ANSWERS

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number

Candidate Number

Mathematics
Paper 3 (Calculator)

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.*
- **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.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

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.

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*.

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

   $$\therefore \quad d-10 = 4 \times 3 = 12$$

   $$\therefore \quad d = 22$$

   d = ...22.......

   (Total for Question 1 is 3 marks)

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?

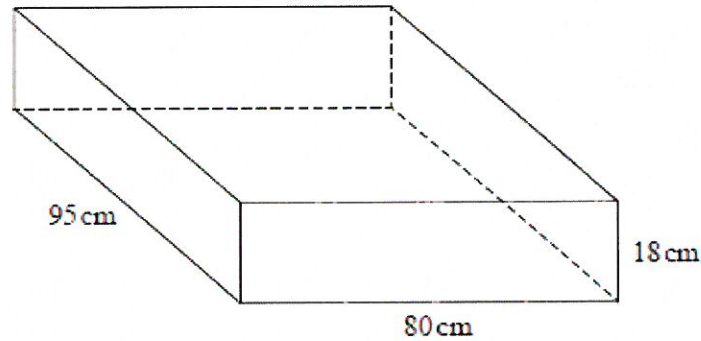Give your answer correct to 1 decimal place.

£222 = 1.38 × 222 = 306.36 EUROS

$$\frac{100}{306.36+100} \times 100$$

.... 24.6 .... %

(Total for Question 2 is 3 marks)

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.

$$\boxed{\text{Spray in this can covers 4 m}^2}$$

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

SURFACE AREA OF A CUSHION $= 2(95 \times 18 + 80 \times 18 + 95 \times 80)$
$$= 21500 \text{ cm}^2$$

∴ S.A. OF 6 CUSHIONS $= 6 \times 21500 = 129000 \text{ cm}^2$

$1m = 100 \text{ cm}$
∴ $1m^2 = 100^2 \text{ cm}^2 = 10,000 \text{ cm}^2$
∴ $4m^2 = 40,000 \text{ cm}^2$

NUMBER OF CANS $= \dfrac{129,000}{40,000} = 3.225$

.................................4.................................

(5)

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.

10% OF 4m^2 = 0.4m^2 ∴ CAN COVERS 4.4m^2 = 44,000cm^2

∴ NUMBER OF CANS = $\frac{129,000}{44,000}$ = 2.932

∴ NUMBER OF CANS REQUIRED = 3,

NUMBER OF CANS REDUCED FROM 4 TO 3

(2)

(Total for Question 3 is 7 marks)

