

Write your name here

Surname

Other names

Pearson Edexcel

Level 1/Level 2 GCSE (9 - 1)

Centre Number

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Candidate Number

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Mathematics

Paper 3 (Calculator)

Solutions

Higher Tier

Mock Set 2 – Spring 2017

Time: 1 hour 30 minutes

Paper Reference

1MA1/3H

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of 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.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.



Information

- The total mark for this paper is 80
- 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.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Pearson

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 A is the point with coordinates $(2, 10)$
 B is the point with coordinates $(5, d)$

The gradient of the line AB is 4

Work out the value of d .

$$\frac{10-d}{2-5} = 4$$

$$\frac{10-d}{-3} = 4$$

$$10-d = -12$$

$$10+12 = d$$

$$22 = d$$

OR

$$\frac{d-10}{5-2} = 4$$

$$\frac{d-10}{3} = 4$$

$$d-10 = 3 \times 4$$

$$d-10 = 12$$

$$d = 12+10$$

$$d = 22$$

$$d = 22$$

(Total for Question 1 is 3 marks)

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- 2 Sophia pays £222 for a plane ticket.
She also pays 100 euros airport tax.

The exchange rate is £1 = 1.38 euros.

What percentage of the total cost of the ticket and the airport tax does Sophia pay for the airport tax?

Give your answer correct to 1 decimal place.

$$100 \text{ Euros} = \frac{100}{1.38} = £72.46$$

$$\text{Total cost} = £222 + £72.46 = £294.46$$

$$\text{Tax} = \frac{72.46}{294.46} \times 100 \%$$

$$= 24.608$$

$$= 24.6 \%$$

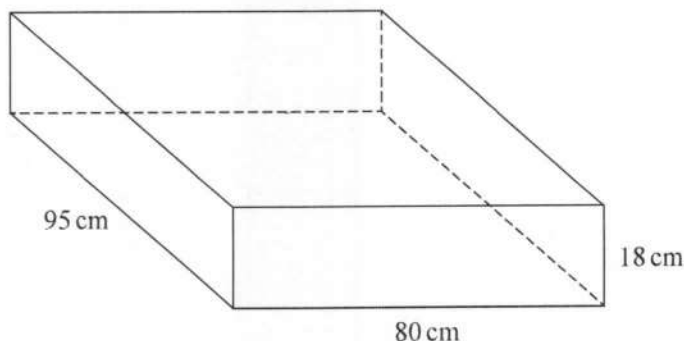
24.6 %

(Total for Question 2 is 3 marks)



S 5 3 6 0 7 A 0 3 2 0

- 3 A sofa has 6 identical cushions.
Each cushion is a cuboid 18 cm by 80 cm by 95 cm.



The cushions are covered with a protective spray.
The protective spray is in cans.

The label on each can has this information.

Spray in this can covers 4 m^2

- (a) Work out how many cans are needed to cover the 6 cushions with protective spray.

$$\begin{aligned}
 \text{Surface area} &= 2 \text{ Tops} = 2 \times 0.95 \times 0.80 = 1.52 \\
 &2 \text{ Fronts} = 2 \times 0.80 \times 0.18 = 0.288 \\
 &2 \text{ Sides} = 2 \times 0.95 \times 0.18 = 0.342 \\
 &1 \text{ cushion} = \underline{2.15 \text{ m}^2}
 \end{aligned}$$

$$6 \text{ cushions} = 6 \times 2.15 = 12.9 \text{ m}^2$$

$$\frac{12.9}{4} = 3.225$$

so 4 cans required

4
(5)



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The information on each label is inaccurate.
The spray in each can covers 10% more than 4 m^2 .

- (b) How will this affect the number of cans needed for the 6 cushions?
You must show how you get your answer.

Each can 4.4 m^2

3 cans 13.2 m^2

$$13.2 > 12.9$$

So 3 cans would be enough

Will need only 3 cans not 4 as in previous part
of question. So number has been reduced.

