Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS   **0580/31**

Paper 3 (Core)   **May/June 2022**

                                                                                  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.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π, use either your calculator value or 3.142.

INFORMATION
- The total mark for this paper is 104.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Any blank pages are indicated.

[Turn over

1   (a) Write the number six and a half million in figures.

$6,000,000$
$500,000$
$6,500,000$

......6,500,000...... [1]

(b) Write 6538 correct to the nearest ten.

$65\overset{+1}{3}\underline{8} \rightarrow 6540$

......6540...... [1]

(c) Work out $6 \times 5 + 12 \div 3$.

$30 + 4 = 34$

......34...... [1]

(d)   9   16   18   29   57   64   87   96

From this list of numbers, write down

(i)   a factor of 48,

48
16 ∧ 3

......16...... [1]

(ii) a cube number,

$4^3 = 4 \times 4 \times 4$
$= \underline{64}$

......64...... [1]

(iii) a prime number.

Number divisible by 1 and Itself.

......29...... [1]

(e) Find the value of $\sqrt{0.001225}$.

0·035   0·035

......0.035...... [1]

(f) Find the reciprocal of 8.

$8 = \frac{1}{8}$

$\frac{1}{8}$

......[1]

(g) Find the value of 8^0.

Any number raised to Power of zero is always 1.

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

(h) **(i)** Write 180 as a product of its prime factors.

```
    180
2  /90        = 2×2×3×3×5
  2 /45        = 2²×3²×5
    3 /15
      3 /5
```

.... $2^2 \times 3^2 \times 5$ .... [2]

(ii) Find the lowest common multiple (LCM) of 160 and 180.

```
2 | 160   180
2 |  80    90
5 |  40    45
2 |   8     9
2 |   4     9
2 |   2     9
9 |   1     9
```

$LCM = 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 9$

$= 1440$

.... 1440 .... [2]

(i) The mass of an aircraft, m tonnes, is 473 tonnes, correct to the nearest tonne.

Complete this statement about the value of m.

473 tonnes

$Limit = \frac{1}{2} = 0.5$

............472.5............ $\leqslant m <$ ....473.5............ [2]

$L-b = 473 - 0.5$

$= 472.5$

$u.b = 473 + 0.5$

$= 473.5$

2   (a) Write down the number of sides of a hexagon.

_____6 sides_____ [1]

   (b)
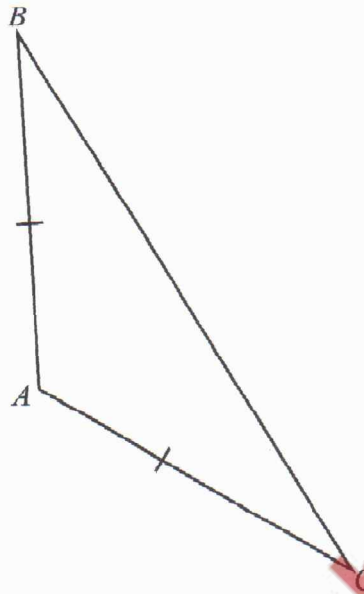
In triangle ABC, $AB = AC$.

   (i)   Write down the mathematical name for this type of triangle.

_____Isosceles_____ [1]

   (ii) Measure angle CAB.

Angle $CAB = $ _____125°_____ [1]

   (iii) Write down the mathematical name for angle CAB.

_____obtuse_____ [1]

   (c) Show that the interior angle of a regular pentagon is 108°.

Interior angle $= \dfrac{(n-2) \times 180}{n}$

Pentagon $= 5$ sides (n)

$= \dfrac{(5-2) \times 180}{5}$

$= \dfrac{3 \times 180}{5} = 108°$

[2]

0580/31/M/J/22

(d)

B⌒112°─────────────C ✗

✗⌒────────────D⌒248°
A
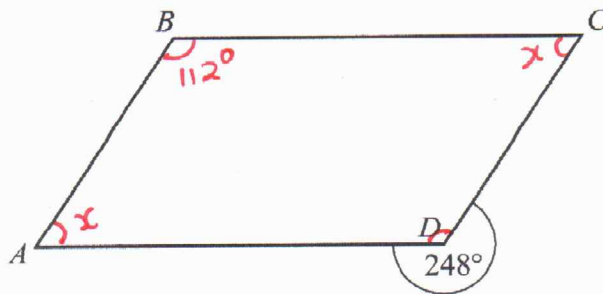
NOT TO SCALE

ABCD is a parallelogram.
The reflex angle at *D* is 248°.

Find angle *DCB*.

∠D = 360° − 248°
= 112°

opposite angles are equal.
x + x + 112 + 112 = 360°
2x + 224 = 360
2x/2 = 136/2
x = 68°

∠DCB = ∠BAD
= 68°

Angle *DCB* = ...68.......... [2]

(e) The angles of a triangle are in the ratio 3 : 5 : 7.

Find the size of the largest angle in this triangle.

