

1 A factory produces bird food made with sunflower seed, millet and maize.

(a) The amounts of sunflower seed, millet and maize are in the ratio

sunflower seed : millet : maize = 5 : 3 : 1 .

(i) How much millet is there in 15 kg of bird food?

Answer(a)(i) kg [2]

(ii) In a small bag of bird food there is 60 g of sunflower seed.

What is the mass of bird food in a small bag?

Answer(a)(ii) g [2]

(b) Sunflower seeds cost \$204.50 for 30 kg from Jon's farm or €96.40 for 20 kg from Ann's farm.
The exchange rate is \$1 = €0.718.

Which farm has the cheapest price per kilogram?

You must show clearly all your working.

Answer(b) [4]

- (c) Bags are filled with bird food at a rate of 420 grams per second.

How many 20 kg bags can be **completely** filled in 4 hours?

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Answer(c) [3]

- (d) Brian buys bags of bird food from the factory and sells them in his shop for \$15.30 each. He makes 12.5% profit on each bag.

How much does Brian pay for each bag of bird food?

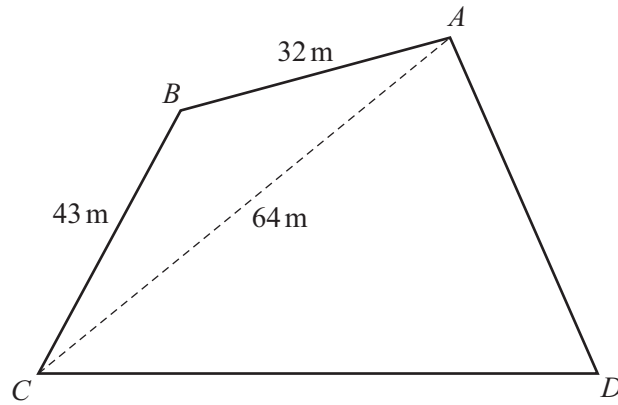
Answer(d) \$ [3]

- (e) Brian orders 600 bags of bird food.

The probability that a bag is damaged is $\frac{1}{50}$.

How many bags would Brian expect to be damaged?

Answer(e) [1]



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The diagram represents a field in the shape of a quadrilateral $ABCD$.
 $AB = 32$ m, $BC = 43$ m and $AC = 64$ m.

- (a) (i) Show clearly that angle $CAB = 37.0^\circ$ correct to one decimal place.

Answer(a)(i)

[4]

- (ii) Calculate the area of the triangle ABC .

Answer(a)(ii) m² [2]

- (b) $CD = 70$ m and angle $DAC = 55^\circ$.

Calculate the perimeter of the whole field $ABCD$.

Answer(b) m [6]

- 3 (a) (i) Factorise completely the expression $4x^2 - 18x - 10$.

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Answer(a)(i) [3]

- (ii) Solve $4x^2 - 18x - 10 = 0$.

Answer(a)(ii) $x =$ or $x =$ [1]

- (b) Solve the equation $2x^2 - 7x - 10 = 0$.

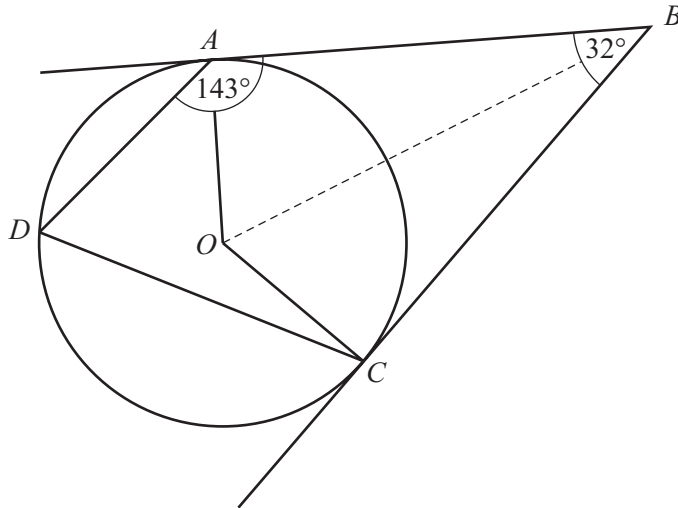
Show all your working and give your answers correct to two decimal places.

