 1/2$

$x = 1/2$

(3)

(Total for Question 6 is 9 marks)

- 7 Mr Rowland has a class of 30 students. He gave them 24 words to spell. The table shows information about the number of correct spellings for each student.

Number of correct spellings	Frequency	$x$	$xf$
0 - 4	1	2	2
5 - 9	5	7	35
10 - 14	6	12	72
15 - 19	10	17	170
20 - 24	8	22	176
	30		455

- (a) Write down the modal class.

15 - 19  
(1)

- (b) Work out an estimate for the mean number of correct spellings. Give your answer to 1 decimal place.

$$\text{mean} = \frac{455}{30} = 15.1666\dots$$

$$= \underline{\underline{15.2}} \text{ (1 dp)}$$

15.2  
(4)

(Total for Question 7 is 5 marks)

8 Ying eats some yoghurt.

The yoghurt contains 192 mg of calcium.

This is 16% of the total amount of calcium that Ying should have each day.

Work out the total amount of calcium that Ying should have each day.



let the total amount needed be  $y$ .

$$16\% y = 192$$

$$0.16y = 192$$

$$y = \frac{192}{0.16}$$

$$y = \underline{\underline{1200}}$$

1200 mg

(Total for Question 8 is 3 marks)

9 A plane flew from Bogotá to Quito.

The distance the plane flew was 725 km.

The time taken by the plane was 1 hour 24 minutes.

Work out the average speed of the plane.

Give your answer correct to 3 significant figures.

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$1 \text{ hour } 24 \text{ minutes} = \left| \frac{24}{60} \right| = 1.4$$

$$\begin{aligned} \text{Speed} &= \frac{725}{1.4} = 517.85\dots \\ &= \underline{\underline{518}} \text{ (3 sf)} \end{aligned}$$

518 km/h

(Total for Question 9 is 3 marks)

10 The table gives the surface areas, in square kilometres, of five seas.

Sea	Surface area in square kilometres
Mediterranean Sea	$2.97 \times 10^6$
East China Sea	$1.25 \times 10^6$
Baltic Sea	$4.22 \times 10^5$
Red Sea	$4.38 \times 10^5$
Okhotsk Sea	$1.59 \times 10^6$

(a) Write  $1.59 \times 10^6$  as an ordinary number.

1 590 000

1 590 000

(1)

(b) Work out the difference, in square kilometres, between the largest surface area and the smallest surface area for these five seas.  
Give your answer in standard form.

$$2.97 \times 10^6 - 4.22 \times 10^5$$

$$= \underline{\underline{2.548 \times 10^6}}$$

$$\underline{\underline{2.548 \times 10^6}} \text{ km}^2$$

(2)

The surface area of the East China Sea is  $k$  times the surface area of the Baltic Sea.

(c) Work out the value of  $k$ .

Give your answer to the nearest whole number.

$$1.25 \times 10^6 = k (4.22 \times 10^5)$$

$$k = \frac{1.25 \times 10^6}{4.22 \times 10^5}$$

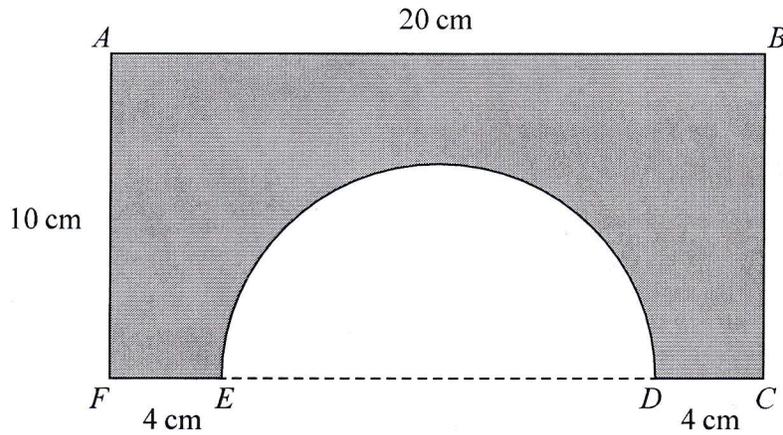
$$= \underline{\underline{2.96}}$$

$$k = \underline{\underline{3}}$$

(2)

(Total for Question 10 is 5 marks)

11

Diagram **NOT**  
accurately drawn

The shaded shape is made by cutting a semicircle from a rectangular piece of card,  $ABCF$ , as shown in the diagram.

