

Surname	Centre Number	Candidate Number
Other Names		0



GCSE

185/09

SOLOUTIONS

**MATHEMATICS
HIGHER TIER
PAPER 1**

P.M. MONDAY, 6 June 2011

2 hours

**CALCULATORS ARE
NOT TO BE USED
FOR THIS PAPER**

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen.
Do not use correction fluid.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

Take π as 3.14.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	7	
2	7	
3	7	
4	7	
5	6	
6	7	
7	7	
8	8	
9	5	
10	7	
11	8	
12	6	
13	13	
14	5	
TOTAL MARK		



JUN1101850901

1. (a) Estimate the value of $\frac{207 \times 148}{49}$.

$$\approx \frac{200 \times 150}{50}$$

$$\approx 200 \times 3$$

$$\approx 600$$

[2]

- (b) Given that $47 \times 235 = 11045$, write down the value of $\frac{1104.5}{0.47}$.

$$\frac{11045}{47} = 235$$

$$= \frac{110450}{47}$$

$$\therefore 2350$$

[1]

- (c) In a quiz, a team scores 13 out of 20. Express this as a percentage.

$$\frac{13}{20} = \frac{65}{100} = 65\%$$

[1]

- (d) Which of the following fractions is closest to $\frac{2}{5}$? $= \frac{8}{20} = \frac{24}{60}$

$$\frac{7}{20}$$

$$\frac{1}{4}$$

$$\frac{7}{15}$$

Show all your working.

$$\frac{21}{60}$$

$$\frac{5}{20} = \frac{15}{60}$$

$$\frac{28}{60}$$

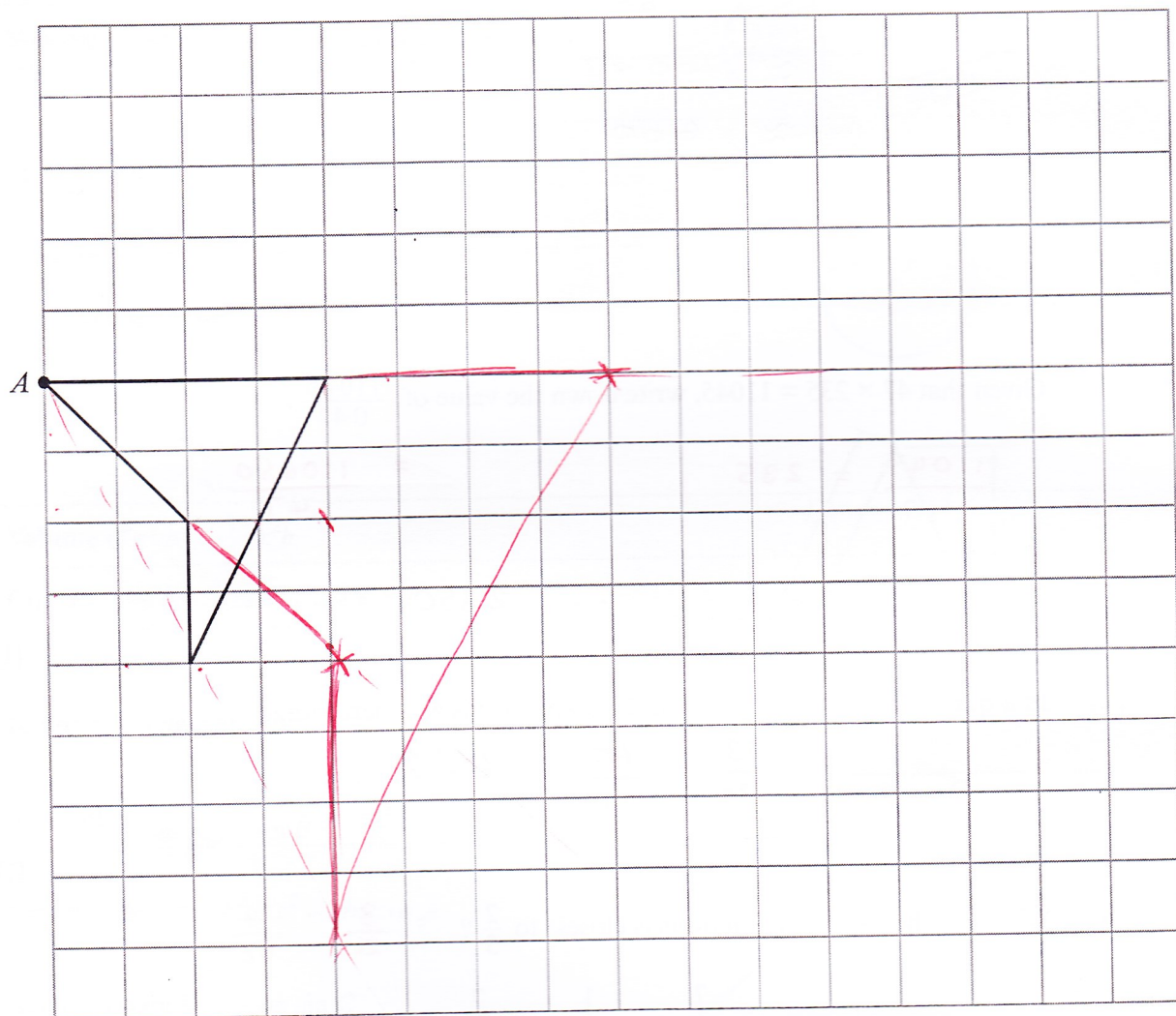
$$\therefore \frac{21}{60} \text{ closest to } \frac{24}{60}$$

$$\therefore \frac{7}{20}$$

[3]



