Cambridge Assessment
International Education

Cambridge O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS (SYLLABUS D)   **4024/12**

Paper 1   **May/June 2020**

                                                               2 hours

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- Calculators must **not** be used in this paper.
- You may use tracing paper.
- You must show all necessary working clearly.

INFORMATION
- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

[Turn over
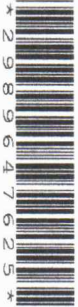
ELECTRONIC CALCULATORS MUST NOT BE USED IN THIS PAPER

1 **(a)** Work out 0.05×0.3 .

$$0.05 \times 0.3 = 0.015$$

.... **0.015** [1]

(b) Work out $2\frac{2}{3} - \frac{1}{5}$.

$$\frac{8}{3} - \frac{1}{5} = \frac{40-3}{15} = \frac{37}{15}$$

.... $2\frac{7}{15}$ or $\frac{37}{15}$ [2]

2 **(a)**
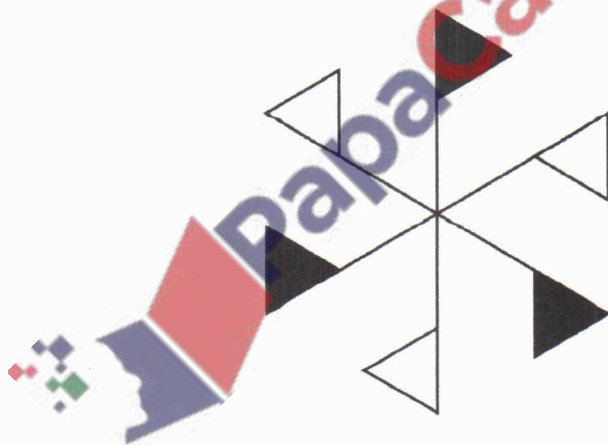
Write down the order of rotational symmetry of this shape.

.... **3** [1]

(b) Samuel describes a special quadrilateral.

It has only one line of symmetry.
Its diagonals cross at right angles.

Write down the name of this special quadrilateral.

.... **kite** [1]

3   Write these numbers in order of size, starting with the smallest.

$$4^3 \qquad 9^2 \qquad \sqrt{196} \qquad \sqrt[3]{125}$$

$4^3 = 64, \quad 9^2 = 81, \quad 14 \qquad 5$

................, ..., ..., ... [2]
smallest

$\sqrt[3]{125} \qquad \sqrt{196} \qquad 4^3 \qquad 9^2$

4   (a) Write 68% as a fraction in its lowest terms.

$\dfrac{68}{100}, \dfrac{34}{50} = \dfrac{17}{25}$

.... [1]

$\dfrac{17}{25}$

(b) A bag contains red balls and blue balls.
    The balls are in the ratio   red : blue = 3 : 5.

    Write down the fraction of the balls that are red.

$R : B$
$3 : 5 \quad = \dfrac{3}{5+3} = \dfrac{3}{8}$

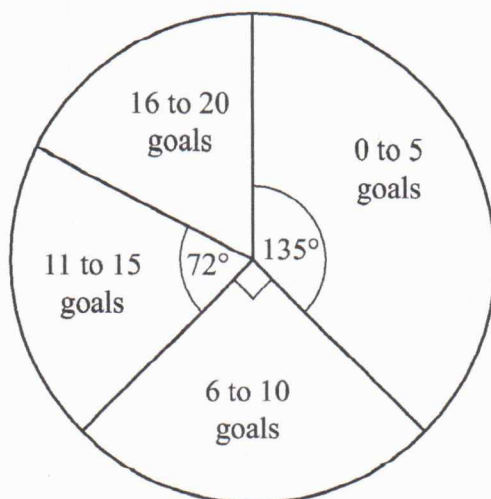.................... [1]

$\dfrac{3}{8}$

5   By writing each number correct to one significant figure, estimate the value of

$$\frac{2.78^3}{61.4 \times 0.893}.$$

$\dfrac{3^3}{60 \times 0.9} = \dfrac{27}{54}, \quad \dfrac{27}{54} = \dfrac{1}{2}$

.... [2]

$\dfrac{1}{2}$

6

The pie chart shows information about the number of goals scored by each player in a football club.