(2)

(Total for Question 3 is 7 marks)



S 5 3 6 0 7 A 0 5 2 0

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

(a) Write down as a column vector

(i) $\mathbf{a} + \mathbf{b}$

$$\begin{pmatrix} 1 \\ 4 \end{pmatrix} + \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 4 \\ 6 \end{pmatrix}$$

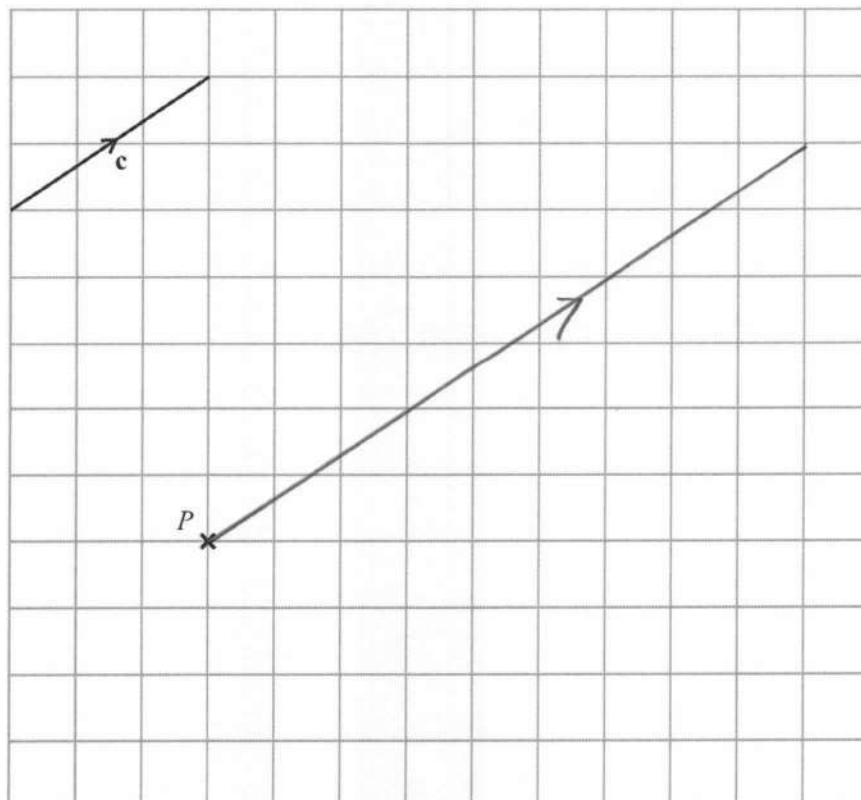
(1)

(ii) $2\mathbf{a} + 3\mathbf{b}$

$$2 \begin{pmatrix} 1 \\ 4 \end{pmatrix} + 3 \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 2 \\ 8 \end{pmatrix} + \begin{pmatrix} 9 \\ 6 \end{pmatrix} = \begin{pmatrix} 11 \\ 14 \end{pmatrix}$$

(2)

The vector $\mathbf{c}$ is drawn on the grid.



(b) From the point P , draw the vector $3\mathbf{c}$

(1)