Answer(b) $x =$ or $x =$ [4]

- (c) Write $\frac{6}{3x-1} - \frac{2}{x-2}$ as a single fraction in its simplest form.

Answer(c) [3]

4 (a)

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Points A , C and D lie on a circle centre O .
 BA and BC are tangents to the circle.
 Angle $ABC = 32^\circ$ and angle $DAB = 143^\circ$.

(i) Calculate angle AOC in quadrilateral $AOCB$.

Answer(a)(i) Angle $AOC =$ [2]

(ii) Calculate angle ADC .

Answer(a)(ii) Angle $ADC =$ [1]

(iii) Calculate angle OCD .

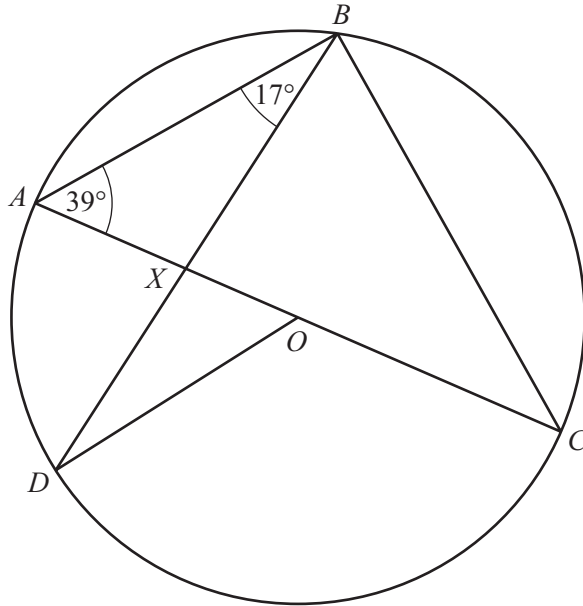
Answer(a)(iii) Angle $OCD =$ [2]

(iv) $OA = 6$ cm.

Calculate the length of AB .

Answer(a)(iv) $AB =$ cm [3]

(b)

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A, B, C and D are on the circumference of the circle centre O .
 AC is a diameter.
 Angle $CAB = 39^\circ$ and angle $ABD = 17^\circ$.

(i) Calculate angle ACB .

Answer(b)(i) Angle $ACB =$ [2]

(ii) Calculate angle BXC .

Answer(b)(ii) Angle $BXC =$ [2]

(iii) Give the reason why angle DOA is 34° .

Answer(b)(iii) [1]

(iv) Calculate angle BDO .

Answer(b)(iv) Angle $BDO =$ [1]

(v) The radius of the circle is 12 cm. Calculate the length of major arc $ABCD$.

Answer(b)(v) Arc $ABCD =$ cm [3]

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- 5 (a) A farmer takes a sample of 158 potatoes from his crop. He records the mass of each potato and the results are shown in the table.

Mass (m grams)	Frequency
$0 < m \leq 40$	6
$40 < m \leq 80$	10
$80 < m \leq 120$	28
$120 < m \leq 160$	76
$160 < m \leq 200$	22
$200 < m \leq 240$	16

Calculate an estimate of the mean mass.
Show all your working.

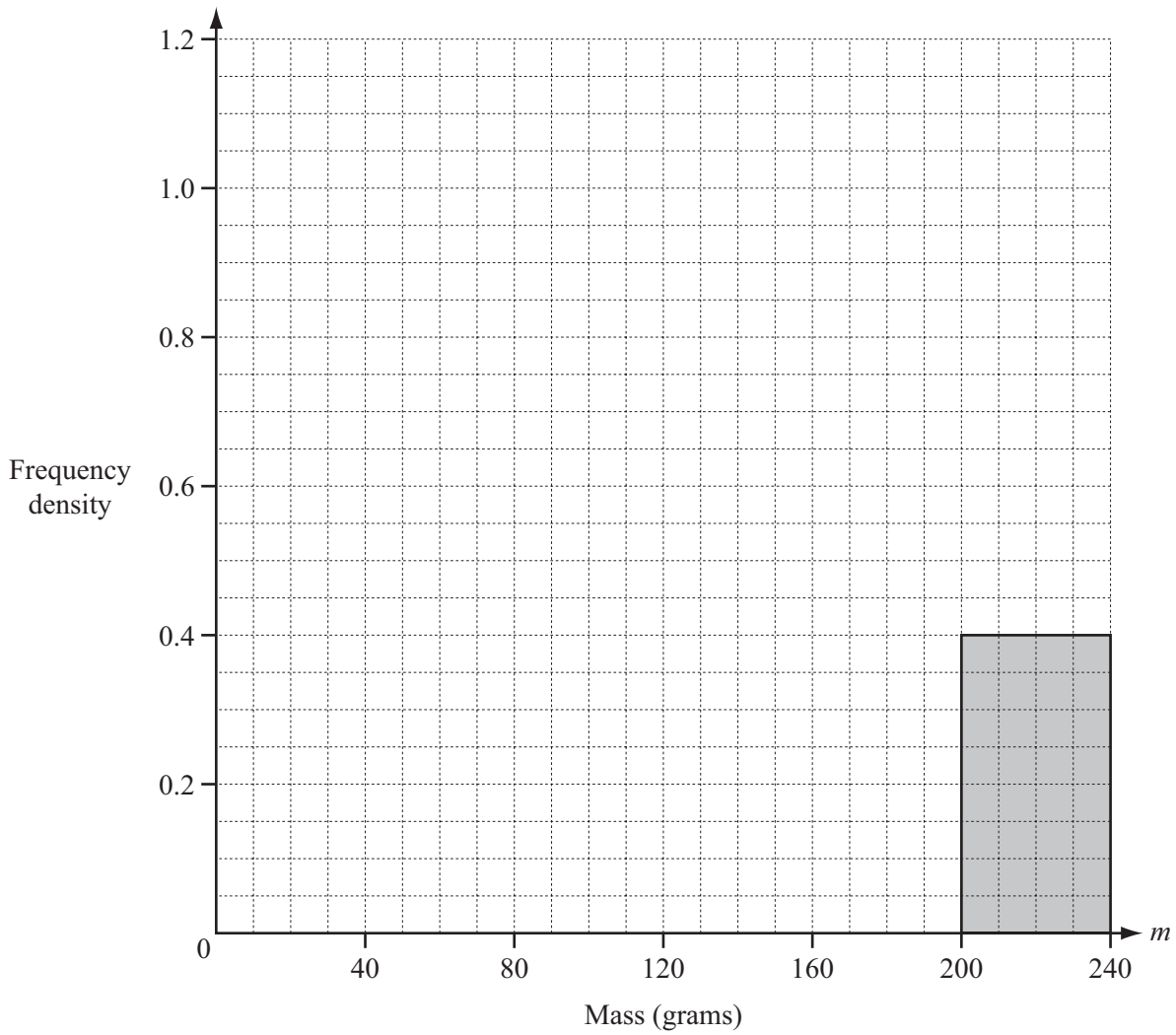
Answer(a) g [4]

- (b) A new frequency table is made from the results shown in the table in **part (a)**.

Mass (m grams)	Frequency
$0 < m \leq 80$	
$80 < m \leq 200$	
$200 < m \leq 240$	16

- (i) Complete the table above. [2]
- (ii) On the grid opposite, complete the histogram to show the information in this new table.

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[3]

- (c) A bag contains 15 potatoes which have a mean mass of 136 g.
The farmer puts 3 potatoes which have a mean mass of 130 g into the bag.