(a) Write down the modal class.

.... 0 to 5 .... [1]

(b) 8 of the players each scored 11 to 15 goals.

Work out the total number of players in the club.

$72° \rightarrow 8$ Players
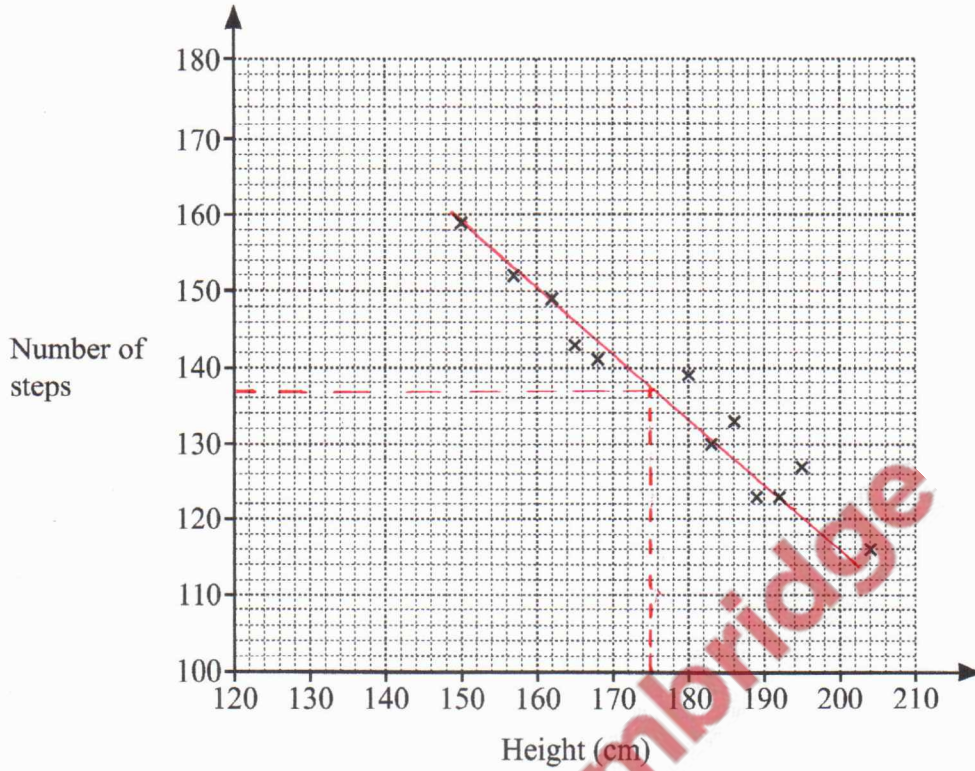
$360° - ?$

$\dfrac{360 \times 8}{72} = 40$

.... 40 .... [2]

7 Factorise $15a - 5x - 2xy + 6ay$.

$5(3a - x) + 2y(3a - x)$

$(5 + 2y)(3a - x)$

........$(5 + 2y)(3a - x)$........ [2]

8   The number of steps taken by 12 people to walk 100 m was recorded.
     The scatter diagram shows the heights of these people and the number of steps they took.

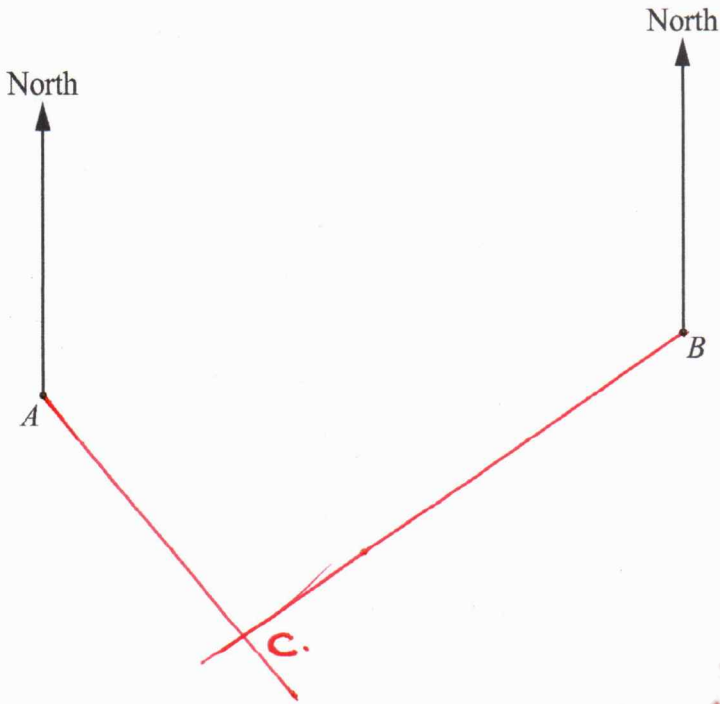(a) What type of correlation is shown in the scatter diagram?

.... Negative .... [1]

(b) Draw a line of best fit.   [1]

(c) The height of another person is 175 cm.

     Use your line of best fit to estimate the number of steps they would take to walk 100 m.

.... 137 .... [1]

9

North

North

B

A

C.

Scale: 1 cm to 10 km

The scale drawing shows the positions of town A and town B.

(a) Find the actual distance, in kilometres, of town A from town B.

8.5cm

8.5×10

.... 85 .... km [1]

(b) Town C is on a bearing of 140° from town A and on a bearing of 235° from town B.

Mark the position of town C on the scale drawing. [2]

10 (a) Bilal goes for a cycle ride.
He starts at 3 pm.
He finishes at 5.38 pm.
He has a total of 25 minutes rest during the ride.

Work out how long, in hours and minutes, he spends cycling.

$3pm - 5:38pm$

2 hrs   38 minutes
   −   25 min
―――――――――――――
2 hrs   13 min

.... 2 ...... hours .... 13 .... minutes [1]

(b) Sonia walks to her aunt's house.
She leaves home at 10 25.
She walks a total of 12 km at an average speed of 5 km/h.

Work out the time Sonia arrives at her aunt's house.

$T = \dfrac{D}{S}$, $T = \dfrac{12}{S} = 2.4$

2 hrs and 24 mins

$\begin{array}{r} 1025 \\ 224 \\ \hline 1249 \end{array}$

.... 1249 .... [3]

11 (a) $c = \dfrac{7-a}{b}$

Find c when $a = -4$ and $b = 2$.

$C = \dfrac{7-(-4)}{2}$, $C = \dfrac{7+4}{2}$
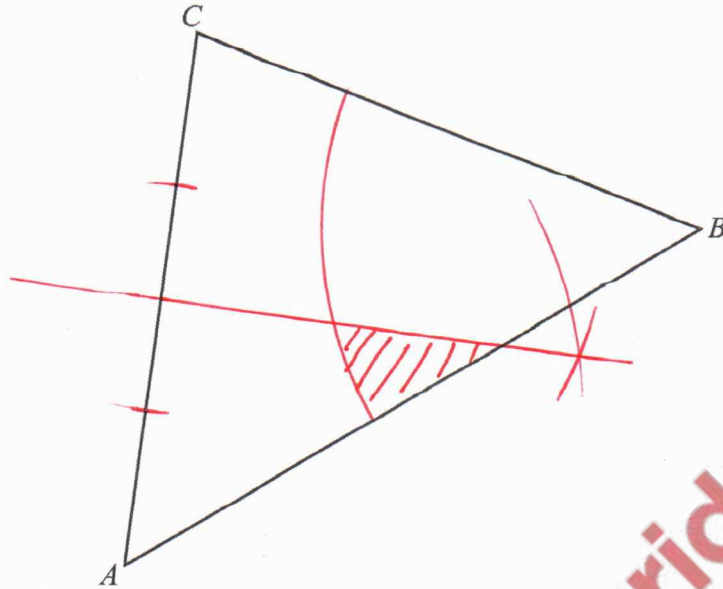
$C = \dfrac{11}{2} = 5.5$ $c =$ .... 5.5 .... [1]

(b) $y = 5^x + 1$

Find y when $x = -2$.

$y = 5^{-2} + 1$

$y = \dfrac{1}{25} + 1$ $y = 1\frac{1}{25}$

$y =$ .... $1\frac{1}{25}$ .... [1]

12 Use a straight edge and compasses only in this question.

(a) Construct the locus of points inside triangle *ABC* that are

    (i) 5 cm from *B*,   [1]

    (ii) equidistant from *A* and *C*.   [2]

(b) Shade the region inside triangle *ABC* containing the points that are

    •   less than 5 cm from *B*

and

    •   closer to *A* than to *C*.   [1]

13 (a) Write 108 as the product of its prime factors.

108
2 54
2 27
3 9
3 3

$= 2^2 \times 3^3$

...........................$2^2 \times 3^3$........................... [2]

(b) Find the lowest common multiple (LCM) of 108 and 180.

$108 = 2^2 \times 3^3$

180
2 90
2 45
3 15
3 5

$= 2^2 \times 3^2 \times 5$

$2^2 \times 3^3 \times 5 = 540$

...........................540........................... [2]

14 (a) In 2017, the population of Egypt was 97 500 000.

Write this population in standard form.

...........................9.75×10^7........................... [1]

(b) The population density of a country is the number of people per square kilometre.
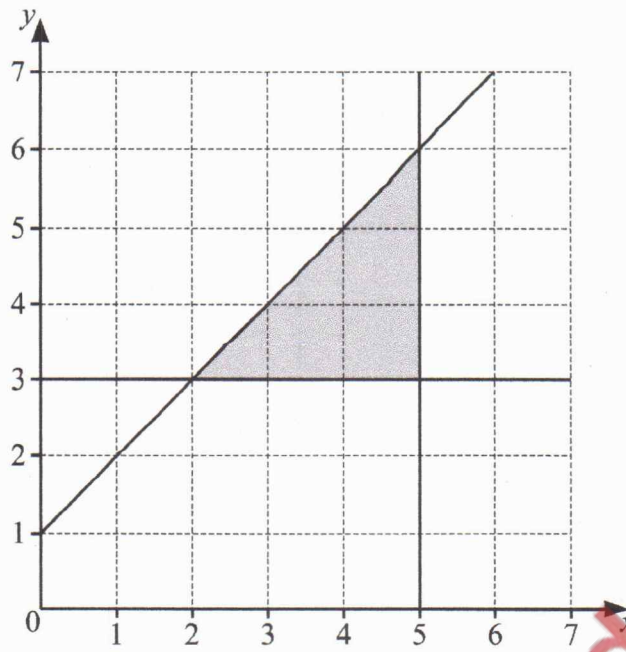
In 2017, the population of Indonesia was 2.62×10^8, correct to 3 significant figures.
The area of Indonesia is $2 \times 10^6 \, \text{km}^2$, correct to 1 significant figure.

Calculate an estimate for the population density of Indonesia.

$\dfrac{2.62 \times 10^8}{2 \times 10^6} = \dfrac{262}{2} = 131$
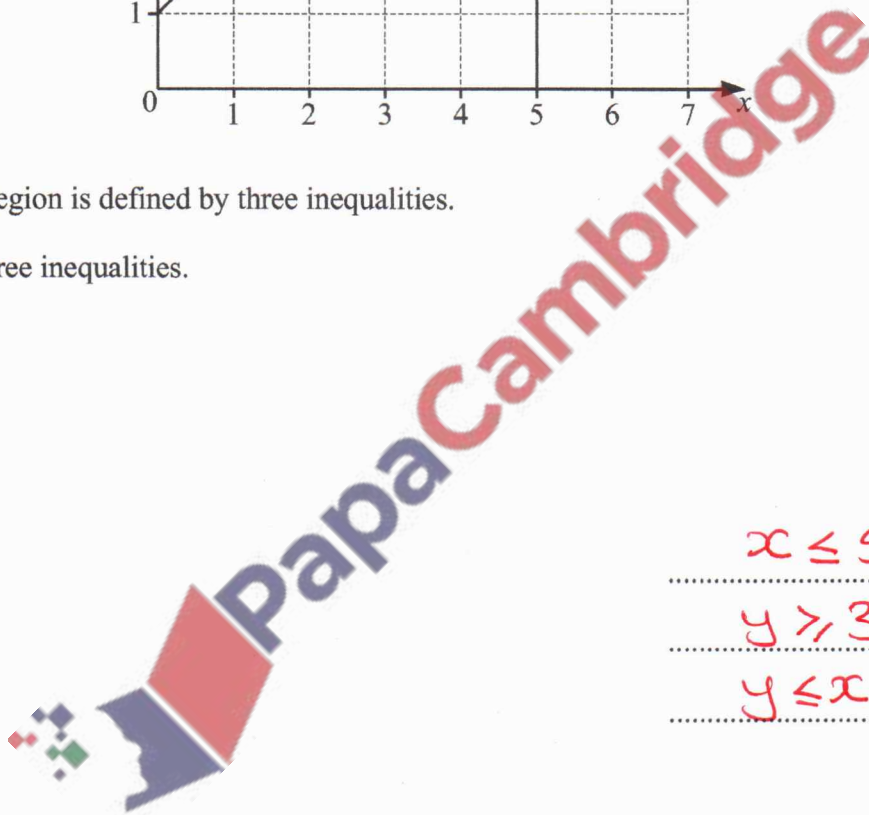
...........................131........................... people/km^2 [2]

15

The shaded region is defined by three inequalities.

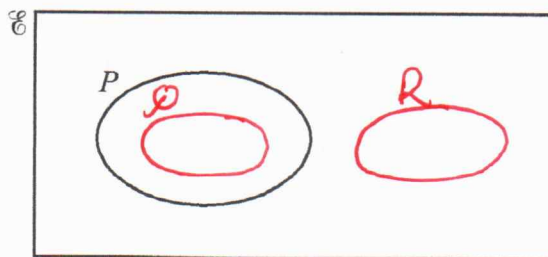Find these three inequalities.

$x \leq 5$

$y \geq 3$

$y \leq x + 1$ [3]

16 $Q \subset P$

$P \cap R = \varnothing$

Complete the Venn diagram to show sets Q and R.

[2]

17 Here are the first four terms of a number sequence.

$$T_1 = 1^2 + 3 = 4$$

$$T_2 = 2^2 + 8 = 12$$

$$T_3 = 3^2 + 13 = 22$$

$$T_4 = 4^2 + 18 = 34$$

(a) Find T_5.

$$T_5 = 5^2 + 18 + 5$$
$$= 25 + 23$$
$$= 48$$

$T_5 =$ .... 48 .... [1]

(b) Find an expression, in terms of n, for T_n.

$$T_n = n^2 + 5n - 2$$

$$3, 8, 13 \ldots$$
$$a + d(n-1)$$
$$3 + 5(n-1)$$
$$3 + 5n - 5$$
$$5n - 2$$

$T_n =$ .... $n^2 + 5n - 2$ .... [3]

18 The diagram is the speed–time graph for part of a car's journey.

NOT TO SCALE
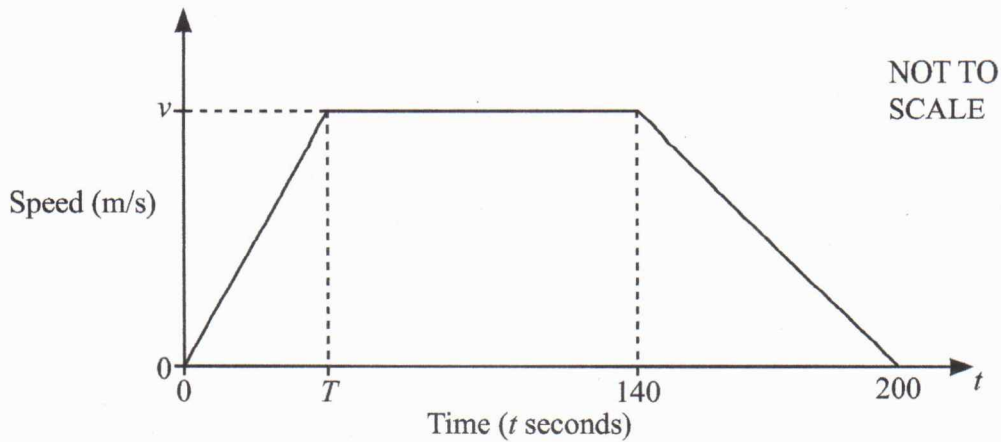
(a) The deceleration of the car between $t = 140$ and $t = 200$ is $0.2\,\text{m/s}^2$.

Find the value of v.

$$0.2 = \frac{v}{200 - 140}$$

$$0.2 = \frac{v}{60}$$

$$v = 12$$

$v =$ .... 12 .... [2]

(b) The car travels a total of $1800\,\text{m}$ in the 200 seconds.

Find the value of T.

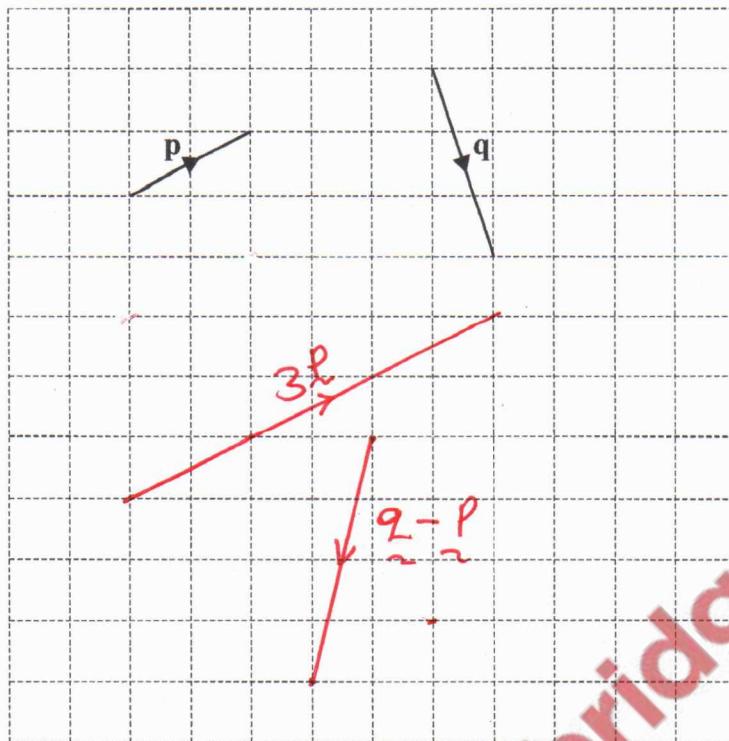$$\frac{1}{2}(a + 200) \times 12 = 1800$$

$$12a + 2400 = 3600$$

$$12a = 3600 - 2400$$

$$12a = 1200$$

$$a = 100$$

$$140 - 100 = 40$$

$T =$ .... 40 .... [3]

19

Vectors **p** and **q** are shown on the grid.

On the grid, draw the vector

(a) 3**p**,   [1]

(b) **q** − **p**.   [1]

20 A plan of a house is drawn to a scale of 1 : 50.
On the plan, the floor area of the kitchen is $30\,cm^2$.

Calculate the floor area of the real kitchen.
Give your answer in square metres.

Let the measurements be 6cm and 5cm

$(6 \times 50)(5 \times 50)$

300×250

$= 75000$

$1m^2 = 100\,cm \times 100\,cm$

$= 10{,}000\,cm^2$

$\dfrac{75000}{10{,}000} = 7.5$

.... 7·5 .... m^2 [3]

21 Simplify $\left(\dfrac{2x^2}{x^5}\right)^{-3}$.

$$\left(\frac{x^5}{2x^2}\right)^3 = \left(\frac{x^{5-2}}{2}\right)^3$$

$$\left(\frac{x^3}{2}\right)^3 = \frac{x^9}{8}$$

$$\frac{x^9}{8}$$

.... [2]

22 $\quad$ f$(x) = 4(3-x)$ $\qquad$ g$(x) = \dfrac{5(3x-2)}{x}$

(a) Find $\text{f}^{-1}(x)$.

$$y = 12 - 4x$$
$$4x = 12 - y$$
$$x = \frac{12-y}{4}$$

$$\text{f}^{-1}(x) = \frac{12-x}{4}$$

f$^{-1}(x) = $ .... $\dfrac{12-x}{4}$ .... [2]

(b) Solve $\text{g}(x) = 6$.

