

Answer **all** the questions.

- 1 (a) Work out.

$$\frac{3}{4} + \frac{1}{6}$$

Give your answer in its simplest form.

$$\frac{9}{12} + \frac{2}{12}$$

✓

$$\frac{11}{12}$$

✓

(a) [2]

- (b) By writing each number correct to 1 significant figure, use estimation to show that

$$\frac{39.6 \times 20.2}{\sqrt{99.2}} \approx 80.$$

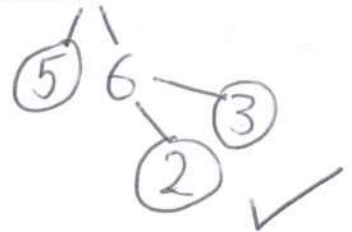
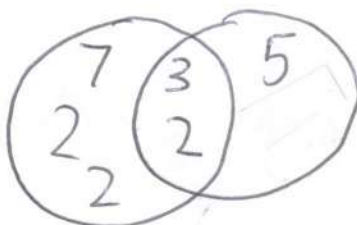
[3]

$$\frac{40 \times 20}{\sqrt{100}} = \frac{800}{10} = 80$$

✓

✓ ✓

- 2 Given that
- $168 = 2^3 \times 3 \times 7$
- , find the lowest common multiple (LCM) of 168 and 30.



$$= 5 \times 3 \times 2 \times 2 \times 2 \times 7$$

$$= 30 \times 4 \times 7$$

$$840$$

✓

..... [3]

- 3 Martina has answered some questions on algebra.
In each question, she has made an error.

Describe her error and give the correct answer to each problem.

- (a) Question 1 Simplify. $2a \times a \times a$

Martina's answer $4a$

Martina's error is Added the terms ✓

Correct answer = $2a^3$ ✓ [2]

- (b) Question 2 Simplify. $\frac{x^{10}}{x^2}$

Martina's answer x^5

Martina's error is Divided powers, should subtract ✓

Correct answer = x^8 ✓ [2]

- (c) Question 3 $s = ut + \frac{1}{2}at^2$

Find s when $u = 0$, $t = 5$ and $a = 6$.

Martina's solution $s = 0 \times 5 + \frac{1}{2} \times 6 \times 5^2$

$$s = 0 + 15^2$$

$$s = 225$$

Martina's error is Squared all of $\frac{1}{2} \times 6 \times 5$ ✓

Correct answer = 75 ✓ [2]

- 4 In 2017, a chocolate bar had a mass of 250 g.
In 2018, the mass of the chocolate bar was reduced to 220 g.

Work out the percentage decrease in the mass of the chocolate bar from 2017 to 2018.

$$\frac{30}{250} \times 100$$

✓✓

$$= \frac{300}{25}$$

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

12 ✓

..... % [3]

- 5 Solve.

$$6x - 10 = 4x + 1$$

$$2x = 11$$

✓✓

$$\frac{11}{2}$$

✓OE

x = [3]

- 6 Solve by factorising.

$$x^2 + 9x + 20 = 0$$

$$(x+4)(x+5) = 0$$

✓✓

$$x = -4 \quad \text{or} \quad x = -5 \quad \checkmark$$

x = or x = [3]

- 7 Sundip and Emma have some money.
The ratio of Sundip's money to Emma's money is 3 : 5.
Emma spends £450 of her money.
The ratio of Sundip's money to Emma's money is now 2 : 3.

Find how much money Sundip has.