$FEDC$  is a straight line.

The centre of the semicircle lies on  $ED$ .

$AF = BC = 10$  cm,  $AB = 20$  cm,  $FE = DC = 4$  cm.

Work out the perimeter of the shaded shape.

Give your answer correct to 3 significant figures.

$$ED = 20 - 4 - 4 = 12$$

$$\text{Length of Arc } ED = \frac{\pi \times 12}{2} = 6\pi$$

$$\text{Perimeter} = 10 + 20 + 10 + 4 + 4 + 6\pi$$

$$= 48 + 6\pi$$

$$= 66.849\dots$$

$$= \underline{\underline{66.8}}$$

66.8

cm

(Total for Question 11 is 3 marks)

12 Simplify fully  $(2x + 3)^2 - (2x - 3)^2$

$$\begin{array}{ccc} & \swarrow & \searrow \\ & 4x^2 + 12x + 9 & 4x^2 - 12x + 9 \end{array}$$

$$(4x^2 + 12x + 9) - (4x^2 - 12x + 9)$$

$$= 12x + 12x$$

$$= \underline{\underline{24x}}$$

24x

(Total for Question 12 is 3 marks)

13 The diagram shows triangle  $ABC$ .

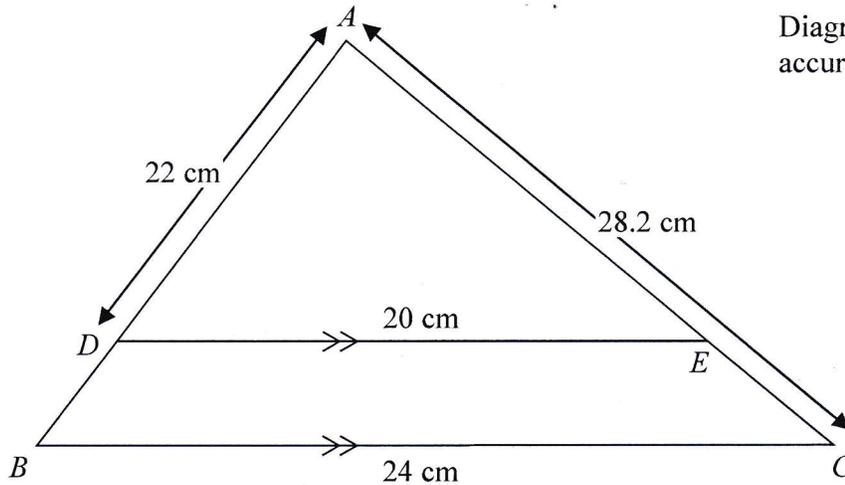


Diagram NOT accurately drawn

$$k = \frac{24}{20} = 1.2$$

$ADB$  and  $AEC$  are straight lines.

$DE$  is parallel to  $BC$ .

$DE = 20$  cm,  $BC = 24$  cm,  $AD = 22$  cm,  $AC = 28.2$  cm

(a) Work out the length of  $AB$ .

$$\begin{aligned} AB &= AD \times k \\ &= 22 \times 1.2 \\ &= \underline{\underline{26.4}} \end{aligned}$$

$$\underline{\underline{26.4}} \text{ cm} \quad (2)$$

(b) Work out the length of  $EC$ .

$$AE = \frac{28.2}{k} = \frac{28.2}{1.2} = 23.5$$

$$\begin{aligned} EC &= 28.2 - 23.5 \\ &= \underline{\underline{4.7}} \end{aligned}$$