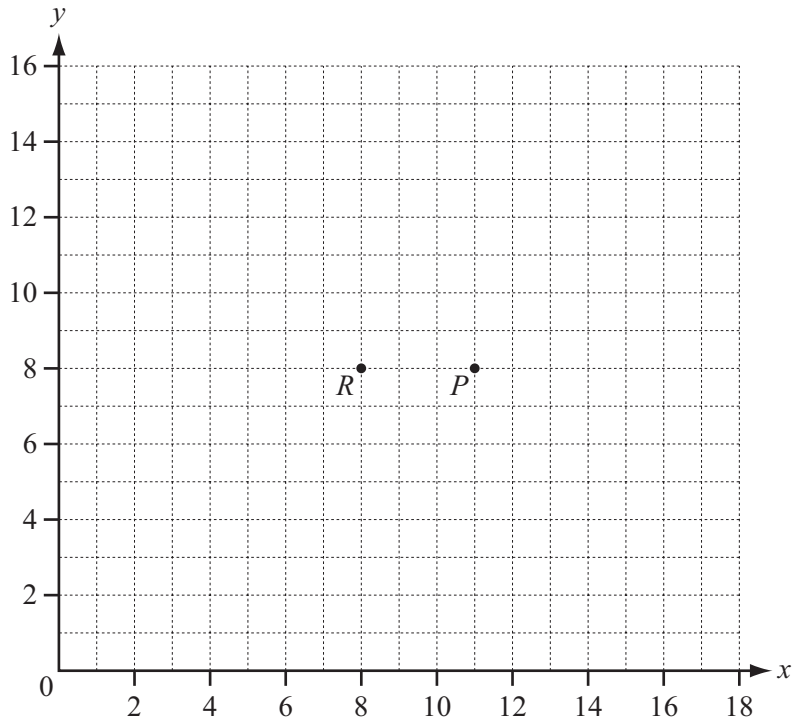
Calculate the mean mass of all the potatoes in the bag.

Answer(c) g [3]

6 (a) Calculate the magnitude of the vector $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$.

Answer(a) [2]

(b)



(i) The points P and R are marked on the grid above.

$\vec{PQ} = \begin{pmatrix} 3 \\ -5 \end{pmatrix}$. Draw the vector \vec{PQ} on the grid above. [1]

(ii) Draw the image of vector \vec{PQ} after rotation by 90° anticlockwise about R . [2]

(c) $\vec{DE} = 2\mathbf{a} + \mathbf{b}$ and $\vec{DC} = 3\mathbf{b} - \mathbf{a}$.

Find \vec{CE} in terms of \mathbf{a} and \mathbf{b} . Write your answer in its simplest form.

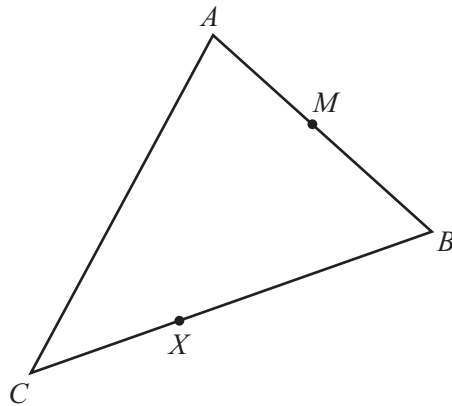
Answer(c) $\vec{CE} =$ [2]

(d) $\vec{OT} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ and $\vec{OV} = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$.

Write \vec{TV} as a column vector.

Answer(d) $\vec{TV} = \begin{pmatrix} \\ \end{pmatrix}$ [2]

(e)



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$\vec{AB} = \mathbf{b}$ and $\vec{AC} = \mathbf{c}$.

(i) Find \vec{CB} in terms of \mathbf{b} and \mathbf{c} .

Answer(e)(i) $\vec{CB} = \dots\dots\dots$ [1]

(ii) X divides CB in the ratio 1 : 3.
 M is the midpoint of AB .