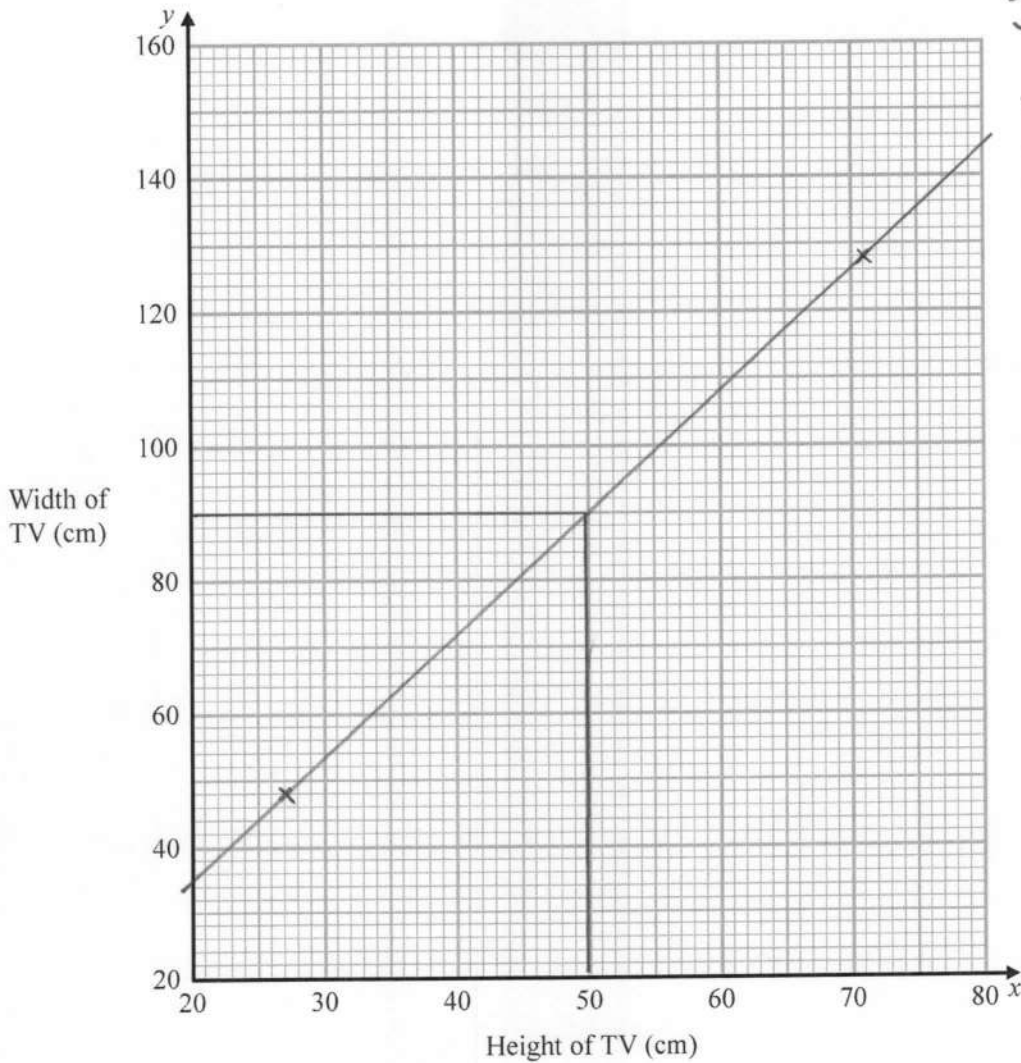
(Total for Question 4 is 4 marks)



5 The height (x cm) and the width (y cm) of TVs are in the ratio 9:16

- (a) Use this information to draw a graph to show the relationship between the height and the width of TVs.

Use values of x from 20 to 80



$$x = 27$$

$$y = 27 \times \frac{16}{9} = 48$$

$$x = 72$$

$$y = 72 \times \frac{16}{9} = 128$$

(2)

A TV has a width of 90 cm.

- (b) Use your graph to work out the height of this TV.

50

cm

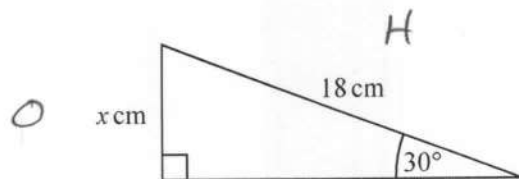
(1)

(Total for Question 5 is 3 marks)



S 5 3 6 0 7 A 0 7 2 0

6



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

Work out the value of x .

$$\frac{x}{18} = \sin 30^\circ$$

$$x = 18 \sin 30^\circ$$

$$x = 9 \text{ cm}$$

$$x = 9 \text{ cm}$$

(Total for Question 6 is 2 marks)

- 7 A train travels from Madrid to Malaga at an average speed of 183 km/h.

The train leaves Madrid at 08 40

The train arrives at Malaga at 11 28

Work out the distance the train travels from Madrid to Malaga.

$$\begin{array}{r} 06+ \\ 11.28 \\ 08.40 \\ \hline 2.48 \end{array}$$

$$2 \text{ hrs } 48 \text{ min}$$

$$2.8 \text{ hrs}$$

$$\frac{48}{60} = 0.8 \text{ hrs}$$

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

$$= 2.8 \times 183$$

$$= 512.4 \text{ km}$$

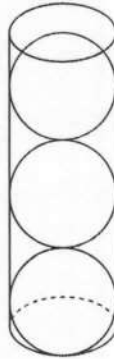
$$512.4 \text{ km}$$

(Total for Question 7 is 3 marks)

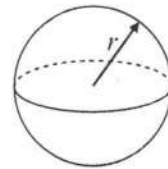


- 8 A hollow cylinder has radius r cm and height $6r$ cm.
3 spheres, also of radius r cm, are put into the cylinder.

$$\begin{aligned}\text{Volume of cylinder} &= \pi r^2 h \\ &= \pi r^2 \times 6r \\ &= 6\pi r^3\end{aligned}$$



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



- (a) Work out the proportion of the cylinder that is **not** filled by the spheres.

$$\text{Volume of 3 spheres} = 3 \times \frac{4}{3}\pi r^3 = 4\pi r^3$$

$$\text{so } 6\pi r^3 - 4\pi r^3 = 2\pi r^3 \text{ not filled}$$

$$\frac{2\pi r^3}{6\pi r^3} = \frac{1}{3} \text{ not filled}$$

$$\frac{1}{3}$$

(3)

The height of the cylinder is increased by $2r$ cm.
Another sphere of radius r cm is put into the cylinder.

Malcolm says,

"There is no change in the proportion of the cylinder **not** filled by the spheres."

- (b) Is Malcolm correct?
Justify your answer.

Yes since each sphere fills same proportion
of its part of cylinder

(1)

(Total for Question 8 is 4 marks)



S 5 3 6 0 7 A 0 9 2 0

- 9 The densities of three metal alloys, A, B and C, are in the ratio

13:15:21

1 m³ of alloy B has a mass of 8600 kg.

Work out the difference between the mass of 5 m³ of alloy A and 3 m³ of alloy C.
Give your answer correct to 3 significant figures.

$$\text{Density of B} = \frac{\text{Mass}}{\text{Vol}} = \frac{8600}{1} = 8600 \text{ kg/m}^3$$

$$\text{Density of A} = 8600 \times \frac{13}{15} \text{ kg/m}^3$$

$$5 \text{ m}^3 \text{ of A} \rightarrow 8600 \times \frac{13}{15} \times 5 = 37266.67 \text{ kg}$$

$$\text{Density of C} = 8600 \times \frac{21}{15} \text{ kg/m}^3$$

$$3 \text{ m}^3 \text{ of C} = 8600 \times \frac{21}{15} \times 3 = 36120 \text{ kg}$$

$$\begin{aligned} \text{Difference} &= 37266.67 - 36120 \\ &= 1146.67 \text{ kg} \\ &= 1150 \text{ kg to 3 s.f} \end{aligned}$$

1150 kg

(Total for Question 9 is 5 marks)

- 10 Write the following numbers in order of size.
Start with the smallest number.

