

14

Harry and Gary have a total of 300 stickers.

The ratio of the number of stickers Harry has to the ratio of the number of stickers Gary has is in the ratio 7 : 3

Harry gives Gary some stickers.

The ratio of the number of stickers Harry has to the ratio of the number of stickers Gary has is now in the ratio 8 : 7

Work out how many stickers Harry gives to Gary.
You must show all your working.

$\boxed{30} \boxed{30} \boxed{30} \boxed{30} \boxed{30} \boxed{30} \boxed{30} : \boxed{30} \boxed{30} \boxed{30}$

$$\frac{300}{10} = 30$$

$$7 \times 30 = 210$$

$$3 \times 30 = 90$$

$\boxed{20} \boxed{20} \boxed{20} \boxed{20} \boxed{20} \boxed{20} \boxed{20} \boxed{20} : \boxed{20} \boxed{20} \boxed{20} \boxed{20}$
 $\boxed{20} \boxed{20} \boxed{20}$

$$\frac{300}{15} = 20$$

$$8 \times 20 = 160$$

$$7 \times 20 = 140$$

$$210 - 160 = \underline{\underline{50}}$$

50

(Total for question 14 is 4 marks)

15 A shop sells small chocolate bars and large chocolate bars.

There are

small chocolate bars are sold in packs of 4

large chocolate bars are sold in packs of 9

On one day

the number of packs of small chocolate bars sold : the number of packs of large chocolate bars sold = 5 : 2

A total of 95 chocolate bars were sold.

Work out the number of small chocolate bars sold.

Chocolate bars sold
S : L
 $5 \times 4 : 2 \times 9$
 $20 : 18$
 $10 : 9$

$\boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} : \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5}$

19 parts

$$\frac{95}{19} = 5$$

$$10 \times 5 = \underline{\underline{50}}$$

50

(Total for question 15 is 4 marks)

- 1 In a bag there are blue sweets and red sweets. The ratio of blue sweets to red sweets is 5:3

What fraction of the sweets are blue?

5 Parts Blue

8 Parts in Total (5+3)

$$\frac{5}{8}$$

(Total for question 1 is 2 marks)

- 2 In a bag there are blue sweets and red sweets. The ratio of blue sweets to red sweets is 2:7

What fraction of the sweets are red?

7 parts red

9 parts in total

$$\frac{7}{9}$$

(Total for question 2 is 2 marks)

- 3 In a bag there are blue sweets and red sweets. The ratio of blue sweets to red sweets is 4:9

What fraction of the sweets are blue?

4 parts blue

13 parts in total

$$\frac{4}{13}$$

(Total for question 3 is 2 marks)

- 4 In a bag there are blue sweets, red sweets and green sweets.
The ratio of blue sweets to red sweets to green sweets is 5:3:2
B R G

What fraction of the sweets are green?

2 parts green
10 parts in total

$$\frac{2}{10} \text{ or } \frac{1}{5}$$

$$\frac{1}{5}$$

(Total for question 4 is 2 marks)

- 5 In a bag there are blue sweets, red sweets and green sweets.
The ratio of blue sweets to red sweets to green sweets is 2:4:5
B R G

What fraction of the sweets are red?

4 parts red
11 parts in total

$$\frac{4}{11}$$

(Total for question 5 is 2 marks)

- 6 In a bag there are blue sweets, red sweets and green sweets.
The ratio of blue sweets to red sweets to green sweets is 6:9:4
B R G

What fraction of the sweets are blue?

6 parts blue
19 parts in total

$$\frac{6}{19}$$

(Total for question 6 is 2 marks)

- 7 In a bag there are only red sweets and yellow sweets. $\frac{2}{3}$ of the sweets are red.

Write down the ratio of red sweets to yellow sweets?

$$\frac{2}{3} \text{ Red} \quad \frac{1}{3} \text{ Yellow}$$

$$2 : 1$$

$$2 : 1$$

(Total for question 7 is 2 marks)

- 8 In a bag there are only red sweets and yellow sweets. $\frac{3}{5}$ of the sweets are red.

Write down the ratio of red sweets to yellow sweets?

$$\frac{3}{5} \text{ Red} \quad \frac{2}{5} \text{ Yellow}$$

$$3 : 2$$

$$3 : 2$$

(Total for question 8 is 2 marks)

- 9 In a bag there are only blue sweets and green sweets. $\frac{5}{6}$ of the sweets are green.

Write down the ratio of blue sweets to green sweets?

$$\frac{5}{6} \text{ green} \quad \frac{1}{6} \text{ Blue}$$

Blue to Green

$$1 : 5$$

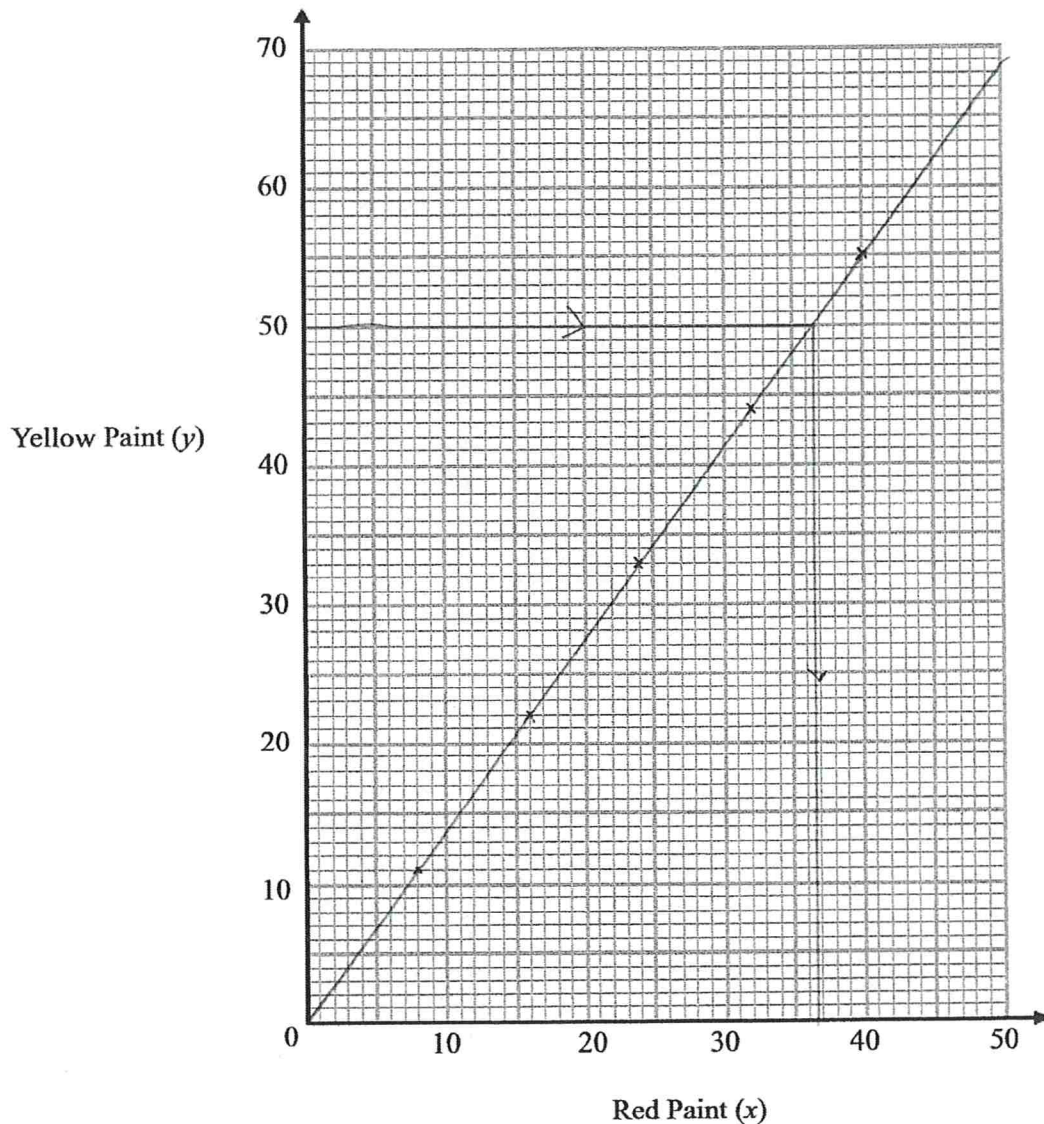
$$1 : 5$$

(Total for question 9 is 2 marks)

10 An artist is making orange paint by mixing red paint (x ml) and yellow paint (y ml) in the ratio 8:11

- (a) Use this information to draw a graph showing the relationship between the amount of red paint and the amount of yellow paint used.

x	8	16	24	32	40
y	11	22	33	44	55



(2)

- (b) The artist decides to use 50ml of yellow paint. Use your graph to work out how much red paint he should use.

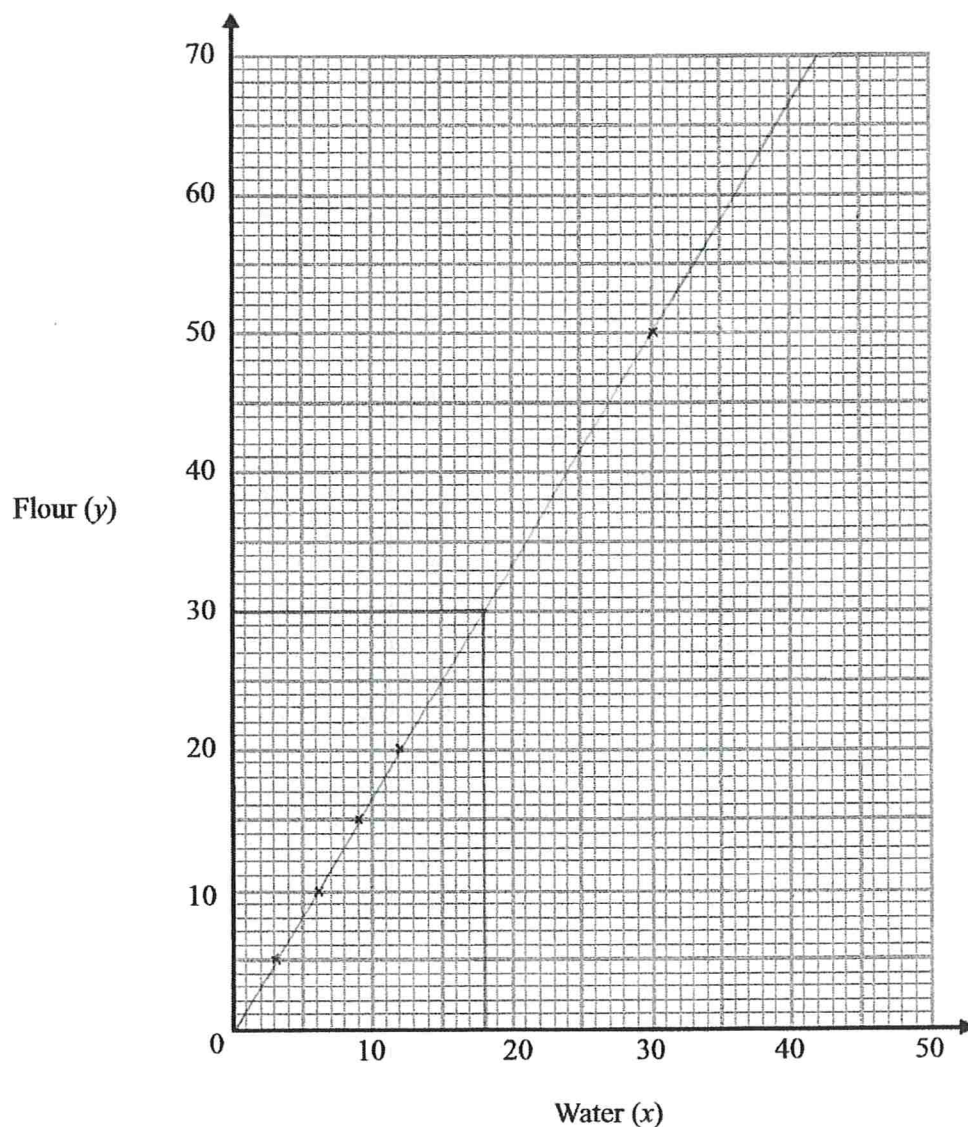
$$\frac{36.5 \text{ ml}}{(36 - 37)(2)}$$

(Total for question 10 is 4 marks)

11 An baker makes bread using the ratio of flour (y cups) to water (x cups) of 5:3.

(a) Use this information to draw a graph showing the relationship between the amount of flour and the amount water used to make bread.

x	3	6	9	12	30
y	5	10	15	20	50



(2)

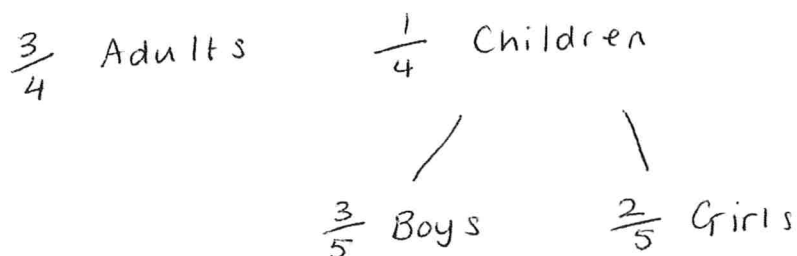
(b) The baker is going to use 30 cups of flour. Use your graph to work out how much water the baker should use.

.....18 cups
(2)

(Total for question 11 is 4 marks)

- 12 In a cinema the ratio of adults to children is 3:1 (4 PARTS)
The ratio of boys to girls is 3:2 (5 PARTS)

What fraction of all the people in the cinema are girls?



$$\frac{2}{5} \text{ of } \frac{1}{4}$$

$$\frac{2}{5} \times \frac{1}{4} = \frac{2}{20} = \frac{1}{10}$$

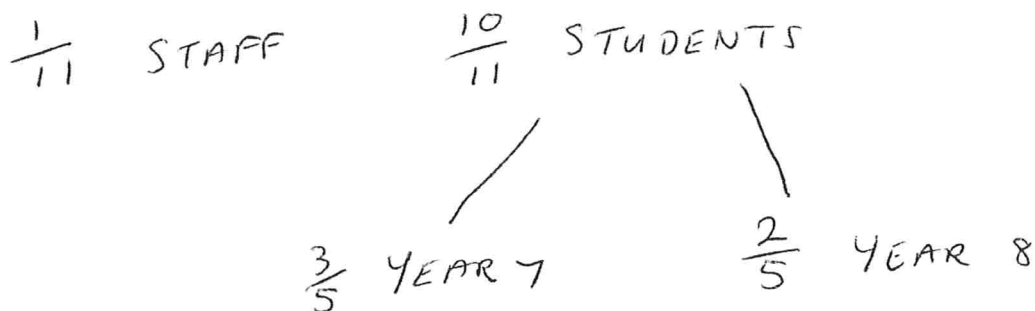
$$\frac{1}{10}$$

(Total for question 12 is 3 marks)

- 13 On a school trip the ratio of staff to students is 1:10 (11 PARTS)
All of the students are from either year 7 or year 8. The ratio of year 7 students to year 8 students is 3:2

(5 PARTS)

What fraction of all the people on the trip are year 7 students?



$$\frac{3}{5} \text{ of } \frac{10}{11}$$

$$\frac{3}{5} \times \frac{10}{11} = \frac{30}{55} = \frac{6}{11}$$

$$\frac{6}{11}$$

(Total for question 13 is 3 marks)

- 14 In a theatre the ratio of adults to children is 7:3 10 PARTS
The ratio of boys to girls is 3:2 5 PARTS

What percentage of all the people in the cinema are girls?

$$\begin{array}{ccc} \frac{7}{10} & \text{ADULTS} & \frac{3}{10} \text{ CHILDREN} \\ & & \swarrow \quad \searrow \\ & & \frac{3}{5} \text{ BOYS} \quad \frac{2}{5} \text{ GIRLS} \end{array}$$

$$\frac{2}{5} \text{ of } \frac{3}{10} = \frac{6}{50} = \frac{12}{100} = 12\%$$

$$\left[\frac{2}{5} \times \frac{3}{10} \right]$$

12%

(Total for question 14 is 3 marks)

- 15 In a company the ratio of men to women is 2:3 (5 PARTS)
30% of the women are under the age of 30.

