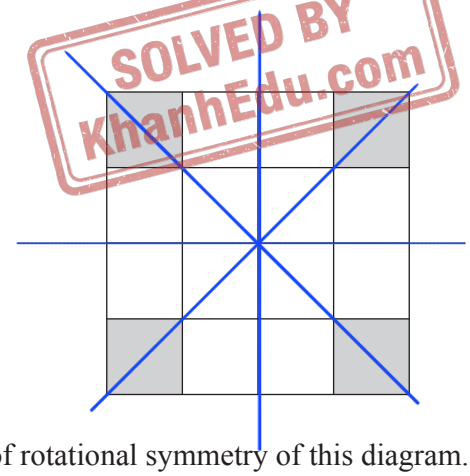
1



(a) Write down the order of rotational symmetry of this diagram.

4 [1]

(b) On the diagram, draw all the lines of symmetry. [2]

2 The probability that a train is late is 0.15 .

Write down the probability that the train is not late.

1 - 0.15

0.85 [1]

3 The stem-and-leaf diagram shows the number of hours that each of 16 students studied last week.

1	2	5	6	8	
2	0	1	1	7	9
3	2	3	4	5	
4	4	5	7		

Key: 1|2 represents 12 hours

Find

(a) the median,

28 h [1]

(b) the mode,

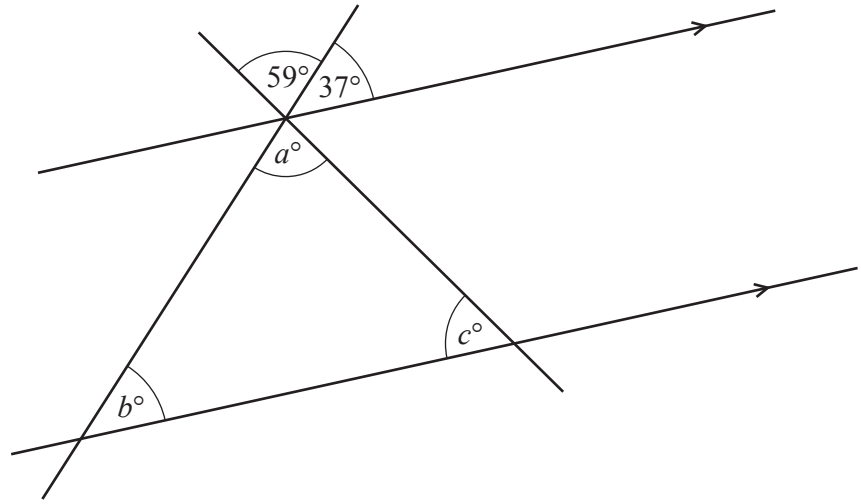
21 h [1]

(c) the range.

47 − 12 = 35

35 h [1]

4



NOT TO SCALE

The diagram shows two parallel lines intersected by two straight lines.

Find the values of a, b and c.

$c = 180° - 59° - 37°$

$a =$ 59°

$b =$ 37°

$c =$ 84° [3]

5 Work out.

(a) $\begin{pmatrix} 6 \\ -5 \end{pmatrix} + \begin{pmatrix} 8 \\ -1 \end{pmatrix}$

$\begin{pmatrix} 6+8 \\ -5+(-1) \end{pmatrix}$

$\begin{pmatrix} 14 \\ -6 \end{pmatrix}$ [1]

(b) $3\begin{pmatrix} -4 \\ 7 \end{pmatrix}$

$\begin{pmatrix} 3 \times (-4) \\ 3 \times 7 \end{pmatrix}$

$\begin{pmatrix} -12 \\ 21 \end{pmatrix}$ [1]

6 **(a)** The nth term of a sequence is $n^2 + 3n$.

Find the first three terms of this sequence.

.....4....., ...10....., ...18..... [2]

(b) These are the first five terms of a different sequence.

25 18 11 4 −3

−7 −7 −7 −7

Find the nth term of this sequence.

.....32 − 7n..... [2]

7 Solve the simultaneous equations.
You must show all your working.

$$2x + y = 3$$
$$x - 5y = 40$$

$2x + y = 3$

$-$ $2x - 10y = 80$

$11y = 3 - 80 = -77$

$y = -7$

$\Rightarrow 2x - 7 = 3$

$2x = 10$

$x = 5$

$x =$ .....5.....

$y =$ .....−7..... [3]

8 **Without using a calculator**, work out $1\frac{3}{8} - \frac{5}{6}$.

You must show all your working and give your answer as a fraction in its simplest form.