$$\underline{\underline{4.7}} \text{ cm} \quad (2)$$

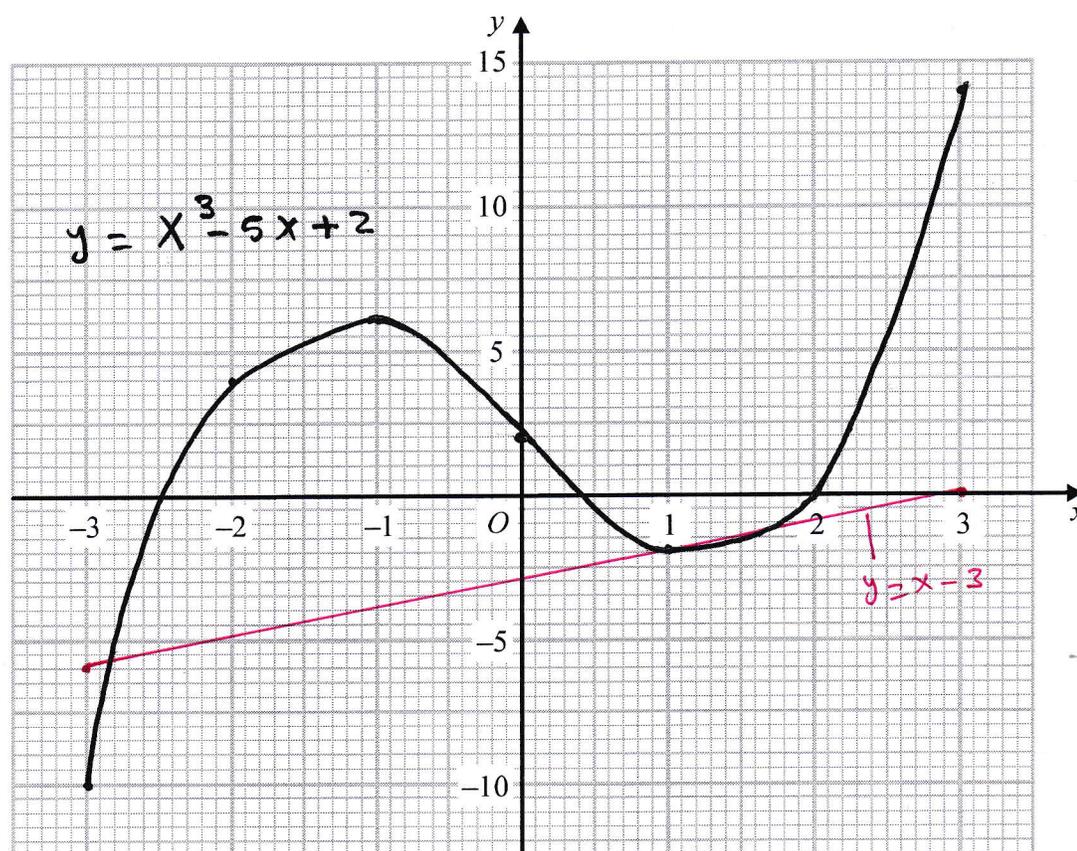
(Total for Question 13 is 4 marks)

14 (a) Complete the table of values for  $y = x^3 - 5x + 2$

x	-3	-2	-1	0	1	2	3
y	-10	4	6	2	-2	0	14

(2)

(b) On the grid, draw the graph of  $y = x^3 - 5x + 2$  for  $-3 \leq x \leq 3$



(2)

The equation  $x^3 - 6x + m = 0$ , where  $m$  is an integer, has one negative solution and two positive solutions.

(c) Given that  $x = 1$  is one of the positive solutions, show that  $m = 5$

$$x^3 - 6x + m = 0$$

$$1^3 - 6(1) + m = 0$$

$$-5 + m = 0$$

$$\underline{m = 5} \text{ as required.}$$

(1)

(d) By drawing a suitable straight line on the grid, find an estimate for the negative solution of  $x^3 - 6x + 5 = 0$   
Give your estimate to 1 decimal place.

Curve:  $y = x^3 - 5x + 2$

NEW:  $x^3 - 6x + 5 = 0$

$$x^3 - 6x + 5 = 0$$

$$x^3 - 5x + 2 = x - 3$$

$y = x - 3$  } suitable  
straight line }

- 2.8

(2)

(Total for Question 14 is 7 marks)

$$x = -3$$

$$x = 3$$

$$y = -6$$

$$y = 0$$

15 Use algebra to show that the recurring decimal  $0.2\dot{6} = \frac{4}{15}$

$$\text{let } x = 0.2666\dots$$

$$10x = 2.6666$$

$$9x = 2.4$$

$$x = \frac{2.4}{9} = \frac{24}{90} = \underline{\underline{\frac{4}{15}}}$$

(Total for Question 15 is 2 marks)

16  $Q$  is inversely proportional to  $t^2 \rightarrow Q \propto \frac{1}{t^2}$   
 $Q = 320$  when  $t = 0.5$