$\times \frac{3}{10}$
What fraction of all the people in the company are women under the age of 30?

$$\frac{2}{5} \text{ MEN} \quad \frac{3}{5} \text{ WOMEN}$$

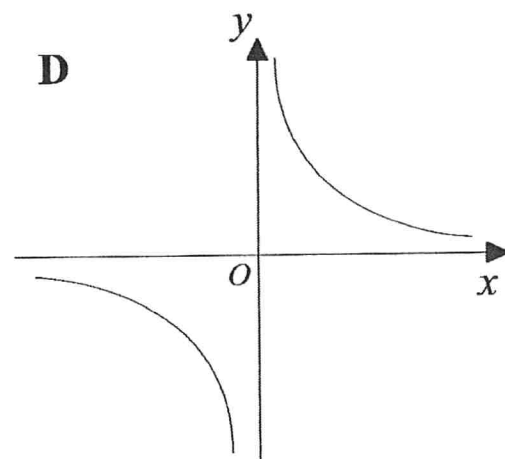
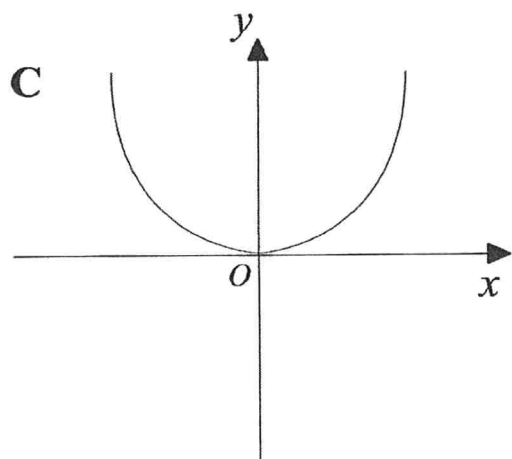
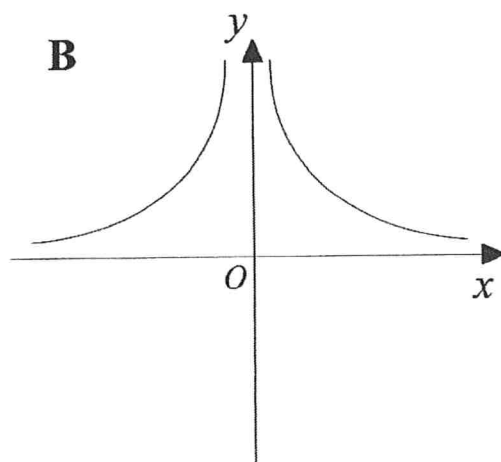
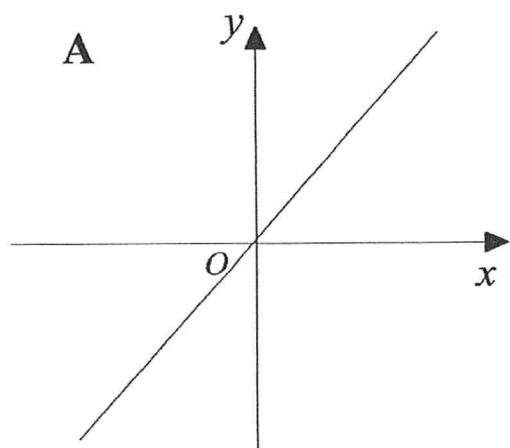
$$\frac{3}{10} \text{ or } \frac{3}{5}$$

$$\frac{3}{10} \times \frac{3}{5} = \frac{9}{50}$$

$\frac{9}{50}$

(Total for question 15 is 3 marks)

1 Here are four graphs.



Match each graph with a statement in the table below.

Proportionality relationship

y is directly proportional to x

y is inversely proportional to x

y is directly proportional to x^2

y is inversely proportional to x^2

Graph letter

A

D

C

B

(Total for question 1 is 2 marks)

2 a is directly proportional to b

When $a = 7, b = 28$

Find the value of b when $a = 5$

$$\begin{aligned}a &= kb \\ 7 &= k(28) \\ k &= \frac{7}{28} \\ &= \frac{1}{4}\end{aligned}$$

$$\therefore a = \frac{1}{4}b$$

when $a = 5$

$$5 = \frac{1}{4}b$$

$$\underline{\underline{b = 20}}$$

$$b = \dots 20 \dots$$

(Total for question 2 is 3 marks)

3 c is inversely proportional to d

When $c = 3, d = 8$

Find the value of c when $d = 2$

$$c = \frac{k}{d}$$

$$3 = \frac{k}{8}$$

$$k = 24$$

$$\therefore c = \frac{24}{d}$$

when $d = 2$

$$c = \frac{24}{2}$$

$$= 12$$

$$c = \dots 12 \dots$$

(Total for question 3 is 3 marks)

4 e is directly proportional to f

When $e = 3, f = 36$

Find the value of f when $e = 4$

$$e = kf$$

$$3 = k(36)$$

$$k = \frac{3}{36}$$

$$= \frac{1}{12}$$

$$\therefore e = \frac{1}{12}f$$

when $e = 4$

$$4 = \frac{1}{12}f$$

$$\underline{\underline{f = 48}}$$

$$f = \underline{\underline{48}}$$

(Total for question 4 is 3 marks)

5 g is directly proportional to the square root of h

When $g = 18, h = 16$

Find the possible values of h when $g = 2$

$$g = k\sqrt{h}$$

$$18 = k\sqrt{16}$$

$$18 = k(4)$$

$$k = \frac{18}{4} = \frac{9}{2}$$

$$\therefore g = \frac{9}{2}\sqrt{h}$$

when $g = 2$

$$2 = \frac{9}{2}\sqrt{h}$$

$$4 = 9\sqrt{h}$$

$$\frac{4}{9} = \sqrt{h}$$

$$h = \frac{16}{81}$$

$$h = \underline{\underline{\frac{16}{81}}}$$

(Total for question 5 is 3 marks)

6 y is inversely proportional to x

When $y = 15$, $x = 4$

Find the value of y when $x = 12$

$$y = \frac{k}{x}$$

$$15 = \frac{k}{4}$$

$$60 = k$$

$$\therefore y = \frac{60}{x}$$

$$\text{when } x = 12 \quad y = \frac{60}{12} = 5$$

$$y = \dots 5$$

(Total for question 6 is 3 marks)

7 x is inversely proportional to the square root of y

When $x = 12$, $y = 9$

Find the value of x when $y = 81$

$$x = \frac{k}{\sqrt{y}}$$

$$12 = \frac{k}{\sqrt{9}}$$

$$12 = \frac{k}{3}$$

$$k = 36$$

$$\therefore x = \frac{36}{\sqrt{y}}$$

$$\text{when } y = 81 \quad x = \frac{36}{\sqrt{81}} = \frac{36}{9} = 4$$

$$x = \dots 4$$

(Total for question 7 is 3 marks)

8 y is inversely proportional to the cube of x

When $y = 250$, $x = 0.2$

Find the value of y when $x = 0.5$

$$y = \frac{k}{x^3}$$

$$250 = \frac{k}{(0.2)^3}$$

$$250 = \frac{k}{(1/125)}$$

$$k = 2$$

$$\therefore y = \frac{2}{x^3}$$

when $x = 0.5$

$$y = \frac{2}{(0.5)^3}$$

$$y = \frac{2}{1/8} = 16$$

$$0.2 = \frac{1}{5}$$

$$(0.2)^3 = \frac{1}{125}$$

$$0.5 = \frac{1}{2}$$

$$0.5^3 = \frac{1}{8}$$

$$y = \dots 16$$

(Total for question 8 is 3 marks)

9 x is directly proportional to the cube of y

When $x = 32$, $y = 0.4$

Find the value of y when $x = 256$

$$x = ky^3$$

$$32 = k(0.4)^3$$

$$32 = \frac{8k}{125}$$

$$k = 500$$

$$\therefore x = 500y^3$$

when $x = 256$

$$256 = 500y^3$$

$$\frac{256}{500} = y^3$$

$$0.4 = \frac{2}{5}$$

$$0.4^3 = \frac{8}{125}$$

$$y^3 = \frac{64}{125}$$

$$y = \frac{4}{5}$$

$$y = \dots \frac{4}{5}$$

(Total for question 9 is 3 marks)

10 The table shows pairs of values for x and y

x	2	3
y	32	72

(i) Tick the correct statement below.

$$y = kx$$

$$32 = 2k$$

$$k = 16$$

and

$$72 = 3k$$

$$k = 24$$

X

$$y = kx^2$$

$$32 = k(4)$$

$$k = 8$$

and

$$72 = k(9)$$

$$k = 8$$

✓

$$y = kx^3$$

$y \propto x$
$y \propto x^2$ ✓
$y \propto x^3$

(ii) Write a formula for y in terms of x

$$\underline{\underline{y = 8x^2}}$$

$$y = 8x^2$$

(Total for question 10 is 4 marks)

11 The table shows pairs of values for x and y

x	4	5
y	256	500

(i) Tick the correct statement below.

$$y = kx$$

$$256 = k(4)$$

$$k = 64$$

$$500 = k(5)$$

$$k = 100$$

X

$$y = kx^2$$

$$256 = k(16)$$

$$k = 16$$

$$500 = k(25)$$

$$k = 20$$

X

$$y = kx^3$$

$$256 = k(64)$$

$$k = 4$$

$$500 = k(125)$$

$$k = 4$$

✓

$y \propto x$
$y \propto x^2$
$y \propto x^3$ ✓

(ii) Write a formula for y in terms of x

$$y = 4x^3$$

$$y = 4x^3$$

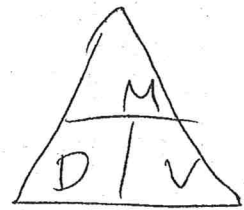
(Total for question 11 is 4 marks)

12 Liquid A has a density of 1.2 g/cm^3

150 cm^3 of Liquid A is mixed with some of Liquid B to make Liquid C.

Liquid C has a mass of 210 g and a density of 1.12 g/cm^3

Find the density of Liquid B.



$$\begin{aligned}\text{Liquid A: } \text{mass} &= \text{density} \times \text{volume} \\ &= 1.2 \times 150 \\ &= 180 \text{ g}\end{aligned}$$

$$\begin{aligned}\text{Liquid C } \text{volume} &= \frac{\text{mass}}{\text{density}} \\ &= \frac{210}{1.12} \\ &= 187.5 \text{ cm}^3\end{aligned}$$

$$\begin{aligned}\text{Liquid B } \text{volume} &= \text{Liquid C} - \text{Liquid A} \\ &= 187.5 - 150 \\ &= 37.5 \text{ cm}^3\end{aligned}$$

$$\begin{aligned}\text{Liquid B } \text{mass} &= \text{Liquid C} - \text{Liquid A} \\ &= 210 - \cancel{150} 180 \\ &= 30 \text{ g}\end{aligned}$$

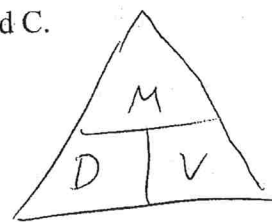
$$\text{Liquid B } \text{density} = \frac{\text{mass}}{\text{volume}} = \frac{30}{37.5} = 0.8$$

..... 0.8 g/cm^3

(Total for question 12 is 3 marks)

- 13 100ml of liquid A and 200ml of liquid B are mixed together to make liquid C.
Liquid A has a density of 0.7g/ml.
Liquid B has a density of 1.1 g/ml.

Work the density of liquid C.



$$\begin{aligned}\text{Liquid A: } \text{mass} &= \text{density} \times \text{volume} \\ &= 0.7 \times 100 \\ &= 70 \text{ g}\end{aligned}$$

$$\begin{aligned}\text{Liquid B: } \text{mass} &= 1.1 \times 200 \\ &= 220 \text{ g}\end{aligned}$$

$$\begin{aligned}\text{Liquid C density} &= \frac{\text{total mass}}{\text{total volume}} \\ &= \frac{70 + 220}{100 + 200} \\ &= \frac{290}{300} \\ &= 0.96 \text{ g/ml}\end{aligned}$$

..... 0.96 g/ml

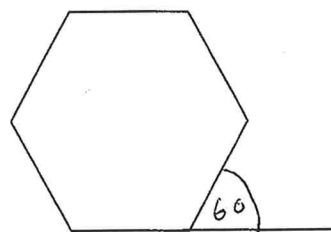
(Total for question 13 is 4 marks)

$$\left[\frac{29}{30} \right]$$

- 1 Work out the size of an exterior angle of a regular hexagon.

(Exterior angles always add to 360°)

$$\frac{360}{6} = 60$$



..... 60

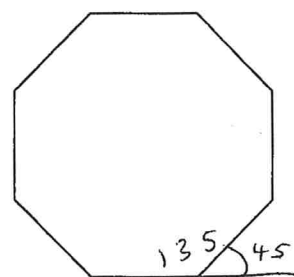
(Total for question 1 is 2 marks)

- 2 Work out the size of each interior angle in a regular octagon.

$$\frac{360}{8} = 45$$

$$180 - 45 = 135$$

(Interior angle + Exterior angle = 180)



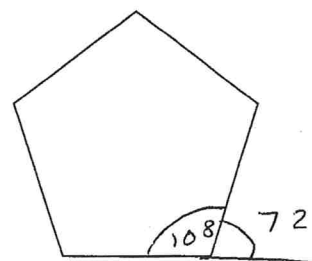
..... 135

(Total for question 2 is 2 marks)

- 3 Work out the size of each interior angle in a regular pentagon

$$\frac{360}{5} = 72$$

$$180 - 72 = 108$$



..... 108

(Total for question 3 is 2 marks)

- 4 The size of each exterior angle in a regular polygon is 20° .
Work out how many sides the polygon has.

$$\frac{360}{20} = \frac{36}{2} = 18$$

.....18.....

(Total for question 4 is 2 marks)

- 5 The size of each exterior angle in a regular polygon is 18° .
Work out how many sides the polygon has.

$$\frac{360}{18} = \frac{180}{9} = 20$$

.....20.....

(Total for question 5 is 2 marks)

- 6 The size of each interior angle in a regular polygon is 165° .
Work out how many sides the polygon has.

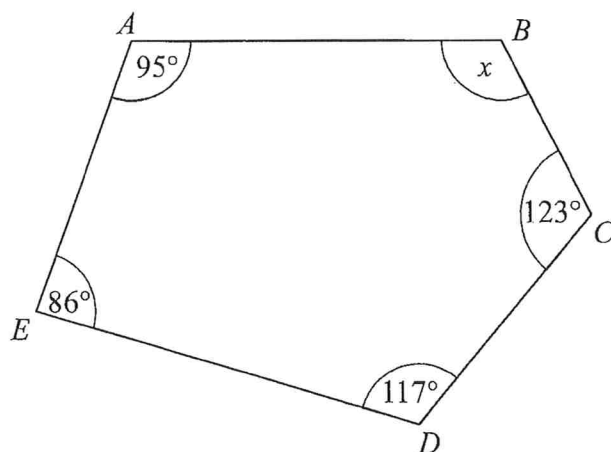
$$180 - 165 = 15 \quad (\text{Exterior angle} = 15^\circ)$$

$$\frac{360}{15} = \frac{120}{5} = 24$$

.....24.....