$$\begin{aligned} 0.045 \times 10^3 \\ = 4.5 \times 10^1 \end{aligned}$$

$$4.5 \times 10^{-3}$$

$$\begin{aligned} 450 \\ = 4.5 \times 10^2 \end{aligned}$$

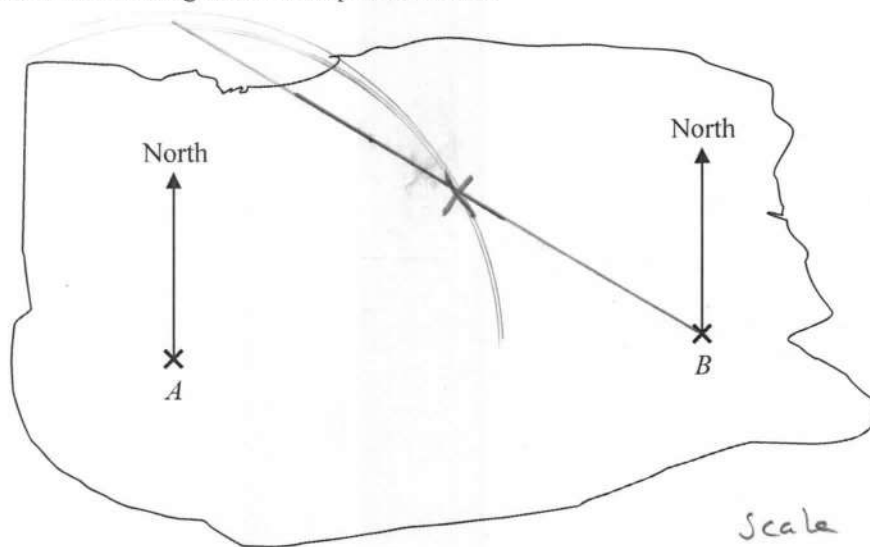
$$\begin{aligned} 0.45 \times 10^{-1} \\ = 4.5 \times 10^{-2} \end{aligned}$$

$$4.5 \times 10^{-3}, 0.45 \times 10^{-1}, 0.045 \times 10^3, 450$$

(Total for Question 10 is 2 marks)



11 The accurate scale drawing shows a map of an island.



A and B are points on the island.
The real distance, in kilometres, between A and B is 56 km.

Treasure is buried at point C on the island.
Point C is 35 km from A and on a bearing of 300° from B .

Mark the point C with a cross (X).

$$\frac{35}{8} = 4.375$$

so 4.375 cm from A

so on arc radius 4.375 cm from A

(Scale distorted by photocopying)

Scale
7 cm = 56 km
1 cm = 8 km

(Total for Question 11 is 5 marks)



- 12 There are 24 girls and 12 boys in a club.

One girl and one boy are going to be chosen to go to a meeting.

Work out the total number of ways of choosing a girl and a boy.

$$24 \times 12 = 288$$

288

(Total for Question 12 is 2 marks)

- 13 (a) Expand and simplify $(x+2)(2x-3)(3x+1)$

$$= (2x^2 + 4x - 3x - 6)(3x+1)$$

$$= (2x^2 + x - 6)(3x+1)$$

$$= 6x^3 + 3x^2 - 18x + 2x^2 + x - 6$$

$$= 6x^3 + 5x^2 - 17x - 6$$

(3)

(b) Simplify $n^4 \div n^{\frac{1}{2}}$ $= n^{4-\frac{1}{2}}$ $= n^{7/2}$

$$n^{7/2}$$

(1)

(Total for Question 13 is 4 marks)



14 $a = \sqrt{7} + \sqrt{c}$ and $b = \sqrt{63} + \sqrt{d}$ where c and d are positive integers.