$$\frac{3}{8}x = \frac{2}{5}(x - 450) \quad \checkmark$$

$$\frac{15x}{8} = 2x - 900 \quad \checkmark$$

$$15x = 16x - 7200 \quad \checkmark$$

$$7200 = x \quad \checkmark$$

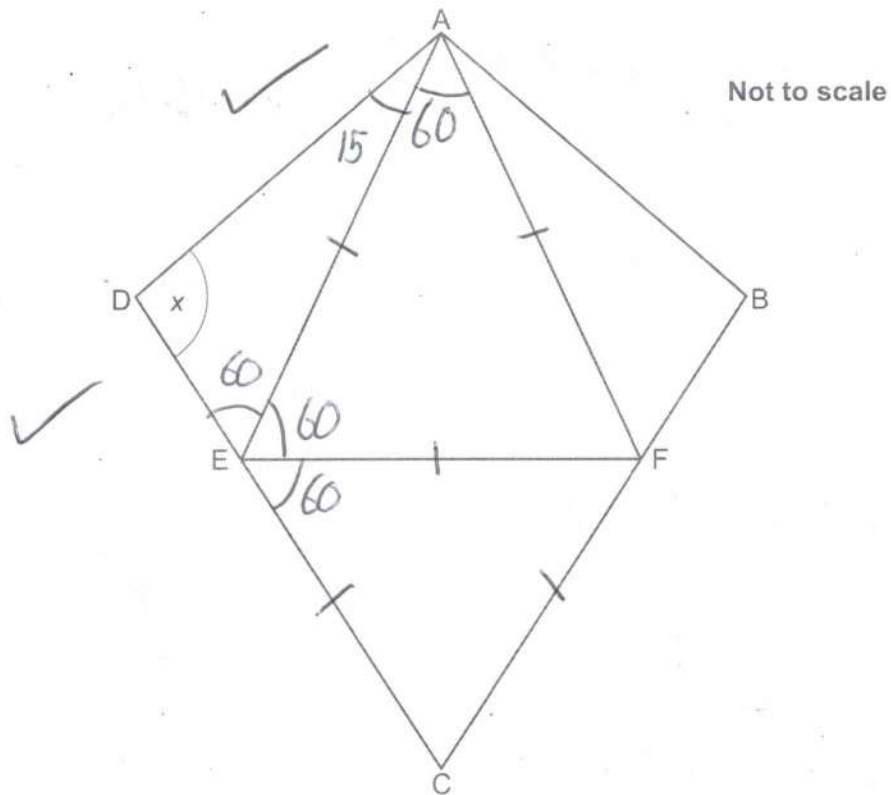
$$S = \frac{3}{8} \times 7200$$

$$= 3 \times 900$$

2700 ✓

£ [4]

- 8 The diagram shows a kite, ABCD.
AFE and CEF are equilateral triangles.



- (a) Write down a mathematical name for quadrilateral AFCE.

(a) rhombus [1]

- (b) The ratio of angle DAE : angle EAF = 1 : 4.

Work out angle x .

Write on the diagram the values of any other angles you use in your working.

$$x = 180 - 60 - 15$$

✓

(b) $x =$ 105 ✓ ° [4]

- 9 (a) The scale 1 cm represents 25 m can be written in the form 1 : k.

Find the value of k.