(Total for question 6 is 2 marks)

7



$$\begin{array}{r} 123 \\ 117 \\ 95 \\ + 86 \\ \hline 421 \end{array}$$

$ABCDE$ is a pentagon.

Work out the size of angle ABC .

$$\begin{aligned} \text{Angle sum} &= (n-2) \times 180 \\ &= (5-2) \times 180 \\ &= 3 \times 180 \\ &= 540 \end{aligned}$$

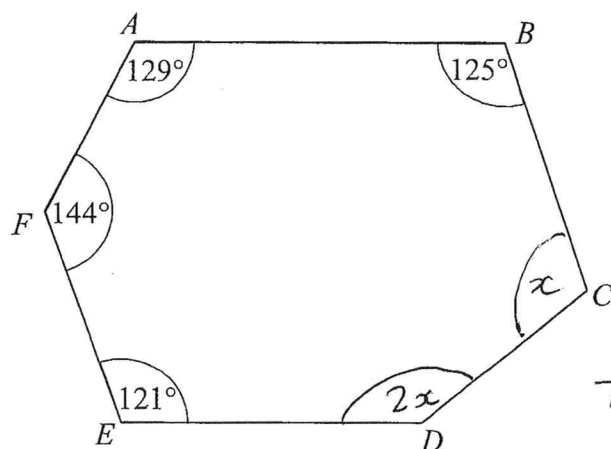
(Angles in a pentagon add to 540°)

$$\begin{aligned} 540 - 421 \\ = 119 \end{aligned}$$

.....119.....°

(Total for question 7 is 2 marks)

8



$$\begin{array}{r} 129 \\ 125 \\ 144 \\ + 121 \\ \hline 519 \end{array}$$

$$720 - 519 = 201$$

$ABCDEF$ is a hexagon.

Angle $CDE = 2 \times$ Angle BCD

Work out the size of angle CDE .

$$\begin{aligned} \text{Angles in a hexagon} &= (6-2) \times 180 \\ &= 4 \times 180 \\ &= 720^\circ \end{aligned}$$

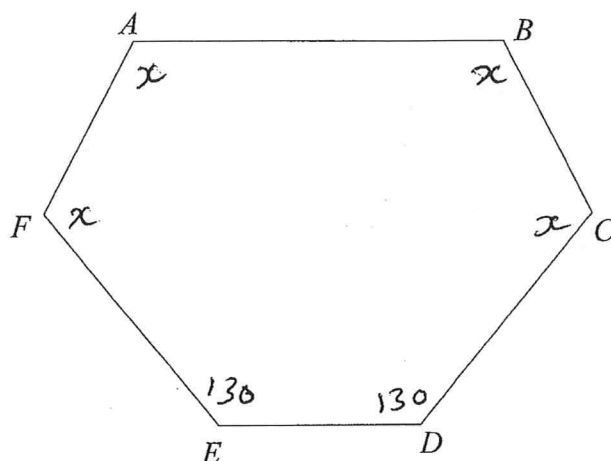
$$3 \overline{) 201}$$

$$x = 67$$

$$\begin{aligned} 2x &= 2 \times 67 \\ &= 134 \end{aligned}$$

.....134.....°

(Total for question 8 is 3 marks)



$ABCDEF$ is a hexagon.

Angle BAF = Angle ABC = Angle AFE = Angle BCD .
 Angle DEF = Angle CDE = 130°

Work out the size of angle BAF .
 You must show all your working.

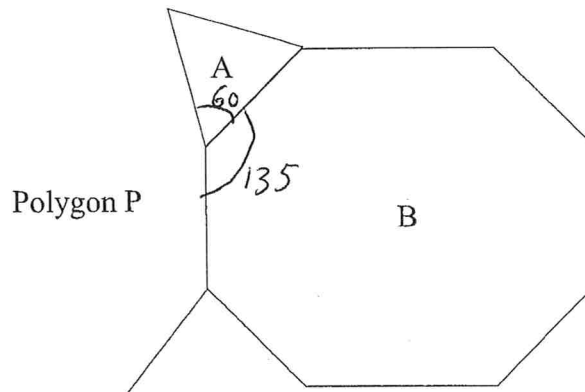
$$\begin{aligned} \text{Angles in a hexagon} &= (6 - 2) \times 180 \\ &= 720^\circ \end{aligned}$$

$$\begin{aligned} 720 - 130 - 130 \\ 720 - 260 &= 460 \end{aligned}$$

$$\frac{460}{4} = \underline{115^\circ}$$

.....115..... $^\circ$

(Total for question 9 is 3 marks)



Shape A is a regular triangle. Shape B is a regular octagon.

Another regular polygon, P, is shown on the diagram.

How many sides does polygon P have?

You must show your working.

$$\text{Interior angle of A} = 60^\circ$$

$$\text{Exterior angle of B} = \frac{360}{8} = 45^\circ$$

$$\begin{aligned} \text{Interior angle of B} &= 180 - 45 \\ &= 135^\circ \end{aligned}$$

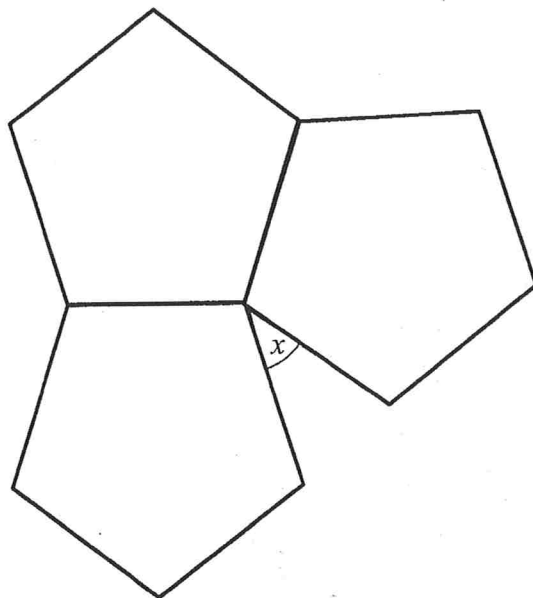
$$\begin{aligned} \text{Interior angle of P} &= 360 - 60 - 135 \\ &= 165^\circ \end{aligned}$$

$$\begin{aligned} \text{Exterior angle of P} &= 180 - 165 \\ &= 15^\circ \end{aligned}$$

$$\frac{360}{15} = \frac{120}{5} = 24$$

.....24.....

(Total for question 10 is 4 marks)



The diagram shows three regular pentagons meeting at a point.

Work out the size of the angle marked x .
You must show all your working.

$$\text{Exterior angle of pentagon} = \frac{360}{5} = 72$$

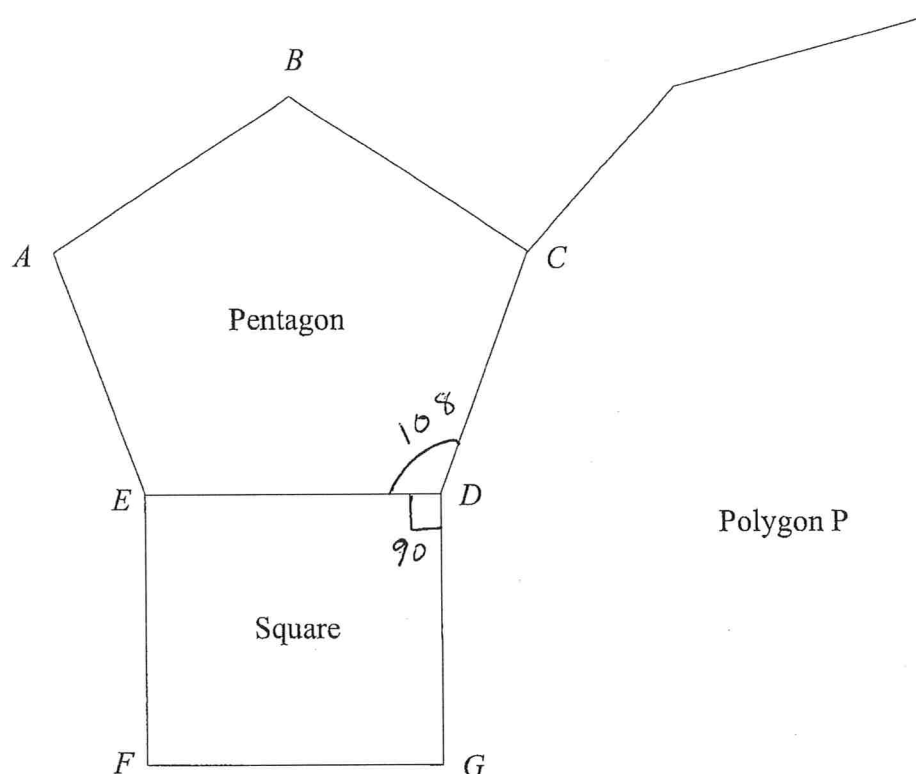
$$\begin{aligned} \text{Interior angle of pentagon} &= 180 - 72 \\ &= 108^\circ \end{aligned}$$

$$3 \times 108 = 324$$

$$360 - 324 = \underline{\underline{36}}$$

..... 36

(Total for question 11 is 3 marks)



The diagram shows a regular pentagon, ABCDE, and a square, EDFG.

The lines CD and DG are both sides of another regular polygon, P.

How many sides does polygon P have?

You must show how you got your answer.

$$\text{Exterior angle of pentagon} = \frac{360}{5} = 72$$

$$\begin{aligned} \text{Interior angle of pentagon} &= \cancel{36} \\ &= 180 - 72 \\ &= 108 \end{aligned}$$

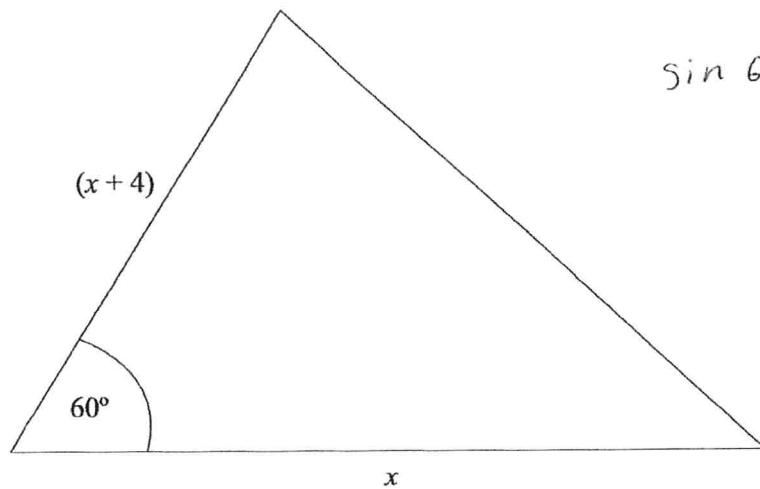
$$\begin{aligned} \text{Interior angle of } P &= 360 - 90 - 108 \\ &= 162^\circ \end{aligned}$$

$$\begin{aligned} \text{Exterior angle of } P &= 180 - 162 \\ &= 18 \end{aligned}$$

$$\frac{360}{18} = 20$$

20

(Total for question 12 is 4 marks)



$$\sin 60 = \frac{\sqrt{3}}{2}$$

The area of the triangle is $15\sqrt{3} \text{ cm}^2$.
Work out the value of x .

$$\frac{1}{2} (x)(x+4) \sin(60) = 15\sqrt{3}$$

$$\frac{1}{2} (x)(x+4) \frac{\sqrt{3}}{2} = 15\sqrt{3}$$

$$\frac{\sqrt{3}}{4} x(x+4) = 15\sqrt{3}$$

$$\sqrt{3} x(x+4) = 60\sqrt{3}$$

$$x(x+4) = 60$$

$$x^2 + 4x = 60$$

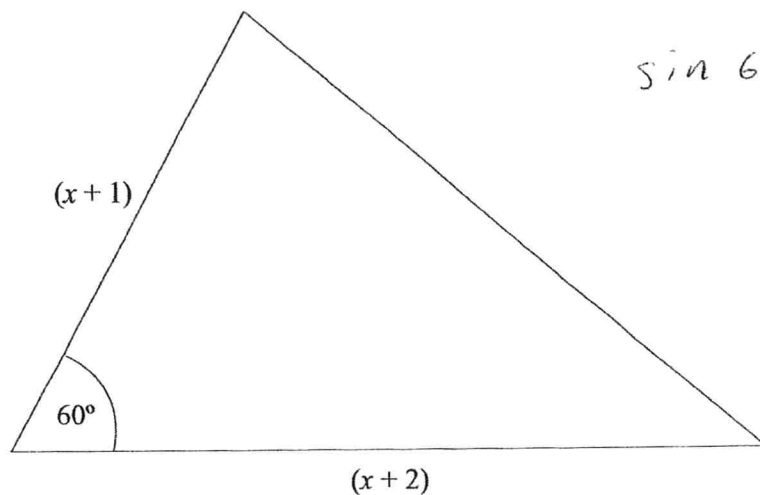
$$x^2 + 4x - 60 = 0$$

$$(x+10)(x-6) = 0$$

$$x = -10 \quad x = 6$$

a length cannot be negative $\therefore \underline{\underline{x=6}}$

11



$$\sin 60 = \frac{\sqrt{3}}{2}$$

The area of the triangle is 25 cm^2 .

Work out the value of x .

Give your answer to 3 significant figures.

$$\frac{1}{2}(x+1)(x+2) \sin 60 = 25$$

$$(x+1)(x+2) \left(\frac{\sqrt{3}}{2}\right) = 50$$

$$(x+1)(x+2) = \frac{100}{\sqrt{3}}$$

$$x^2 + 2x + x + 2 = \frac{100}{\sqrt{3}}$$

$$x^2 + 3x + 2 = \frac{100}{\sqrt{3}}$$

$$x^2 + 3x - 55.735 = 0$$

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

$$a = 1$$

$$b = 3$$

$$c = -55.735 \dots$$

$$= 6.11 \text{ (3sf)} \quad \text{or} \quad -9.11 \text{ (3sf)}$$

~~x~~ lengths cannot be negative.

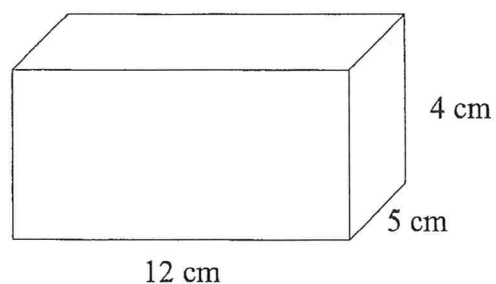
$$x = 6.11$$

$$6.11$$

(Total for question 11 is 5 marks)

1 The diagram shows a cuboid..

Find the total surface area of the cuboid.



Front $12 \times 4 = 48 \text{ cm}^2$

Back 48 cm^2

Top $12 \times 5 = 60 \text{ cm}^2$

Bottom 60 cm^2

Side $5 \times 4 = 20 \text{ cm}^2$

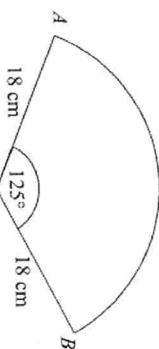
Side 20 cm^2

$$\begin{array}{r} 48 \\ 48 \\ 60 \\ 60 \\ 20 \\ 20 \\ \hline 256 \end{array}$$

256 cm^2

(Total for question 1 is 3 marks)

AOB is a sector of a circle, centre O and radius 18 cm.
The angle of the sector is 125° .



Calculate the length of the arc AB .
Give your answer in terms of π .

