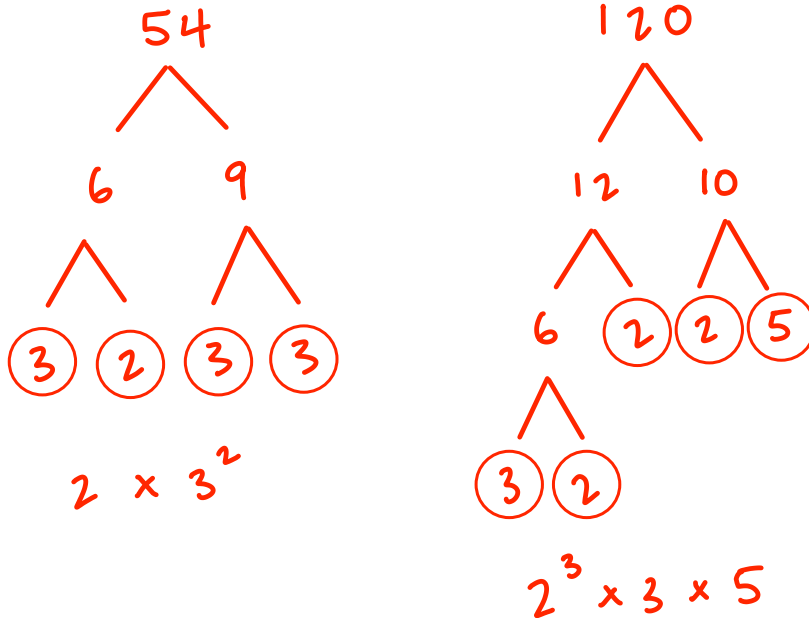


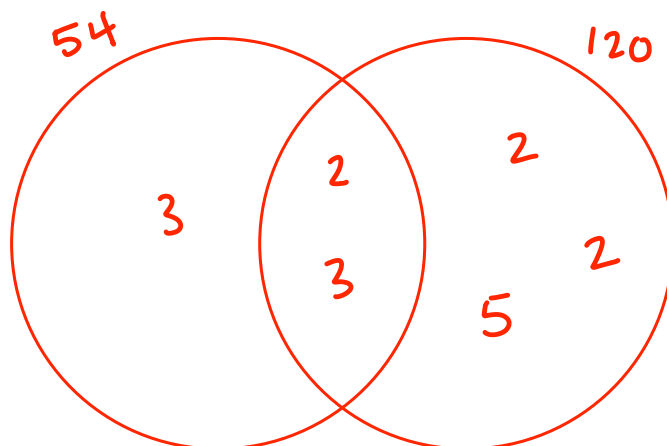


- 1 Find the highest common factor (HCF) of 54 and 120



6

(Total for Question 1 is 2 marks)



$$2 \times 3 = 6$$

- 2 There are only red counters, white counters, blue counters and green counters in a bag.

Chris is going to take at random a counter from the bag.

The table shows the probability that he will take a red counter and the probability that he will take a white counter.

Colour	red	white	blue	green
Probability	0.3	0.1	0.4	0.2

= 1

There are twice as many blue counters as there are green counters in the bag.

- (a) Work out the probability that Chris will take a blue counter.

$$0.3 + 0.1 = 0.4$$

$$1 - 0.4 = 0.6$$

$$x + 2x = 0.6$$

$$\begin{array}{r|l} 3x & = 0.6 \\ \div 3 & \div 3 \end{array}$$

$$x = 0.2$$

$$0.4$$

(3)

There are 45 red counters in the bag.

- (b) Work out the total number of counters in the bag.

$$0.3 = 45$$

OR

$$\begin{array}{l} \div 3 \quad 30\% = 45 \\ \downarrow \quad 10\% = 15 \\ \downarrow \quad 100\% = 150 \end{array} \quad \begin{array}{l} \div 3 \\ \downarrow \quad \times 10 \end{array}$$

$$150$$

(2)

(Total for Question 2 is 5 marks)

