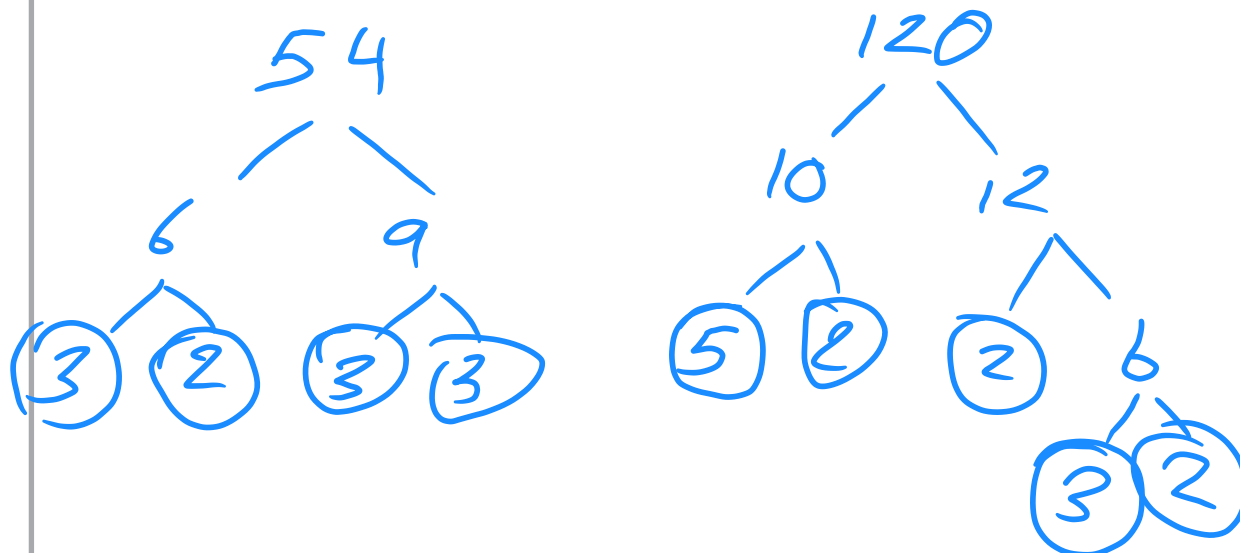


Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

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



$$54 = 2 \times 3 \times 3 \times 3$$
$$120 = 2 \times 2 \times 2 \times 3 \times 5$$

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	$2x$	x

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.

$$\begin{aligned}
 0.3 + 0.1 + 2x + x &= 1 \\
 0.4 + 3x &= 1 \\
 3x &= 0.6 \\
 x &= 0.2
 \end{aligned}$$

$$0.2 \times 2 = 0.4$$

(3)

There are 45 red counters in the bag.

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

$$\begin{aligned}
 0.3 \times \text{Total} &= 45 \\
 \frac{3}{10} \times \text{Total} &= 45 \\
 3 \times \text{total} &= 450 \\
 \text{total} &= \frac{450}{3} = 150
 \end{aligned}$$

(2)

(Total for Question 2 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.

$$\rightarrow \frac{1}{7} \times 280 = 40$$

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.

$$\boxed{d \mid m \mid w} = 280$$

$$40 \quad \underbrace{\hspace{2cm}}_{240}$$

$$m : w =$$

$$1 : 3 = 4$$

$$\times 60 \rightarrow \cancel{60} : 180$$

$$240$$

$$w : d$$

$$n : 1$$

$$\div 40$$

$$n = 4.5$$

$$180 : 40$$

$$n = \dots\dots\dots$$

(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 because there are the same no. of white and dark chocolates.

(1)

(Total for Question 4 is 6 marks)



P 7 6 4 0 3 A 0 5 2 0

- 5 Work out $5.7 \times 10^2 + 9.8 \times 10^3$
Give your answer in standard form.

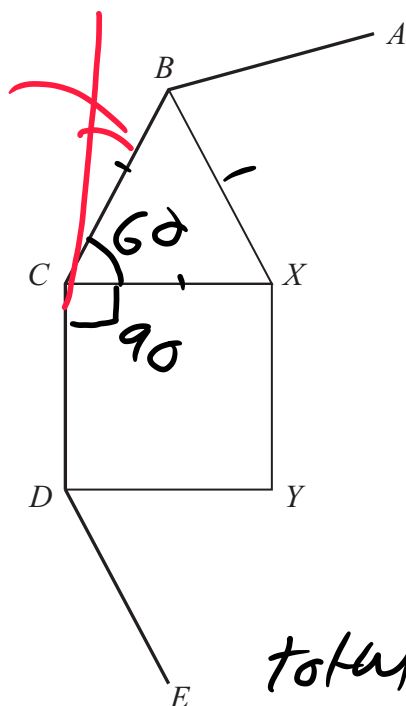
$$\begin{array}{r}
 \boxed{5.7 \times 10^2} = 570 \\
 9.8 \times \boxed{10^3} = 9800 + \\
 \hline
 10370 \\
 \hline
 1.037 \times 10^4 \\
 \hline
 \hline
 \end{array}$$

(Total for Question 5 is 3 marks)

$$\begin{array}{r}
 0.57 \times 10 \times 10^2 \\
 = 0.57 \times 10^3 \\
 = 9.8 \times 10^3 \\
 \hline
 10.37 \times 10^3 \\
 \hline
 1.037 \times 10 \times 10^3 \\
 = 1.037 \times 10^4
 \end{array}$$



- 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.

$$\begin{aligned} \text{total interior} &= 60 + 90 \\ &= 150 \end{aligned}$$

$$180 - 150 = 30$$

$$\frac{360}{30} = 12$$

$n = \dots\dots\dots$

(Total for Question 6 is 4 marks)

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

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

$$3(2-m)$$

$$6 - 3m \quad (1)$$

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

$$14 + 2x \leq 5x - 16$$

$$14 \leq 3x - 16$$

$$30 \leq 3x$$

$$10 \leq x$$

$$x \geq 10 //$$

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

$$5 < 2y < 8$$

$$\frac{5}{2} < y < 4$$

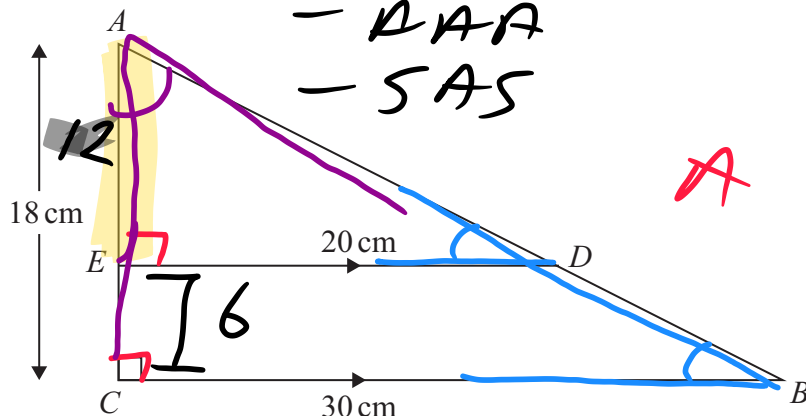
(3)

(2)

(Total for Question 7 is 6 marks)



8 ABC is a right-angled triangle.



AEC and ADB are straight lines.

ED is parallel to CB .

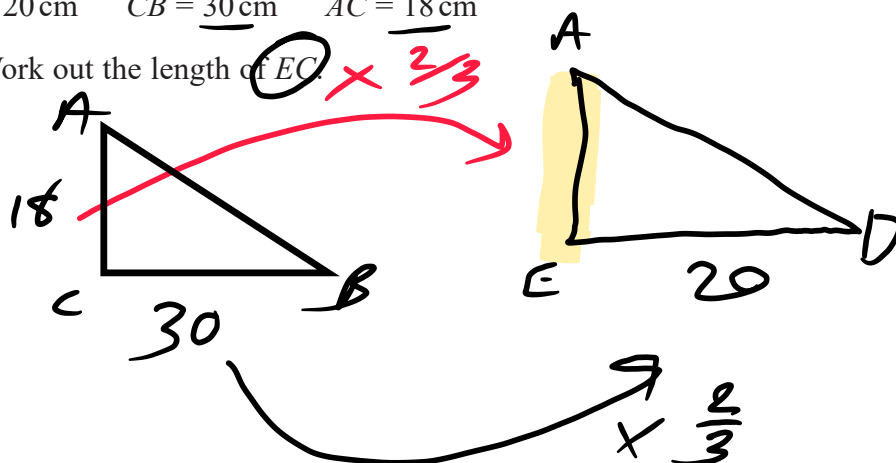
(a) Prove that triangle ABC is similar to triangle ADE .

$\angle AED = \angle ACB = 90^\circ$.
 $\angle CBD = \angle EDA \rightarrow$ corresponding
 $\angle CAB$ angle is common to both
hence using AAA, the 2 Δ s are
similar.

(2)

$ED = 20$ cm $CB = 30$ cm $AC = 18$ cm

(b) Work out the length of EC .



$$\frac{18 \times 2}{3} = 12$$

$$18 - 12 = 6$$

6

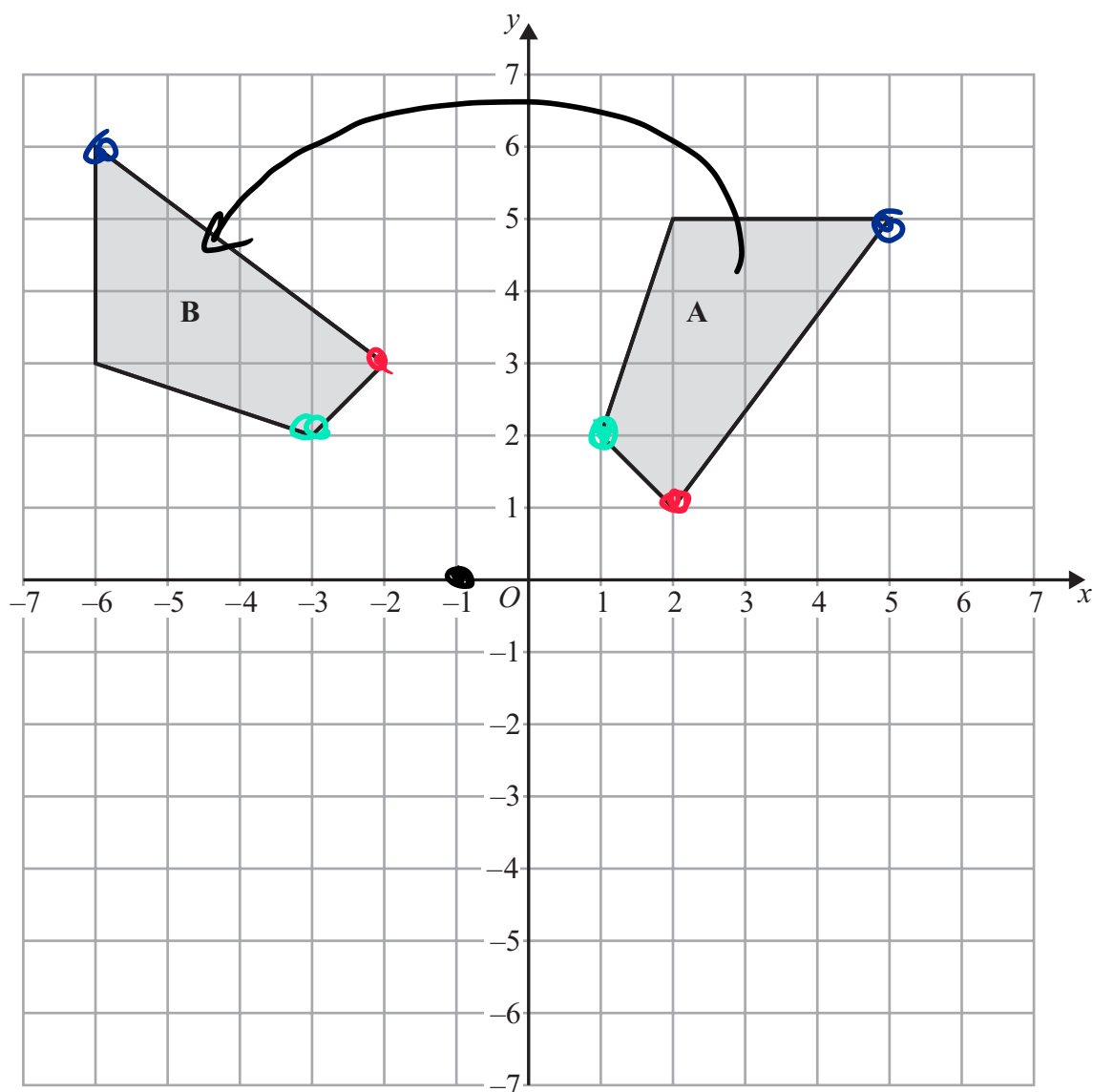
..... cm

(3)

(Total for Question 8 is 5 marks)



P 7 6 4 0 3 A 0 9 2 0



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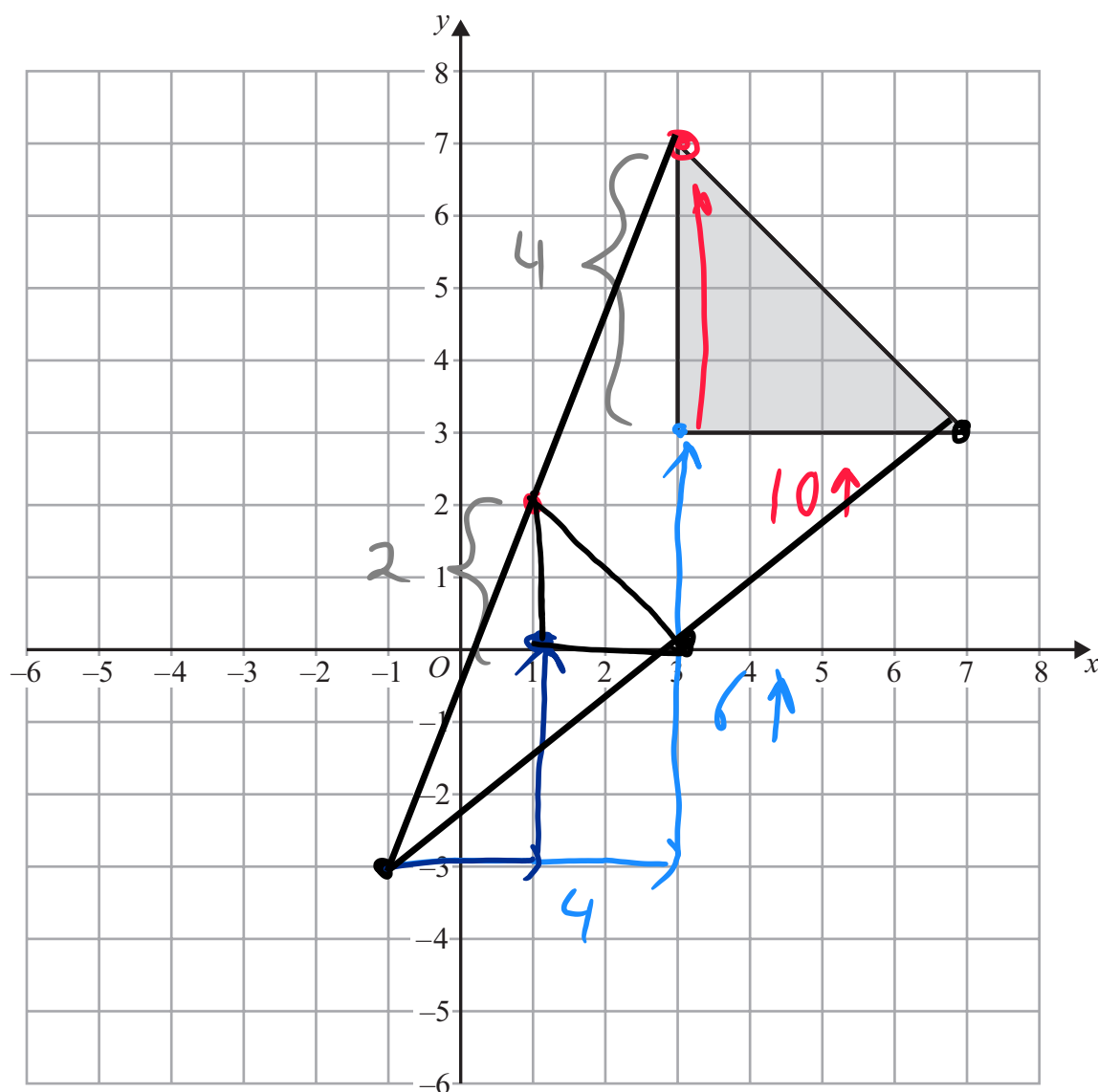
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(a) Describe fully the single transformation that maps shape A onto shape B.

Rotation 90° , centre $(-1, 0)$
anticlockwise

(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

$$2n, 2n+2$$

$$(2n+2)^2 - (2n)^2$$

$$\cancel{4n^2} + 8n + 4 - \cancel{4n^2}$$

$$8n + 4$$

$$\underline{4[2n+1]}$$

(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 $T = 48$

$$T \propto 1/w \Rightarrow T = k/w$$

$$w \propto \sqrt[3]{d} \Rightarrow w = c\sqrt[3]{d}$$

$$20 = k/6$$

$$k = 20 \times 6 = 120$$

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

$$1 = c\sqrt[3]{8}$$

$$1 = c(2)$$

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

$$w = \left(\frac{1}{2}\right)\sqrt[3]{d}$$

$$T \rightarrow w \rightarrow d$$

$$T = 48$$

$$48 = \frac{120}{w} \Rightarrow w = \frac{120}{48} = 2.5$$

$$w = 2.5$$

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

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

$$5^3 = d$$

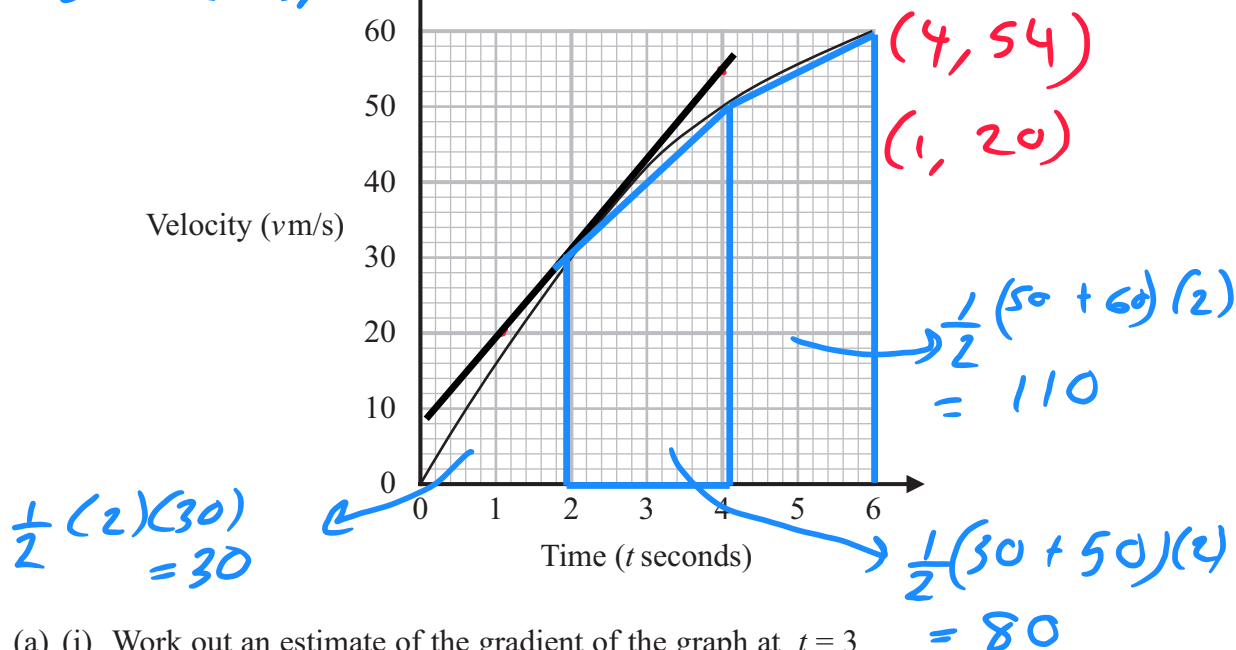
$$d = 125$$

(Total for Question 11 is 5 marks)

$$d = 125$$

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

distance = speed $\times$ time



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

gradient = $\frac{\text{change in } y}{\text{change in } x}$

$$\frac{54 - 20}{4 - 1} = \frac{34}{3} = 11.3$$

(3)

- (ii) What does this gradient represent?

$\frac{\text{change in velocity}}{\text{change in time}}$

(1)

= acceleration



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

$$30 + 80 + 110 = \underline{\underline{220\text{ m}}}$$

..... m

(3)

(Total for Question 12 is 7 marks)



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.

$$\begin{array}{r} x = 0.222222\ldots \\ 10x = 2.222222\ldots \\ \hline \end{array}$$

$$9x = 2$$

$$x = \frac{2}{9}$$

$$\begin{array}{r} y = 0.681818181\ldots \\ 100y = 68.181818181\ldots \\ \hline \end{array}$$

$$99y = 67.5$$

$$y = \frac{67.5}{99}$$

$$xy = \frac{2}{9} \times \frac{67.5}{99} = \frac{135}{891}$$

$$\frac{135 \div 9}{891 \div 9} = \frac{15 \div 3}{99 \div 3} = \frac{5}{33}$$

(Total for Question 13 is 5 marks)

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

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.

1 2 3 4 5 6 7 8 9

Sum

even + even

$$\frac{4}{9} \times \frac{3}{8}$$

$$\frac{12}{72} + \frac{20}{72}$$

odd + odd

$$\frac{5}{9} \times \frac{4}{8}$$

$$= \frac{32}{72}$$

No he's wrong because $\frac{32}{72}$ is $< \frac{52}{72}$

Product

even x odd

$$\frac{4}{9} \times \frac{5}{8}$$

$$\frac{20}{72} + \frac{20}{72}$$

odd x even

$$\frac{5}{9} \times \frac{4}{8}$$

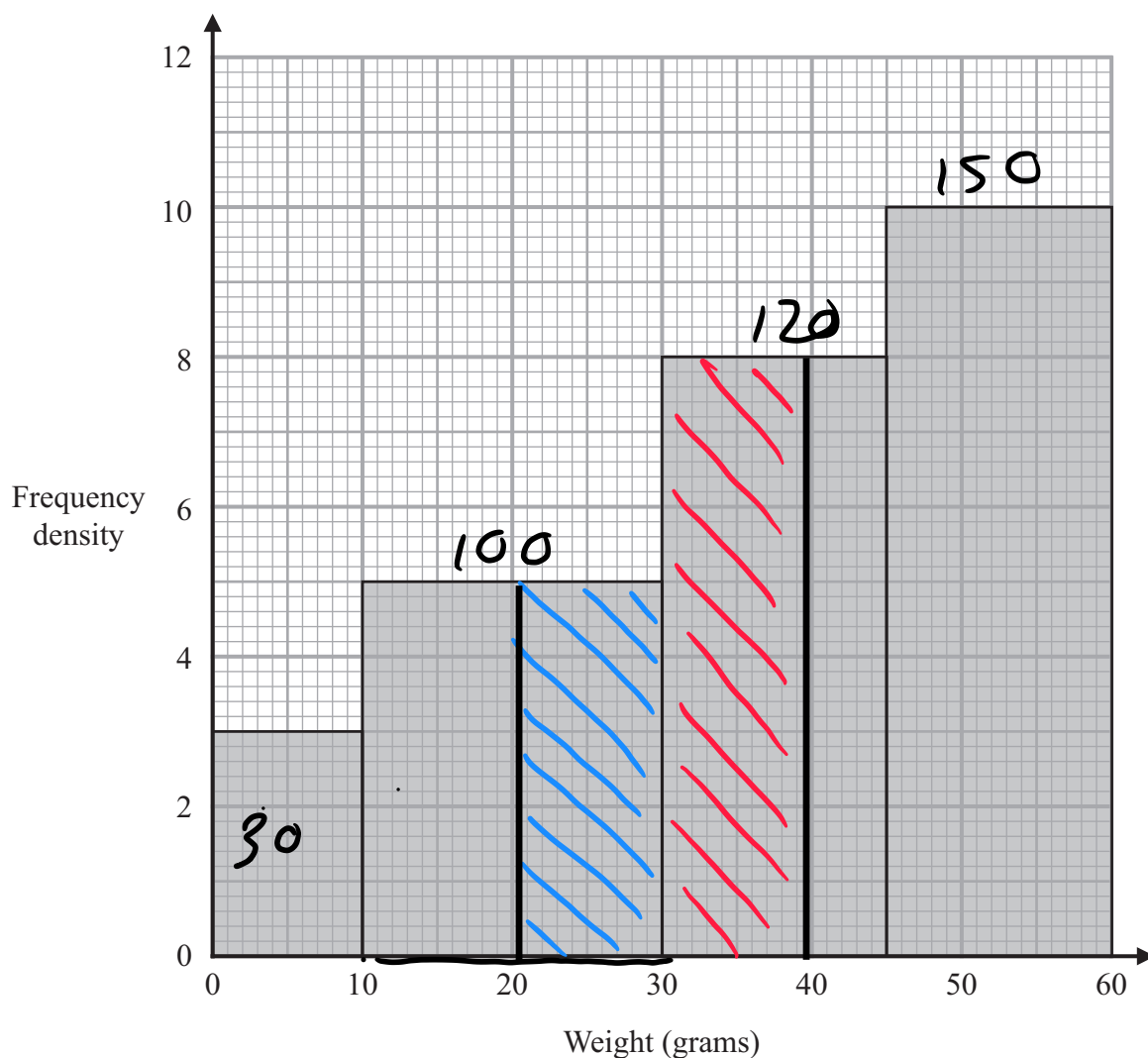
$$+ \frac{12}{72} = \frac{52}{72}$$

even x even

$$\frac{12}{72}$$

(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.

$$10 \times 5 = 50$$

$$10 \times 8 = 80 \rightarrow 130$$

$$30 + 100 + 120 + 150 = 400$$

$$\frac{130}{400} = \frac{13}{40}$$

(Total for Question 15 is 4 marks)



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

Give your answer in its simplest form.

$$\frac{35}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{35\sqrt{7}}{7} = 5\sqrt{7}$$

(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 .

$$\frac{\sqrt{27}-1}{2-\sqrt{3}} \times \frac{(2+\sqrt{3})}{(2+\sqrt{3})}$$

$$= \frac{2\sqrt{27} + \sqrt{27 \times 3} - 2 - \sqrt{3}}{4 + 7\sqrt{3} - 2\sqrt{3} - 9}$$

$$= \frac{2\sqrt{27} + \sqrt{81} - 2 - \sqrt{3}}{1}$$

$$= 2\sqrt{27} + 9 - 2 - \sqrt{3}$$

$\uparrow$
 3×9

$$6\sqrt{27} + 7 - \sqrt{3}$$

$$7 + 5\sqrt{3}$$

$$a = 7$$

$$b = 5$$

(4)

(Total for Question 16 is 6 marks)

Turn over for Question 17

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

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

$$g(h(x))$$

$$1 - 3x$$

$$1 - 3[2x^2 - 1]$$

$$1 - 6x^2 + 3$$

$$4 - 6x^2 = gh$$

$$3gh = 12 - 18x^2$$

$$h(g(x))$$

$$2x^2 - 1$$

$$2[1 - 3x]^2 - 1$$

$$2(1 - 3x)(1 - 3x) - 1$$

$$2[1 - 6x + 9x^2] - 1$$

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

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

$$\cancel{12 - 18x^2} + 1 - 12x + \cancel{18x^2}$$

$$13 - 12x = 0$$

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

(Total for Question 17 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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