Total ratio = 3 + 5 + 7
= 15

Angles in triangle = 180° (sum up)

$\frac{3}{15}$ × 180 = 36°

$\frac{5}{15}$ × 180 = 60°

$\frac{7}{15}$ × 180 = 84°

Largest angle = 84°

.....................84°................... [3]

3 Sachin, his wife and three children go on a coach holiday.

(a) Each adult ticket costs $375 and each child ticket costs $194.

Work out the total cost of the tickets.

2 Adults Cost = 375 × 2 = $750

3 Children Costs = 194 × 3 = $582

1332

$ .... 1332 .... [2]

(b) A meal costs $110 plus a service charge of 18%.

Calculate the total cost of the meal.

Service Charge = $\frac{18}{100}$ × 110 = 19·8

Total Cost = (19·8 + 110)

= 129·8

$ .... 129·8 .... [2]

(c) One day, the temperature at midday is 16 °C.
At midnight the temperature has fallen by 23 °C.

Work out the temperature at midnight.

Midday = 16°c   16°C − 23°C = −7°C

Midnight = 23°c

.... −7 .... °C [1]

(d) Sachin spends $768 on holiday.
He spends $\frac{3}{8}$ of this amount on presents.

Find how much he spends on presents.

Presents = 3/8

$\frac{3}{8}$ × 768

= 288

$ .... 288 .... [1]

(e) There are 604 passengers on the holiday.

    (i) The coach company uses coaches which can carry 46 passengers.

        Work out the number of coaches needed.

Number of Passengers = 604
Each Coach = 46
$$\frac{604}{46} = 13.13 \approx 14 \text{ Coaches}$$

..................**14**.................. [2]

    (ii) 268 of the 604 passengers are women.

        Find the percentage of the passengers that are women.

Percentage of Women = $\frac{268}{604} \times 100\%$

$$= 44.37$$
$$\approx 44.4$$

..................**44.4**.................. % [1]

(f) A coach travels at an average speed of 54 km/h.

    Find how long, in hours and minutes, this coach takes to travel 126 km.

Average speed = 54 km/hr
Distance = 126 km

Time = $\frac{D}{S}$

$$= \frac{126 \text{ km}}{54}$$
$$= 2.333$$
$$= 0.333 \times 60$$
$$= 20 \text{ mins}$$

..........**2**.......... h ....**20**.......... min [3]

4 (a)
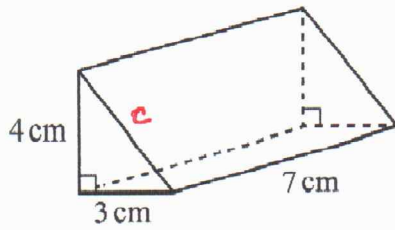
NOT TO SCALE
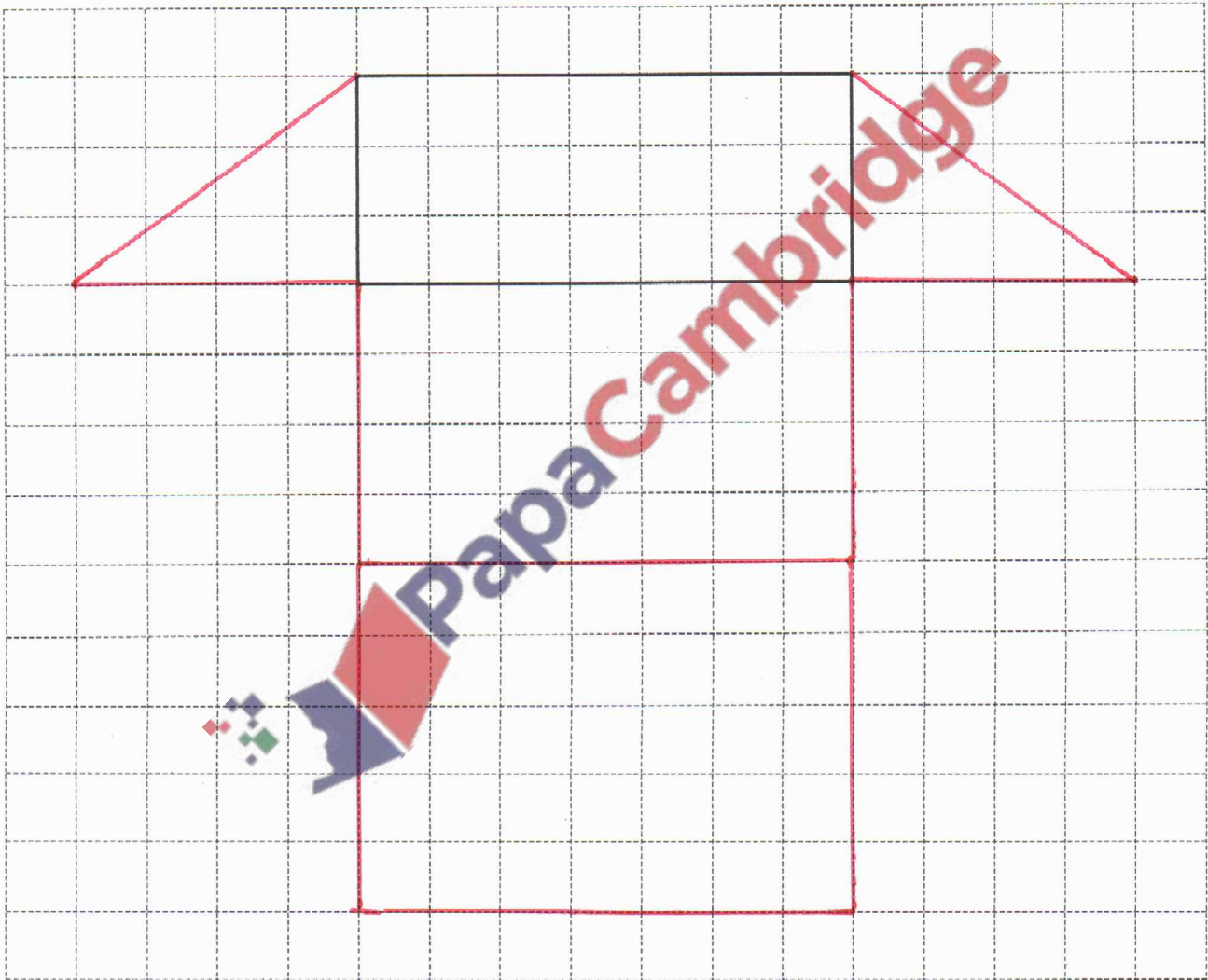
$c^2 = 4^2 + 3^2$
$c^2 = 16 + 9$
$c^2 = \sqrt{25}$ $c = 5\,cm$