Find \vec{MX} in terms of \mathbf{b} and \mathbf{c} .
Show all your working and write your answer in its simplest form.

Answer(e)(ii) $\vec{MX} = \dots\dots\dots$ [4]

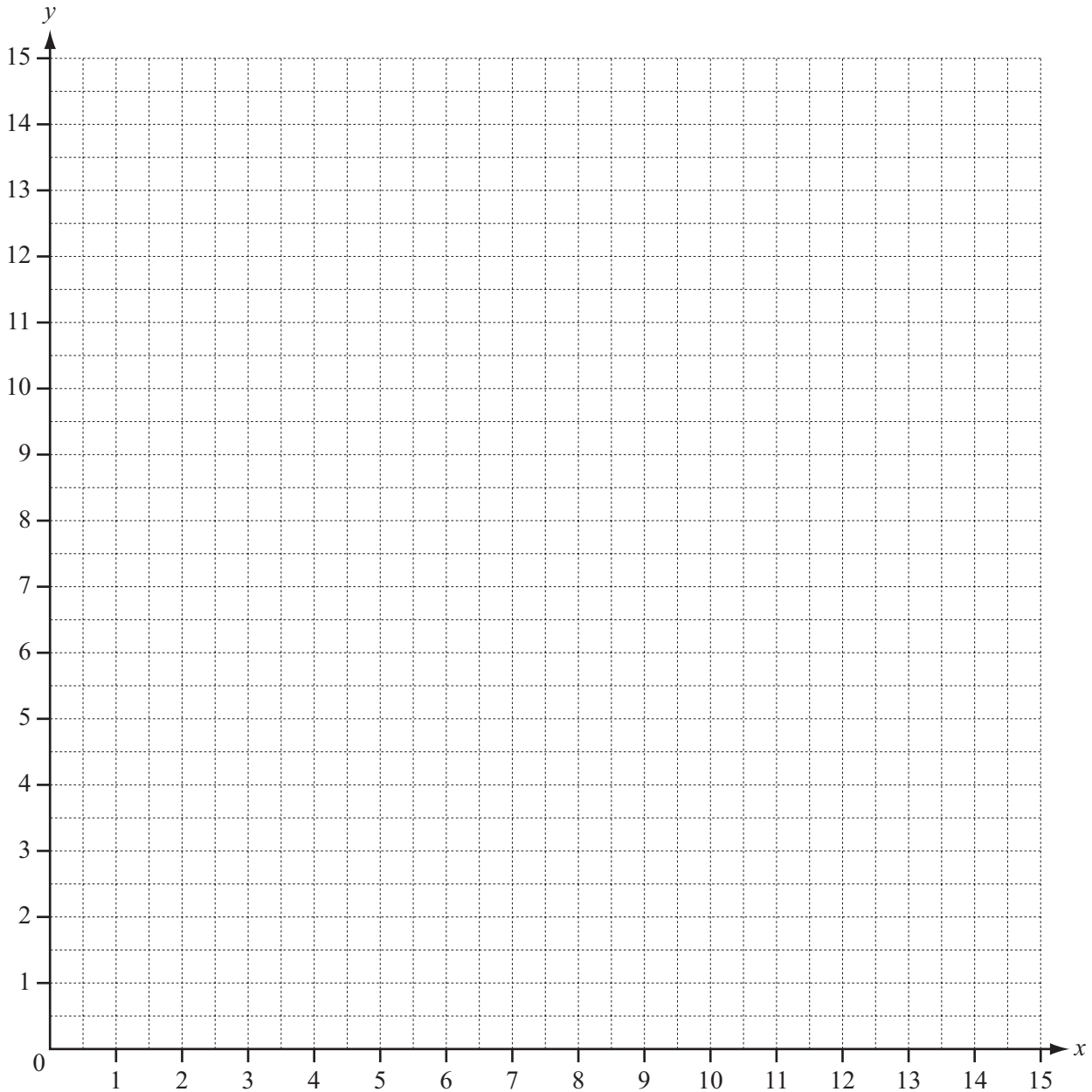
- 7 Jay makes wooden boxes in two sizes. He makes x small boxes and y large boxes.
 He makes at least 5 **small** boxes.
 The greatest number of **large** boxes he can make is 8.
 The greatest total number of boxes is 14.
 The number of **large** boxes is at least half the number of **small** boxes.