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

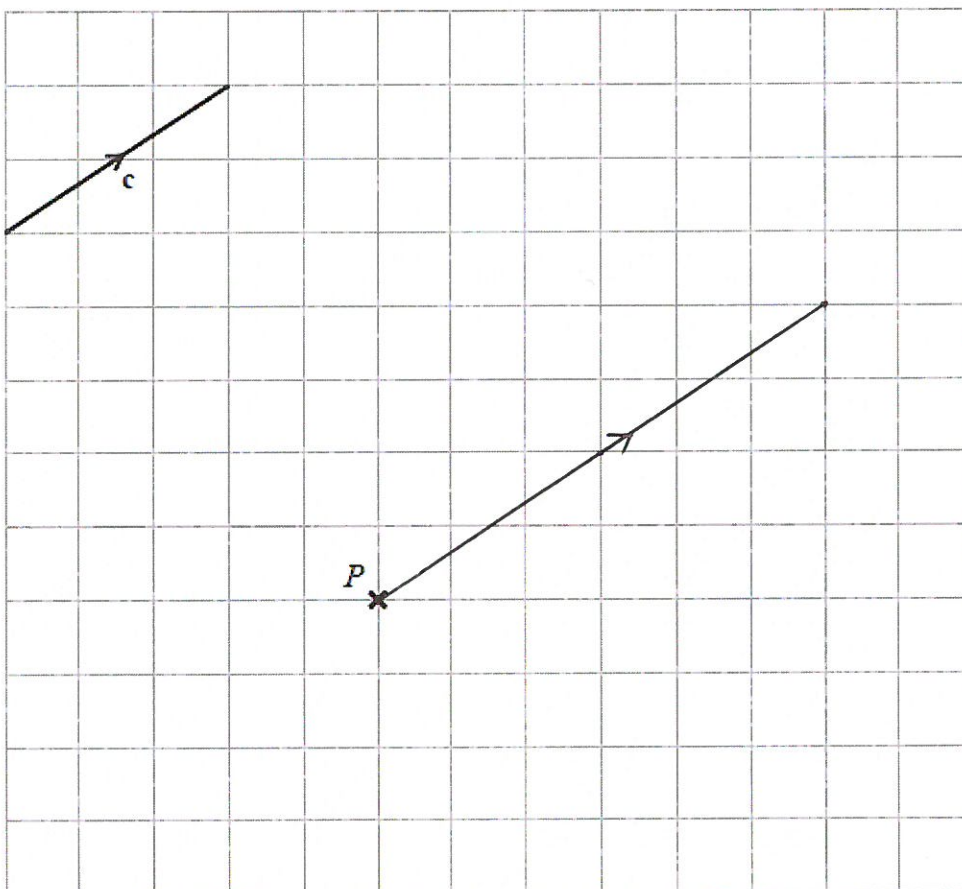(i) $\mathbf{a} + \mathbf{b}$

$\begin{pmatrix} 4 \\ 6 \end{pmatrix}$

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

$= \begin{pmatrix} 2 \\ 8 \end{pmatrix} + \begin{pmatrix} 9 \\ 6 \end{pmatrix}$

$\begin{pmatrix} 11 \\ 14 \end{pmatrix}$

(3)

The vector **c** is drawn on the grid.

(b) From the point P, draw the vector 2**c**

(1)

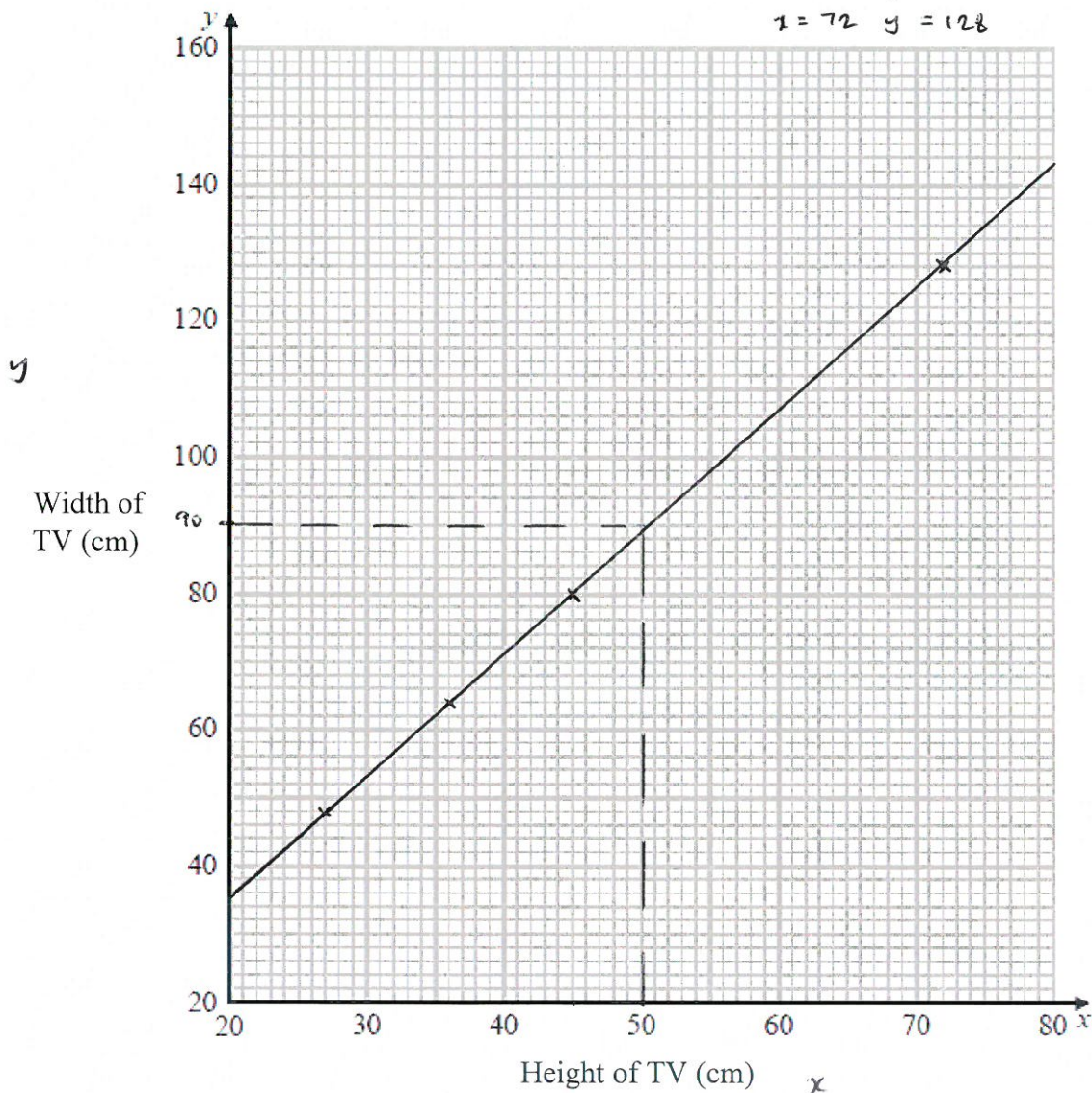**(Total for Question 4 is 4 marks)**

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.

$y = \frac{16}{9}x$ $x = 27 \quad y = 48$

$x = 36 \quad y = 64$

Use values of *x* from 20 to 80

$x = 45 \quad y = 80$

$x = 72 \quad y = 128$

Width of TV (cm)

Height of TV (cm)   *x*

y

(2)

A TV has a width of 90 cm.

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

50

.... cm

(48–52)   (1)

(Total for Question 5 is 3 marks)

6.
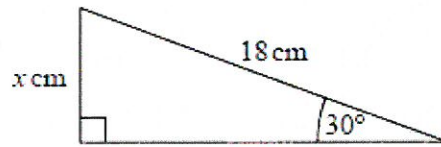
Work out the value of x.

$$\sin \text{ } 30 = \frac{x}{18}$$

$$x = 18\sin 30$$

.... 9 ....

(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.

20 mins $+ 2$ hrs $+ 28$ mins $= 2$ hrs 48 mins $= 2.8$ HOURS

DISTANCE $= 183 \times 2.8 = 512.4$ km.

.... 512.4 .... km
(or 512)

(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.

Volume of sphere = $\frac{4}{3}\pi r^3$
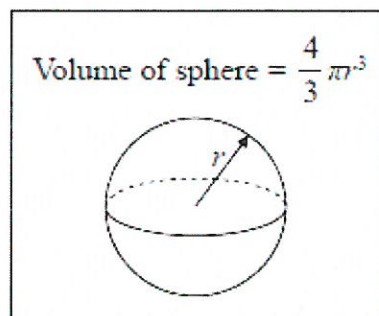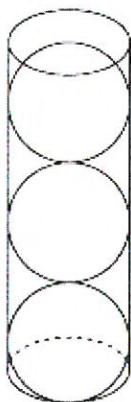
(a) Work out the proportion of the cylinder that is **not** filled by the spheres.

VOLUME OF CYLINDER = $\pi r^2 \cdot 6r = 6\pi r^3$

VOLUME OF 3 SPHERES = $3 \times \frac{4}{3}\pi r^3 = 4\pi r^3$

∴ VOLUME NOT FILLED BY SPHERES = $6\pi r^3 - 4\pi r^3 = 2\pi r^3$

∴ PROPORTION = $\frac{2\pi r^3}{6\pi r^3} = \frac{1}{3}$

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

(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.

NEW VOLUME OF CYLINDER = $8\pi r^3$ VOLUME OF 4 SPHERES = $\frac{4}{3} \times 4\pi r^3 = \frac{16\pi r^3}{3}$

∴ NEW VOLUME NOT FILLED = $\frac{8\pi r^3}{3}$ ∴ NEW PROPORTION = $\frac{1}{3}$ SO MALCOM IS CORRECT

(1)

(Total for Question 8 is 4 marks)

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

$$13 : 15 : 21$$

1 m^3 of alloy B has a mass of 8600 kg.

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

1m^3 OF A HAS MASS $\dfrac{13}{15} \times 8600$ kg

$\therefore 5 \text{m}^3$ of A HAS MASS $5 \times \dfrac{13}{15} \times 8600 = 37266\frac{2}{3}$ kg.

1m^3 of C HAS MASS $\dfrac{21}{15} \times 8600$ kg.

$\therefore 3 \text{m}^3$ of C HAS MASS $3 \times \dfrac{21}{15} \times 8600 = 36120$ kg.

$\therefore$ DIFFERENCE $= 37266\frac{2}{3} - 36120 = 1146\frac{2}{3}$

........................1150........................ kg
$(1146 - 1150)$

(Total for Question 9 is 5 marks)

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

0.045×10^3 4.5×10^{-3} 450 0.45×10^{-1}
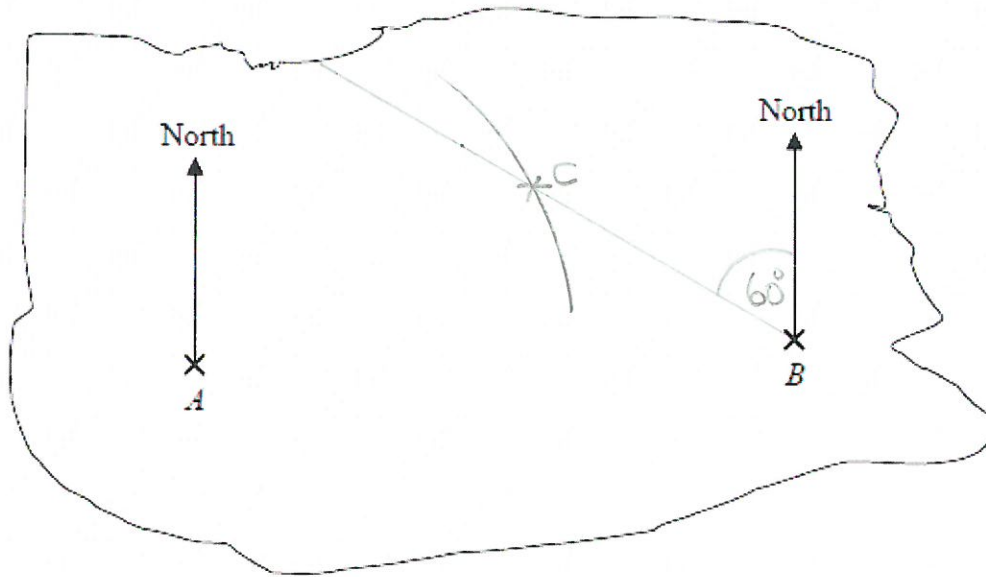$= 45$ $= 0.0045$ $= 0.045$

........4.5×10^{-3}........,........0.45×10^{-1}........,........0.045×10^3........,........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).

∴ 56km is 8cm
∴ 7km is 1cm
∴ 35km is 5cm.

(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 ....

(Total for Question 12 is 2 marks)

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

$$(x + 2)(6x^2 + 2x - 9x - 3)$$
$$= (x + 2)(6x^2 - 7x - 3)$$
$$= 6x^3 - 7x^2 - 3x + 12x^2 - 14x - 6$$

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

(3)

(b) Simplify $n^4 \div n^{\frac{1}{2}}$

$$4 - \frac{1}{2} = 3\frac{1}{2} = \frac{7}{2}$$

.... $\wedge$ $\frac{7}{2}$ ....

(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 $c : d = 1 : 9$ $\therefore d = 9c$ $\therefore \sqrt{d} = 3\sqrt{c}$

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

$b = \sqrt{63} + \sqrt{d} = 3\sqrt{7} + 3\sqrt{c} = 3\left(\sqrt{7} + \sqrt{c}\right)$

$\therefore a : b = \sqrt{7} + \sqrt{c} : 3\left(\sqrt{7} + \sqrt{c}\right)$

$= 1 : 3$

.... $1 : 3$ ....

(Total for Question 14 is 3 marks)

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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**.

VOLUME SCALE FACTOR $(A \ TO \ B) = 8$

$\therefore$ LENGTH S.F. $= 2$

$\therefore$ AREA S.F. $= 2^2 = 4$

.... $1 : 4$ ....

(Total for Question 15 is 3 marks)

16. Here are 8 cards.

There is a number on each card.

| 2 | 3 | 3 | 4 | 4 | 6 | 6 | 6 |

Erin puts the 8 cards in a bag.
She takes at random a card from the bag and <u>does not replace it</u>.
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.

VALID COMBINATIONS ARE 2,4   2,4   3,6   3,6   3,6

3,6   3,6   3,6

$$P(2,4) = \frac{1}{2} \times \frac{2}{7} = \frac{2}{56}$$

$$P(3,6) = \frac{2}{8} \times \frac{3}{7} = \frac{6}{56}$$

$$\therefore \quad P(2,4) \text{ or } P(3,6) = \frac{2}{56} + \frac{6}{56} = \frac{8}{56}$$

$\frac{8}{56}$
....

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

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

$N = 100a + 10b + c$

$K = 100c + 10b + a$

$\therefore N - K = 100a + 10b + c - 100c - 10b - a$

$= 99a - 99c$

$= 99(a - c)$

$QED.$

(3)

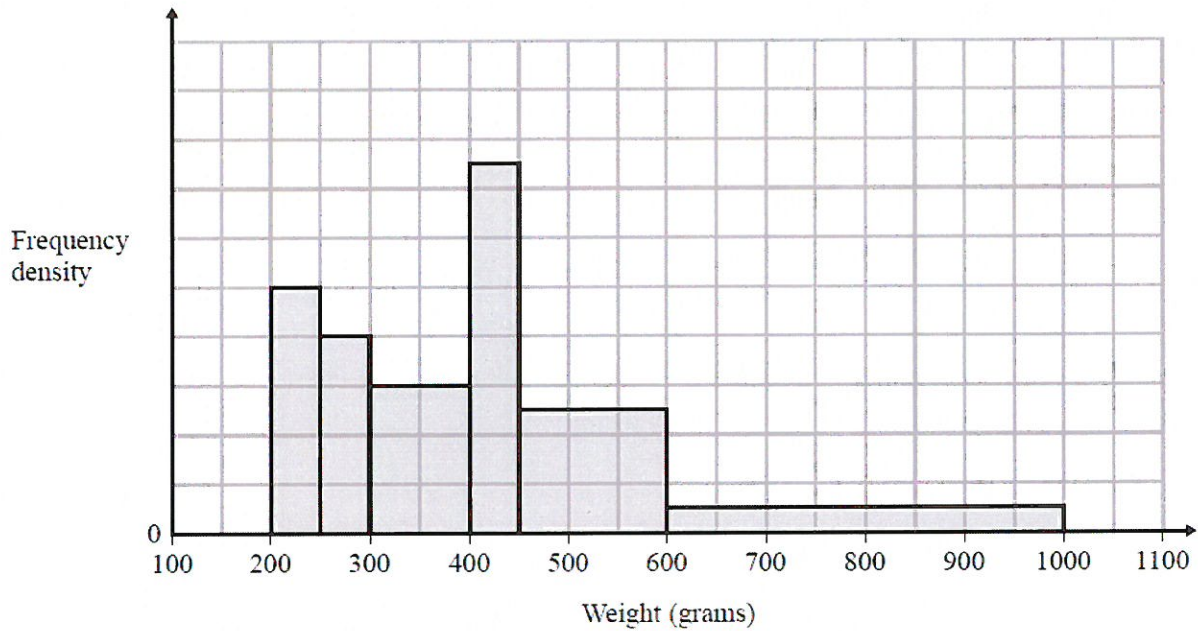(b) If $a > b$ and $b = c$ will the difference between N and K still be a multiple of 99?
Justify your answer.

YES $N - K = 99(a - c)$ So PUTTING $c = b$ JUST GIVES $99(a - b)$

(or b HAS NO EFFECT SINCE THEY CANCEL)

(1)

(Total for Question 17 is 4 marks)

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

Weight (grams)

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.

400 - 450g IS 7.5 SQUARES } ∴ 3.5 SQUARES IS 7 FISH
250 - 300g IS 54 SQUARES } ∴ 5 SQUARES IS 14 FISH
∴ 1 SQUARE IS 2 FISH

NUMBER OF SQUARES = 5 + 4 + 6 + 7.5 + 7.5 + 4
= 34

∴ NUMBER OF FISH = 34 × 2
= 68

.... 68 ....

(3)

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

$\frac{1}{2} \times$ ~~34~~ ~~[crossed out]~~ 17 SQUARES.   15 OF THESE IN 1ST 3 BARS

∴ 4th BAR $\frac{2}{7.5} \times 50 + 400 = 413$

.... $\underset{(412 - 417)}{413}$ .... g

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

..HISTOGRAM ONLY GIVES NUMBERS IN INTERVALS...................

....

(3)

(Total for Question 18 is 6 marks)

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

$(2x + 3)(x - 4) > 0$
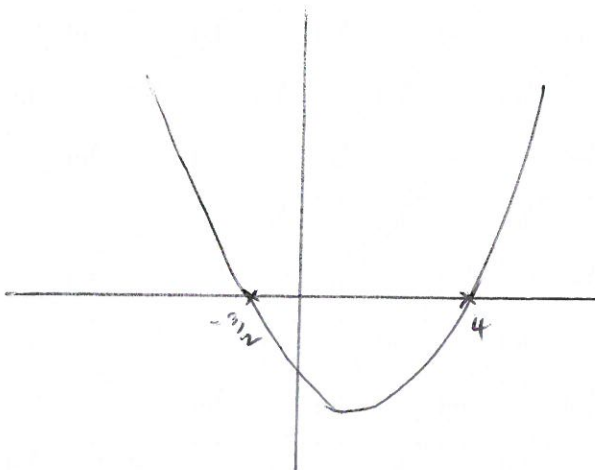
.....$x > 4$....,....$x < -\frac{3}{2}$.....

(Total for Question 19 is 3 marks)

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.

$$P(H, 6) = P(H) \times P(6)$$
$$0.11 = 0.55 \times P(6)$$
$$\therefore P(6) = \frac{0.11}{0.55} = \frac{1}{5}$$

$$P(T) = 1 - 0.55 = 0.45$$

$$\therefore P(T, 6) = 0.45 \times \frac{1}{5} = 0.09$$

.... 0.09 ....

(Total for Question 20 is 3 marks)

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

(a) Work out f(5)

Give your answer as a fraction.

$f(5) = \dfrac{1}{7} + \dfrac{1}{2} = \dfrac{2+7}{14}$

.......................$\dfrac{9}{14}$...............

(2)

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

...............$x = 3 \text{ or } -2$..............

(1)

Given that f(x) = 4

(c) find the possible values of x.

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

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

$\therefore \dfrac{x-3 + x+2}{(x+2)(x-3)} = 4$

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

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

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

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

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

$a = 4$
$b = -6$
$c = -23$

$= \dfrac{6 \pm \sqrt{36 + 4 \times 4 \times 23}}{8}$

$= \dfrac{6 \pm \sqrt{404}}{8}$

$x = \dfrac{6 \pm \sqrt{404}}{8} = \dfrac{3 \pm \sqrt{101}}{4}$

(5)

(Total for Question 21 is 8 marks)

TOTAL FOR PAPER: 80 MARKS

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