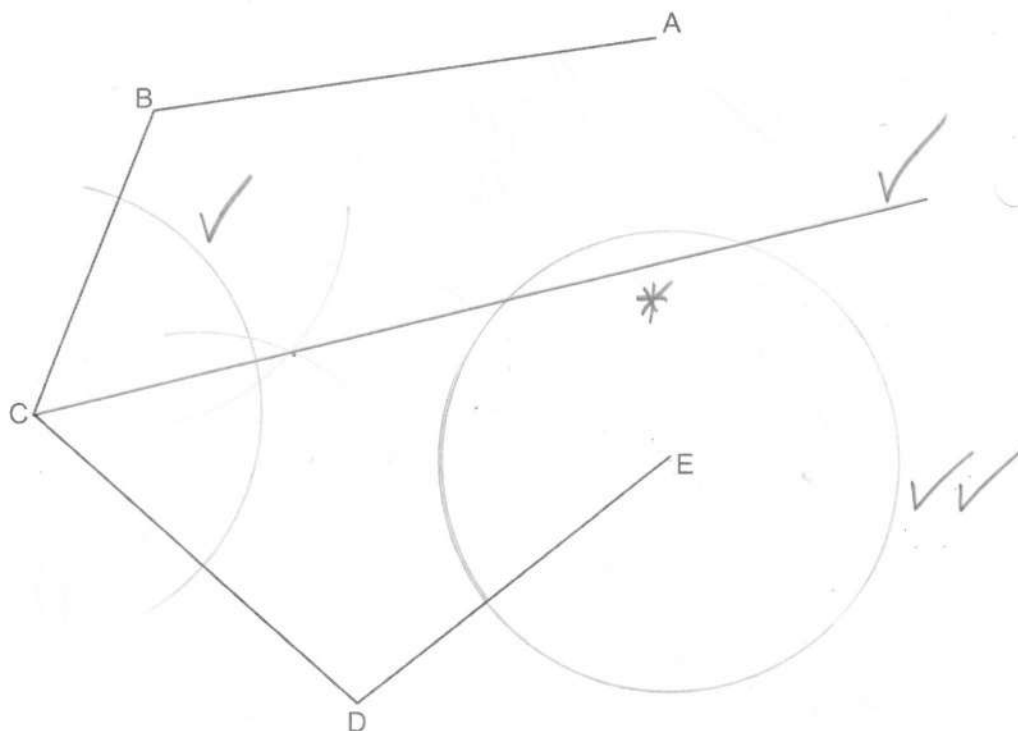
$$25 \times 100$$

$$2500$$

(a) $k = \dots\dots\dots$ [1] ✓

- (b) The scale drawing represents a harbour.

Scale: 1 cm represents 25 m



A boat leaves the harbour from point C and sails on a path that is equidistant from BC and CD. The harbour rules do not allow boats to sail within 75 m of point E. → 3 cm

Find by construction whether the path of the boat will follow the harbour rules. Show all your construction lines.

* No

✓ dep

..... [5]

- 10 On a plane, $\frac{2}{5}$ of the passengers were British.

30% of the British passengers were men.
There were 36 British men on the plane.

$$\rightarrow \frac{3}{10}$$

Find the total number of passengers on the plane.

$$\frac{2}{5} \times \frac{3}{10} = 36 \text{ men} \quad \checkmark \checkmark$$

$$\frac{3}{25} = 36 \quad \checkmark$$

$$\frac{1}{25} = 12 \quad \checkmark$$

$$25 \times 12$$

$$= 12 \times 5 \times 5$$

$$= 60 \times 5 = 300 \quad \checkmark$$

[5]

- 11 A bag contains 100 pencils that are either red or green.

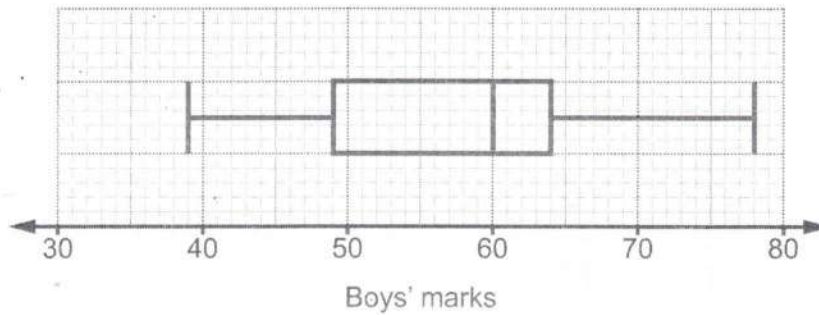
Describe a method you could use to estimate the number of red pencils in the bag without looking into the bag or having more than one of the pencils out of the bag at any one time.

Select random pencil. Replace. Record. $\checkmark \checkmark$
> 10 trials $\checkmark$

Multiply relative frequency by 100 $\checkmark$

[4]

- 12 The box plot shows the distribution of the marks scored by some boys in a test.



- (a) Find the interquartile range.

$$64 - 49$$

✓ (a)

15

✓ [2]

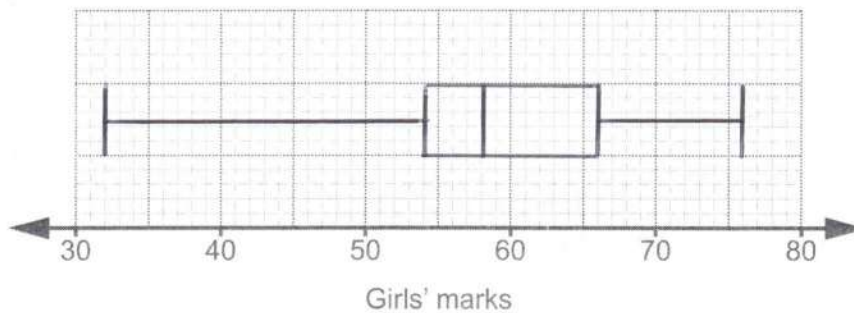
- (b) The marks for some girls in the same test are summarised below.