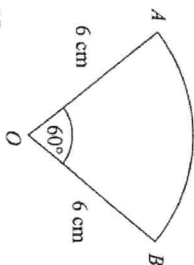
$$\frac{125}{360} \times 2\pi(18) = \frac{25}{2}\pi$$

$$\frac{25}{2}\pi$$

cm

(Total for Question 2 is 2 marks)

AOB is a sector of a circle, centre O and radius 6 cm.
The angle of the sector is 60° .



Find the length of the arc AB .
Give your answer in terms of π .

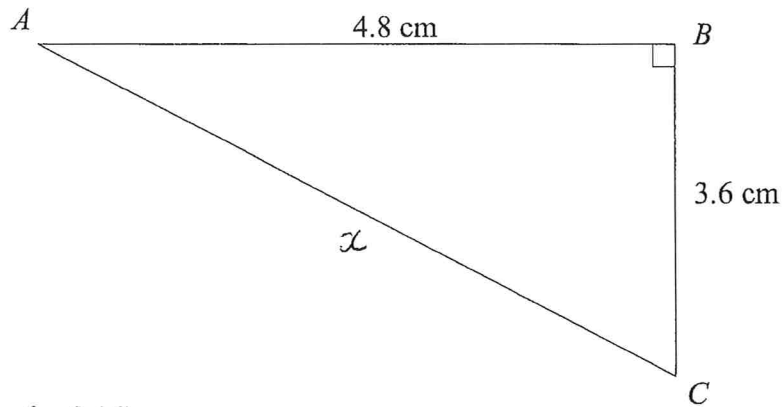
$$\frac{60}{360} \times 2\pi(6) = 2\pi$$

$$2\pi$$

cm

(Total for Question 4 is 2 marks)

1



Calculate the length of AC.

$$3.6^2 + 4.8^2 = x^2$$

$$36 = x^2$$

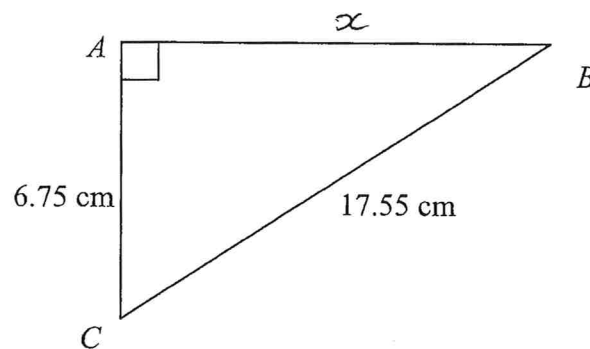
$$x = \sqrt{36}$$

$$= 6$$

.....6.....cm

(Total for question 1 is 3 marks)

2



Calculate the length of ~~BC~~
AB

$$x^2 + 6.75^2 = 17.55^2$$

$$x^2 = 17.55^2 - 6.75^2$$

$$x^2 = 262.44$$

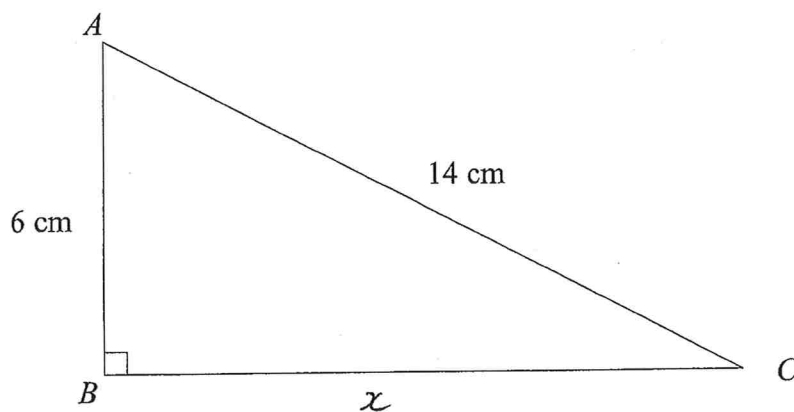
$$x = \sqrt{262.44}$$

$$= 16.2$$

.....16.2.....cm

(Total for question 2 is 3 marks)

3



Calculate the length of BC .
Give your answer to 1 decimal place.

$$x^2 + 6^2 = 14^2$$

$$x^2 = 14^2 - 6^2$$

$$x^2 = 160$$

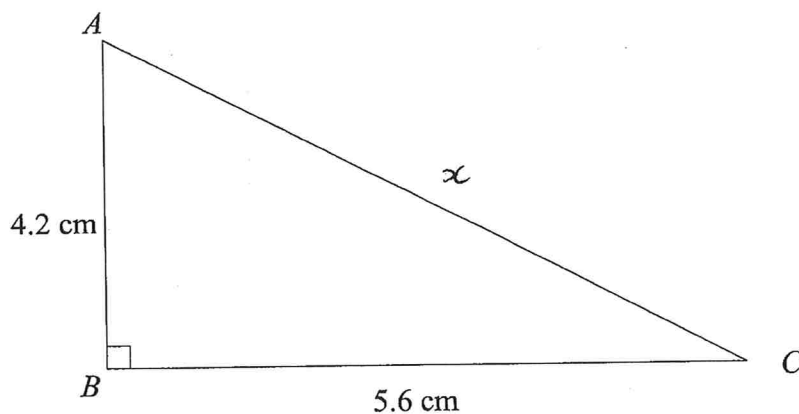
$$x = \sqrt{160}$$

$$= 12.6 \text{ (1dp)}$$

..... 12.6cm

(Total for question 3 is 3 marks)

4



Calculate the length of AC .

$$4.2^2 + 5.6^2 = x^2$$

$$49 = x^2$$

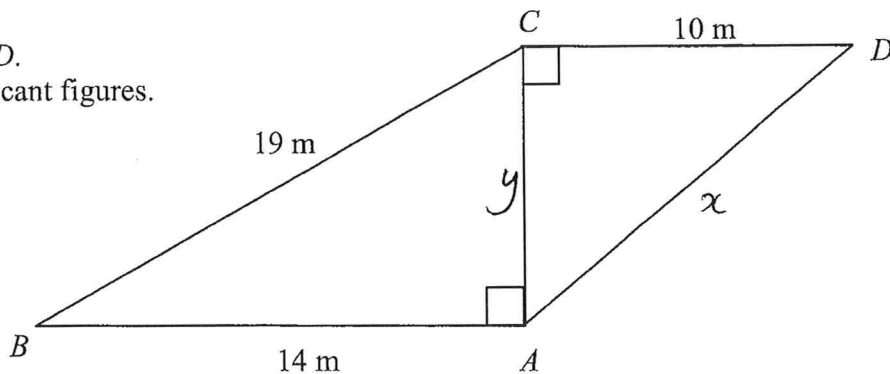
$$x = \sqrt{49}$$

$$= 7$$

..... 7cm

(Total for question 4 is 3 marks)

- 5 Calculate the length of the AD .
Give your answer to 3 significant figures.



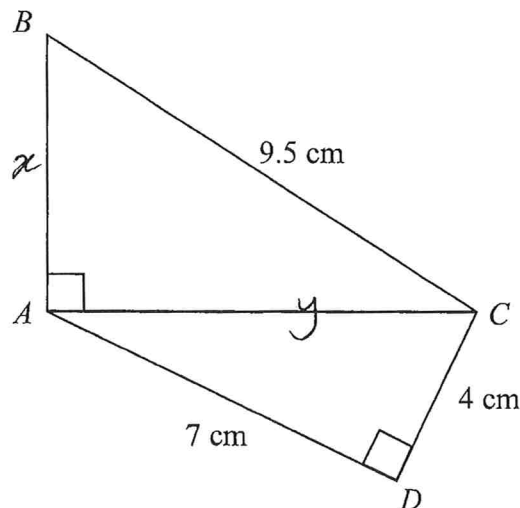
$$\begin{aligned}
 14^2 + y^2 &= 19^2 \\
 y^2 &= 19^2 - 14^2 \\
 y^2 &= 165 \\
 y &= \sqrt{165} \\
 &= 12.84523\dots
 \end{aligned}$$

$$\begin{aligned}
 10^2 + 12.84523^2 &= x^2 \\
 265 &= x^2 \\
 x &= \sqrt{265} \\
 &= 16.3 \text{ (3sf)}
 \end{aligned}$$

.....16.3.....m

(Total for question 5 is 4 marks)

- 6 Calculate the length of the AB .
Give your answer to 3 significant figures.



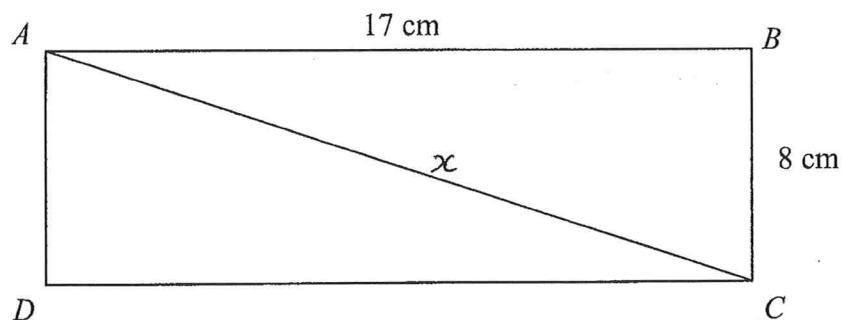
$$\begin{aligned}
 4^2 + 7^2 &= y^2 \\
 65 &= y^2
 \end{aligned}$$

$$\begin{aligned}
 x^2 + y^2 &= 9.5^2 \\
 x^2 + 65 &= 9.5^2 \\
 x^2 &= 9.5^2 - 65 \\
 x^2 &= 25.25 \\
 x &= \sqrt{25.25} \\
 &= 5.02 \text{ (3sf)}
 \end{aligned}$$

.....5.02.....cm

(Total for question 5 is 4 marks)

7



$ABCD$ is a rectangle.

Calculate the length of the diagonal AC .

Give your answer correct to 1 decimal place.

$$\begin{aligned} 8^2 + 17^2 &= x^2 \\ 353 &= x^2 \\ x &= \sqrt{353} \\ x &= 18.8 \text{ (1dp)} \end{aligned}$$

.....18.8.....cm

(Total for question 7 is 3 marks)

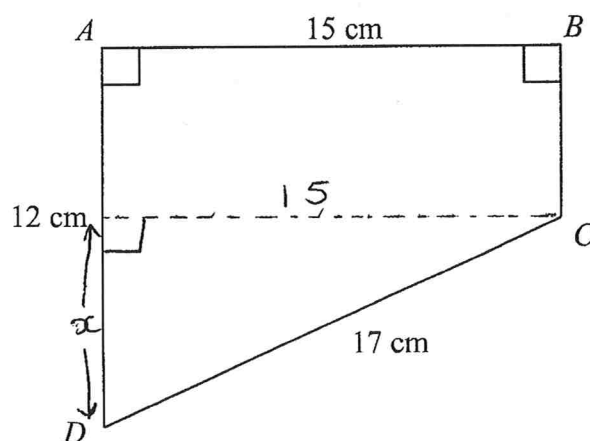
8

$ABCD$ is a trapezium.

Calculate the length of BC .

$$\begin{aligned} x^2 + 15^2 &= 17^2 \\ x^2 &= 17^2 - 15^2 \\ x^2 &= 64 \\ x &= \sqrt{64} \\ &= 8 \end{aligned}$$

$$BC = 12 - 8 = 4$$



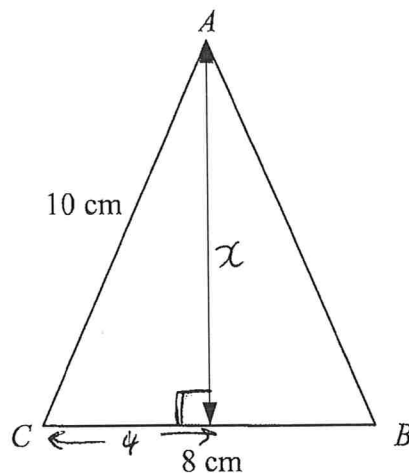
.....4.....cm

(Total for question 8 is 3 marks)

- 9 *ABC* is an isosceles triangle.

Calculate the perpendicular height of *ABC*.
Give your answer correct to 3 significant figures..

$$\begin{aligned}x^2 + 4^2 &= 10^2 \\x^2 &= 10^2 - 4^2 \\x^2 &= 84 \\x &= \sqrt{84} \\&= 9.17 \text{ (3sf)}\end{aligned}$$

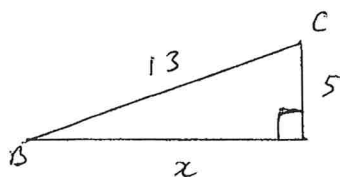


.....9.17.....cm

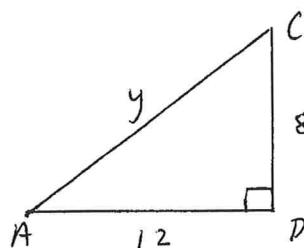
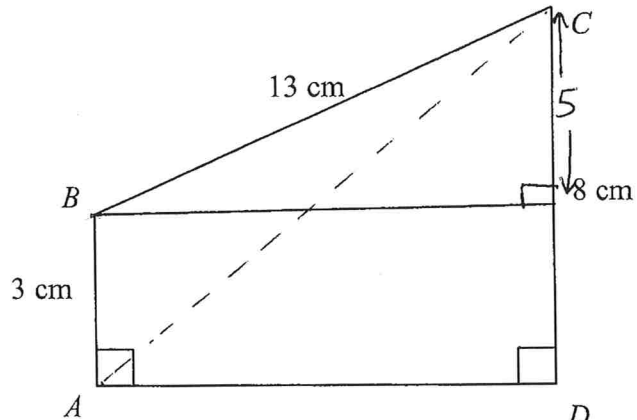
(Total for question 9 is 3 marks)

- 10 *ABCD* is a trapezium.

Calculate the length of *AC*.
Give your answer correct to 3 significant figures..



$$\begin{aligned}x^2 + 5^2 &= 13^2 \\x^2 &= 13^2 - 5^2 \\x^2 &= 144 \\x &= \sqrt{144} \\&= 12\end{aligned}$$



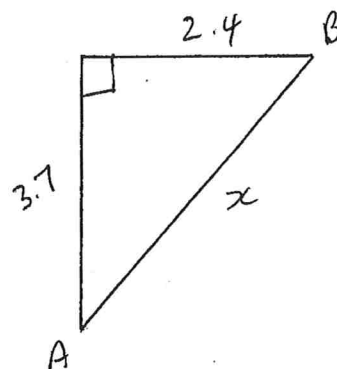
$$\begin{aligned}8^2 + 12^2 &= y^2 \\y^2 &= 208 \\y &= \sqrt{208} \\y &= 14.4 \text{ (3sf)}\end{aligned}$$

.....14.4.....cm

(Total for question 10 is 4 marks)

- 11 A ship leaves point A and sails for 3.7 km due North.
The ship then sails for 2.4 km due East to reach point B.

Calculate the shortest distance between point A and point B.
Give your answer correct to 1 decimal place.



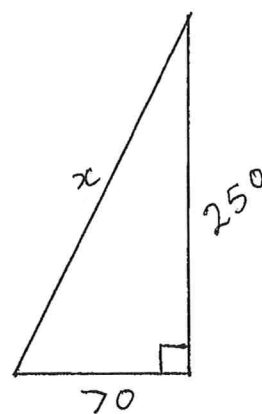
$$\begin{aligned} 2.4^2 + 3.7^2 &= x^2 \\ x^2 &= 19.45 \\ x &= \sqrt{19.45} \\ &= 4.4 \text{ km (1dp)} \end{aligned}$$

..... 4.4 km

(Total for question 11 is 3 marks)

- 12 A ladder reaches ^{250cm} 2.5 m up a vertical wall.
The base of the ladder is 70 cm from the base of the wall on a horizontal ground.

Find the length of the ladder.



$$\begin{aligned} 70^2 + 250^2 &= x^2 \\ 67400 &= x^2 \\ x^2 &= 67400 \\ x &= \sqrt{67400} \\ &= 259.6150997 \text{ cm} \\ &= 260 \text{ cm (nearest cm)} \end{aligned}$$

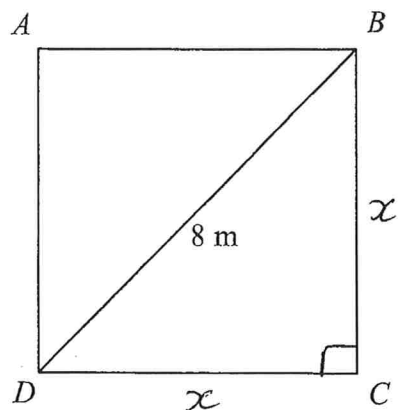
..... 260 cm

(Total for question 12 is 4 marks)

OR 2.6 m

- 13 $ABCD$ is a square.
The diagonal of the square is 8 m.

Calculate the perimeter of the square.
Give your answer correct to one decimal place.



$$x^2 + x^2 = 8^2$$

$$2x^2 = 64$$

$$x^2 = 32$$

$$x = \sqrt{32}$$

$$= 5.656854249 \text{ m}$$

$$4 \times 5.656... = 22.6 \text{ m (1dp)}$$

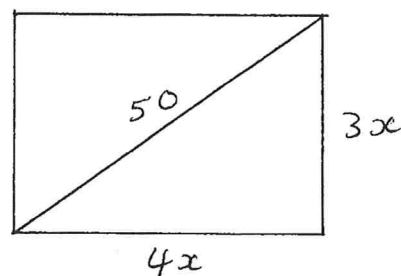
$$\dots\dots\dots 22.6 \dots\dots\dots \text{m}$$

(Total for question 13 is 3 marks)

- 14 A television has a diagonal length of 50 inches.

The ratio of the length of the television to the width of the television is 4:3

Calculate the length and the width of the television.
Give your answers correct to 1 decimal place.



$$(3x)^2 + (4x)^2 = 50^2$$

$$9x^2 + 16x^2 = 2500$$

$$25x^2 = 2500$$

$$x^2 = 100$$

$$x = 10$$

$$4 \times 10 = 40$$

$$3 \times 10 = 30$$

$$\text{Length } \dots\dots\dots 40 \dots\dots\dots \text{ inches}$$

$$\text{Width } \dots\dots\dots 30 \dots\dots\dots \text{ inches}$$

(Total for question 14 is 3 marks)

- 1 Write down the exact value of $\sin(45^\circ)$

$$\frac{\sqrt{2}}{2}$$

(Total for Question 1 is 1 marks)

- 2 Write down the exact value of $\cos(90^\circ)$

$$0$$

(Total for Question 2 is 1 marks)

- 3 Write down the exact value of $\tan(30^\circ)$

$$\frac{1}{\sqrt{3}} \quad \text{or} \quad \frac{\sqrt{3}}{3}$$

$$\frac{\sqrt{3}}{3}$$

(Total for Question 3 is 1 marks)

- 4 Write down the exact value of $\sin(30^\circ)$

$$\frac{1}{2}$$

(Total for Question 4 is 1 marks)

- 5 Write down the exact value of $\tan(45^\circ)$

$$1$$

(Total for Question 5 is 1 marks)

- 6 Write down the exact value of $\cos(0^\circ)$

$$1$$

(Total for Question 6 is 1 marks)

- 7 Write down the exact value of $\sin(60^\circ)$

$$\frac{\sqrt{3}}{2}$$

(Total for Question 7 is 1 marks)

	0	30	45	60	90
\sin	0	1	2	3	4
\cos	4	3	2	1	0

2

8 Write down the exact value of $\sin(0)$

0

(Total for Question 8 is 1 marks)

9 Write down the exact value of $\cos(60^\circ)$

$\frac{1}{2}$

(Total for Question 9 is 1 marks)

10 Write down the exact value of $\tan(0)$

0

(Total for Question 10 is 1 marks)

11 Write down the exact value of $\sin(90^\circ)$

1

(Total for Question 11 is 1 marks)

12 Write down the exact value of $\cos(45^\circ)$

$\frac{\sqrt{2}}{2}$

(Total for Question 12 is 1 marks)

13 Write down the exact value of $\tan(60^\circ)$

$\sqrt{3}$

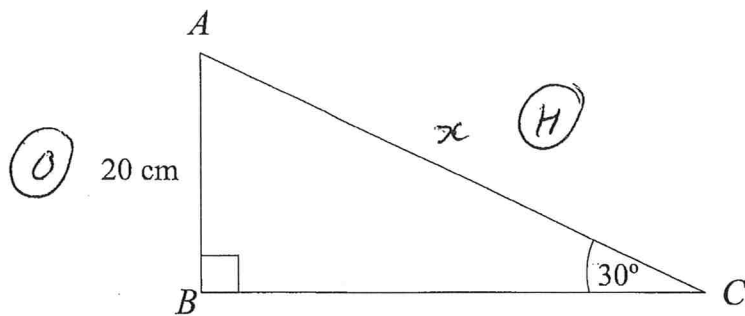
(Total for Question 13 is 1 marks)

14 Write down the exact value of $\cos(30^\circ)$

$\frac{\sqrt{3}}{2}$

(Total for Question 14 is 1 marks)

15



Calculate the length AC.

$$\sin \theta = \frac{O}{H}$$

$$\sin 30 = \frac{20}{x}$$

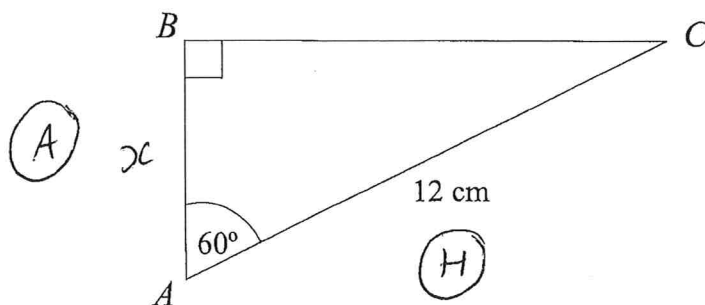
$$\frac{1}{2} = \frac{20}{x}$$

$$x = 40 \text{ cm}$$

.....40.....cm

(Total for Question 15 is 3 marks)

16



Calculate the length AB.

$$\cos \theta = \frac{A}{H}$$

$$\cos(60) = \frac{x}{12}$$

$$\frac{1}{2} = \frac{x}{12}$$

$$x = 6 \text{ cm}$$

.....6.....cm

(Total for Question 16 is 3 marks)

1

$$a = \begin{pmatrix} 2 \\ 3 \end{pmatrix} \text{ and } b = \begin{pmatrix} 1 \\ 5 \end{pmatrix}$$

(a) Write down as a column vector

(i) $a + b$ $\begin{pmatrix} 2 \\ 3 \end{pmatrix} + \begin{pmatrix} 1 \\ 5 \end{pmatrix}$

$$\begin{pmatrix} 3 \\ 8 \end{pmatrix}$$

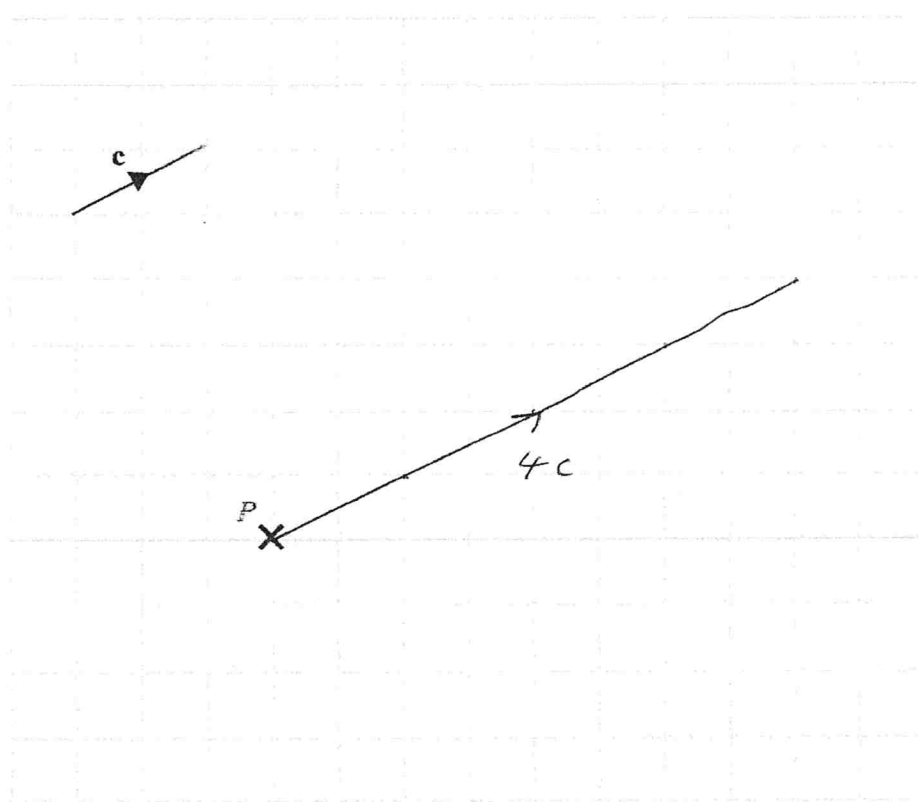
(1)

(ii) $2a + 3b$ $2 \begin{pmatrix} 2 \\ 3 \end{pmatrix} + 3 \begin{pmatrix} 1 \\ 5 \end{pmatrix}$

$$\begin{pmatrix} 4 \\ 6 \end{pmatrix} + \begin{pmatrix} 3 \\ 15 \end{pmatrix}$$

$$\begin{pmatrix} 7 \\ 21 \end{pmatrix}$$

(2)

The vector c is drawn on the grid.(b) From the point P , draw the vector $4c$ 

(1)

(Total for question 1 is 4 marks)

2

$$a = \begin{pmatrix} 4 \\ 1 \end{pmatrix} \text{ and } b = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$$

(a) Write down as a column vector

(i) $a + b$ $\begin{pmatrix} 4 \\ 1 \end{pmatrix} + \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

$$\begin{pmatrix} 7 \\ 3 \end{pmatrix}$$

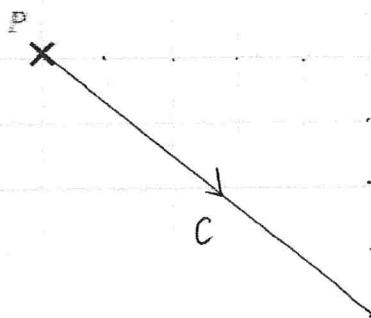
(1)

(ii) $2a - b$ $2\begin{pmatrix} 4 \\ 1 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \end{pmatrix}$
 $\begin{pmatrix} 8 \\ 2 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

$$\begin{pmatrix} 5 \\ 0 \end{pmatrix}$$

(2)

$$c = \begin{pmatrix} 5 \\ -4 \end{pmatrix}$$

(b) From the point P , draw the vector c 

(1)

(Total for question 2 is 4 marks)

3

$$a = \begin{pmatrix} -2 \\ 3 \end{pmatrix} \text{ and } b = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$$

(a) Write down as a column vector

(i) $a + b$ $\begin{pmatrix} -2 \\ 3 \end{pmatrix} + \begin{pmatrix} 5 \\ -1 \end{pmatrix}$

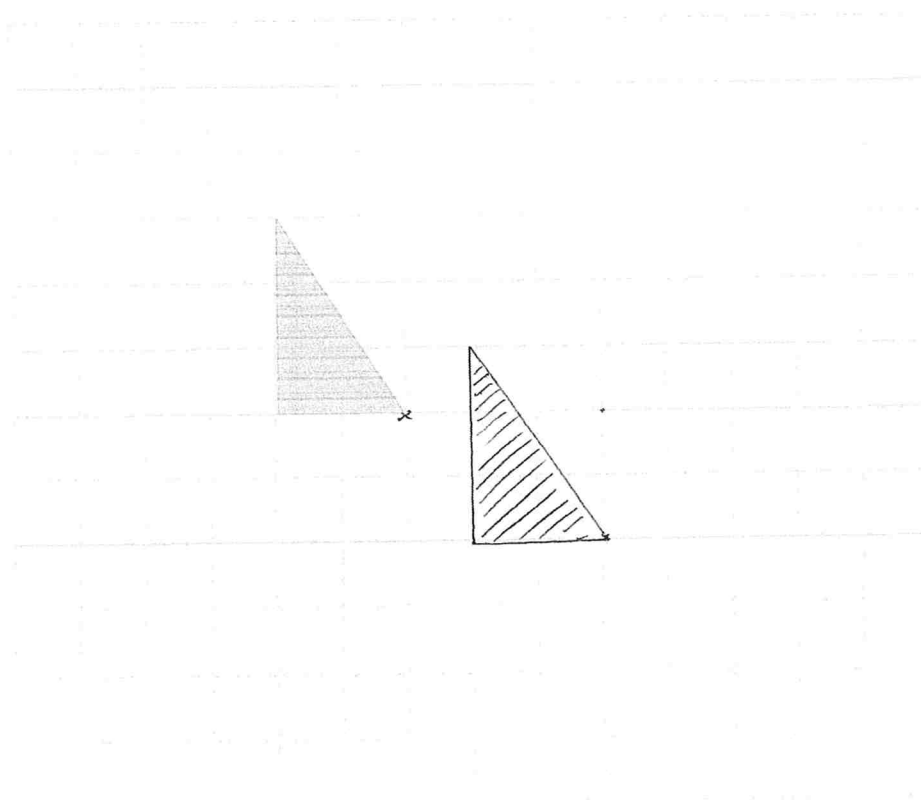
$$\begin{array}{r} \begin{pmatrix} 3 \\ 2 \end{pmatrix} \\ \hline (1) \end{array}$$

(ii) $2a - b$

$$2 \begin{pmatrix} -2 \\ 3 \end{pmatrix} - \begin{pmatrix} 5 \\ -1 \end{pmatrix}$$

$$\begin{pmatrix} -4 \\ 6 \end{pmatrix} - \begin{pmatrix} 5 \\ -1 \end{pmatrix}$$

$$\begin{array}{r} \begin{pmatrix} -9 \\ 7 \end{pmatrix} \\ \hline (2) \end{array}$$

(b) Translate the triangle by the vector $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ 

(1)

(Total for question 3 is 4 marks)

4 A is the point $(3, 2)$ and B is the point $(4, -1)$.

(a) Write down as a column vector \overrightarrow{AB}

$$\begin{pmatrix} 4 \\ -1 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \end{pmatrix}$$

$$\begin{pmatrix} 1 \\ -3 \end{pmatrix}$$

(1)

C is the point $(5, -2)$ and D is the point $(2, 1)$.

(b) Write down as a column vector \overrightarrow{CD}

$$\begin{pmatrix} 2 \\ 1 \end{pmatrix} - \begin{pmatrix} 5 \\ -2 \end{pmatrix}$$

$$\begin{pmatrix} -3 \\ 3 \end{pmatrix}$$

(1)

(Total for question 4 is 2 marks)

5 A is the point $(5, -1)$ and B is the point $(4, -3)$.

(a) Write down as a column vector \overrightarrow{AB}

$$\begin{pmatrix} 4 \\ -3 \end{pmatrix} - \begin{pmatrix} 5 \\ -1 \end{pmatrix}$$

$$\begin{pmatrix} -1 \\ -2 \end{pmatrix}$$

(1)

C is the point $(1, 6)$ and D is the point $(-3, 9)$.