$\frac{11}{8} - \frac{5}{6}$

$\frac{33}{24} - \frac{20}{24} = \frac{33 - 20}{24} = \frac{13}{24}$

..... $\frac{13}{24}$ ..... [3]

9 A is the point $(5, -5)$ and B is the point $(9, 3)$.

(a) Find the coordinates of the midpoint of AB.

$\left(\frac{5 + 9}{2}, \frac{-5 + 3}{2}\right)$

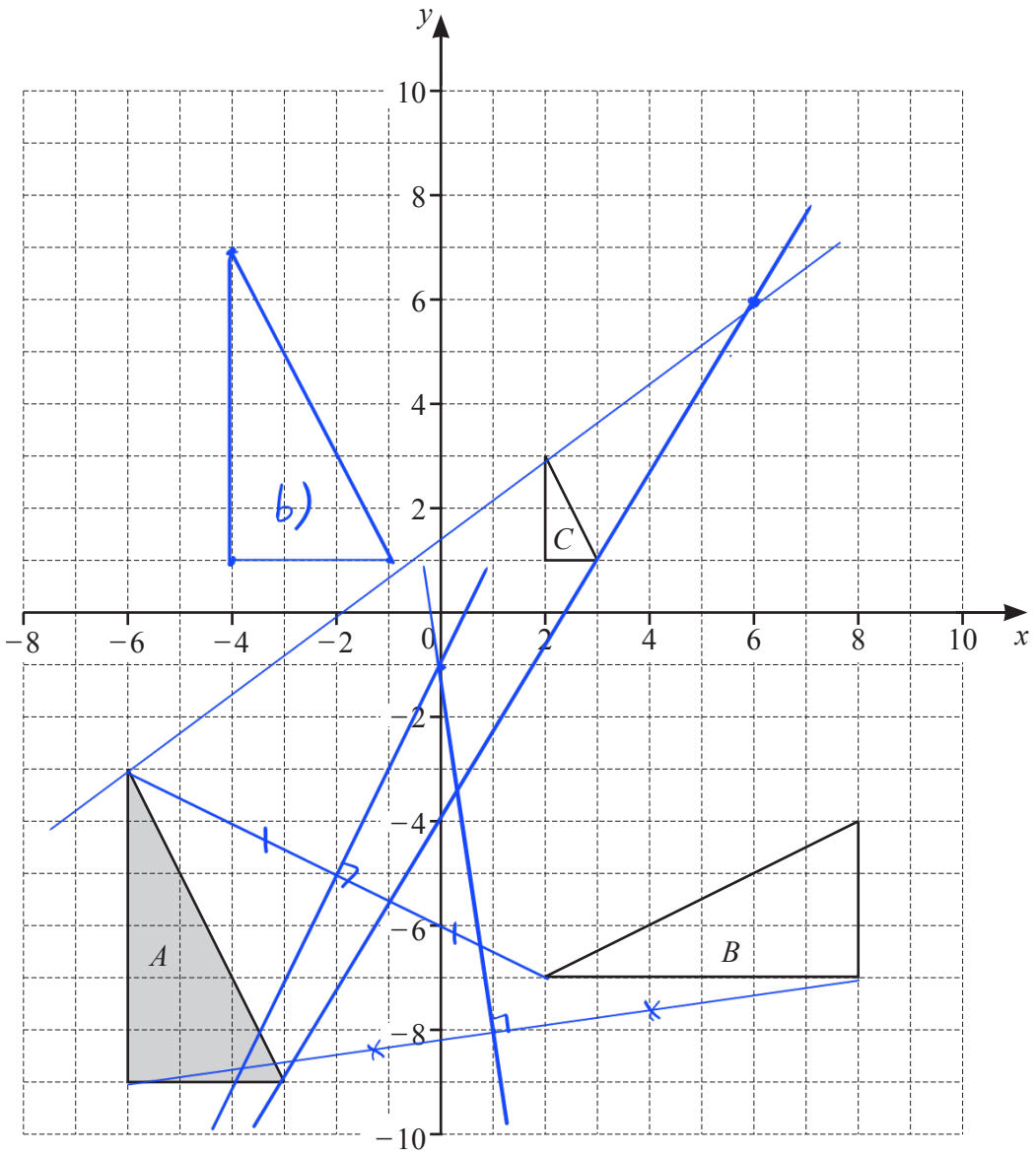
(..... 7 ....., ... −1 .....) [2]

(b) Find the length of AB.

$\sqrt{(5 - 9)^2 + (-5 - 3)^2} = \sqrt{80}$

..... 8.94 ..... [3]

10



(a) Describe fully the **single** transformation that maps

(i) triangle A onto triangle B,

Rotation, center (0, −1), anticlockwise, 90°

..... [3]

(ii) triangle A onto triangle C.