- median = 58
- lowest mark = 32
- range = 44
- upper quartile = 66
- interquartile range = 12

$$32 + 44 = 76$$

$$66 - 12 = 54$$

Draw a box plot to show the distribution of the marks scored by the girls.



3 ✓
4 ✓
5 ✓

[3]

- (c) Eleanor says

The boys did better, on average, in the test as they had a bigger interquartile range.

Is her statement correct?

Explain your reasoning.

NO - IQR is measure of spread, not average ✓✓

[2]

- 13 (a) (i) Write $\frac{1}{3}$ as a recurring decimal.

(a)(i) $0.\dot{3}$ ✓ [1]

- (ii) Write $\frac{1}{30}$ as a recurring decimal.

$\div 10$

(ii) $0.0\dot{3}$ ✓ [1]

- (b) Simplify fully by rationalising the denominator.

$\frac{20}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$ ✓

$\frac{20\sqrt{5}}{5}$ ✓

(b) $4\sqrt{5}$ ✓ [3]

- 14 y is inversely proportional to the square root of x .
 $y = 7$ when $x = 25$.

Find the value of y when $x = 100$.

$y = \frac{K}{\sqrt{x}}$

$7 = \frac{K}{5}$

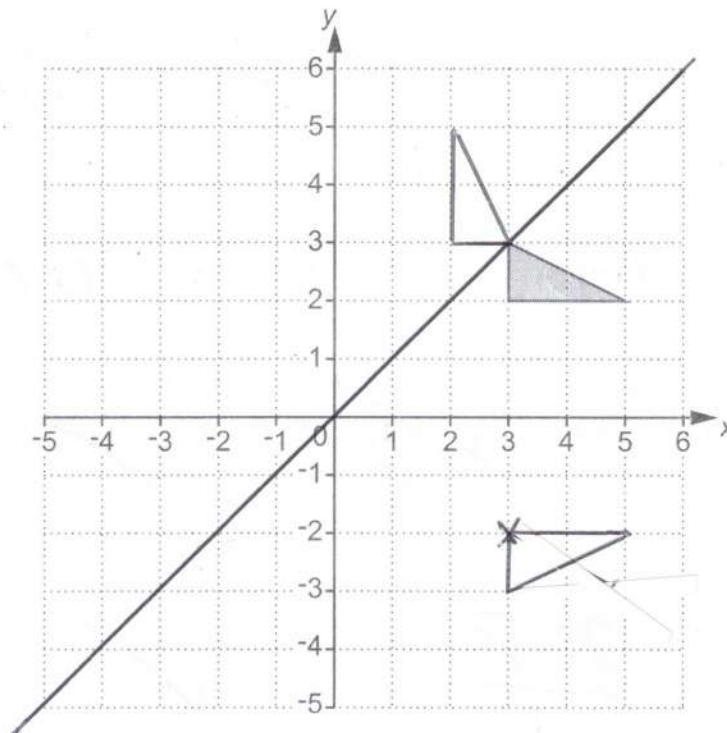
$K = 35$ ✓

$y = \frac{35}{\sqrt{x}}$ ✓

$y = \frac{35}{\sqrt{100}} = \frac{35}{10}$

$y = 3.5$ ✓ [3]

15 You may use this coordinate grid to help you answer the following questions.



Describe fully the **single** transformation that is equivalent to

- (a) a translation of $\begin{pmatrix} -7 \\ 2 \end{pmatrix}$ followed by a translation of $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$,

translation $\begin{bmatrix} -4 \\ -3 \end{bmatrix}$ ✓✓

[2]

- (b) a reflection in the line $y = x$ followed by a rotation of 90° clockwise around $(0, 0)$.

reflection in x -axis ✓✓

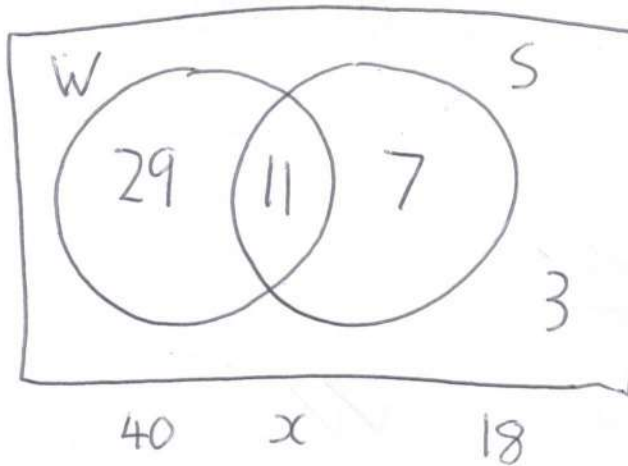
[3]

16 50 people attended an outdoor activity day.

- 40 took part in walking.
- 18 took part in sailing.
- 3 did neither activity.

One of the people who walked is chosen at random.

Find the probability that this person also sailed.



$$40 - x + 18 = 50 - 3 \quad \checkmark$$

$$58 - x = 47$$

$$11 = x$$

$$\frac{11}{40} \quad \checkmark$$

[5]

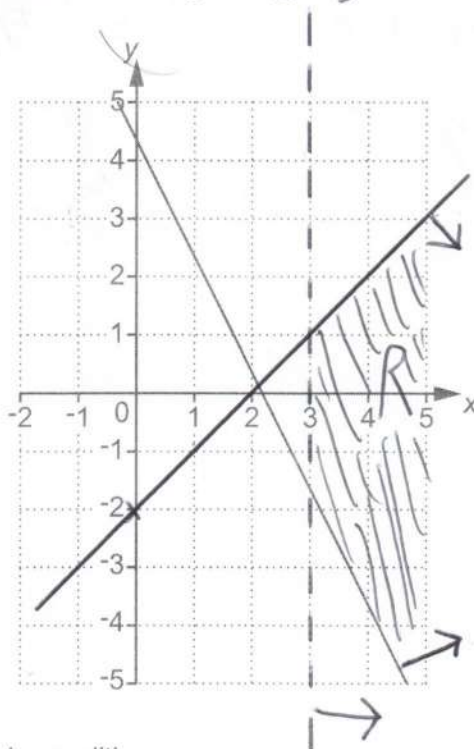
- 17 Show that $\sqrt[3]{a^4} \times \frac{1}{a}$ can be expressed as $a^{\frac{1}{3}}$.

[3]

$$\checkmark a^{\frac{4}{3}} \times a^{-1} = a^{\frac{4}{3}-1} \checkmark$$

$$\checkmark = a^{\frac{1}{3}}$$

- 18 The graph of $3y + 6x = 13$ is drawn on the grid. $x=3$



The region R satisfies these inequalities.

$$3y + 6x \geq 13 \quad y \leq x - 2 \quad x > 3$$

By drawing two more straight lines, find and label the region R.

[6]

- 19 (a) Write down the value of $\sin 45^\circ$.

$$\frac{\sqrt{2}}{2} \text{ or } \frac{1}{\sqrt{2}} \quad \checkmark$$

(a) [1]

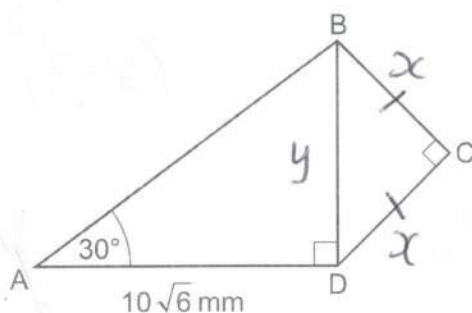
- (b) ADB and BCD are right-angled triangles.

$$BC = CD.$$

$$AD = 10\sqrt{6} \text{ mm.}$$

$$\text{Angle BAD} = 30^\circ.$$

$$\tan 30^\circ = \frac{1}{\sqrt{3}}$$



Not to scale

Work out the length of BC.

T A

$$y = \tan 30^\circ \times 10\sqrt{6}$$

$$= \frac{1}{\sqrt{3}} \times 10\sqrt{3}\sqrt{2} = 10\sqrt{2}$$

✓✓

✓

$$x^2 + x^2 = (10\sqrt{2})^2$$

✓✓

$$2x^2 = 200$$

$$x^2 = 100$$

10

✓

(b)mm [6]

- 20 (a) Write $x^2 - 6x + 11$ in the form $(x - a)^2 + b$.

$$(x-3)^2 - 9 + 11$$

✓

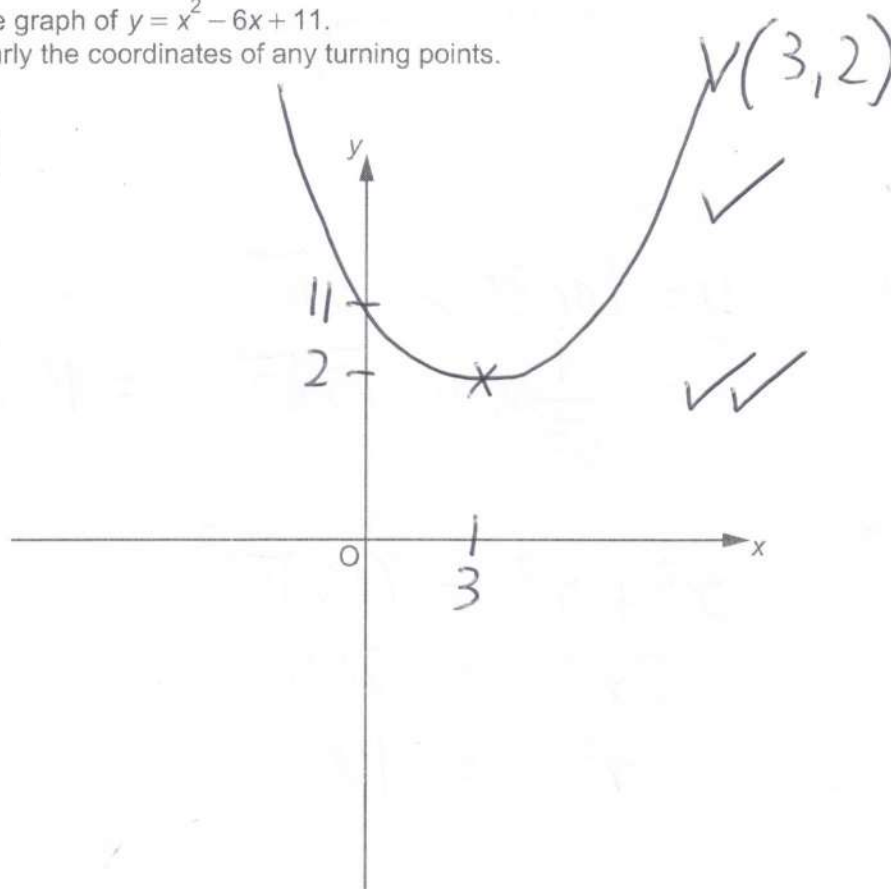
$$(x-3)^2 + 2$$

✓

✓

(a) [3]

- (b) Sketch the graph of $y = x^2 - 6x + 11$.
Show clearly the coordinates of any turning points.



[3]

Turn over for Question 21

21 In this question all units are in cm.

A circle has equation $x^2 + y^2 = 36$.

(a) Write down the radius and centre of the circle.

(a) radius: 6 cm ✓

centre: (..... 0 0) [2] ✓

(b) The distinct points A ($a, \sqrt{11}$) and B ($b, \sqrt{11}$) lie on the circumference of the circle.

Work out the length AB.

$$x^2 + \sqrt{11}^2 = 36 \quad \checkmark$$

$$x^2 = 25 \quad \checkmark$$

$$x = \pm 5 \quad \checkmark$$

$$A(-5, \sqrt{11}) \quad B(5, \sqrt{11})$$

(b) 10 cm [4] ✓

END OF QUESTION PAPER

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