Find a formula for  $Q$  in terms of  $t$

$$Q = k \cdot \frac{1}{t^2}$$

$$Q = \underline{\underline{\frac{80}{t^2}}}$$

$$320 = \frac{k}{0.5^2}$$

$$k = 320 \times 0.5^2$$

$$k = 80$$

$$Q = \frac{80}{t^2}$$

(Total for Question 16 is 3 marks)

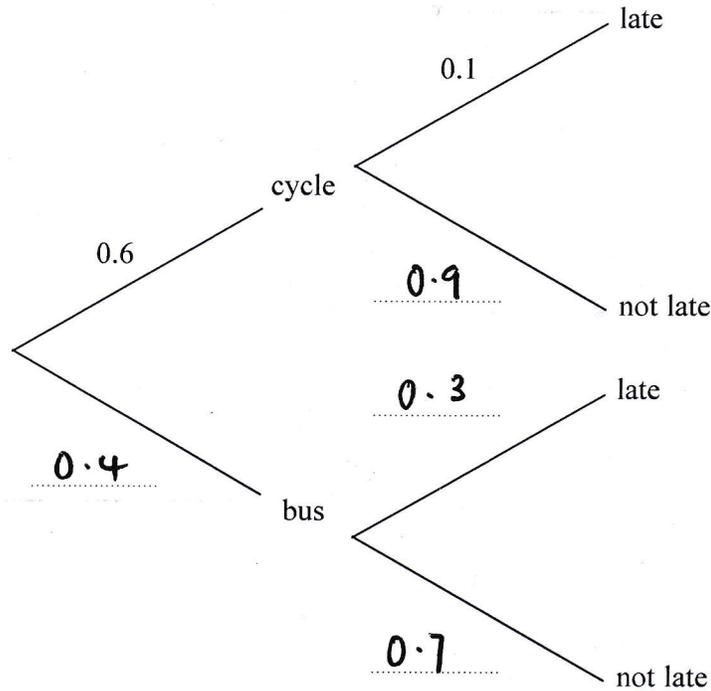
17 Chaiwat either cycles to work or goes by bus.

On any day that he goes to work, the probability that he cycles is 0.6

When he cycles, the probability that he is late is 0.1

When he goes by bus, the probability that he is late is 0.3

(a) Complete the probability tree diagram.



(2)

(b) Calculate the probability that on a day Chaiwat goes to work, he cycles and is late for work.

$$P(\text{cycle and late}) = 0.6 \times 0.1$$

$$= \underline{\underline{0.06}}$$

0.06

(2)

(c) Calculate the probability that on a day Chaiwat goes to work, he is **not** late for work.

$$P(\text{not late}) = P(\text{cycle, not late}) \text{ or } P(\text{bus, not late})$$

$$= (0.6 \times 0.9) + (0.4 \times 0.7)$$

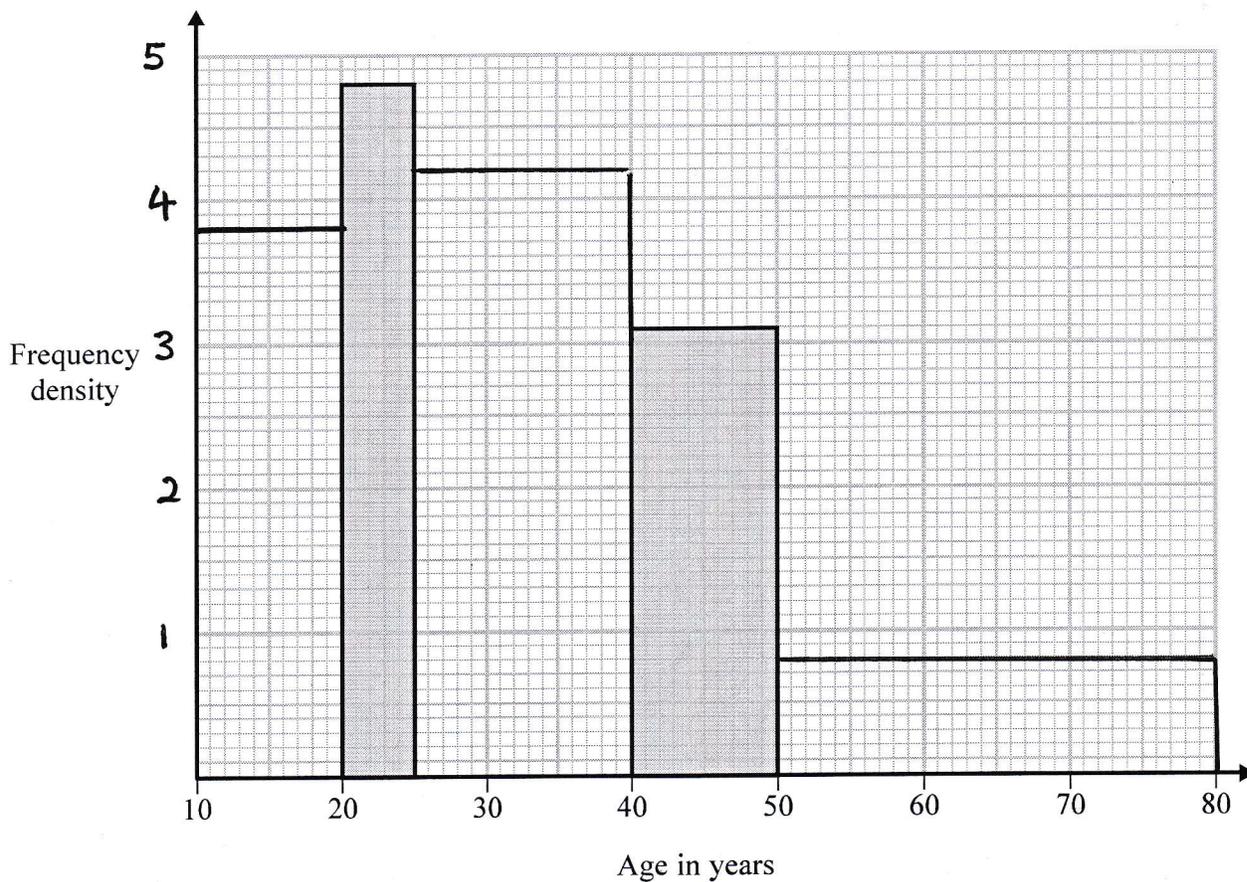
$$= \underline{\underline{0.82}}$$

0.82

(3)

(Total for Question 17 is 7 marks)

18 The incomplete histogram and the incomplete table show information about the ages of people watching a film in a cinema.



Age ( $a$ years)	Number of people	F.D
$10 \leq a < 20$	38	3.8
$20 \leq a < 25$	24	4.8
$25 \leq a < 40$	63	4.2
$40 \leq a < 50$	31	3.1
$50 \leq a < 80$	24	0.8

(a) Use the histogram to complete the table.

(2)

(b) Use the table to complete the histogram.

(2)

(Total for Question 18 is 4 marks)

19 Make  $g$  the subject of  $3e + 4g = 7 + 9eg$

$$4g - 9eg = 7 - 3e$$

$$g(4 - 9e) = 7 - 3e$$

$$g = \frac{7 - 3e}{4 - 9e}$$

(Total for Question 19 is 3 marks)

20 Express  $\frac{3}{x+2} - \frac{6}{2x+5}$  as a single fraction.

Simplify your answer.

$$\frac{3(2x+5) - 6(x+2)}{(x+2)(2x+5)}$$

$$\frac{6x + 15 - 6x - 12}{(x+2)(2x+5)}$$

$$\frac{3}{(x+2)(2x+5)}$$

$$\frac{3}{(x+2)(2x+5)}$$

(Total for Question 20 is 3 marks)

21  $ABCDE$  is a square-based pyramid.

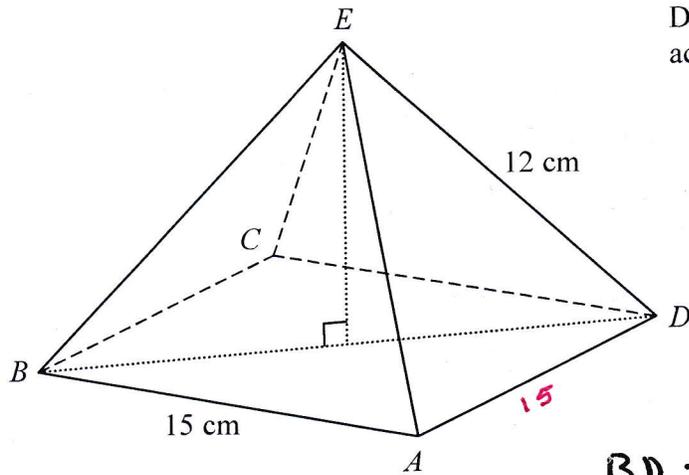
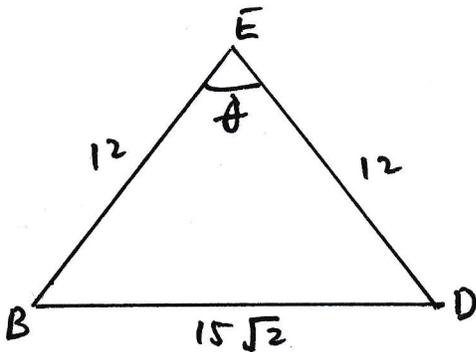