- 3 (a) Complete the table of values for $y = x^2 + x - 4$

x	-3	-2	-1	0	1	2
y	2	-2	-4	-4	-2	2

$$(2)^2 + (2) - 4$$

$$4 + 2 - 4 = 2$$

$$(-2)^2 + (-2) - 4$$

$$4 - 2 - 4 = -2$$

$$(0)^2 + (0) - 4$$

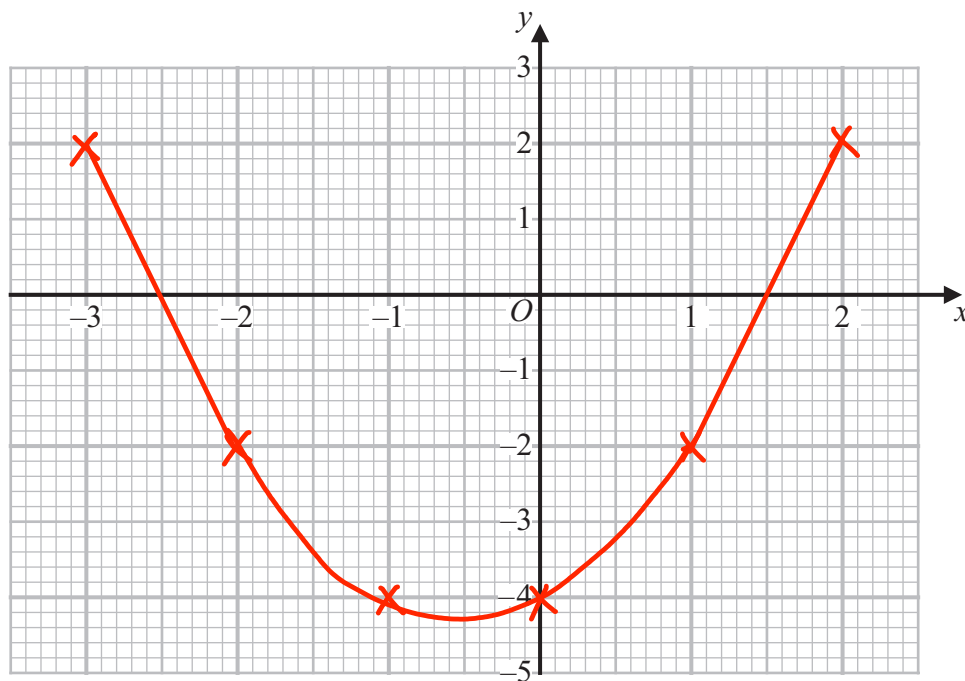
$$0 + 0 - 4 = -4$$

$$(1)^2 + (1) - 4$$

$$1 + 1 - 4 = -2$$

(2)

- (b) On the grid, draw the graph of $y = x^2 + x - 4$ for values of x from -3 to 2



(2)

- (c) Write down the coordinates of the turning point of the graph of $y = x^2 + x - 4$

$$(-0.5, -4.25)$$

(1)

(Total for Question 3 is 5 marks)

- 4 There are 280 chocolates in a box.
There are only dark chocolates, milk chocolates and white chocolates.

$\frac{1}{7}$ of the 280 chocolates are dark chocolates. $280 \div 7 = 40$ (Dark)

The number of milk chocolates : the number of white chocolates = 1 : 3

The number of white chocolates : the number of dark chocolates = n : 1

- (a) Work out the value of n .
You must show all your working.

$$280 - 40 = 240$$

$$M : W$$

$$\begin{array}{c} 1 : 3 \\ \times 60 \quad \downarrow \quad \times 60 \\ 60 : 180 \end{array}$$

$$\begin{array}{r} 060 \\ 4 \overline{) 240} \end{array}$$

$$\text{Dark} = 40$$

$$\text{Milk} = 60$$

$$\text{White} = 180$$

$$\begin{array}{r} 004.5 \\ 40 \overline{) 180.0} \end{array}$$

$$\begin{array}{c} W : D \\ 180 : 40 \\ \div 40 \quad \downarrow \quad \div 40 \\ 4.5 : 1 \end{array}$$

$$n = \underline{4.5} \quad (5)$$

10 milk chocolates from the box are eaten.

- (b) Does this affect your answer to part (a)?
Give a reason for your answer.

NO, the amount of white and dark chocolates has not changed.

(1)

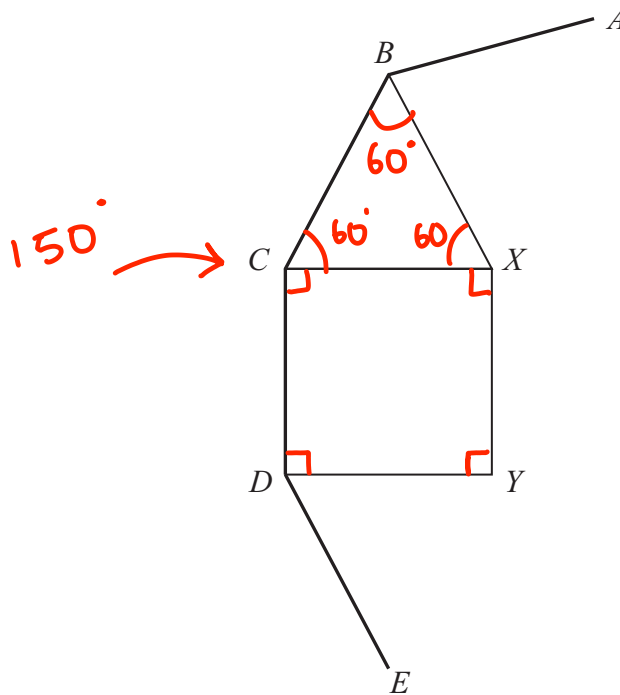
(Total for Question 4 is 6 marks)