(b) Write down as a column vector \overrightarrow{CD}

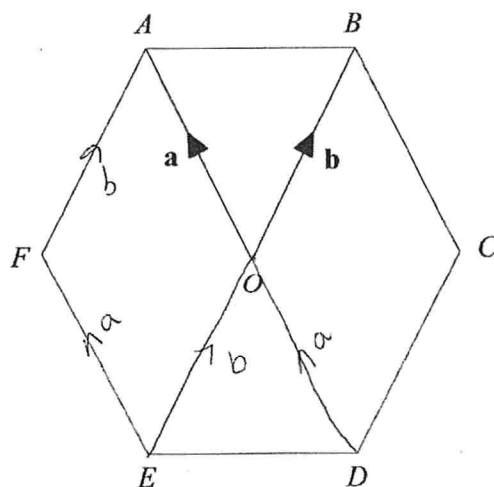
$$\begin{pmatrix} -3 \\ 9 \end{pmatrix} - \begin{pmatrix} 1 \\ 6 \end{pmatrix}$$

$$\begin{pmatrix} -4 \\ 3 \end{pmatrix}$$

(1)

(Total for question 5 is 2 marks)

6 $ABCDEF$ is a regular hexagon with centre O .



$$\vec{OA} = a$$

$$\vec{OB} = b$$

(a) Find, in terms of a , the vector \vec{AD}

$$\frac{-2a}{(1)}$$

(b) Find, in terms of a and b , the vector \vec{AB}

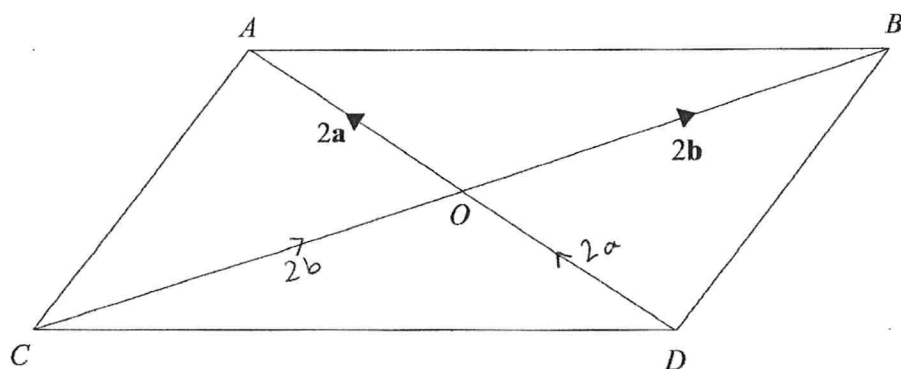
$$\frac{-a + b}{(1)}$$

(c) Find, in terms of a and b , the vector \vec{AF}

$$\frac{-b}{(1)}$$

(Total for question 6 is 3 marks)

- 7 The diagram shows a parallelogram.



$$\vec{OA} = 2a$$

$$\vec{OB} = 2b$$

- (a) Find, in terms of a , the vector \vec{DA}

$$\frac{4a}{(1)}$$

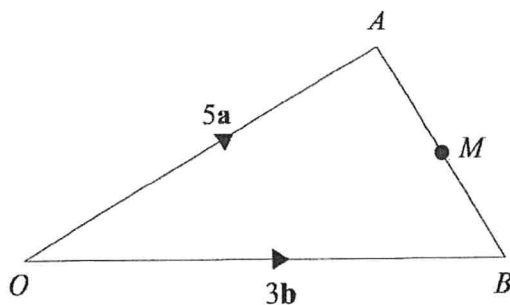
- (b) Find, in terms of a and b , the vector \vec{AB}

$$\frac{-2a + 2b}{(1)}$$

- (c) Find, in terms of a and b , the vector \vec{AC}

$$\frac{-2a - 2b}{(1)}$$

(Total for question 7 is 3 marks)



$$\vec{OA} = 5a$$

$$\vec{OB} = 3b$$

M is the midpoint of AB

- (a) Find, in terms of a and b, the vector \vec{AB}

$$\frac{-5a + 3b}{(1)}$$

- (b) Find, in terms of a and b, the vector \vec{AM}

half of \vec{AB}

$$\frac{-\frac{5}{2}a + \frac{3}{2}b}{(1)}$$

- (c) Find, in terms of a and b, the vector \vec{OM}

$$5a - \frac{5}{2}a + \frac{3}{2}b$$

or $5a - 2.5a + 1.5b$

$$\frac{\frac{5}{2}a + \frac{3}{2}b}{(1)}$$

(Total for question 8 is 3 marks)

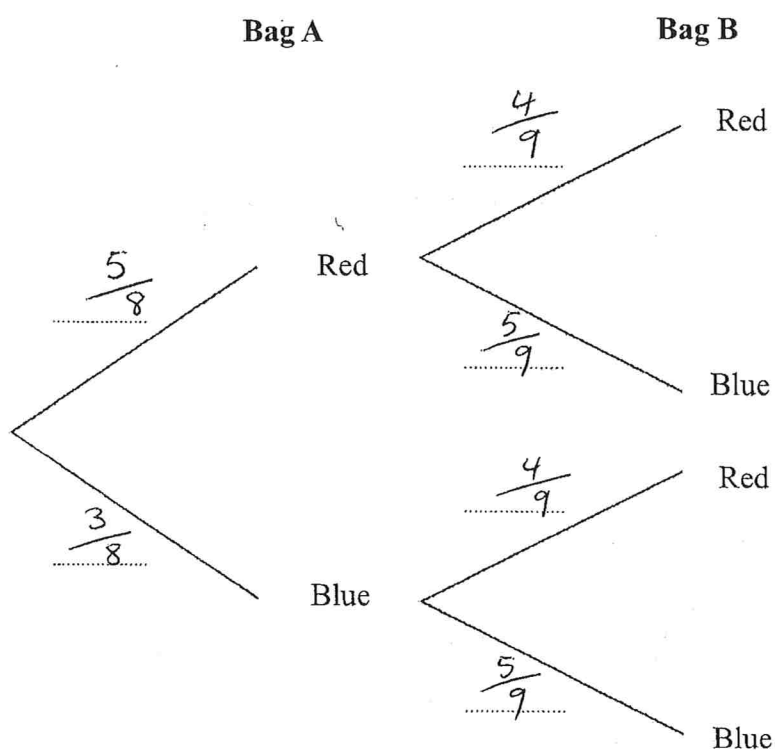
1 Tina has two bags of counters, Bag A and Bag B.

There are 5 red counters and 3 blue counters in bag A.

There are 4 red counters and 5 blue counters in bag B.

Tina takes at random a counter from each bag.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Tina takes two blue ~~pens~~ ^{Counters}.

$$\frac{3}{8} \times \frac{5}{9} = \frac{15}{72}$$

$$\frac{15}{72}$$

(2)

(Total for question 1 is 4 marks)

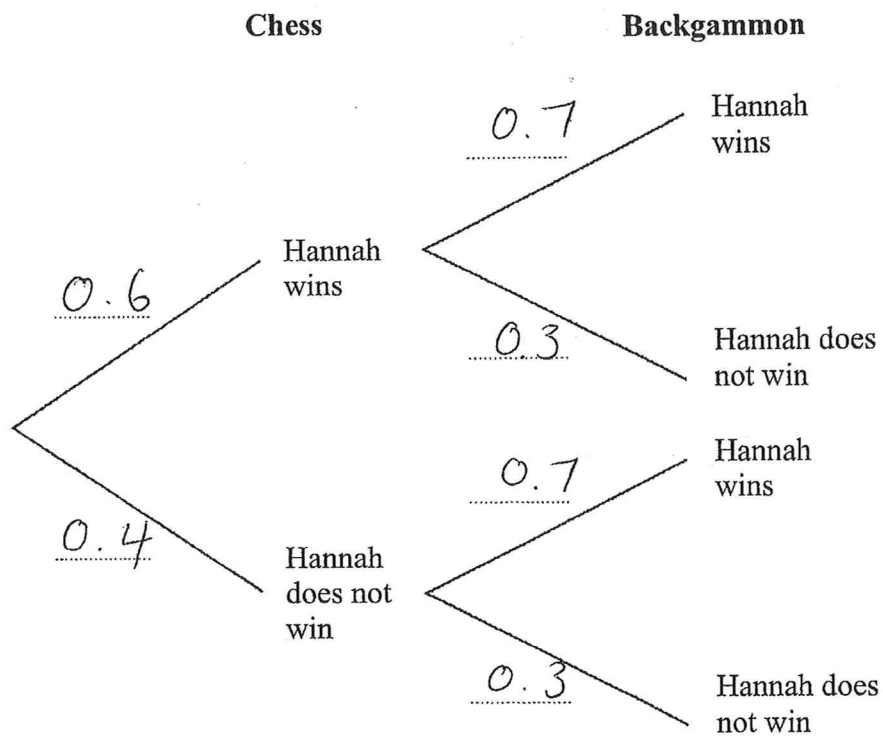
$$\left[\frac{5}{24} \right]$$

- 2 Hannah is going to play one game of chess and one game of backgammon.

The probability she will win the game of chess is 0.6

The probability she will win the game of backgammon is 0.7.

- (a) Complete the probability tree diagram.



(2)

- (b) Work out the probability that Hannah will win both games.

$$0.6 \times 0.7 = 0.42$$

0.42

(2)

(Total for question 2 is 4 marks)

3 Rachel has two bags.

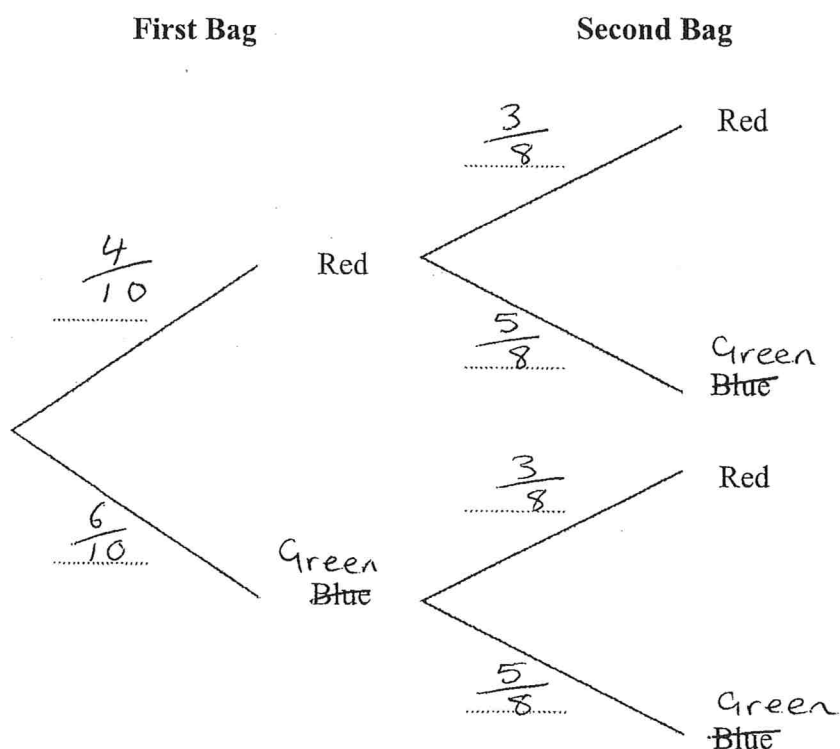
In the first bag there are 4 red balls and 6 green balls.

In the second bag there are 3 red balls and 5 green balls.

Rachel takes at random a ball from the first bag.

She then takes at random a ball from the second bag.

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Rachel takes two ~~blue~~ ^{green balls} pens.

$$\frac{6}{10} \times \frac{5}{8} = \frac{30}{80}$$

$$\frac{30}{80}$$

(2)

(Total for question 3 is 4 marks)

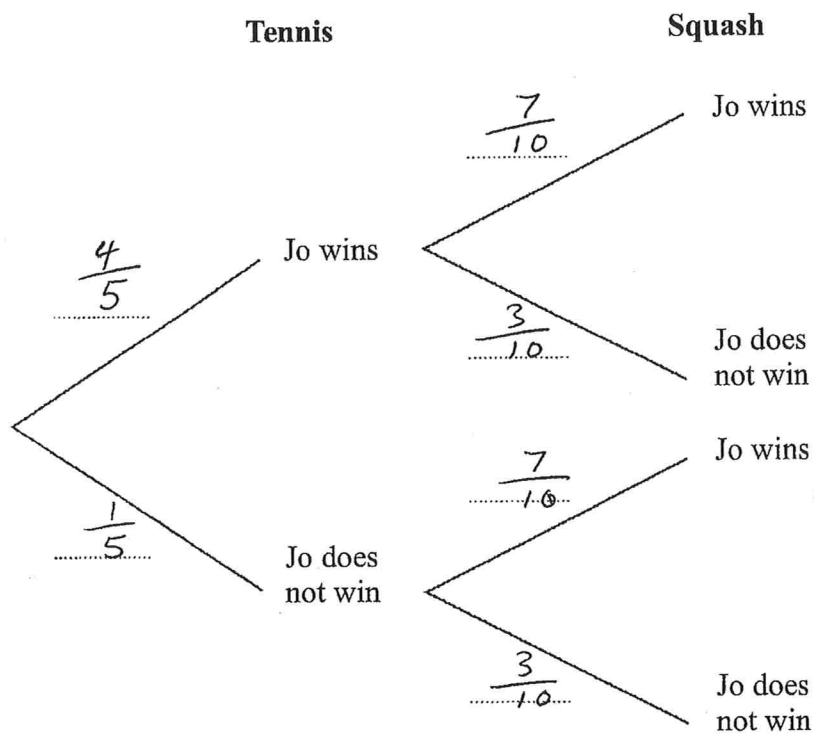
$$\left[\frac{3}{8} \right]$$

4 Jo is going to play one tennis match and match of squash.

The probability she will win the tennis match is $\frac{4}{5}$

The probability she will win the squash match is $\frac{7}{10}$

(a) Complete the probability tree diagram.



(2)

(b) Work out the probability that Jo will win both matches.

$$\frac{4}{5} \times \frac{7}{10} = \frac{28}{50}$$

$$\frac{28}{50}$$

(2)

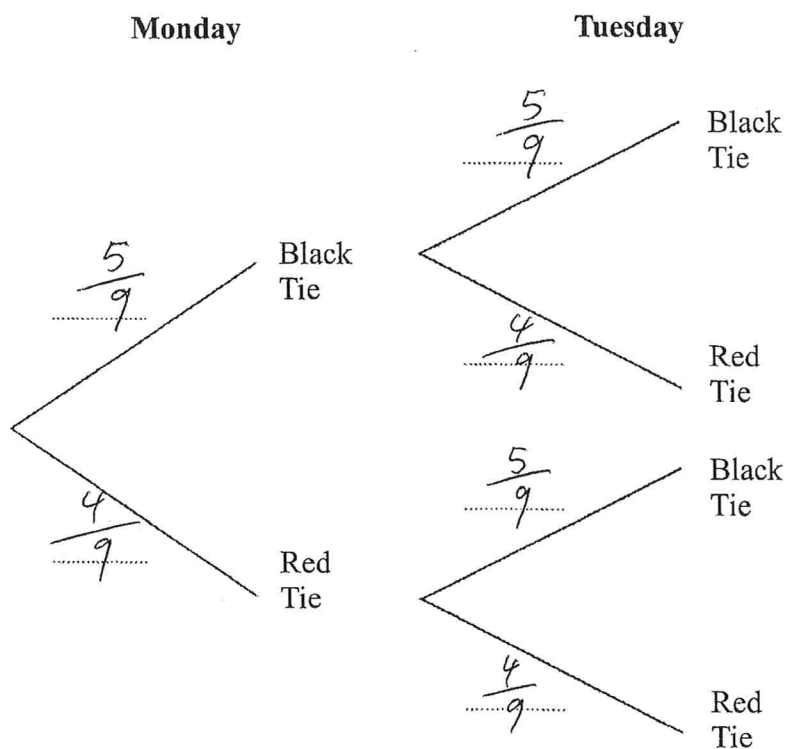
(Total for question 4 is 4 marks)

$$\boxed{\frac{14}{25}}$$

5 Each day Paul wears either a black tie or a red tie to work.

On any day the probability he wears a black tie is $\frac{5}{9}$

(a) Complete the probability tree diagram for Monday and Tuesday.