Diagram NOT accurately drawn

$AE = BE = CE = DE = 12$  cm  
 $AB = 15$  cm

$$BD = \sqrt{15^2 + 15^2} = 15\sqrt{2}$$

Calculate the size of angle  $DEB$ .  
 Give your answer to the nearest degree.



$$\cos \theta = \frac{12^2 + 12^2 - (15\sqrt{2})^2}{2 \times 12 \times 12} = \frac{288 - 450}{288} = -\frac{162}{288}$$

$$\cos \theta = -0.5625$$

$$\theta = \cos^{-1}(-0.5625)$$

$$= \underline{\underline{124.2288}}$$

124

(Total for Question 21 is 4 marks)

22  $(a + \sqrt{b})^2 = 49 + 12\sqrt{b}$  where  $a$  and  $b$  are integers, and  $b$  is prime.

Find the value of  $a$  and the value of  $b$

$$(a + \sqrt{b})^2 = a^2 + 2a\sqrt{b} + b$$

$$a^2 + b + 2a\sqrt{b} = 49 + 12\sqrt{b}$$

$$2a\sqrt{b} = 12\sqrt{b}$$

$$a = 6$$

$$a^2 + b = 49$$

$$b = 49 - 6^2 = 13$$

$$a = 6$$

$$b = 13$$

(Total for Question 22 is 3 marks)

23  $ABC$  is a triangle.

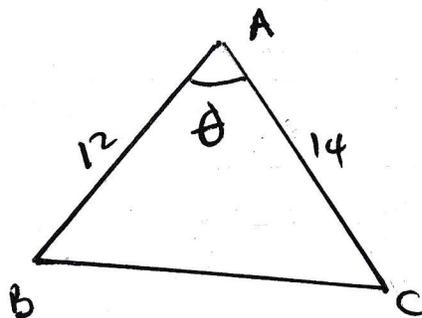
$$AB = 12 \text{ cm}$$

$$AC = 14 \text{ cm}$$

The area of triangle  $ABC$  is  $72 \text{ cm}^2$

Find, in degrees, the two possible sizes of angle  $BAC$ .

Give your answers correct to the nearest degree.



$$72 = \frac{1}{2} \times 12 \times 14 \sin \theta$$

$$\sin \theta = \frac{72 \times 2}{12 \times 14}$$

$$\sin \theta = \frac{6}{7}$$

$$\theta = \sin^{-1}\left(\frac{6}{7}\right)$$

$$= 58.99$$

$$\theta = 59^\circ$$

$\theta$  also equals

$$180 - 59$$

$$= 121$$

$$\theta = 59 \text{ or } 121$$

(Total for Question 23 is 4 marks)

24 Solve the simultaneous equations

$$\begin{aligned}y &= 3x + 2 \\ x^2 + y^2 &= 20\end{aligned}$$

Show clear algebraic working.

$$x^2 + y^2 = 20$$

$$x^2 + (3x + 2)^2 = 20$$

$$x^2 + 9x^2 + 12x + 4 = 20$$

$$10x^2 + 12x - 16 = 0$$

$$5x^2 + 6x - 8 = 0$$

$$(5x - 4)(x + 2) = 0$$

$$x = \frac{4}{5} \text{ or } -2$$

$$y = 3x + 2$$

$$y = 4.4 \text{ or } -4$$

$$\underline{\underline{(-2, -4) \text{ or } (\frac{4}{5}, 4.4)}}$$

(Total for Question 24 is 6 marks)

TOTAL FOR PAPER IS 100 MARKS

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