(a) (i) Write down four inequalities in x and y to show this information.

Answer(a)(i)

 [4]

(ii) Draw four lines on the grid and write the letter R in the region which represents these inequalities.



[5]

(b) The price of the small box is \$20 and the price of the large box is \$45.

(i) What is the greatest amount of money he receives when he sells all the boxes he has made?

Answer(b)(i) \$ [2]

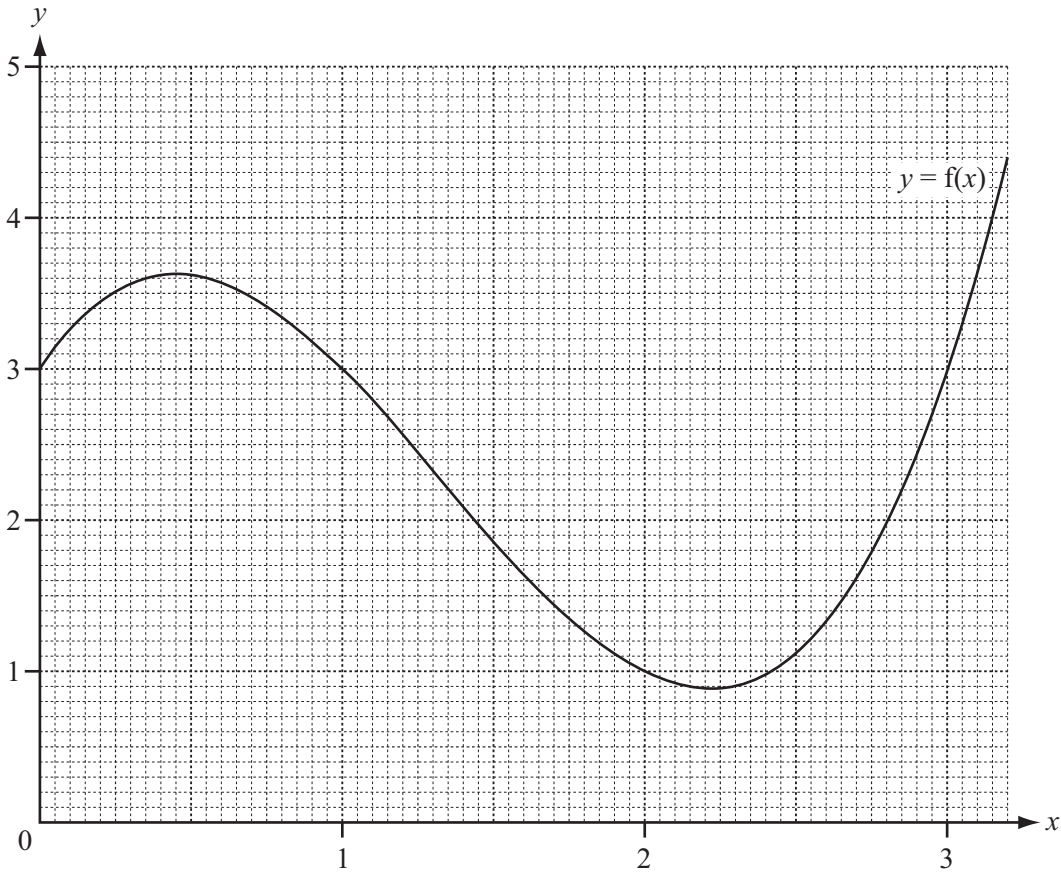
(ii) For this amount of money, how many boxes of each size did he make?