- $$\begin{array}{r} 570 \\ + 9800 \\ \hline 10370 \\ + \end{array}$$

$$1.037 \times 10^4$$

(Total for Question 5 is 3 marks)

- 6 AB , BC , CD and DE are four sides of a regular polygon with n sides.



BCX is an equilateral triangle.

$CDYX$ is a square.

Work out the value of n .

You must show all your working.

$$\begin{aligned} \text{interior angle} &= 150^\circ \\ \text{exterior angle} &= 30^\circ \end{aligned}$$

Tip: Interior and exterior angles sum to 180°

$$360 \div 30 = 12$$

Tip: Exterior angles always sum to 360° , no matter how many sides the shape has

$$n = 12$$

(Total for Question 6 is 4 marks)

7 (a) Simplify $\frac{3(2-m)^2}{2-m}$

$$\frac{3(2-m)(2-m)}{\cancel{2-m}}$$

$$\frac{3(2-m)}{(1)}$$

(b) Solve $7 + x \leq \frac{5x}{2} - 8$

$$\begin{array}{rcl} & +8 & +8 \\ 15 + x & \leq & \frac{5x}{2} \\ & \times 2 & \times 2 \\ 30 + 2x & \leq & 5x \\ & -2x & -2x \\ 30 & \leq & 3x \\ & \div 3 & \div 3 \\ 10 & \leq & x \end{array}$$

$$\frac{x \geq 10}{(3)}$$

(c) Solve $9 < 2y + 4 < 12$

$$\begin{array}{rcl} & -4 & -4 & -4 \\ 5 & < & 2y & < & 8 \\ & \div 2 & \div 2 & \div 2 \\ 2.5 & < & y & < & 4 \end{array}$$

$$\frac{2.5 < y < 4}{(2)}$$

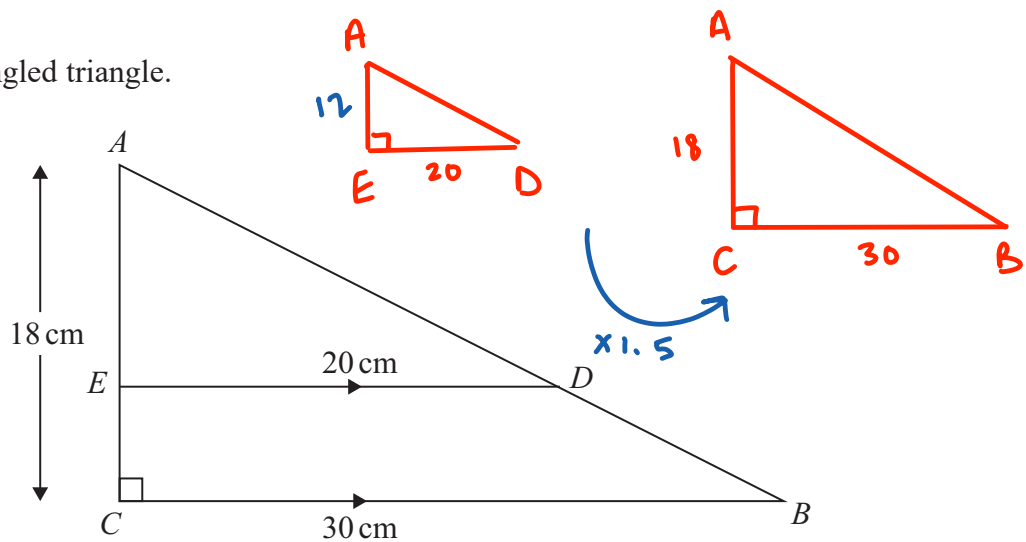
(Total for Question 7 is 6 marks)

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8 ABC is a right-angled triangle.



AEC and ADB are straight lines.
 ED is parallel to CB .