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

$$15x - 10 = 6x$$

$$15x - 6x = 10$$

$$9x = 10$$

$$x = \frac{10}{9}$$

$x = $ .... $\dfrac{10}{9}$ .... [3]

23 Express as a single fraction in its simplest form.

$$\frac{5}{2x-1} - \frac{3}{x+4}$$

$$\frac{5(x+4) - 3(2x-1)}{(2x-1)(x+4)} = \frac{5x+20-6x+3}{(2x-1)(x+4)}$$

$$= \frac{23-x}{(2x-1)(x+4)}$$

.... $\frac{23-x}{(2x-1)(x+4)}$ .... [3]

24 P is the point $(h, 7)$.
    P lies on the line $3y + 2x = 5$.

(a) Find the value of h.

$$3(7) + 2x = 5$$
$$2x = 5 - 21$$
$$2x = -16$$

$$x = \frac{-16}{2}$$
$$x = -8$$

$h =$ .... -8 .... [2]

(b) Line L is perpendicular to the line $3y + 2x = 5$ and passes through P.

Find the equation of line L.

$$3y = -2x + 5$$
$$y = -\tfrac{2}{3}x + \tfrac{5}{3}$$

$$m_1 \times m_2 = -1$$
$$-\tfrac{2}{3}m_2 = -1, \quad m_2 = \tfrac{3}{2}$$

$$y = \tfrac{3}{2}x + c$$
$$7 = \tfrac{3}{2}(-8) + c$$
$$7 = -12 + c$$
$$c = 19$$

$$y = \tfrac{3}{2}x + 19$$

.... $y = \tfrac{3}{2}x + 19$ .... [4]

Question 25 is printed on the next page

25 $A = \begin{pmatrix} 2 & 0 \\ -3 & -1 \end{pmatrix}$

(a) Evaluate $2A - \begin{pmatrix} -5 & 4 \\ 0 & 3 \end{pmatrix}$.

$2\begin{pmatrix} 2 & 0 \\ -3 & -1 \end{pmatrix} - \begin{pmatrix} -5 & 4 \\ 0 & 3 \end{pmatrix}$

$\begin{pmatrix} 4 & 0 \\ -6 & -2 \end{pmatrix} - \begin{pmatrix} -5 & 4 \\ 0 & 3 \end{pmatrix} = \begin{pmatrix} 9 & -4 \\ -6 & -5 \end{pmatrix}$

$\begin{pmatrix} 9 & -4 \\ -6 & -5 \end{pmatrix}$ [2]

(b) Find $|A|$.

$(-1 \times 2) - (3 \times 0)$

$= -2$

.... -2 .... [1]

(c) Find A^{-1}.

$-\frac{1}{2}\begin{pmatrix} -1 & 0 \\ 3 & 2 \end{pmatrix}$

$-\frac{1}{2}\begin{pmatrix} -1 & 0 \\ 3 & 2 \end{pmatrix}$ [1]

(d) Find the matrix X, where $XA = \begin{pmatrix} 4 & -2 \end{pmatrix}$.

$X = \begin{pmatrix} 4 & -2 \end{pmatrix} A^{-1}$

$X = \begin{pmatrix} 4 & -2 \end{pmatrix} \begin{pmatrix} \frac{1}{2} & 0 \\ -\frac{3}{2} & -1 \end{pmatrix}$

$X = \begin{pmatrix} 2+3 \\ 0+2 \end{pmatrix}$ $x = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$

$X = \begin{pmatrix} 5 & 2 \end{pmatrix}$ [2]