Given that $c:d = 1:9$

find, in its simplest form, the ratio $a:b$

$$c:d = 1:9$$

$$\Rightarrow d = 9c$$

$$a:b$$

$$= \sqrt{7} + \sqrt{c} : \sqrt{63} + \sqrt{9c}$$

$$= \sqrt{7} + \sqrt{c} : \sqrt{9 \times 7} + \sqrt{9c}$$

$$= \sqrt{7} + \sqrt{c} : 3\sqrt{7} + 3\sqrt{c} = 3(\sqrt{7} + \sqrt{c})$$

$$= 1:3$$

$$1:3$$

(Total for Question 14 is 3 marks)

15 Two solid cones are mathematically similar.

Cone A has a volume of 120 cm^3

Cone B has a volume of 960 cm^3

Work out the ratio of the surface area of cone A to the surface area of cone B.

$$\text{Vol} = 120 : 960$$

$$\text{Vol} = 1 : 8$$

$$\text{Lengths} = \sqrt[3]{1} : \sqrt[3]{8}$$

$$= 1 : 2$$

$$\text{Areas} = 1^2 : 2^2$$

$$= 1 : 4$$

$$1:4$$

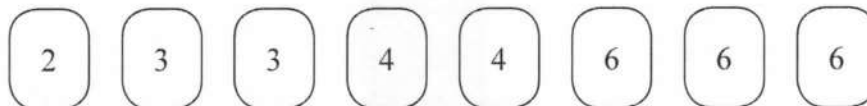
(Total for Question 15 is 3 marks)



S 5 3 6 0 7 A 0 1 3 2 0

16 Here are 8 cards.

There is a number on each card.

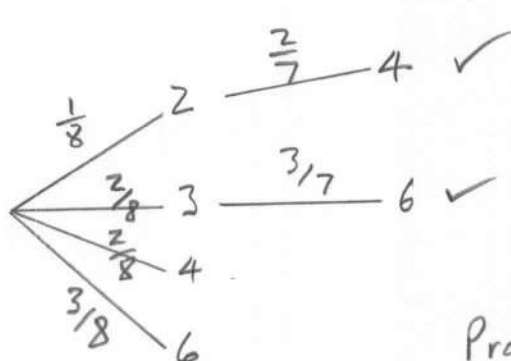


Erin puts the 8 cards in a bag.

She takes at random a card from the bag and does not replace it.

Erin then takes at random a second card from the bag.

Calculate the probability that the number on the second card is double the number on the first card.



$$\frac{1}{8} \times \frac{2}{7} = \frac{2}{56}$$

$$\frac{2}{8} \times \frac{3}{7} = \frac{6}{56}$$

Prob(2nd card double first card)

$$= \frac{2}{56} + \frac{6}{56} = \frac{8}{56}$$

$$= \frac{1}{7}$$

$$\frac{1}{7}$$

(Total for Question 16 is 3 marks)



17 a, b, c are positive integers such that $a > b > c$

N is the largest three digit number that has the digits a, b and c .

K is the smallest three digit number that has the digits a, b and c .

(a) Use algebra to show that the difference between N and K is always a multiple of 99

$$N = 100a + 10b + c$$

$$K = 100c + 10b + a$$

$$\begin{aligned} N - K &= 100a + 10b + c - (100c + 10b + a) \\ &= 100a + \cancel{10b} + c - 100c - \cancel{10b} - a \\ &= 99a - 99c \\ &= 99(a - c) \end{aligned}$$

which is a multiple of 99
since 99 is a factor

(3)

(b) If $a > b$ and $b = c$ will the difference between N and K still be a multiple of 99?

Justify your answer.

Yes as algebra is unchanged with b s cancelling out

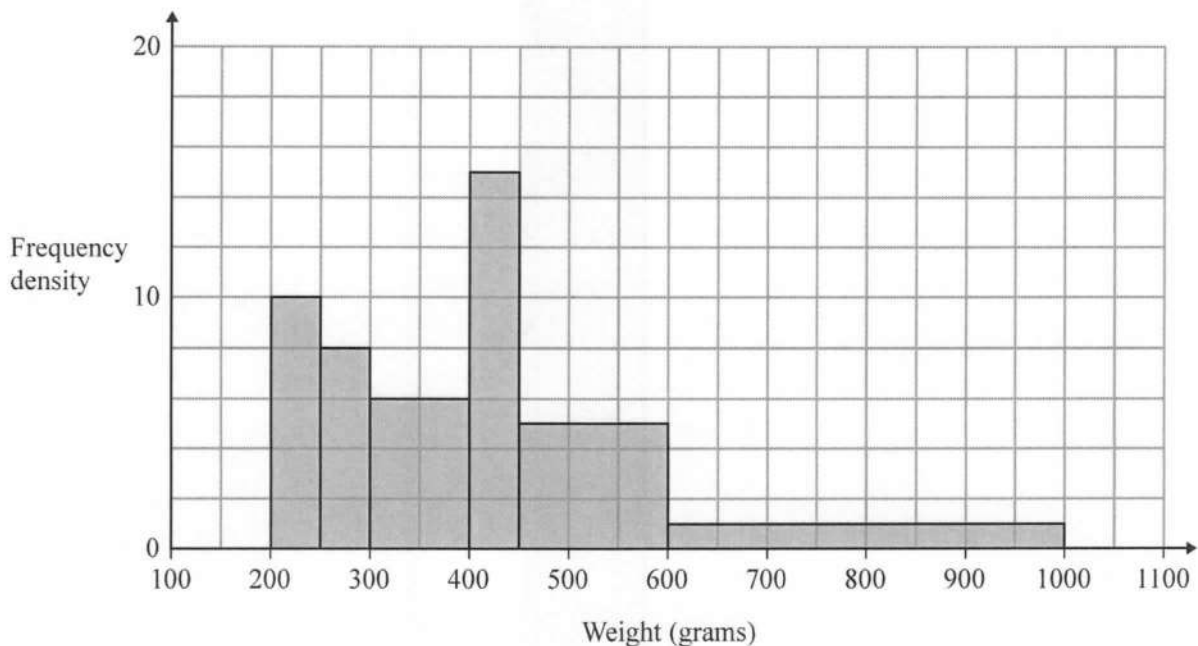
(1)

(Total for Question 17 is 4 marks)



S 5 3 6 0 7 A 0 1 5 2 0

18 The histogram gives information about the weights of some fish.



The number of fish with a weight between 400 g and 450 g is 7 more than the number of fish with a weight between 250 g and 300 g.

(a) Calculate the total number of fish represented by the histogram.

$$\begin{array}{l}
 \text{FD} \times \text{width for } 400-450 \quad 15 \times 50 = 750 \\
 \text{FD} \times \text{width for } 250-300 \quad 8 \times 50 = 400 \\
 \text{Difference } \overline{350} \text{ scaled down to 7} \\
 \text{so divide by 50} \\
 \begin{array}{r}
 10 \times 50 = 500 \\
 8 \times 50 = 400 \\
 6 \times 100 = 600 \\
 15 \times 50 = 750 \\
 5 \times 150 = 750 \\
 1 \times 400 = 400 + \\
 \hline
 3400
 \end{array} \\
 \frac{3400}{50} = 68
 \end{array}$$

68
(3)

(b) (i) Use the histogram to find an estimate for the median weight.

$$\begin{array}{l}
 \text{Total area } 3400 \text{ so median at } 1700 \\
 500 + 400 + 600 = 1500 \\
 \text{so } 250 \text{ through next interval of } 750 \\
 \text{so } \frac{1}{3} \text{ of way through } 4^{\text{th}} \text{ bar} = 417
 \end{array}$$

417 g
(2)



(ii) Give a reason why your answer to part (b)(i) is only an estimate.

Actual data not known, just estimated to be evenly spread in known intervals

(1)

(Total for Question 18 is 6 marks)

19 Solve $2x^2 - 5x - 12 > 0$

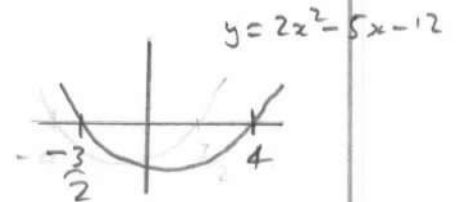
$$\begin{aligned} 2x^2 - 12 \\ = -24 \\ -8 + 3 \end{aligned}$$

$$2x^2 - 8x + 3x - 12 > 0$$

$$2x(x-4) + 3(x-4) > 0$$

$$(2x+3)(x-4) > 0$$

$$x < -\frac{3}{2} \quad \text{or} \quad x > 4$$



(Total for Question 19 is 3 marks)



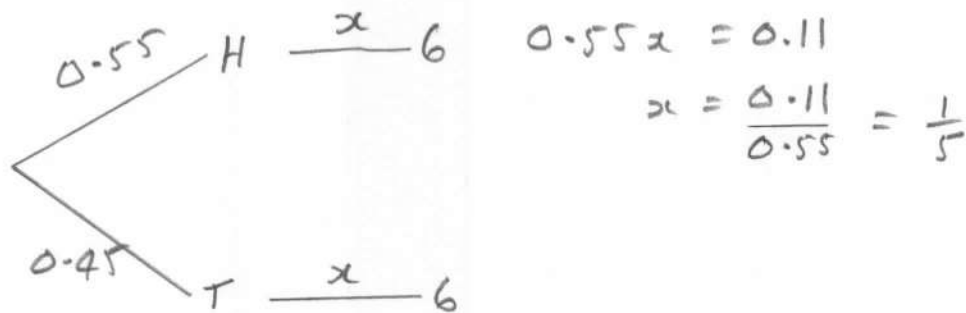
S 5 3 6 0 7 A 0 1 7 2 0

20 Azmol rolls a biased dice and spins a biased coin.

The probability that the coin will land on Heads is 0.55

The probability that the dice will land on 6 and the coin will land on Heads is 0.11

Work out the probability that the dice will land on 6 and the coin will land on Tails.



$$\begin{aligned} \text{Prob}(\text{Tail and 6}) &= 0.45 \times \frac{1}{5} \\ &= 0.09 \end{aligned}$$

0.09

(Total for Question 20 is 3 marks)



21 $f(x) = \frac{1}{x+2} + \frac{1}{x-3}$

$$f(5) = \frac{1}{5+2} + \frac{1}{5-3}$$

- (a) Work out $f(5)$
Give your answer as a fraction.

$$= \frac{1}{7} + \frac{1}{2}$$

$$= \frac{2}{14} + \frac{7}{14}$$

$$= \frac{9}{14}$$

$$\frac{9}{14}$$

(2)

- (b) Write down a value of x for which $f(x)$ is not defined.

$x = 3$ would give denominator = 0
not allowed !!

($x = -2$ not defined either)

$$x = 3$$

(1)

Given that $f(x) = 4$

- (c) find the possible values of x .

Give your answer in the form $\frac{p \pm \sqrt{q}}{r}$ where p, q and r are positive integers.

$$\frac{1}{x+2} + \frac{1}{x-3} = 4$$

$$1(x-3) + 1(x+2) = 4(x+2)(x-3)$$

$$x-3 + x+2 = 4(x^2+2x-3x-6)$$

$$2x-1 = 4(x^2-x-6)$$

$$2x-1 = 4x^2-4x-24$$

$$0 = 4x^2-4x-24-2x+1$$

$$0 = 4x^2-6x-23$$

$$x = \frac{+6 \pm \sqrt{6^2 - 4 \times 4 \times (-23)}}{8}$$

$$x = \frac{+6 \pm \sqrt{404}}{8}$$

(5)

(Total for Question 21 is 8 marks)

TOTAL FOR PAPER IS 80 MARKS



S 5 3 6 0 7 A 0 1 9 2 0