(a) Prove that triangle ABC is similar to triangle ADE .

$$\angle AED = \angle ACB = 90^\circ$$

They share angle A

$$\angle ADE = \angle ABC$$

Similar as all angles are the same (2)

$$ED = 20 \text{ cm} \quad CB = 30 \text{ cm} \quad AC = 18 \text{ cm}$$

(b) Work out the length of EC .

$$30 \div 20 = 1.5$$

$$18 \div 1.5 = 12$$

$$18 - 12 = 6$$

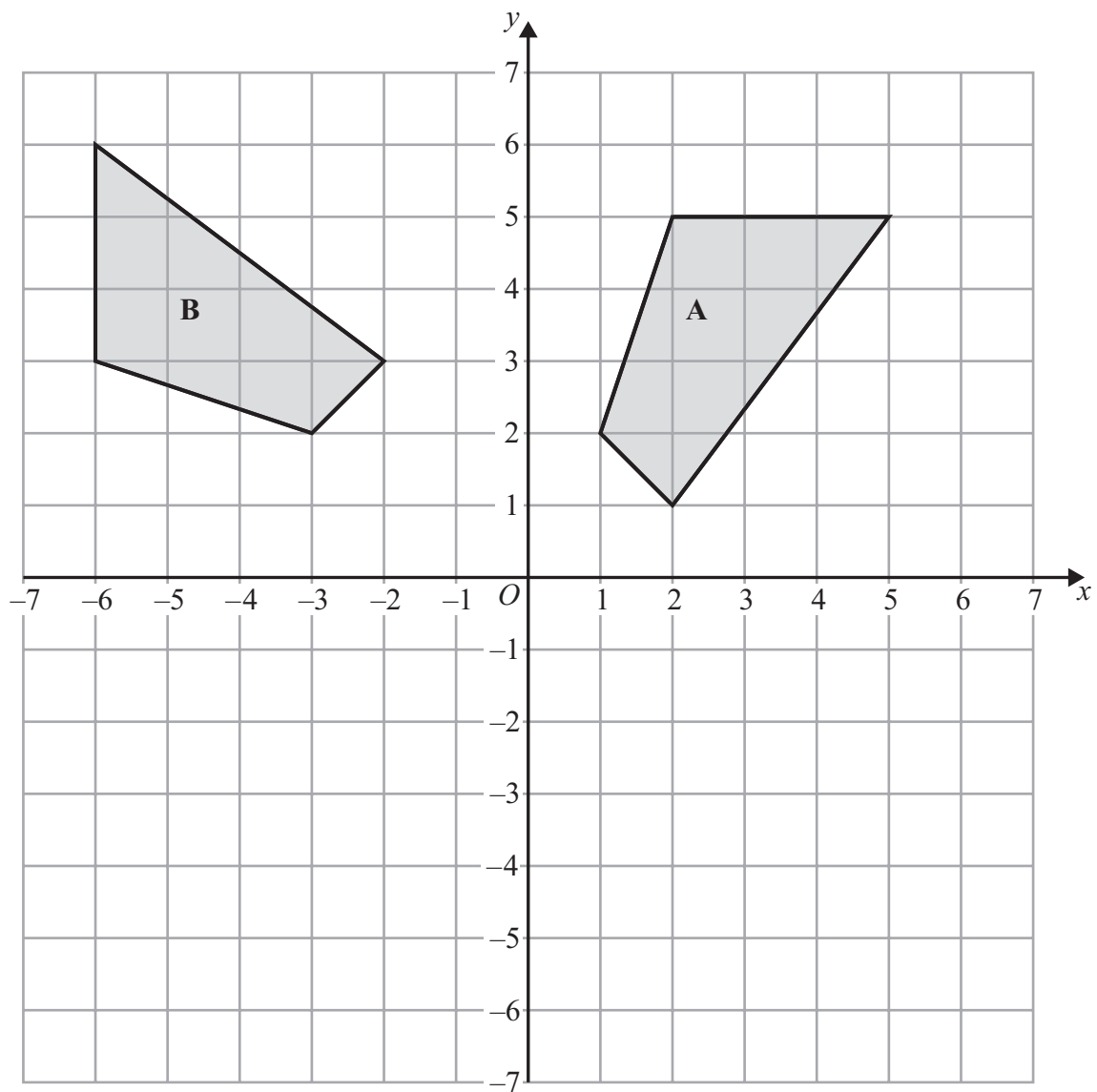
6

..... cm
 (3)

(Total for Question 8 is 5 marks)