(2)

(b) Work out the probability Paul wears different coloured ties on Monday and Tuesday .

$$\frac{5}{9} \times \frac{4}{9} = \frac{20}{81}$$

$$\frac{4}{9} \times \frac{5}{9} = \frac{20}{81}$$

$$\frac{20}{81} + \frac{20}{81} = \frac{40}{81}$$

$$\frac{40}{81}$$

(2)

(Total for question 5 is 4 marks)

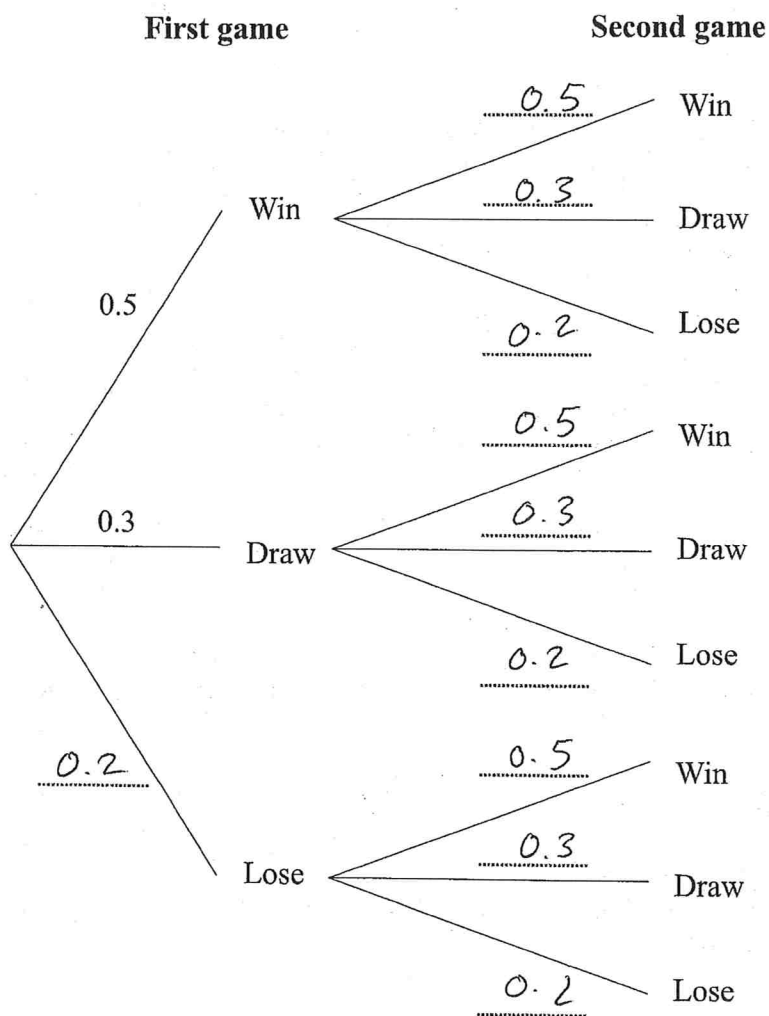
6 Jon plays a game where he can win, draw or lose.

The probability Jon wins any game 0.5.

The probability Jon draws any game is 0.3

Jon plays two games.

(a) Complete the probability tree diagram



(b) Work out the probability Jon wins both games.

(2)

$$0.5 \times 0.5 = 0.25$$

0.25

(2)

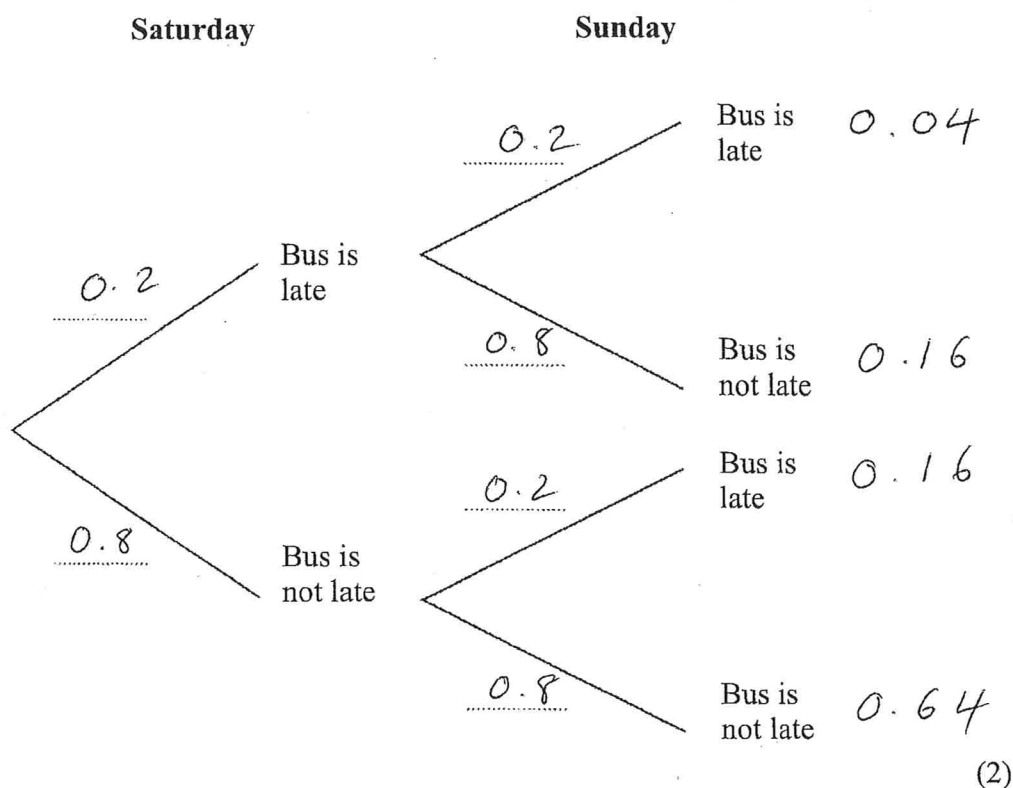
(Total for question 6 is 4 marks)

7

Bradley gets the bus on Saturday and Sunday.

The probability that Bradley's bus will be late on any day is 0.2

(a) Complete the probability tree diagram.



(b) Work out the probability that Bradley's bus is late on at least one of these days.

$$\begin{aligned}
 0.2 \times 0.2 &= 0.04 \\
 0.2 \times 0.8 &= 0.16 \\
 0.8 \times 0.2 &= 0.16
 \end{aligned}$$

$$0.04 + 0.16 + 0.16$$

$$0.36$$

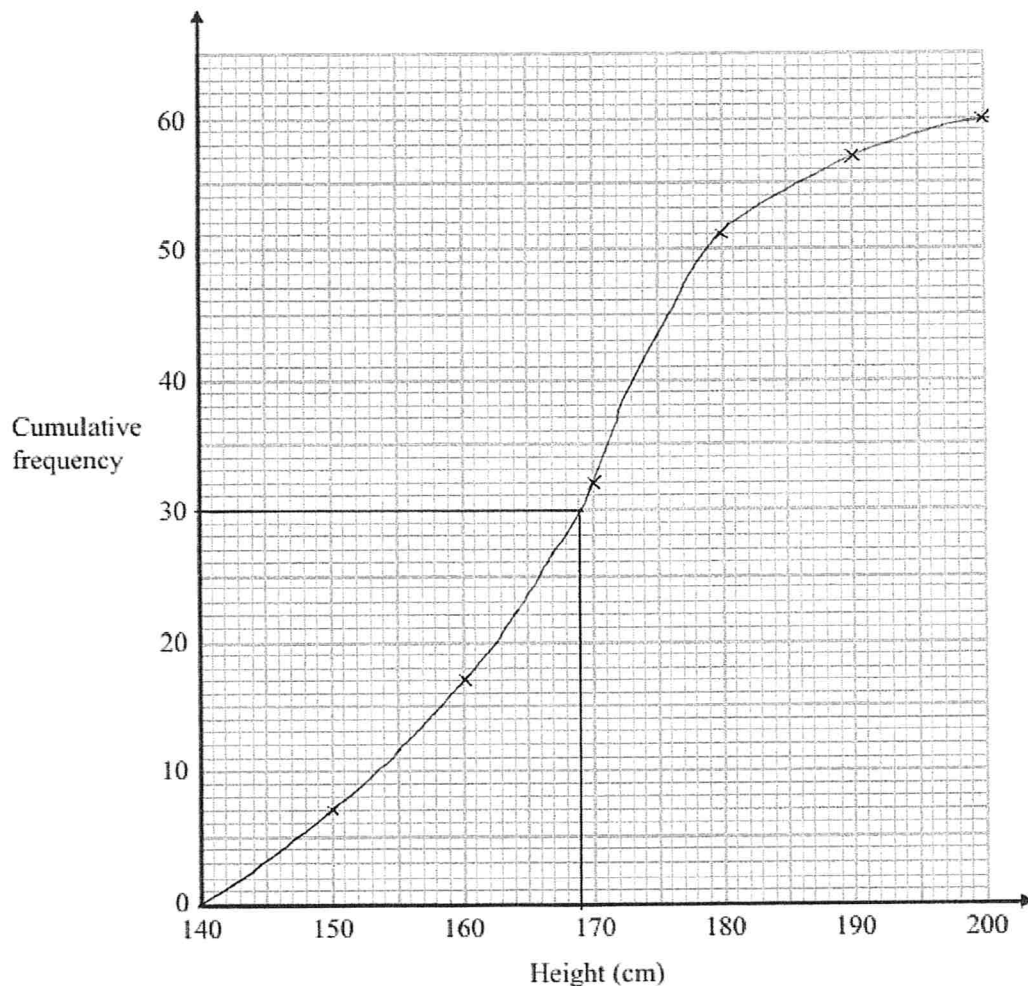
(2)

(Total for question 7 is 4 marks)

- 1 The cumulative frequency table shows the height, in cm, of some tomato plants.

Height	Cumulative Frequency
$140 < h \leq 150$	7
$140 < h \leq 160$	17
$140 < h \leq 170$	32
$140 < h \leq 180$	51
$140 < h \leq 190$	57
$140 < h \leq 200$	60

- (a) On the grid, plot a cumulative frequency graph for this information.



(2)

- (b) Find the median height.

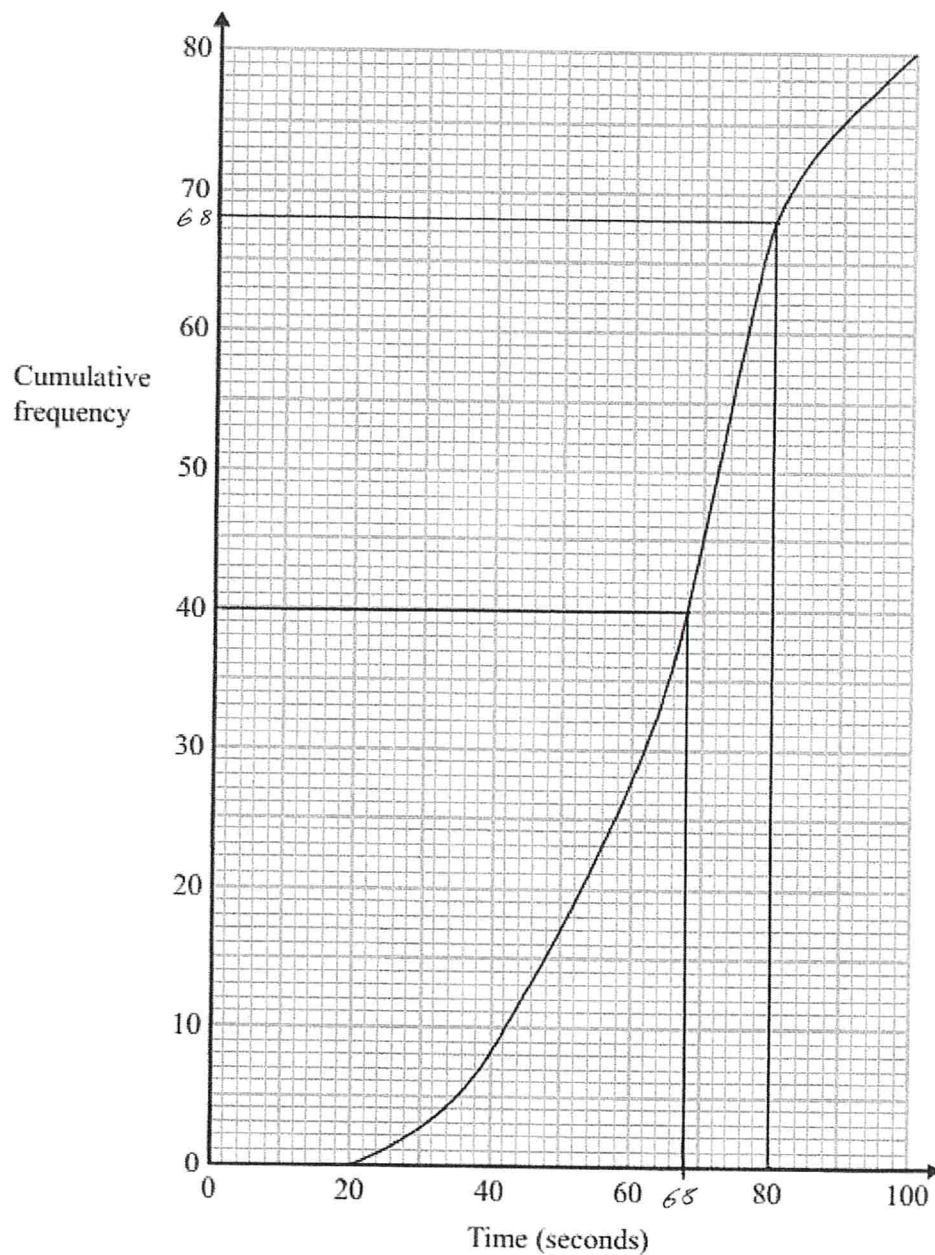
an estimate for

.....169.....cm

168 - 169 (1)

(Total for question 1 is 3 marks)

- 2 The cumulative frequency graph gives some information the times it took people to complete a challenge.



- (a) Find the median time.

..... 68 seconds
(1)

- (b) Find the number of people who took longer than 80 seconds to complete the challenge.

$$80 - 68 = 12$$

..... 12
(1)

(Total for question 2 is 2 marks)

- 3 The frequency table shows the weight, in kg, of some cats.

Weight (kg)	Frequency
$0 < w \leq 1$	8
$1 < w \leq 2$	10
$2 < w \leq 3$	21
$3 < w \leq 4$	19
$4 < w \leq 5$	13
$5 < w \leq 6$	9

- (b) Complete the cumulative frequency table

(1)

Weight (kg)	Cumulative Frequency
$0 < w \leq 1$	8
$0 < w \leq 2$	18
$0 < w \leq 3$	39
$0 < w \leq 4$	58
$0 < w \leq 5$	71
$0 < w \leq 6$	80

- (b) On the grid opposite draw a cumulative frequency graph for this information.

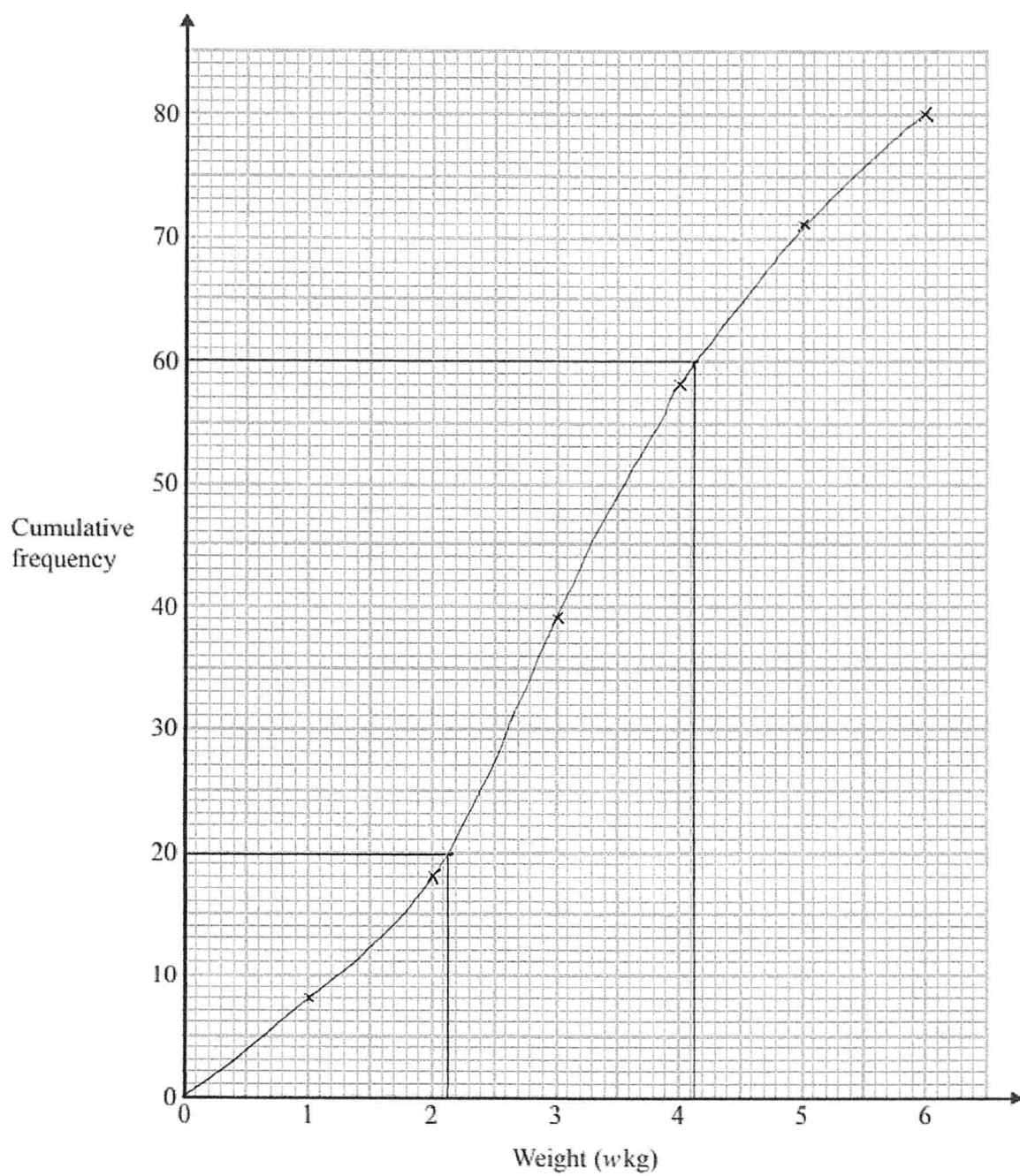
(2)

- (c) Use your cumulative frequency graph to find an estimate for the interquartile range.

$$4.1 - 2.1 = 2$$

$$\dots\dots\dots 2 \dots\dots\dots \text{kg}$$

$$1.9 - 2.1 \quad (2)$$



(Total for question 3 is 5 marks)

- 4 The frequency table shows the time taken for 100 people to travel to an event.

Time (minutes)	Frequency
$20 < t \leq 30$	9
$30 < t \leq 40$	16
$40 < t \leq 50$	20
$50 < t \leq 60$	29
$60 < t \leq 70$	15
$70 < t \leq 80$	11

C.F

9

25

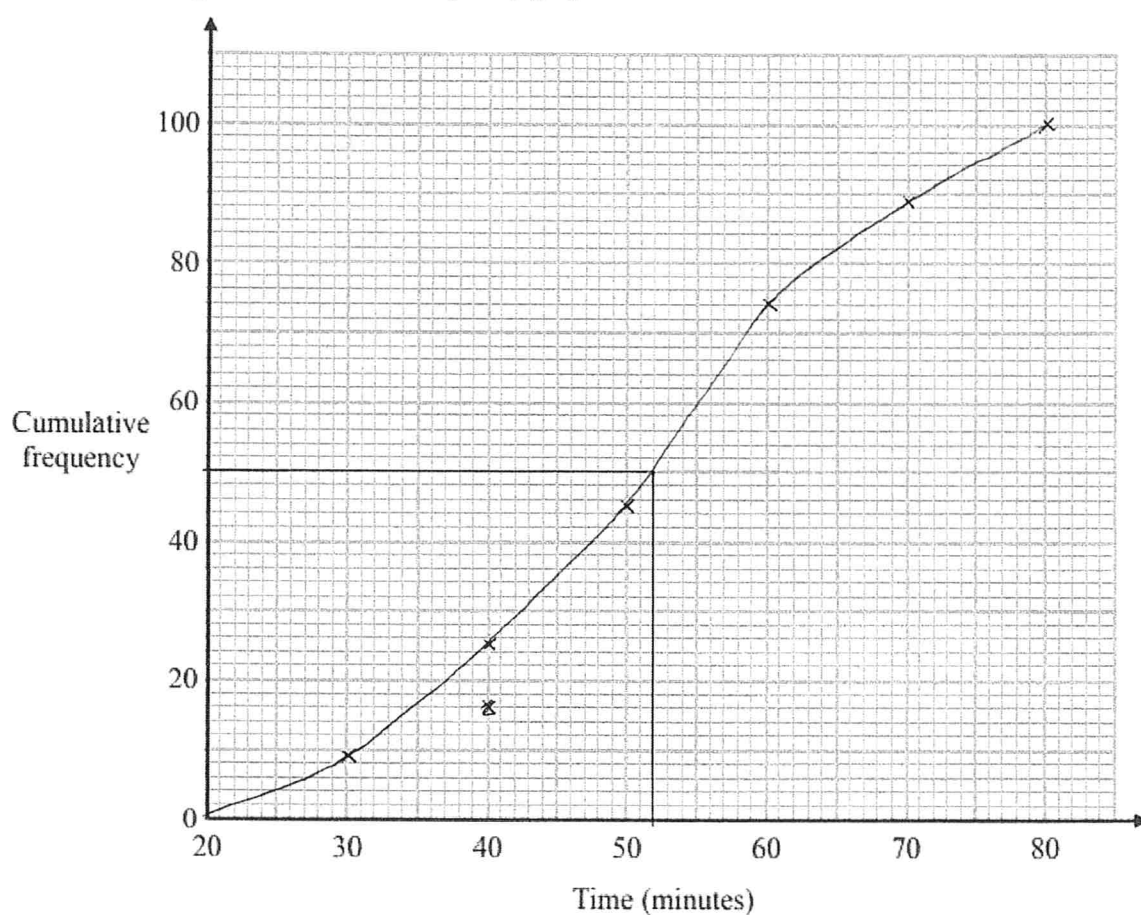
45

74

89

100

- (a) On the grid, plot a cumulative frequency graph for this information.



(2)

- (b) Find an estimate for the median time taken.

52 minutes

51-53 (1)

(Total for question 4 is 3 marks)

- 5 The frequency table shows the speeds of 100 cars.

Speed (km/h)	Frequency
$0 < s \leq 20$	6
$20 < s \leq 40$	17
$40 < s \leq 60$	29
$60 < s \leq 80$	25
$80 < s \leq 100$	20
$100 < s \leq 120$	3

C.F

6

23

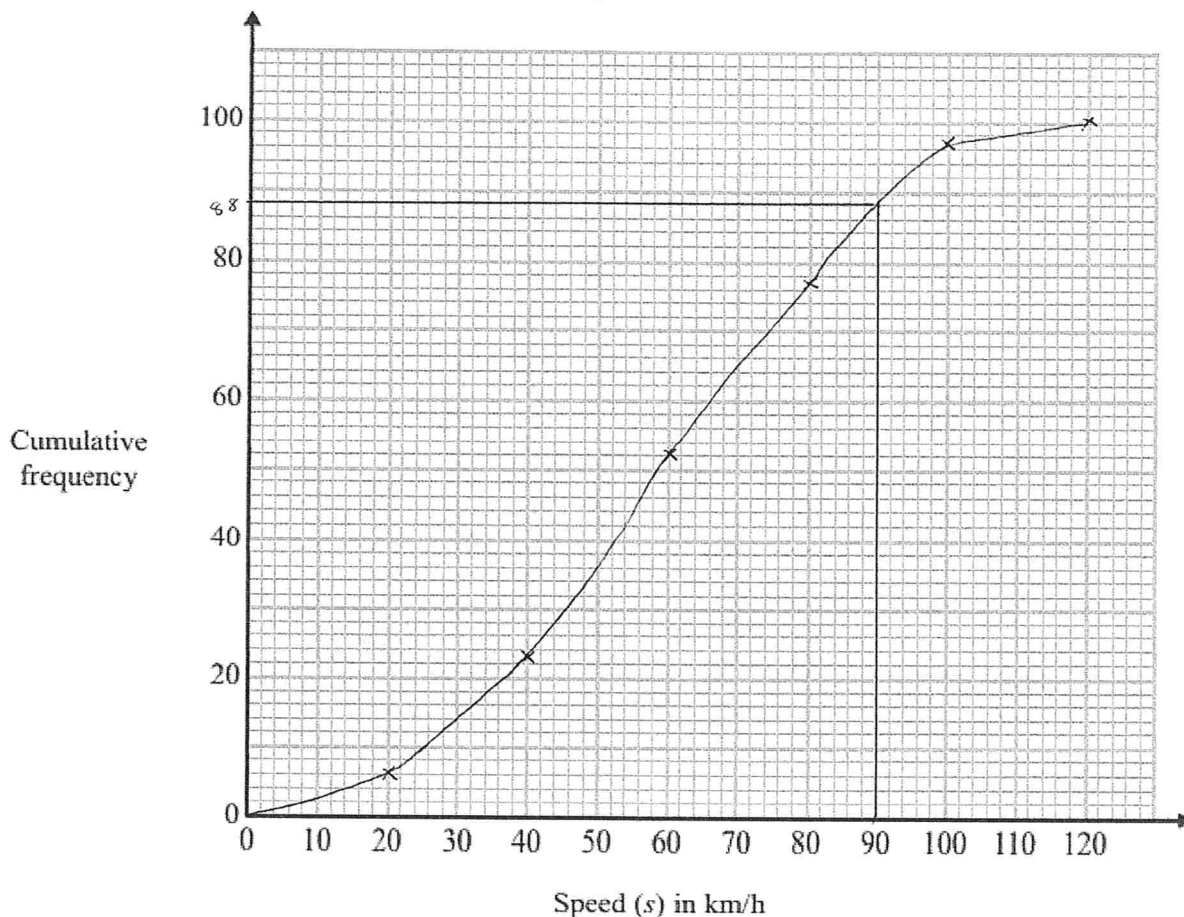
52

77

97

100

- (a) On the grid, plot a cumulative frequency graph for this information.



- (b) Find an estimate for the number of cars travelling over 90 km/h.

(2)

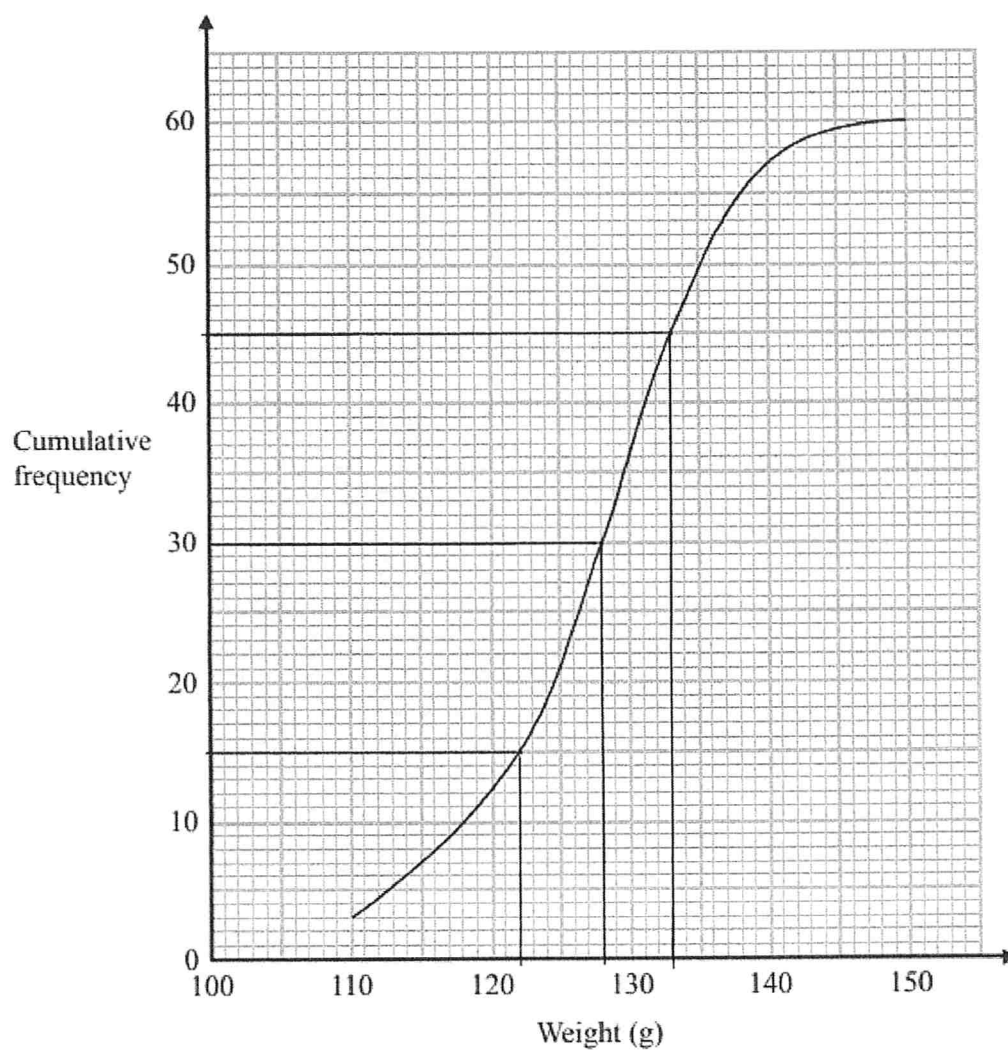
$$100 - 88 = 12$$

12

10 - 14 (1)

(Total for question 5 is 3 marks)

- 6 The cumulative frequency graph gives some information about the weights of some objects.



- (a) Find the median weight.

- (b) Find the inter quartile range.

.....128.....g
(1)

$$133 - 122 = 11$$

.....11.....g
(2)

(Total for question 6 is 3 marks)