The diagram shows a right-angled triangular prism.

(i) On the 1 cm² grid, complete a net of this prism.
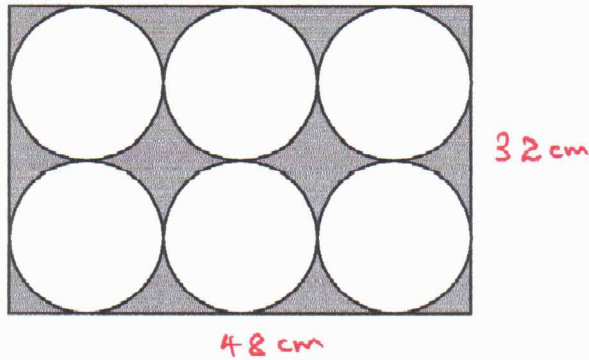One face has been drawn for you.

[4]

(ii) Work out the volume of this prism.

Volume = Area of Cross-section × length
= ($\frac{1}{2}$ × 3 × 4) × 7cm
= 6 × 7 = 42 cm³

.... 42 .... cm³ [2]

(b)

32 cm

48 cm

NOT TO
SCALE

The diagram shows a rectangle with 6 congruent circles inside.
Each circle touches the adjacent circles and the sides of the rectangle.
The radius of each circle is 8 cm.

(i) Show that the length of the rectangle is 48 cm.

Length = 6 circles × 8 cm

= 48 cm

[1]

(ii) Find the area of the rectangle.
Give the units of your answer.

Area = Length × width

A = 48 cm × 32

= 1536 cm²

.... 1536 cm² [3]

(iii) Calculate the percentage of the rectangle that is shaded.

Area of circle = πr^2

= $\pi \times 8 \times 8$

= (201.0619 × 6)

= 1206.372 cm²

Shaded area = 1536 − 1206.372

= 329.63 cm²

Percentage of shaded part

= $\frac{329.63 \times 100\%}{1536\%}$

= 21.46%

.... 21.46 % [3]

5   **(a)**   The grid shows a point *A*.
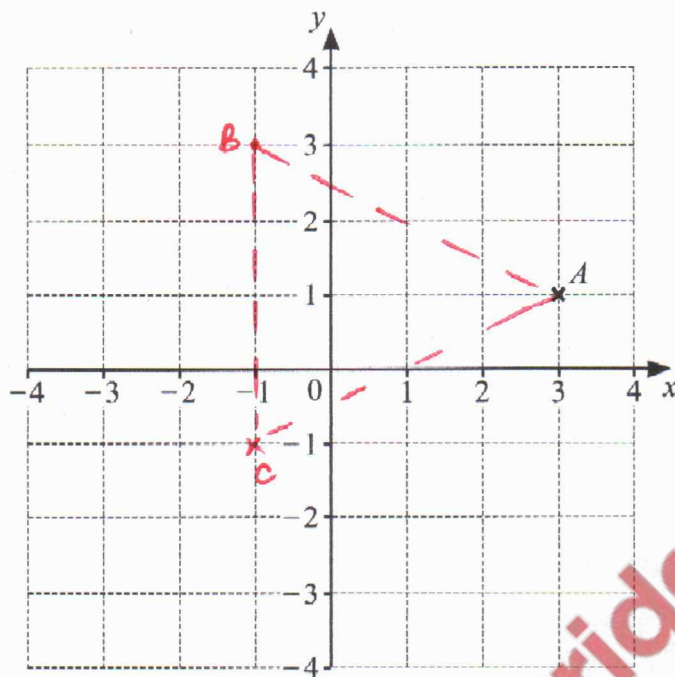
(i)   Write down the coordinates of point *A*.