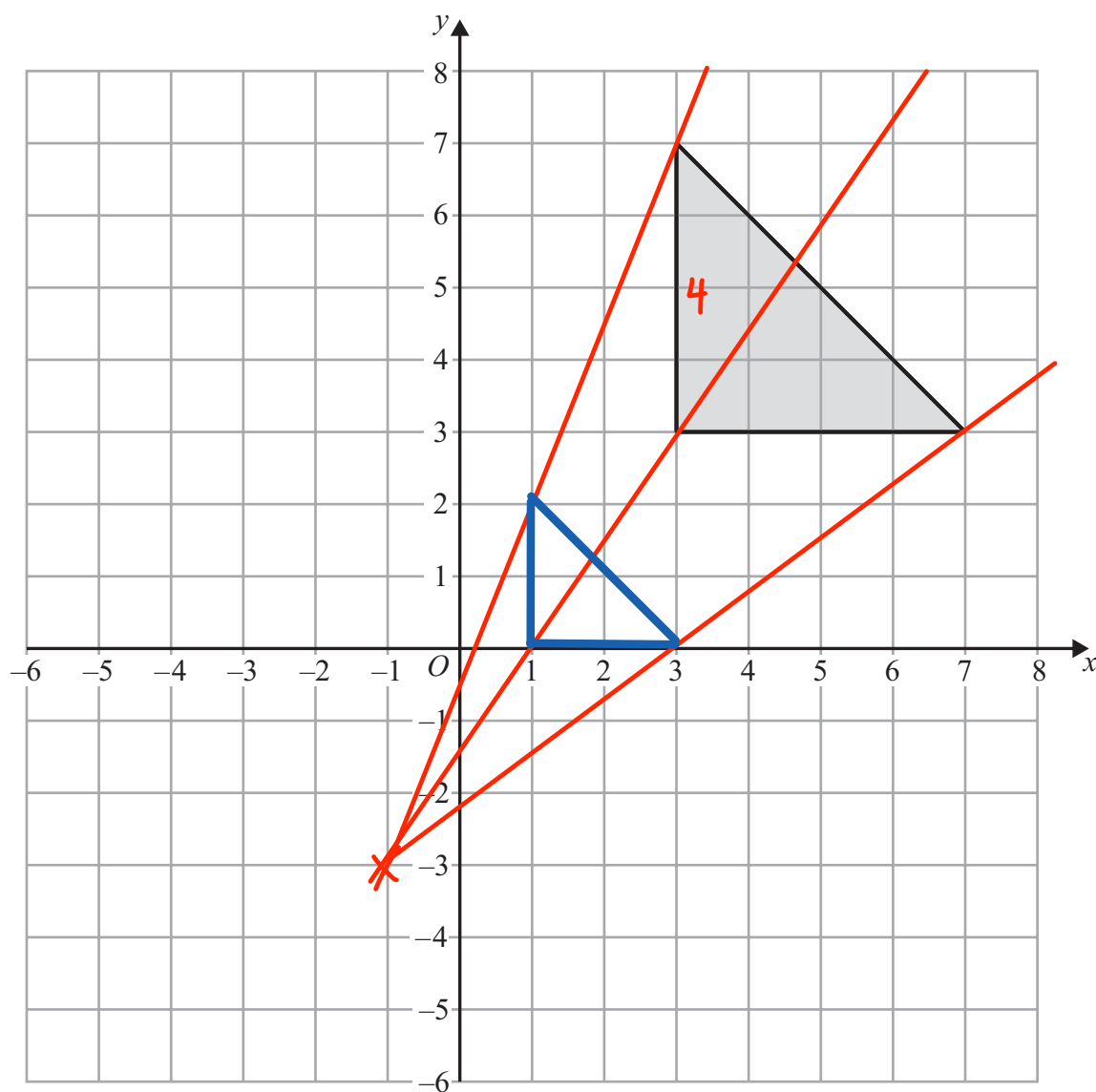
9



- (a) Describe fully the single transformation that maps shape A onto shape B.

Rotated 90° anti-clockwise about $(-1, 0)$

(2)



- (b) Enlarge the triangle by scale factor $\frac{1}{2}$ centre $(-1, -3)$

(2)

(Total for Question 9 is 4 marks)

- 10 Prove that the difference in the squares of two consecutive even numbers is always a multiple of 4


 $2n, 2n+2$

$$\begin{aligned}(2n+2)(2n+2) &= 4n^2 + 4n + 4n + 4 \\ &= 4n^2 + 8n + 4\end{aligned}$$

$$2n \times 2n = 4n^2$$

$$\begin{aligned}4n^2 + 8n + 4 - 4n^2 &= 8n + 4 \\ &= 4(2n+1)\end{aligned}$$

Therefore, always a multiple of 4

(Total for Question 10 is 3 marks)

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11 T is inversely proportional to w .

w is directly proportional to the cube root of d .