Enlargement, center (6, 6), scale factor $\frac{1}{3}$

..... [3]

(b) Draw the image of triangle A after a translation by the vector $\begin{pmatrix} 2 \\ 10 \end{pmatrix}$. [2]

11 **(a)** Simplify fully.

$(4ab^5)^4$

$4^4 a^4 (b^5)^4 = 256 a^4 b^{20}$

.....$256a^4b^{20}$..... [2]

(b) $2p^{\frac{1}{3}} = 6$

Find the value of p.

$p^{\frac{1}{3}} = 3$

$\sqrt[3]{p} = 3$

$p =$ .....27..... [1]

(c) $81^2 \div 3^t = 9$

Find the value of t.

$(3^4)^2 \div 3^t = 3^2$

$3^8 \div 3^t = 3^2$

$8 - t = 2$

$t = 6$

$t =$ .....6..... [2]

12 The profit a company makes decreases exponentially at a rate of 0.9% per year.
In 2014, the profit was \$9500.

Calculate the profit in 2019.

$9500\left(1 - \frac{0.9}{100}\right)^5$

\$ .....9080..... [2]

13 On a map, a lake has an area of 32 cm^2.
The scale of the map is 1 : 24 000.

Calculate the actual area of the lake.
Give your answer in km^2.

$1\,km = 10^5\,cm$

$1\,km^2 = 10^{10}\,cm^2$

$\frac{area_{map}}{area_{actual}} = \left(\frac{1}{24000}\right)^2 = \frac{1}{5.76 \times 10^8}$

$area_{actual} = 32 : \frac{1}{5.76 \times 10^8} = 1.8432 \times 10^{10}\ cm^2$

$= 1.8432\ km^2$

..... 1.8432 ..... km^2 [2]

14 y is directly proportional to the square root of $(x-3)$.
When $x = 28$, $y = 20$.

Find y when $x = 39$.

$y \propto \sqrt{x-3} \Rightarrow y = k\sqrt{x-3}$

$20 = k\sqrt{28-3} = 5k$

$\Rightarrow k = 4$

$y = 4\sqrt{x-3}$

When $x = 39$, $y = 4\sqrt{39-3} = 24$

$y =$ ..... 24 ..... [3]

15 Make h the subject of the formula $2mh = g(1-h)$.

$2mh = g - gh$

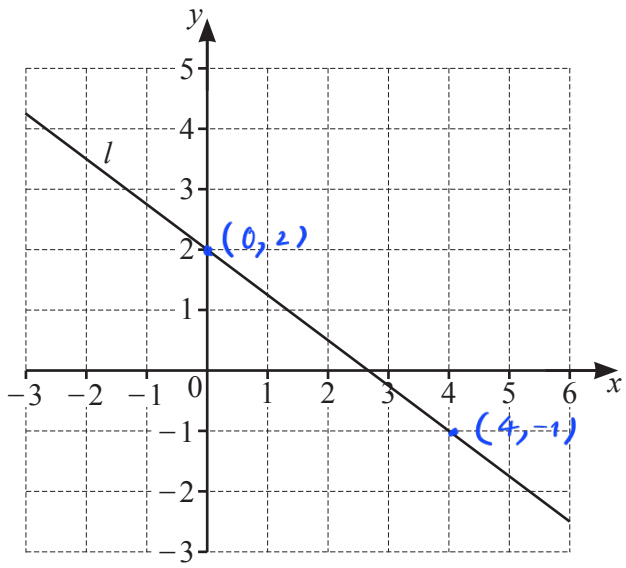
$2mh + gh = g$

$(2m+g)h = g$

$h = \frac{g}{2m+g}$

$h =$ ..... $\frac{g}{2m+g}$ ..... [4]

16



(a) Find the gradient of line l.

$m_l = \frac{-1-2}{4-0}$

..... $-\frac{3}{4}$ ..... [2]

(b) Find the equation of line l in the form $y = mx + c$.

$y - 2 = -\frac{3}{4}(x - 0)$

$y =$ ..... $-\frac{3}{4}x + 2$ ..... [2]

(c) Find the equation of the line that is perpendicular to line l and passes through the point $(12, -7)$. Give your answer in the form $y = mx + c$.

$m_p = -1 : (-\frac{3}{4}) = \frac{4}{3}$

Equation of p: $y - (-7) = \frac{4}{3}(x - 12)$

$y + 7 = \frac{4}{3}x - 16$

$y =$ ..... $\frac{4}{3}x - 23$ ..... [3]

17 A bag contains 3 blue buttons, 8 white buttons and 5 red buttons.
Two buttons are picked at random from the bag, without replacement.