Answer(b)(ii) small boxes and large boxes [1]

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8 The graph of $y = f(x)$ is drawn on the grid for $0 \leq x \leq 3.2$.

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Use



(a) (i) Draw the tangent to the curve $y = f(x)$ at $x = 2.5$. [1]

(ii) Use your tangent to estimate the gradient of the curve at $x = 2.5$.

Answer(a)(ii) [2]

(b) Use the graph to solve $f(x) = 2$, for $0 \leq x \leq 3.2$.

Answer(b) $x =$ or $x =$ [2]

(c) $g(x) = \frac{x}{2} + \frac{2}{x^2} \quad x \neq 0.$

For
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- (i) Complete the table for values of $g(x)$, correct to 1 decimal place.

x	0.7	1	1.5	2	2.5	3
$g(x)$			1.6		1.6	1.7

[2]

- (ii) On the grid opposite, draw the graph of $y = g(x)$ for $0.7 \leq x \leq 3$.

[3]

- (iii) Solve $f(x) = g(x)$ for $0.7 \leq x \leq 3$.

Answer(c) (iii) $x = \dots\dots\dots$ or $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [3]

9 (a) $\mathcal{U} = \{25 \text{ students in a class}\}$

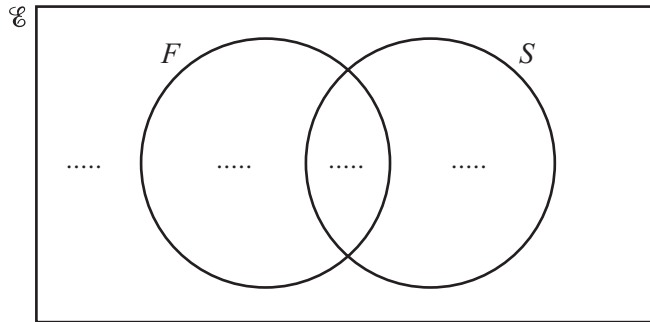
$F = \{\text{students who study French}\}$

$S = \{\text{students who study Spanish}\}$

16 students study French and 18 students study Spanish.

2 students study neither of these.

(i) Complete the Venn diagram to show this information.



(ii) Find $n(F')$.

[2]

Answer(a)(ii)

[1]

(iii) Find $n(F \cap S)'$.

Answer(a)(iii)

[1]

(iv) One student is chosen at random.

Find the probability that this student studies both French and Spanish.

Answer(a)(iv)

[1]

(v) Two students are chosen at random without replacement.

Find the probability that they both study only Spanish.

Answer(a)(v)

[2]

(b) In another class the students all study at least one language from French, German and Spanish.

No student studies all three languages.

The set of students who study German is a proper subset of the set of students who study French.

4 students study both French and German.

12 students study Spanish but not French.

9 students study French but not Spanish.

A total of 16 students study French.

(i) Draw a Venn diagram to represent this information.

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[4]

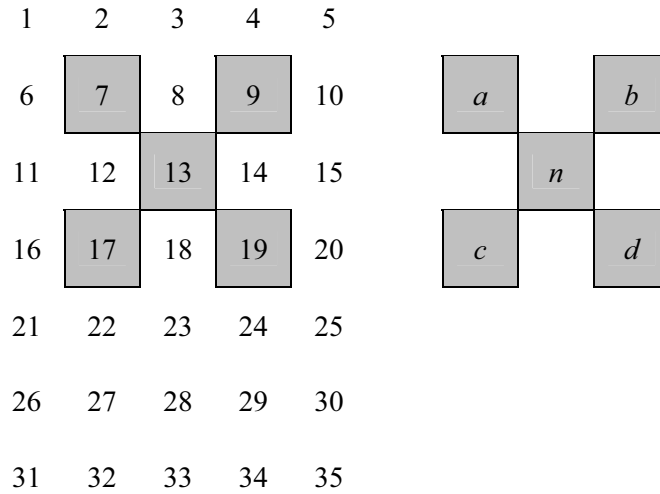
(ii) Find the total number of students in this class.

Answer(b)(ii) [1]

10 Consecutive integers are set out in rows in a grid.

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(a) This grid has 5 columns.



The shape drawn encloses five numbers 7, 9, 13, 17 and 19. This is the $n = 13$ shape.

In this shape, $a = 7, b = 9, c = 17$ and $d = 19$.

(i) Calculate $bc - ad$ for the $n = 13$ shape.

Answer(a)(i) [1]

(ii) For the 5 column grid, $a = n - 6$.

Write down b, c and d in terms of n for this grid.

Answer(a)(ii) $b =$

$c =$

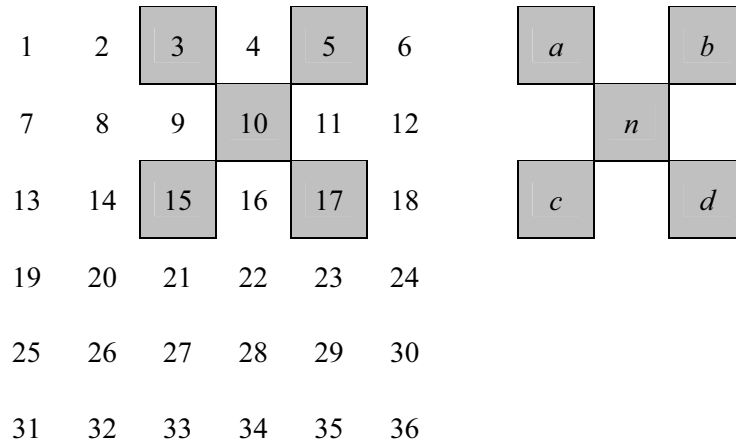
$d =$ [2]

(iii) Write down $bc - ad$ in terms of n .
Show clearly that it simplifies to 20.

Answer(a)(iii)

[2]

(b) This grid has 6 columns. The shape is drawn for $n = 10$.



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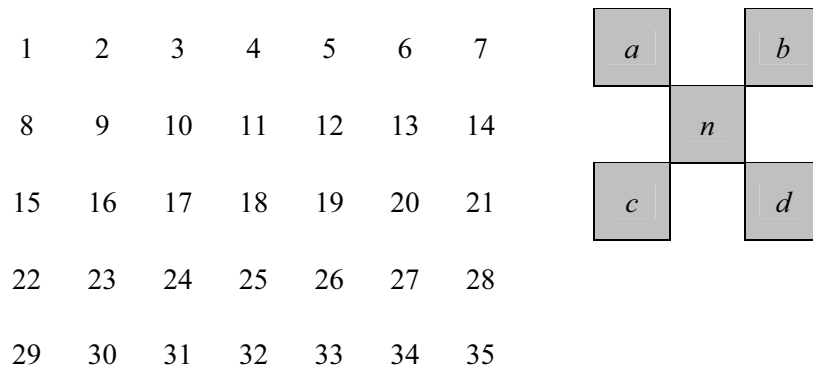
(i) Calculate the value of $bc - ad$ for $n = 10$.

Answer(b)(i) [1]

(ii) Without simplifying, write down $bc - ad$ in terms of n for this grid.

Answer(b)(ii) [2]

(c) This grid has 7 columns.



Show clearly that $bc - ad = 28$ for $n = 17$.

Answer(c)

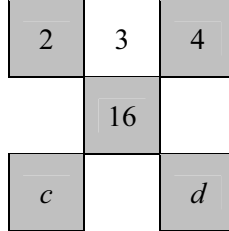
[1]

Question 10 continues on the next page.

(d) Write down the value of $bc - ad$ when there are t columns in the grid.

Answer(d) [1]

(e) Find the values of c , d and $bc - ad$ for this shape.



Answer (e) $c =$

$d =$

$bc - ad =$ [2]

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