When $w = 6$, $T = 20$

When $w = 1$, $d = 8$

Find the value of d when $T = 48$

$$T = \frac{K}{w}$$

$$20 = \frac{K}{6}$$

$$\times 6 \quad \times 6$$

$$120 = K$$

$$T = \frac{120}{w}$$

$$T = 48$$

$$48 = \frac{120}{w}$$

$$\times w \quad \times w$$

$$48w = 120$$

$$\div 48 \quad \div 48$$

$$w = 2.5$$

$$w = K \sqrt[3]{d}$$

$$1 = K \times \sqrt[3]{8}$$

$$1 = K \times 2$$

$$\div 2 \quad \div 2$$

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

$$w = \frac{1}{2} \sqrt[3]{d}$$

$$2.5 = \frac{1}{2} \sqrt[3]{d}$$

$$\times 2 \quad \times 2$$

$$5 = \sqrt[3]{d}$$

$$^3 \quad ^3$$

$$125 = d$$

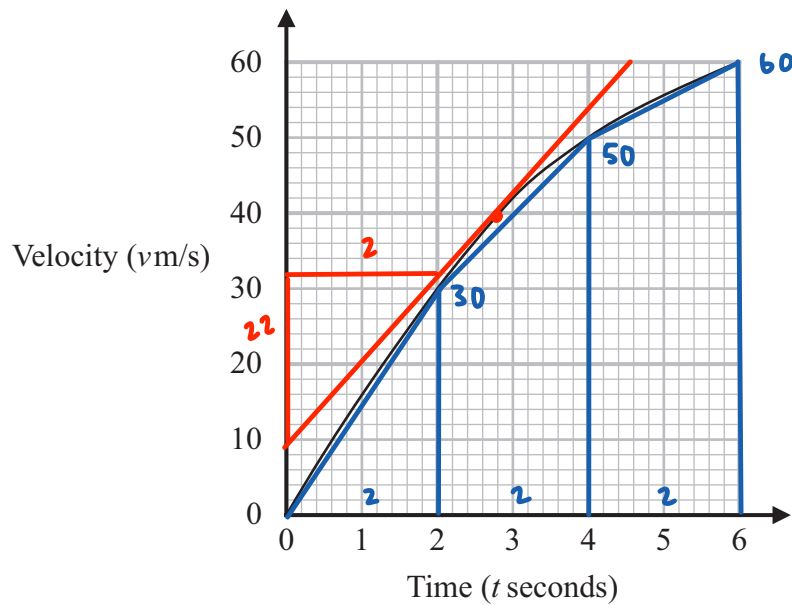
$$d = 125$$

(Total for Question 11 is 5 marks)

$$\begin{array}{r} 002.5 \\ 48 \overline{) 120.0} \end{array}$$

$$\begin{array}{r} 48 \\ 96 \\ 144 \\ 192 \\ 240 \end{array}$$

12 The graph shows the velocity, v m/s, of a particle t seconds after it starts to move.



- (a) (i) Work out an estimate of the gradient of the graph at $t = 3$
You must show how you get your answer.

$$\text{gradient} = \frac{\text{rise}}{\text{run}} = \frac{22}{2} = 11$$

$$\frac{11}{(8.5 \text{ to } 11.5)}$$

(3)

- (ii) What does this gradient represent?

The acceleration

(1)

- (b) Work out an estimate for the distance the particle travelled in the first 6 seconds.
Use 3 strips of equal width.

$$\frac{2 \times 30}{2} = \frac{60}{2} = 30$$

$$\frac{1}{2} (30 + 50) \times 2 = 30 + 50 = 80$$

$$\frac{1}{2} (50 + 60) \times 2 = 50 + 60 = 110$$

220
..... m
(3)

(Total for Question 12 is 7 marks)

$$30 + 80 + 110 = 220$$

13 $x = 0.\dot{2}$ $y = 0.6\dot{8}1$

Work out the value of xy .