(..........3........ , ...1..........) [1]

(ii)   On the grid, plot the point *B* at $(-1, 3)$. [1]
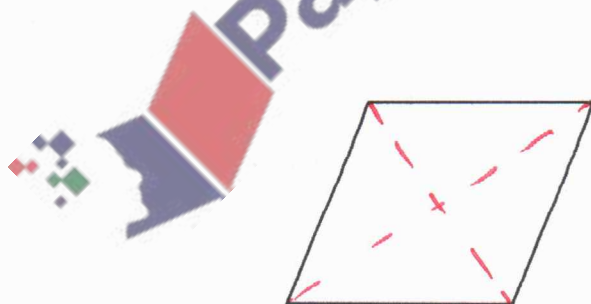
(iii)   *C* is a point on the grid whose coordinates are whole numbers.

On the grid, mark a point *C* so that triangle *ABC* is isosceles. [1]

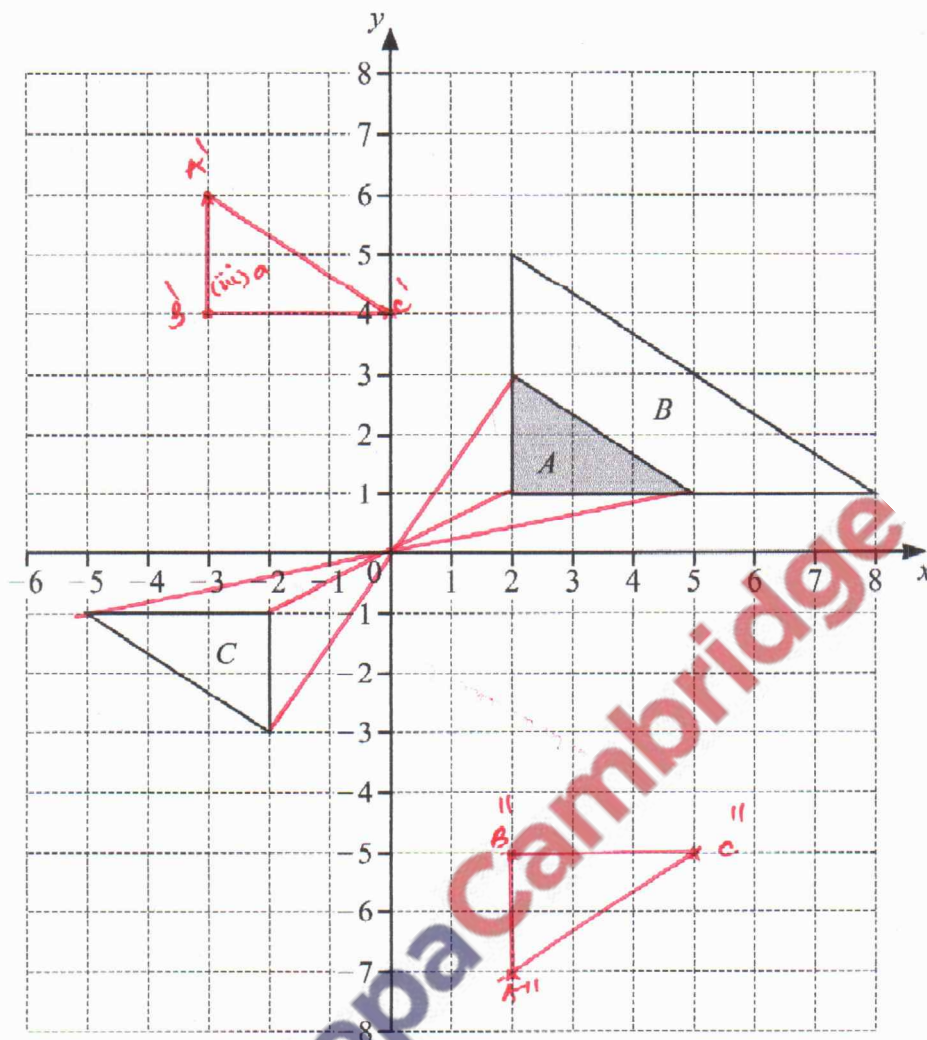**(b)**

The diagram shows a rhombus.

(i)   Write down the order of rotational symmetry.

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

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

(c) The grid shows triangles *A*, *B* and *C*.

(i) Describe fully the **single** transformation that maps triangle *A* onto triangle *B*.

It is enlargement by a scale factor of 2 about centre (3,1). [3]

(ii) Describe fully the **single** transformation that maps triangle *A* onto triangle *C*.

Rotation 180° about the origin (0,0). [3]

(iii) Draw the image of

(a) triangle *A* after a translation by the vector $\begin{pmatrix} -5 \\ 3 \end{pmatrix}$, [2]

(b) triangle *A* after a reflection in the line $y = -2$. [2]

6 **(a)** A football team has w wins and d draws.
The team scores 3 points for each win and 1 point for each draw.