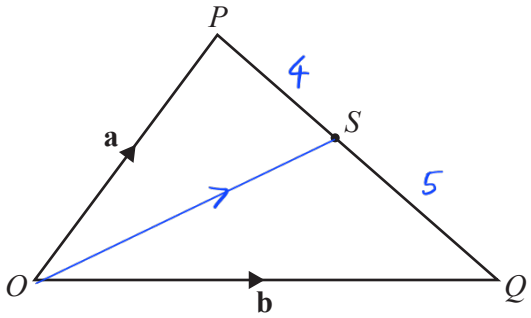
Work out the probability that the two buttons are either both red or both white.

$P(R \cap R) + P(W \cap W)$

$\frac{5}{16} \times \frac{4}{15} + \frac{8}{16} \times \frac{7}{15} = \frac{19}{60}$

..... $\frac{19}{60}$ ..... [3]

18



NOT TO SCALE

S is a point on PQ such that $PS : SQ = 4 : 5$.

Find $\overrightarrow{OS}$, in terms of **a** and **b**, in its simplest form.

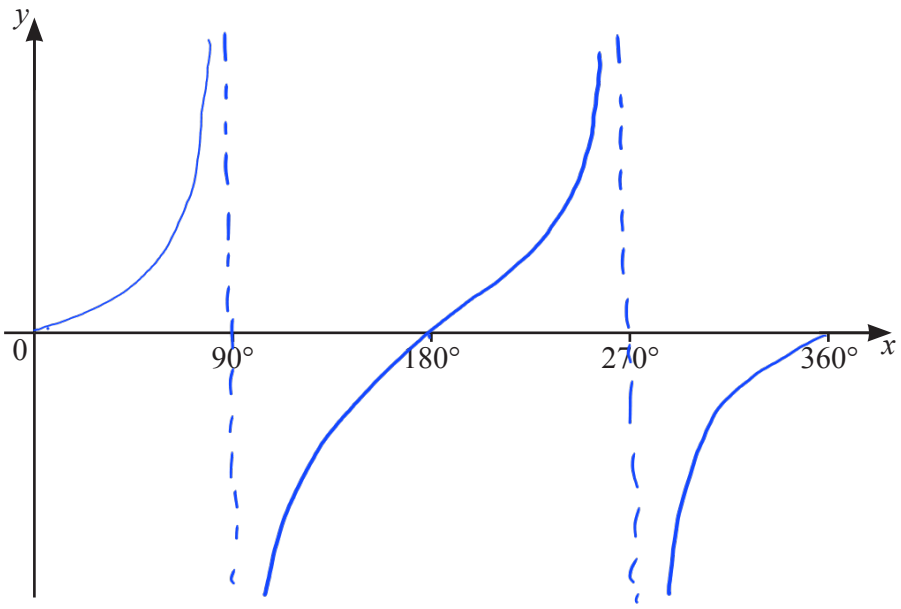
$\overrightarrow{PQ} = \overrightarrow{PO} + \overrightarrow{OQ} = -a + b$

$\overrightarrow{PS} = \frac{4}{9}\overrightarrow{PQ} = \frac{4}{9}(-a + b)$

$\overrightarrow{OS} = \overrightarrow{OP} + \overrightarrow{PS} = a + \frac{4}{9}(-a + b)$

$\overrightarrow{OS} =$ ..... $\frac{5}{9}a + \frac{4}{9}b$ ..... [2]

19 **(a)** Sketch the graph of $y = \tan x$ for $0° \leqslant x \leqslant 360°$.



[2]

(b) Solve the equation $5\tan x = 1$ for $0° \leqslant x \leqslant 360°$.

$\tan x = \frac{1}{5}$

$x = 11.3°$ or $x = 11.3° + 180° = 191.3°$

$x =$ 11.3° or $x =$ 191.3° [2]

20 The distance between two towns is 600 km, correct to the nearest 10 km.
A car takes 8 hours 40 minutes, correct to the nearest 10 minutes, to travel this distance.

Calculate the lower bound for the average speed of the car in km/h.

$\text{speed (min)} = \frac{\text{distance (min)}}{\text{time (max)}}$

$\text{distance}_{min} = 600 - \frac{10}{2} = 595 \text{ (km)}$

$\text{time}_{max} = 8\text{h } 40' + \frac{10'}{2} = 8\text{h } 45' = 8\frac{45}{60}\text{ h}$

$\text{Speed}_{min} = \frac{595}{8\frac{45}{60}} = 68 \text{ km/h}$

68 km/h [3]