Give your answer as a fraction in its simplest form.

$$\begin{array}{r} 10x = 2.\dot{2}22\ldots \\ - x = 0.\dot{2}22\ldots \\ \hline \end{array}$$

$$\begin{array}{r|l} 9x & = 2 \\ \div 9 & \div 9 \\ \hline x & = \frac{2}{9} \end{array}$$

$$\begin{array}{r} 100y = 6\dot{8}18181\ldots \\ - y = 0.6\dot{8}181\ldots \\ \hline \end{array}$$

$$\begin{array}{r|l} 99y & = 67.5 \\ \div 99 & \div 99 \\ \hline y & = \frac{67.5}{99} = \frac{675}{990} \end{array}$$

$$\begin{aligned} & \frac{\overset{\div 2}{2}}{\underset{\div 9}{9}} \times \frac{\overset{\div 9}{675}}{\underset{\div 2}{990}} \\ &= \frac{1}{1} \times \frac{75}{495} \\ &= \frac{75}{495} = \frac{15}{99} \end{aligned}$$

$$\begin{array}{r} 015 \\ 9 \overline{) 675} \end{array}$$

$$\begin{array}{r} 495 \\ 2 \overline{) 990} \end{array}$$

$$\frac{5}{33}$$

(Total for Question 13 is 5 marks)

$$= \frac{5}{33}$$

$$\begin{array}{r} 15 \\ 5 \overline{) 75} \end{array}$$

$$\begin{array}{r} 099 \\ 5 \overline{) 495} \end{array}$$

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- 14 There are nine balls labelled 1 to 9 in a box.

→ 5 odd
4 even

Lee will take at random two balls from the box.

Lee says,

“The probability that the sum of the numbers on the two balls will be an even number is greater than the probability that the product of the numbers will be an even number.”

Is Lee correct?

You must show how you get your answer.

The sum is even :

$$\begin{array}{lcl} \text{even} + \text{even} & = & 4/9 \times 3/8 = 12/72 \\ \text{odd} + \text{odd} & = & 5/9 \times 4/8 = 20/72 \end{array} \left. \vphantom{\begin{array}{lcl} \text{even} + \text{even} \\ \text{odd} + \text{odd} \end{array}} \right\} \frac{32}{72}$$

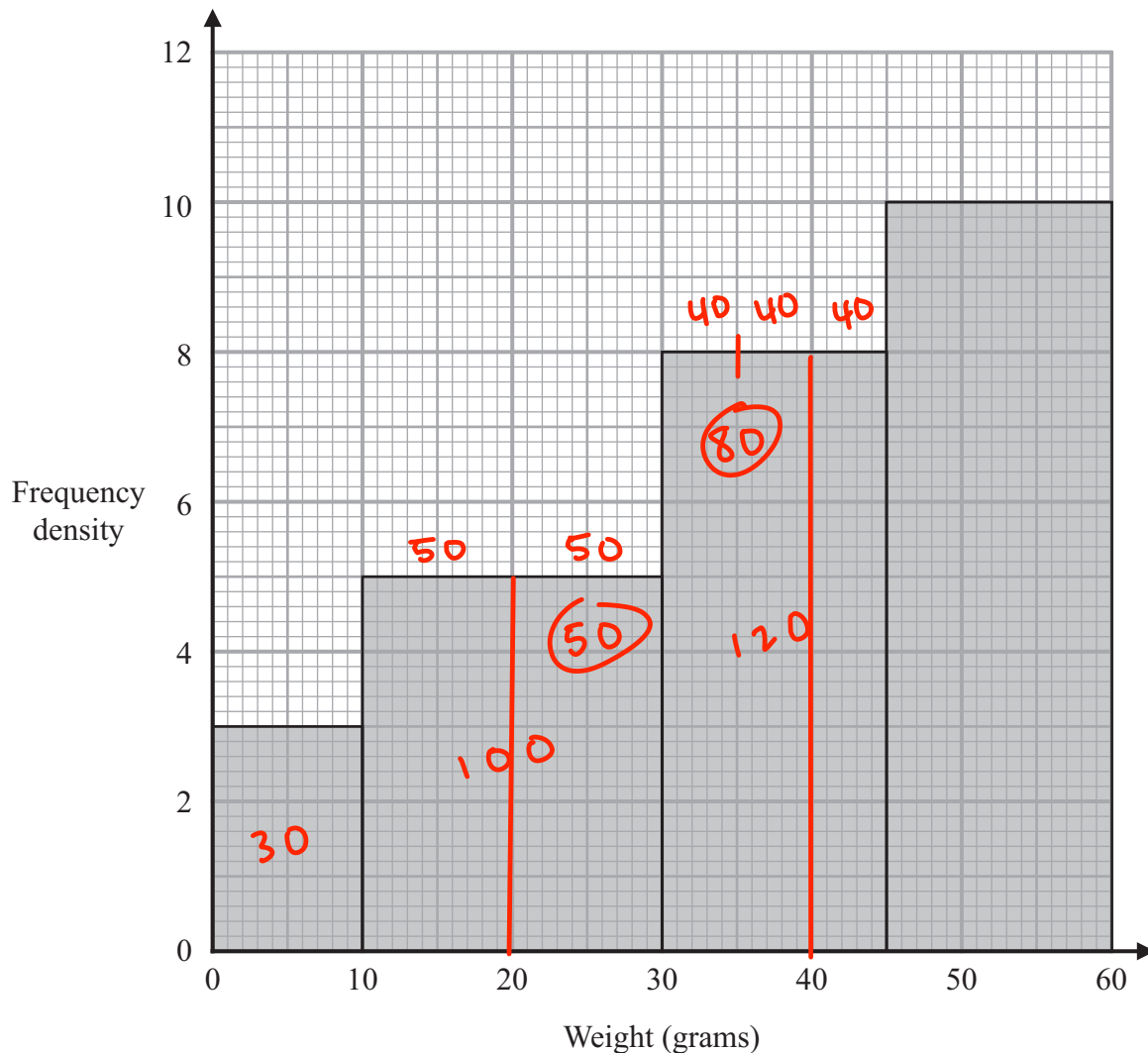
The product is even :