Write an expression, in terms of w and d, for the total number of points scored by the team.

Let win $= w$
$(w \times 3) + d = \underline{3w + d}$

.... $3w+d$ .... [2]

(b) Athletic, Rovers and United are three football teams.

Athletic have a point score of x.
Rovers have 12 points more than Athletic's point score. $(x+12)$
United have 3 points fewer than twice Athletic's point score. $(2x-3)$

The total point score of all three teams is 121.

Use this information to write down an equation in terms of x.
Solve your equation to work out the point score for each team.

Rovers $= x+12$
United $= (2x-3)$
Athletic $= x$

$x + (x+12) + (2x-3) = 121$

$4x + 9 = 121$

$4x = 121 - 9$

$\dfrac{4x}{4} = \dfrac{112}{4}$

$x = \underline{28}$

Rovers $= 28+12$
$= \underline{40}$

United $= 2(28) - 3$
$= 56 - 3$
$= \underline{53}$

Athletic .... 28 .... points

Rovers .... 40 .... points

United .... 53 .... points [5]

(c) Simplify.

(i) $4a - 3b + 5a + 6b$

$$4a + 5a + 6b - 3b$$
$$9a + 3b$$

$9a + 3b$ .... [2]

(ii) $6(2x + 1) - 5(x - 2)$

$$6(2x + 1) - 5(x - 2)$$
$$12x + 6 - 5x + 10$$
$$12x - 5x + 6 + 10$$
$$7x + 16$$

$7x + 16$ .... [2]

(d) Solve the simultaneous equations.
You must show all your working.

$$3x + 5y = 11$$
$$2x - 3y = 20$$

$$3x + 5y = 11 \times 3 \quad (i)$$
$$2x - 3y = 20 \times 5 \quad (ii)$$

Using elimination Multiply
equation (i) by 3 and (ii) by 5

$$9x + 15y = 33$$
$$10x - 15y = 100$$
$$\frac{0}{}$$

$$\frac{19x}{19} = \frac{133}{19}$$

$$x = \underline{\underline{7}}$$

Substitute $x = 7$

$$3x + 5y = 11$$
$$3(7) + 5y = 11$$
$$21 + 5y = 11$$
$$5y = 11 - 21$$
$$\frac{5y}{5} = \frac{-10}{5}$$
$$y = \underline{\underline{-2}}$$

$x =$ ....7............

$y =$ ....−2............ [4]

7 (a) A class of 15 students take two tests in science, paper 1 and paper 2.
The scores for each student are shown in the table.

Paper 1	5	11	12	20	26	31	32	37	45	47	51	54	55	23	42
Paper 2	12	15	27	27	51	44	52	54	54	74	66	72	78	30	58
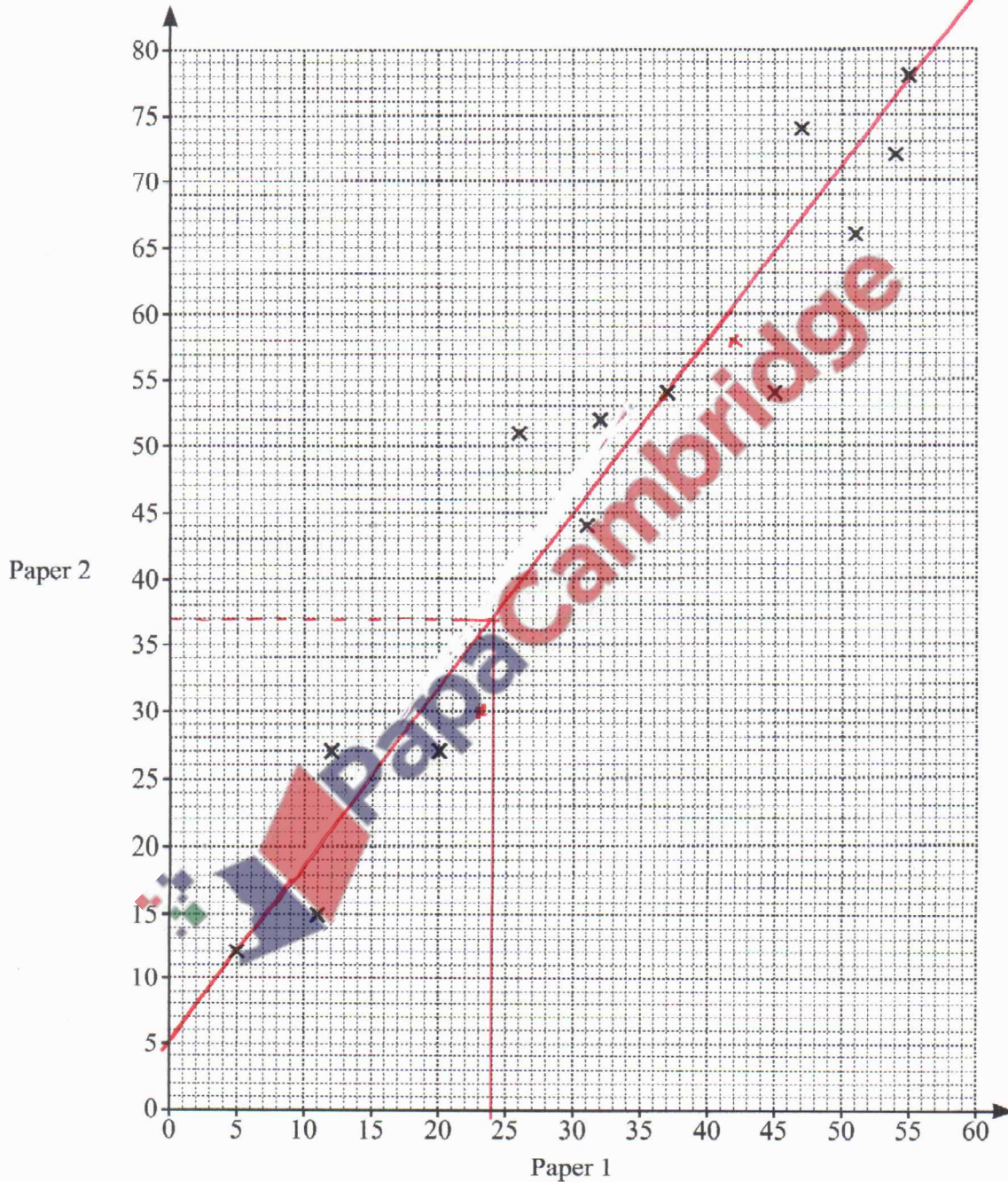
(i) Complete the scatter diagram.
The first thirteen points have been plotted for you. [1]

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

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

(iii) On the grid, draw a line of best fit. [1]

(iv) Another student scores 24 on paper 1.

Use your line of best fit to find an estimate for their score on paper 2.

.................37....................... [1]

(b) 140 students choose which subjects they want to study.

- 122 students choose biology (*B*).
- 55 students choose chemistry (*C*).
- 2 students do not choose biology and do not choose chemistry.
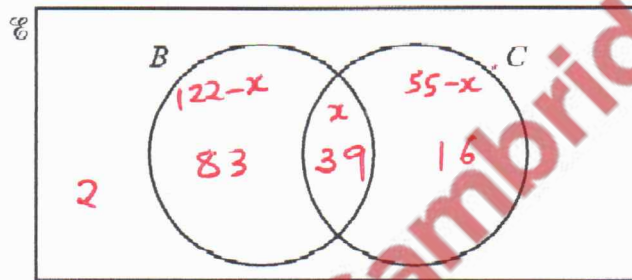
$(122-x) + x + (55-x) = 138$

$177 - x = 138$

$x = 39$

Venn diagram: $\mathscr{E}$, B: 122−x, 83; middle: x, 39; C: 55−x, 16; outside: 2

(i) Complete the Venn diagram.

[2]

(ii) One of these students is picked at random.

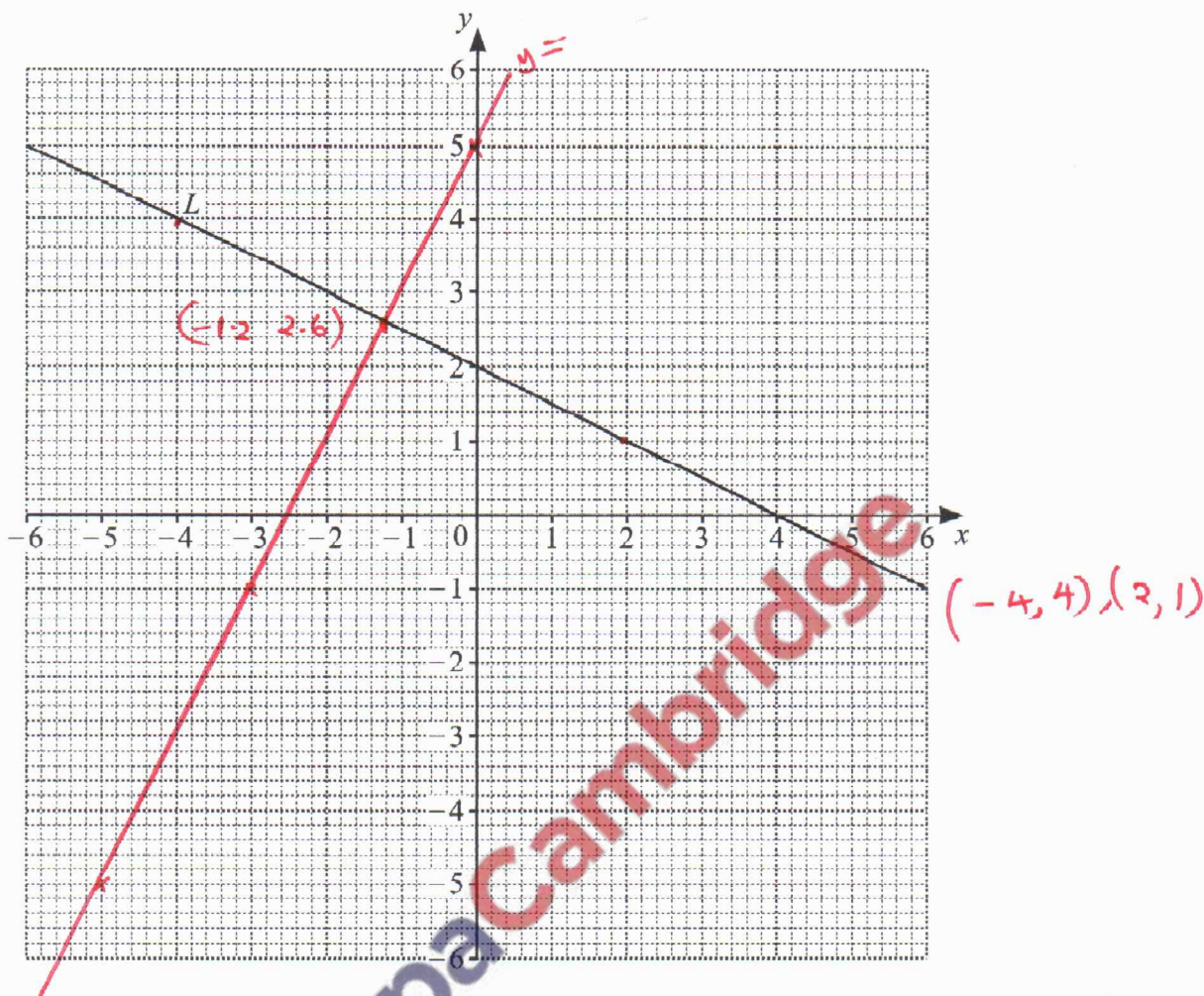Find the probability that this student chooses biology and chemistry.

Biology ∩ chemistry

$P(B \cap C) = \dfrac{39}{140}$

$\dfrac{39}{140}$

.... [1]

8 The grid shows a line *L*.

(annotations on graph): $y=$

$(-12 \ 2\cdot6)$

$(-4,4)(3,1)$

(a) Find the equation of line *L*.
Give your answer in the form $y = mx + c$.

$Y = MX + C$

$1 = -\frac{1}{2}(2) + C$

$1 = -1 + C \quad C = 2$

$Y = -\frac{1}{2}x + 2$

Gradient $= \dfrac{1-4}{2-(-4)} = \dfrac{-3}{6} = -\frac{1}{2}$

$y = \underline{\quad -\frac{1}{2}x + 2 \quad}$ [2]

(b) (i) Complete the table of values for $y = 2x + 5$.

x	-5	-3	0
y	-5	-1	5

[1]

(ii) On the grid, draw the graph of $y = 2x + 5$. [1]

(c) Write down the coordinates of the point which lies on both line L and the graph of $y = 2x + 5$.

Consider the Points of Intersection of the lines:

(....*−1.2*...., ...*2.6*....) [1]

(d) Write down the equation of the line that is parallel to $y = 2x + 5$ and passes through the point $(0, 18)$.

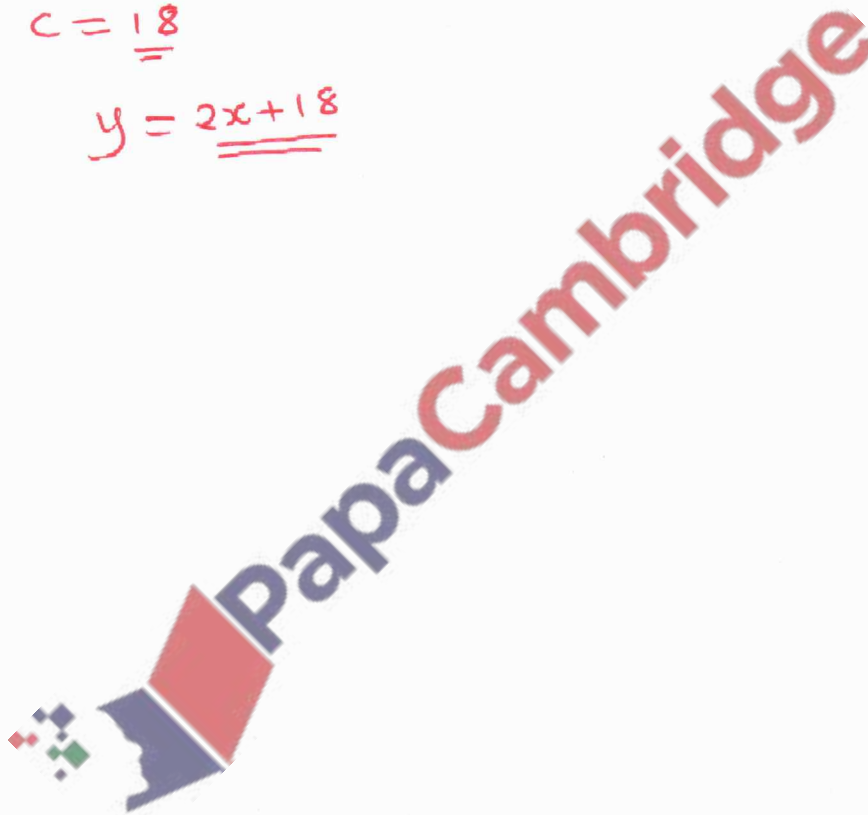*Parallel lines have same gradient*

$y = mx + c$

$18 = 2(0) + c$

....*$y = 2x + 18$*.... [1]

$c = 18$

$y = 2x + 18$

9 **(a)** Complete the table of values for $y = \dfrac{12}{x}$, $x \neq 0$.

x	-6	-4	-3	-2	-1		1	2	3	4	6
y	-2	-3	-4	-6	-12		12	6	4	3	2

[3]

(b) On the grid, draw the graph of $y = \dfrac{12}{x}$ for $-6 \leqslant x \leqslant -1$ and $1 \leqslant x \leqslant 6$.

$y = 5$
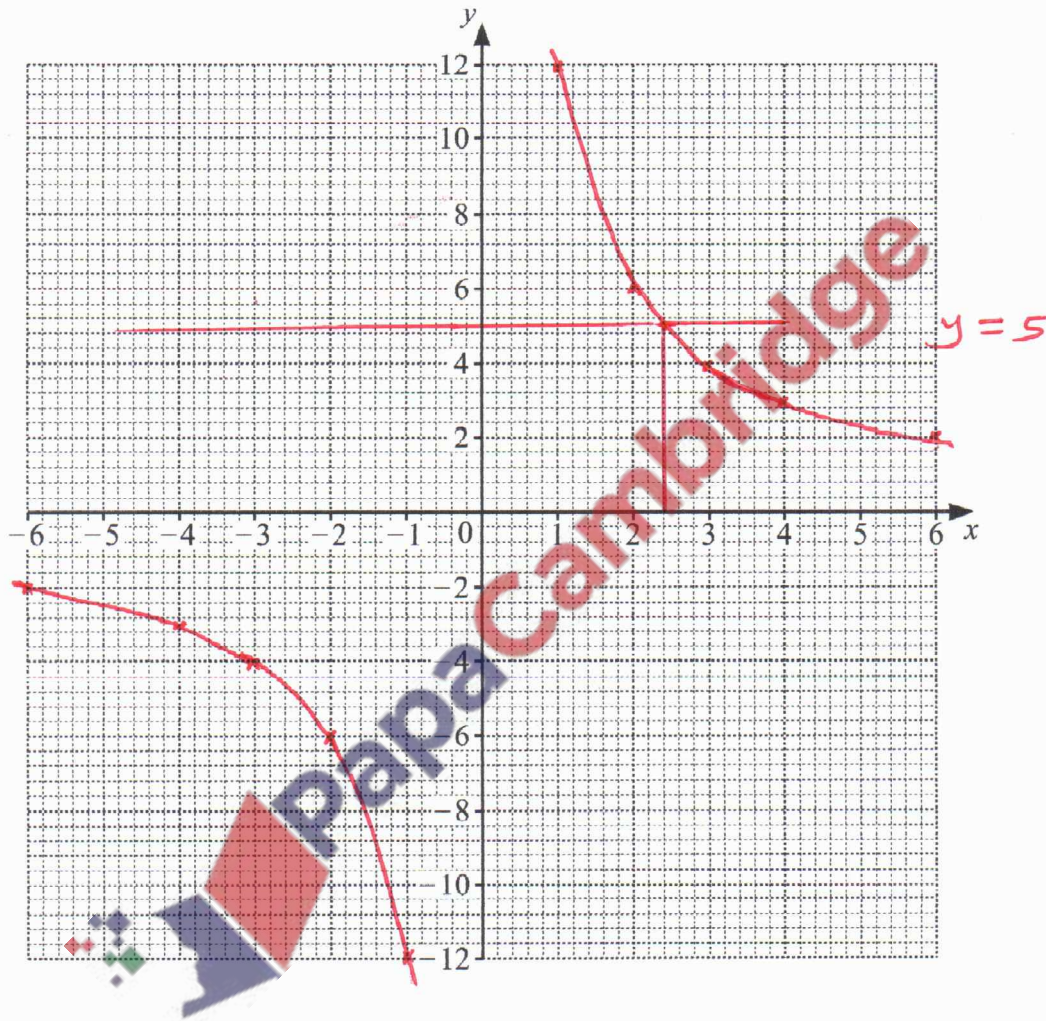
[4]

(c) On the grid, draw the line $y = 5$. [1]

(d) Use your graph to solve the equation $\dfrac{12}{x} = 5$.

$y = \dfrac{12}{x}$

$\dfrac{12}{x} = 5$ $x = 2.4$

$x =$ ....2.4............... [1]