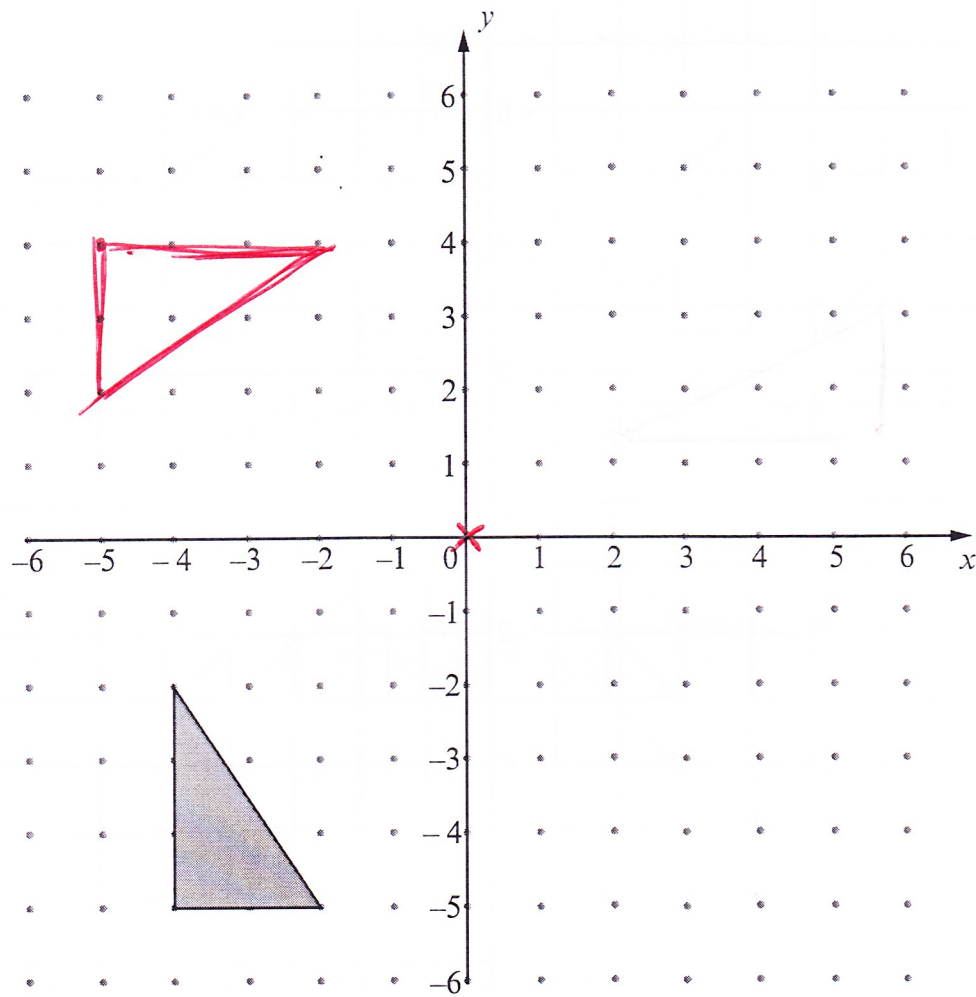
2. (a) Enlarge the shape shown on the grid by a scale factor of 2 using A as the centre of the enlargement.



[3]



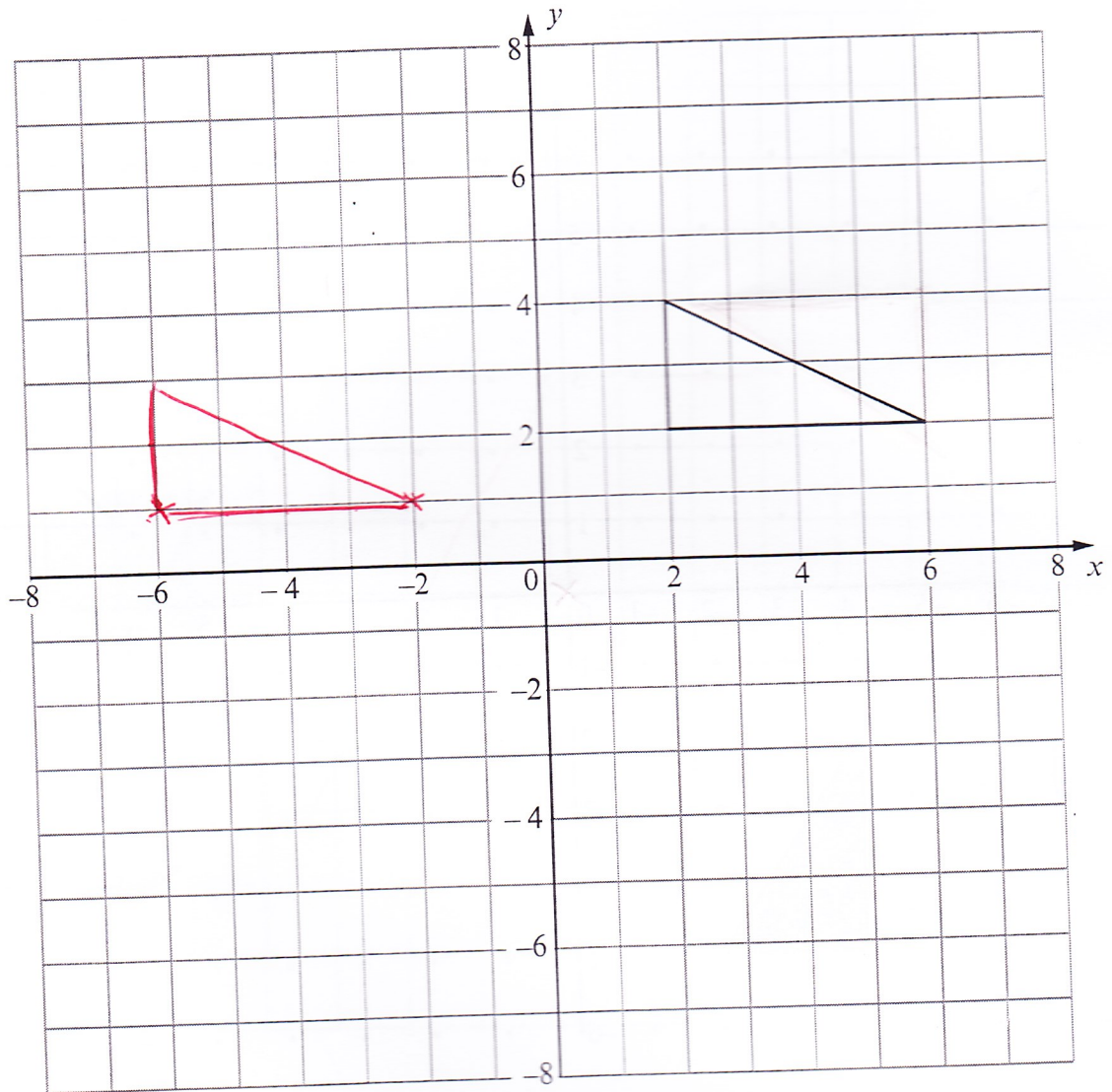
(b) Rotate the triangle shown through 90° clockwise about the origin.



[2]



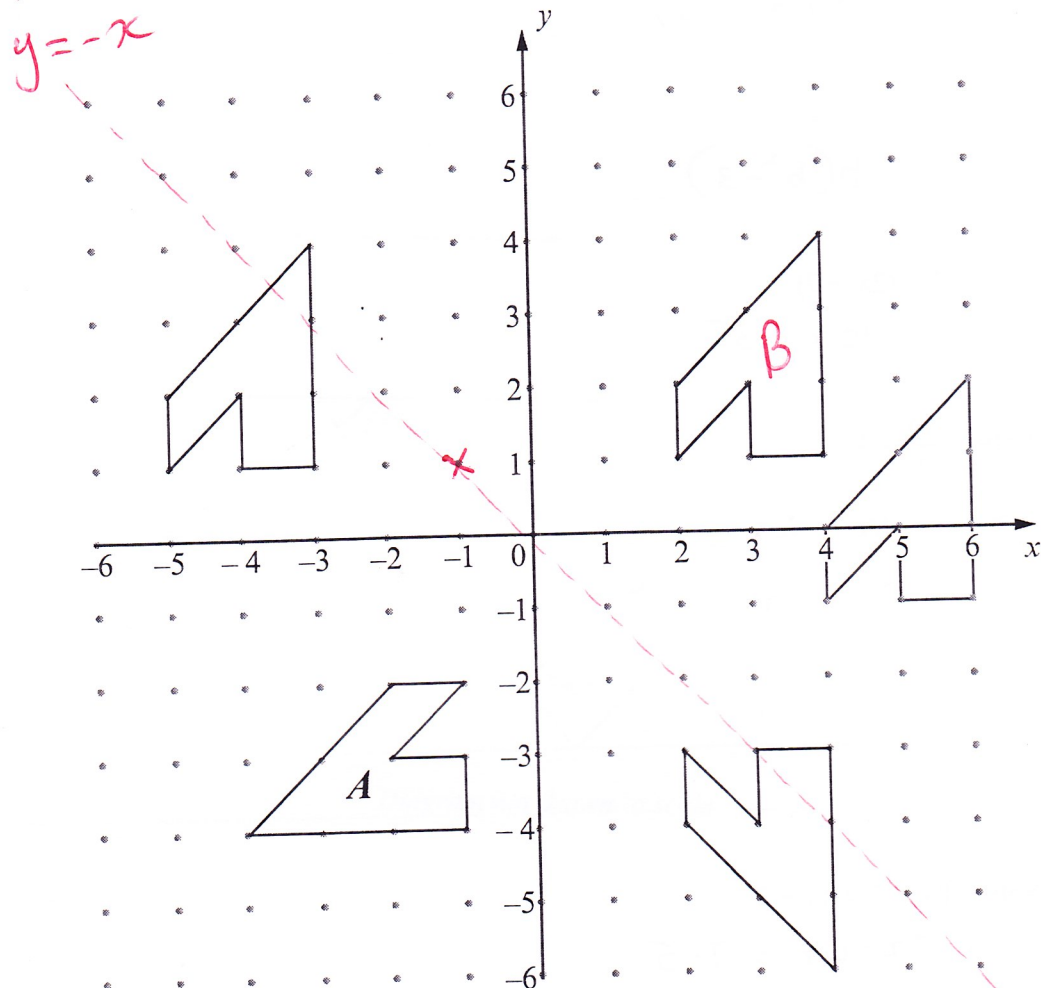
- (c) Translate the triangle shown by 8 units to the left and 1 unit down.



[1]



(d)



Indicate with the letter **B** on the diagram which one of the shapes shown may be obtained by reflecting shape **A** in the line $y = -x$.

[1]



3. (a) Factorise $18a - 27$.

$$= 9(2a - 3)$$

[1]

- (b) Factorise $b^3 - 3b$.

$$b(b^2 - 3)$$

[1]

- (c) Expand $5(2x + 7)$.

$$10x + 35$$

[1]

- (d) Solve $\frac{12}{x} = 4$.

$$\begin{aligned} \times x & \quad 12 = 4x \\ 3 & = x \quad \div 4 \end{aligned}$$

[1]

- (e) Solve $8x + 5 = 4x + 7$.

$$8x - 4x = 7 - 5$$

$$4x = 2$$

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

[3]



4. (a) Calculate the size of each of the angles marked x , y and z in the diagram below.

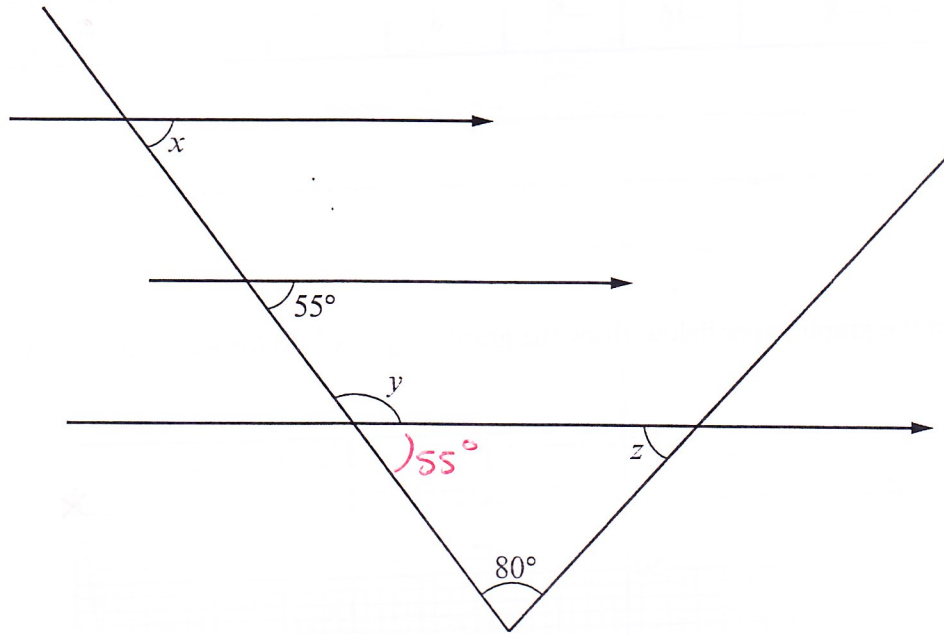


Diagram not drawn to scale

$$x = 55^\circ \quad y = 125^\circ \quad z = 45^\circ$$

[4]

- (b) Calculate the size of each of the exterior angles of a regular pentagon.

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

$$\therefore 180^\circ - 72^\circ = 108^\circ$$

[3]

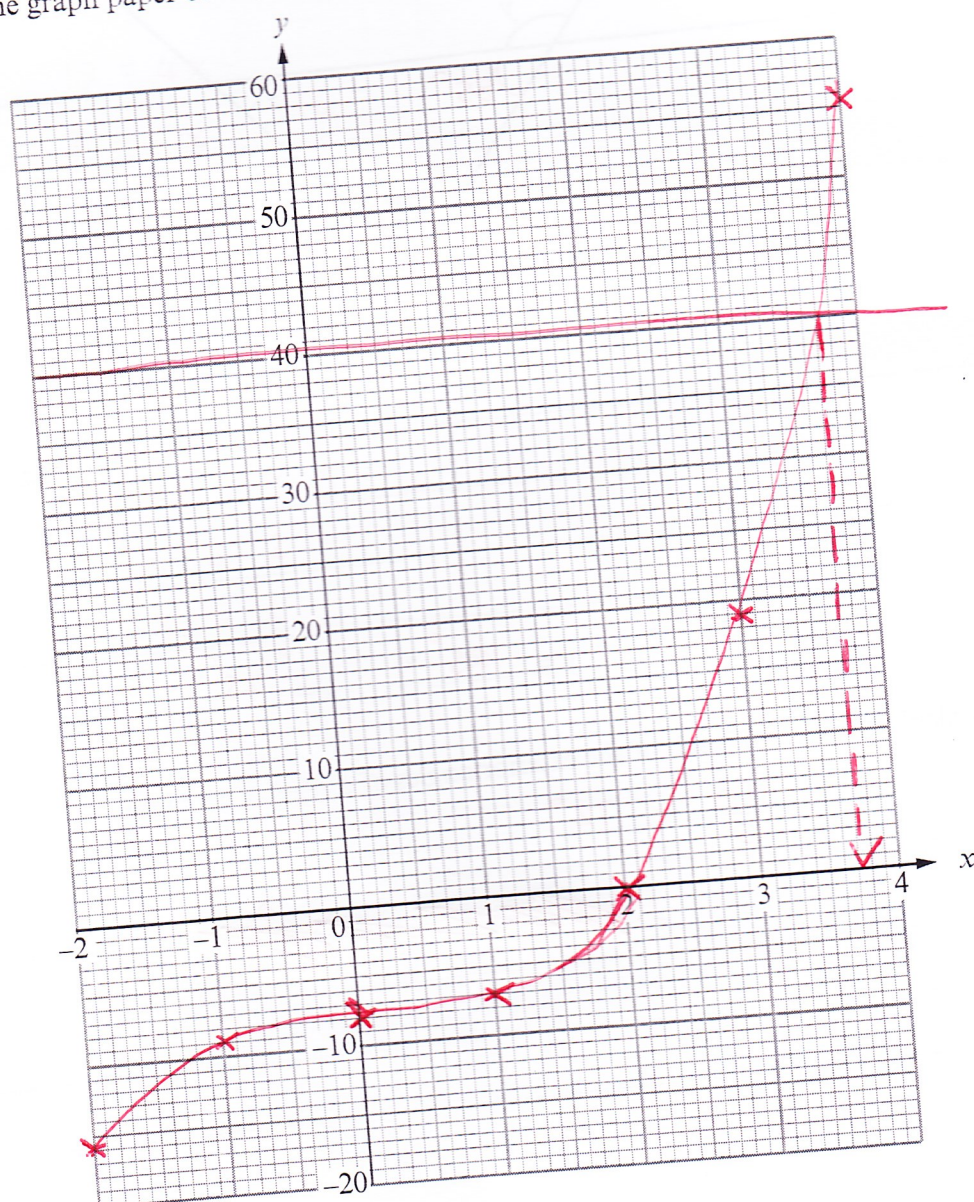


5. The table shows some of the values of $y = x^3 - 8$ for values of x from -2 to 4 .

(a) Complete the table by finding the values of y for $x = -1$ and $x = 3$.

x	-2	-1	0	1	2	3	4
$y = x^3 - 8$	-16	-9	-8	-7	0	19	56

- (b) On the graph paper below, draw the graph of $y = x^3 - 8$ for values of x from -2 to 4 .



(c) Use your graph to solve the equation $x^3 - 8 = 40$.

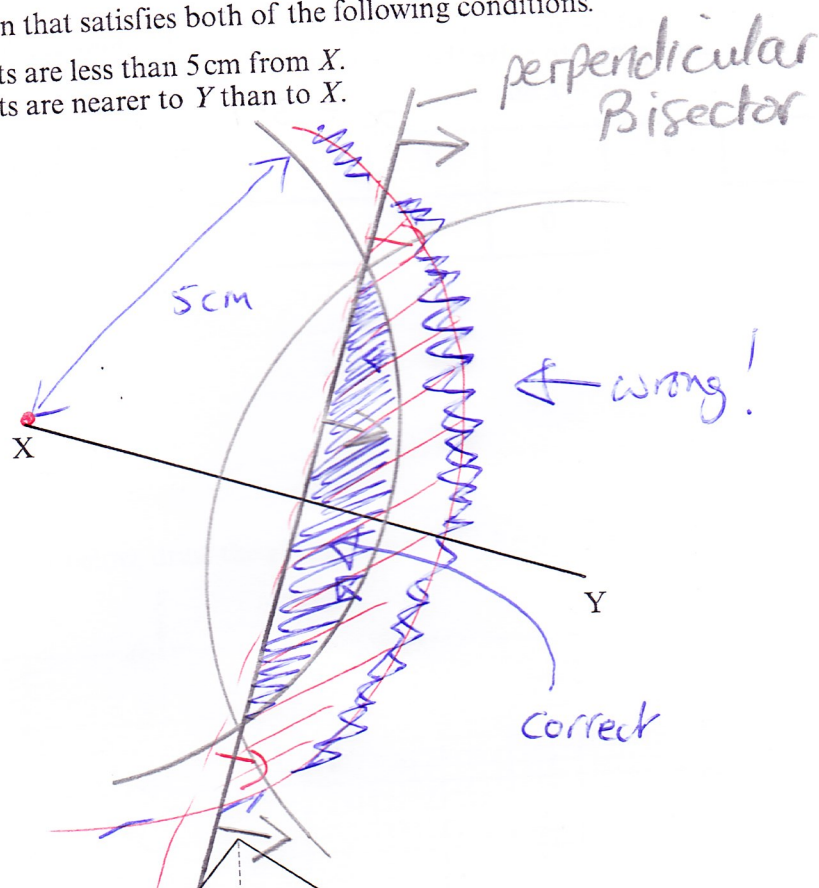
$$x = 3.7$$

[2]



6. (a) Shade the region that satisfies both of the following conditions.

- (i) The points are less than 5 cm from X.
 (ii) The points are nearer to Y than to X.



[3]

(b)

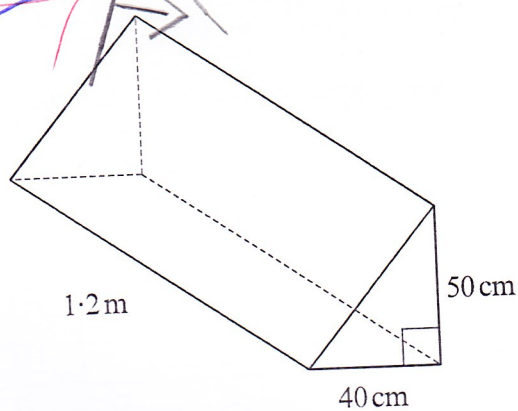


Diagram not drawn to scale

Calculate the volume of the triangular prism, giving your answer in cm^3 .

$$V = \text{CSA} \times d$$

$$V = \frac{bh}{2} \times d$$

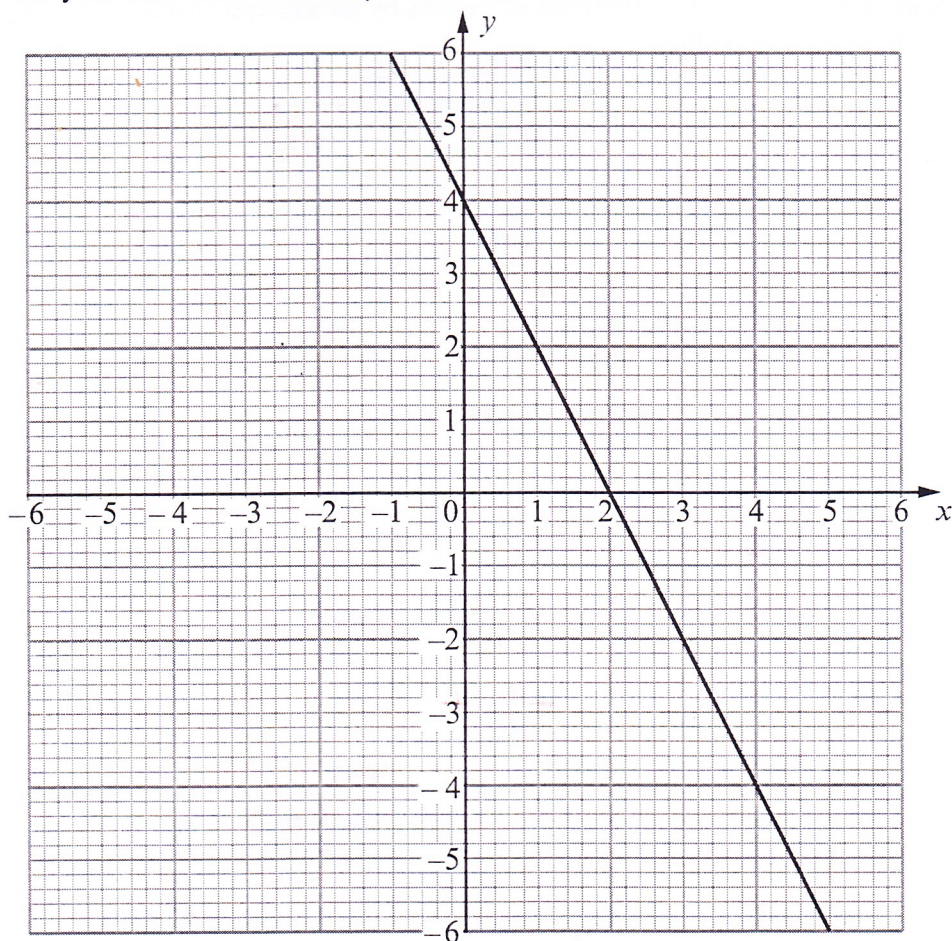
$$V = \frac{40 \times 50 \times 120}{2}$$

$$V = 120,000 \text{ cm}^3$$

[4]



7. (a) Find the equation of the straight line shown in the following diagram.
Write your answer in the form $y = mx + c$.



$$c = +4 \quad m = -\frac{4}{2} = -2$$

Equation of the straight line is $y = -2x + 4$

[3]

- (b) Write down the equation of a straight line that is parallel to $y = 5x$.

$$y = 5x + c$$

[1]

- (c) Find the mid-point of the straight line that joins the points with coordinates (2, -7) and (6, 13).

$$\frac{2+6}{2} = 4$$

$$\frac{-7+13}{2} = 3$$

$$\therefore (4, 3)$$

[3]



8. (a) Solve the following simultaneous equations by an algebraic method.
Show all your working.

$$\begin{array}{rcl} 3x + 4y = 19 & \text{---} \textcircled{1} & \times 5 \\ 4x + 5y = 23 & \text{---} \textcircled{2} & \times 4 \end{array}$$

$$15x + 20y = 95$$

$$16x + 20y = 92$$

$$\text{ADD } -x = 3$$

$$x = -3$$

$$\textcircled{1} \Rightarrow$$

$$3(-3) + 4y = 19$$

$$-9 + 4y = 19$$

$$4y = 28$$

$$y = 7$$

[4]



(b) Solve the following equation.

$$\left(\frac{x+3}{6}\right) + \left(\frac{2x-5}{3}\right) = \frac{2}{9}$$

15

Put Brackets in

LCM of 6, 3 and 9 = 18

$$\frac{3(x+3)}{18} + \frac{6(2x-5)}{18} = \frac{4}{18}$$

 $\times 18$

$$3(x+3) + 6(2x-5) = 4$$

$$3x + 9 + 12x - 30 = 4$$

$$15x - 21 = 4$$

$$15x = 4 + 21$$

$$15x = 25$$

$$x = \frac{25}{15}$$

$$x = \frac{5}{3}$$

[4]



9. (a) Write each of the following numbers in standard form.

(i) 5800

$$5.8 \times 10^3$$

(ii) 0.004

$$4 \times 10^{-3}$$

[2]

- (b) Find, in standard form, the value of $\frac{5.6 \times 10^6}{2 \times 10^{-3}}$.

$$2.8 \times 10^9$$

To get this answer $(5.6 \div 2) = 2.8$
 $\frac{10^6}{10^{-3}} = 10^{6 - (-3)} = 10^{6+3} = 10^9$

[2]

- (c) Find the value of $(8 \times 10^3) - (2 \times 10^3)$.

$$6 \times 10^3$$

Simply do $8 - 2 = 6$

[1]

10. Customers collect reward points for shopping at a local supermarket. The following table shows a grouped frequency distribution of the number of points collected by 60 different customers.

Number of points collected	1 - 20	21 - 40	41 - 60	61 - 80
Number of customers	4	12	34	10

- (a) Complete the following cumulative frequency table.

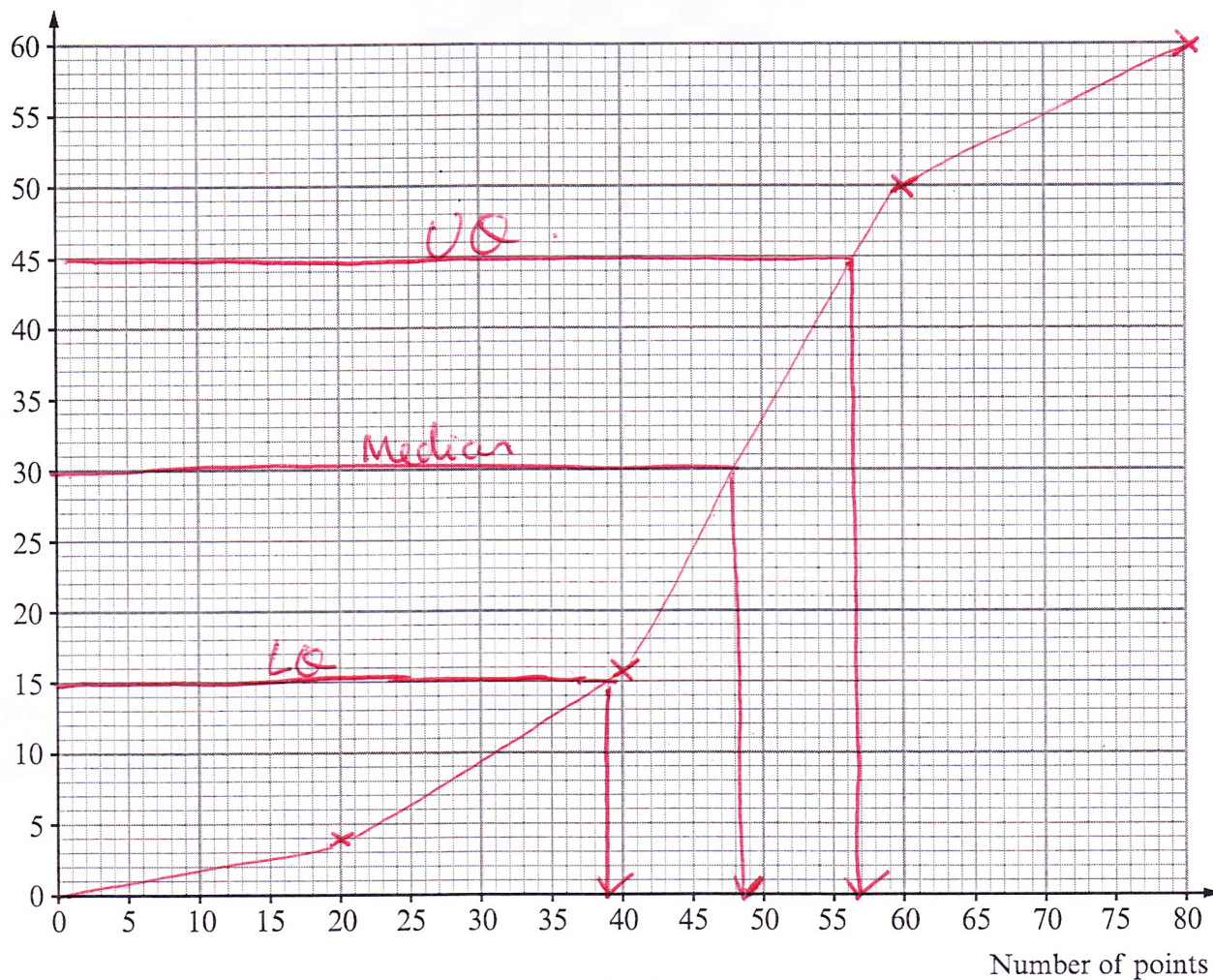
Number of points collected	≤ 20	≤ 40	≤ 60	≤ 80
Cumulative frequency	4	16	50	60

[1]



- (b) On the graph paper below, draw a cumulative frequency diagram to show this information.

[3]

Cumulative
frequency

- (c) Use your cumulative frequency diagram to find an estimate for

- (i) the median,

30th 48 points

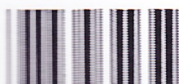
- (ii) the interquartile range.

LQ 15th = 39 points

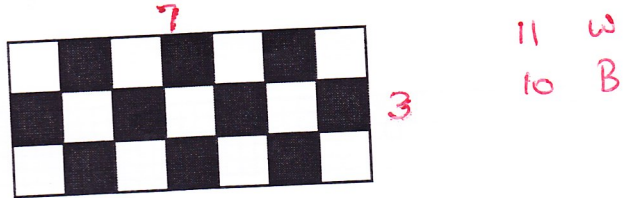
UQ 45th = 57 points

IQR = 57 - 39 = 18 points

[3]



11. A tiler makes rectangular patterns using black and white tiles placed alternately. He always starts by placing a white tile in the top left hand corner. The diagram shows the 7 tile by 3 tile pattern.



- (a) Find the number of black tiles and the number of white tiles needed to form the 20 tile by 20 tile pattern.

$$20 \times 20 = 400$$

Number of black tiles 200

Number of white tiles 200

[2]

- (b) Find the number of black tiles and the number of white tiles needed to form the 15 tile by 15 tile pattern.

$$15 \times 15 = 225$$

Number of black tiles 112

Number of white tiles 113

[2]



- (c) Find, in terms of x , the number of black tiles and the number of white tiles needed to form the x tile by x tile pattern when x is an even number.

$$x \times x = x^2$$

Number of black tiles $\frac{x^2}{2}$

Number of white tiles $\frac{x^2}{2}$

[2]

- (d) Find, in terms of y , the number of black tiles and the number of white tiles needed to form the y tile by y tile pattern when y is an odd number.

$$y \times y = y^2 \text{ tiles}$$

$$\frac{y^2 + 1}{2}$$

$$\frac{y^2 - 1}{2}$$

$$= \frac{y^2 + 1}{2}$$

$$\frac{y^2 - 1}{2}$$

Number of black tiles $\frac{y^2 - 1}{2}$

Number of white tiles $\frac{y^2 + 1}{2}$

[2]



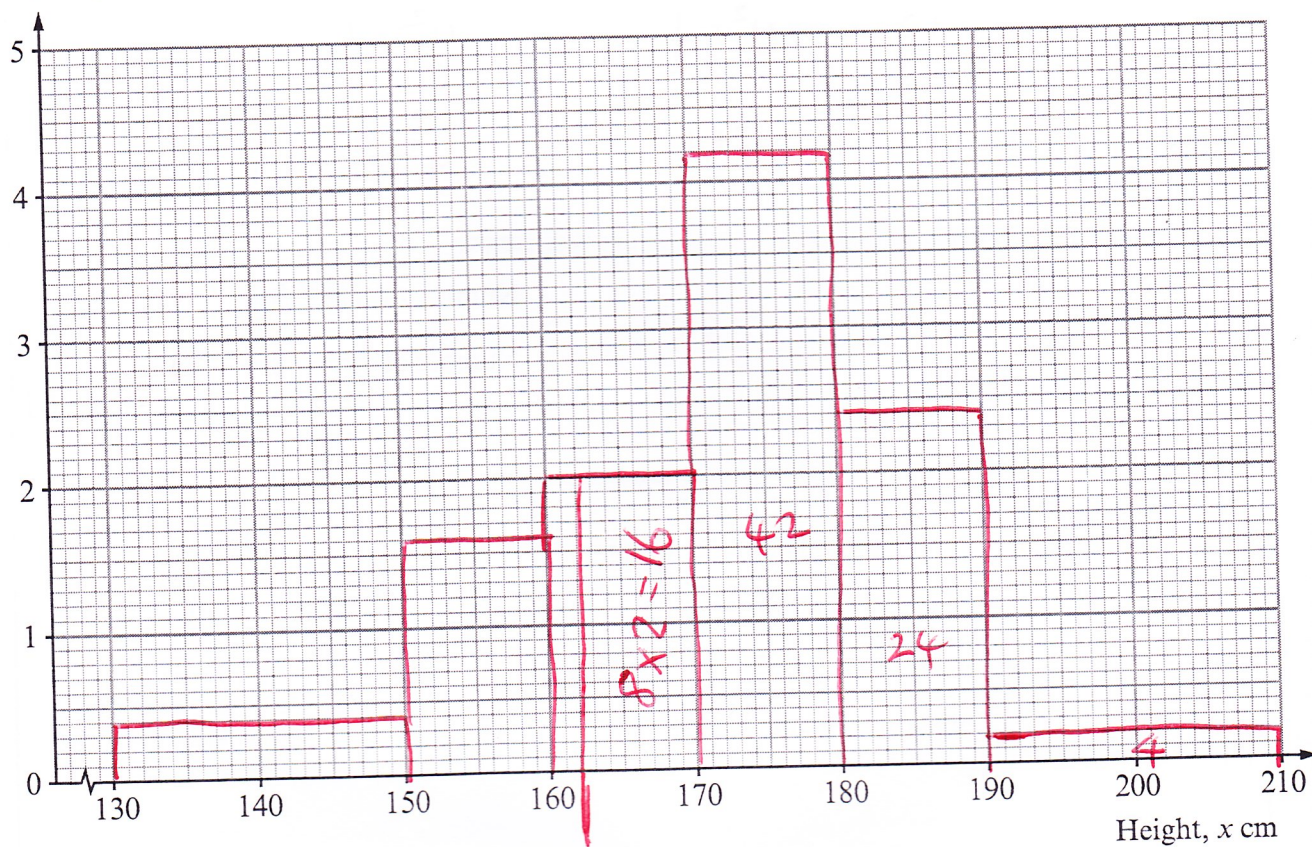
12. The heights of a group of people are summarised in the grouped frequency distribution below.

Height, x cm	Number of people	Frequency density
$130 \leq x < 150$	8	0.4
$150 \leq x < 160$	16	1.6
$160 \leq x < 170$	20	$\frac{20}{10} = 2$ ✓
$170 \leq x < 180$	42	$\frac{42}{10} = 4.2$
$180 \leq x < 190$	24	$\frac{24}{10} = 2.4$
$190 \leq x < 210$	4	$\frac{4}{20} = 0.2$

- (a) Complete the frequency density column in the table and draw a histogram.

[3]

Frequency density



- (b) Calculate an estimate for the number of people in the group whose heights are at least 162 cm.

$$4 + 24 + 42 + 16$$
$$= 86$$

[3]



13. (a) (i) Factorise
- $x^2 - 64$
- .

$$(x+8)(x-8)$$

- (ii) Simplify
- $\frac{x^2-64}{2x^2-15x-8}$
- .

$$\frac{(x+8)(x-8)}{(2x+1)(x-8)}$$

$$= \frac{(x+8)}{(2x+1)}$$

[4]

- (b) Express
- $0.8\dot{2}\dot{3}$
- as a fraction.

$$x = 0.8\dot{2}\dot{3}$$

$$1000x = 823.\dot{2}\dot{3}$$

$$\underline{10x = 8.\dot{2}\dot{3}}$$

$$990x = 815$$

$$x = \frac{815}{990}$$

$$\therefore 0.8\dot{2}\dot{3} = \frac{815}{990}$$

[2]

- (c) Evaluate
- $(\sqrt{72} - \sqrt{2})^2$
- .

$$(\sqrt{36\sqrt{2}} - \sqrt{2})^2$$

$$= (6\sqrt{2} - \sqrt{2})^2$$

$$= (5\sqrt{2})^2$$

$$= 5\sqrt{2} \times 5\sqrt{2}$$

$$= 25 \times 2$$

$$= 50$$

[3]



(d) Simplify

(i) $81^{-\frac{1}{2}}$,

$$\frac{1}{\sqrt{81}} = \frac{1}{9}$$

(ii) $125^{\frac{2}{3}}$.

$$\left(\sqrt[3]{125}\right)^2$$

$$= 5^2$$

$$= 25$$

[4]



14. A bag contains 11 marbles.
There are 3 yellow, 3 blue and 5 red marbles in the bag.
Two marbles are selected at random from the bag.

(a) Calculate the probability that both the selected marbles are blue.

$$\begin{aligned}
 &P(B \text{ and } B) \\
 &= \frac{3}{11} \times \frac{2}{10} \\
 &= \frac{6}{110} = \frac{3}{55}
 \end{aligned}$$

[2]

(b) Calculate the probability that exactly one of the selected marbles is red.

$$\begin{aligned}
 &P(R \text{ and NOT } R \text{ OR NOT Red and } R) \\
 &= \left(\frac{5}{11} \times \frac{6}{10} \right) + \left(\frac{6}{11} \times \frac{5}{10} \right) \\
 &= \frac{30}{110} + \frac{30}{110} \\
 &= \frac{60}{110} \\
 &= \frac{6}{11}
 \end{aligned}$$

[3]