$$\begin{array}{lcl} \text{even} \times \text{even} & = & 4/9 \times 3/8 = 12/72 \\ \text{even} \times \text{odd} & = & 4/9 \times 5/9 = 20/72 \\ \text{odd} \times \text{even} & = & 5/9 \times 4/9 = 20/72 \end{array} \left. \vphantom{\begin{array}{lcl} \text{even} \times \text{even} \\ \text{even} \times \text{odd} \\ \text{odd} \times \text{even} \end{array}} \right\} \frac{52}{72}$$

No, there is a greater probability of the product being even

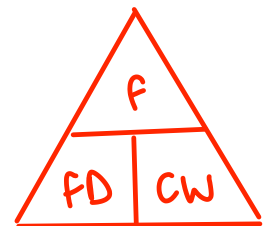
(Total for Question 14 is 5 marks)

15 The histogram gives information about the weights, in grams, of some biscuits.



One of these biscuits is taken at random.

Work out an estimate for the probability that the biscuit will have a weight between 20 grams and 40 grams.



$$\begin{array}{rcl}
 10 \times 3 & = & 30 \\
 20 \times 5 & = & 100 \\
 & & + \\
 15 \times 8 & = & 120 \\
 15 \times 10 & = & 150 \\
 \hline
 & & 400
 \end{array}$$

$$\begin{array}{r}
 130 \\
 \hline
 400
 \end{array}$$

(Total for Question 15 is 4 marks)

16 (a) Rationalise the denominator of $\frac{35}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{35\sqrt{7}}{7}$

Give your answer in its simplest form.

$$\frac{5\sqrt{7}}{(2)}$$

(2)

$\frac{\sqrt{27}-1}{2-\sqrt{3}}$ can be written in the form $a + b\sqrt{3}$ where a and b are integers.

(b) Work out the value of a and the value of b .

$$\begin{aligned}\sqrt{27} &= \sqrt{9} \times \sqrt{3} \\ &= 3\sqrt{3}\end{aligned}$$

$$\frac{(3\sqrt{3}-1)}{(2-\sqrt{3})} \times \frac{(2+\sqrt{3})}{(2+\sqrt{3})}$$

$$= \frac{6\sqrt{3} + 3(3) - 2 - \sqrt{3}}{4 + 2\sqrt{3} - 2\sqrt{3} - 3}$$

$$= \frac{5\sqrt{3} + 7}{1} = 7 + 5\sqrt{3}$$

$$a = 7$$

$$b = 5$$

(4)

(Total for Question 16 is 6 marks)

17 $g(x) = 1 - 3x$ $h(x) = 2x^2 - 1$

Show that $3gh(x) + hg(x) = 0$ has just one solution for x .

$$\begin{aligned} gh(x) &= 1 - 3(2x^2 - 1) \\ &= 1 - 6x^2 + 3 \\ &= 4 - 6x^2 \end{aligned}$$

$$\begin{aligned} 3gh(x) &= 3(4 - 6x^2) \\ &= 12 - 18x^2 \end{aligned}$$

$$\begin{aligned} hg(x) &= 2(1 - 3x)^2 - 1 \\ &= 2(9x^2 - 6x + 1) - 1 \\ &= 18x^2 - 12x + 2 - 1 \\ &= 18x^2 - 12x + 1 \end{aligned}$$

$$\begin{aligned} (1 - 3x)(1 - 3x) &= 1 - 6x + 9x^2 \\ &= 9x^2 - 6x + 1 \end{aligned}$$

$$12 - 18x^2 + 18x^2 - 12x + 1 = 0$$

$$13 - 12x = 0$$

$$13 = 12x$$

$$\frac{13}{12} = x$$

(Total for Question 17 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS