



- 1 (a) Here is a list of ingredients to make 20 biscuits.

260g of butter  
 500g of sugar  
 650g of flour  
 425g of rice

- (i) Find the mass of rice as a percentage of the mass of sugar.

..... % [1]

- (ii) Find the mass of butter needed to make 35 of these biscuits.

..... g [2]

- (iii) Michel has 2 kg of each ingredient.

Work out the greatest number of these biscuits that he can make.

..... [3]

- (b) A company makes these biscuits at a cost of \$1.35 per packet.  
 These biscuits are sold for \$1.89 per packet.

- (i) Calculate the percentage profit the company makes on each packet.

..... % [3]

- (ii) The selling price of \$1.89 has increased by 8% from last year.

Calculate the selling price last year.

\$ ..... [3]

- (c) Over a period of 3 years, the company's sales of biscuits increased from 15.6 million packets to 20.8 million packets.

The sales increased exponentially by the same percentage each year.

Calculate the percentage increase **each year**.

..... % [3]

- (d) The people who work for the company are in the following age groups.

Group A	Group B	Group C
Under 30 years	30 to 50 years	Over 50 years

The ratio of the number in group A to the number in group B is 7 : 10.

The ratio of the number in group B to the number in group C is 4 : 3.

- (i) Find the ratio of the number in group A to the number in group C.  
Give your answer in its simplest form.

..... : ..... [3]

- (ii) There are 45 people in group C.

Find the total number of people who work for the company.

..... [3]

- 2 The time taken for each of 120 students to complete a cooking challenge is shown in the table.

Time ( $t$ minutes)	$20 < t \leq 25$	$25 < t \leq 30$	$30 < t \leq 35$	$35 < t \leq 40$	$40 < t \leq 45$
Frequency	44	32	28	12	4

- (a) (i) Write down the modal time interval.

.....  $< t \leq$  ..... [1]

- (ii) Write down the interval containing the median time.

.....  $< t \leq$  ..... [1]

- (iii) Calculate an estimate of the mean time.

..... min [4]

- (iv) A student is chosen at random.

Find the probability that this student takes more than 40 minutes.

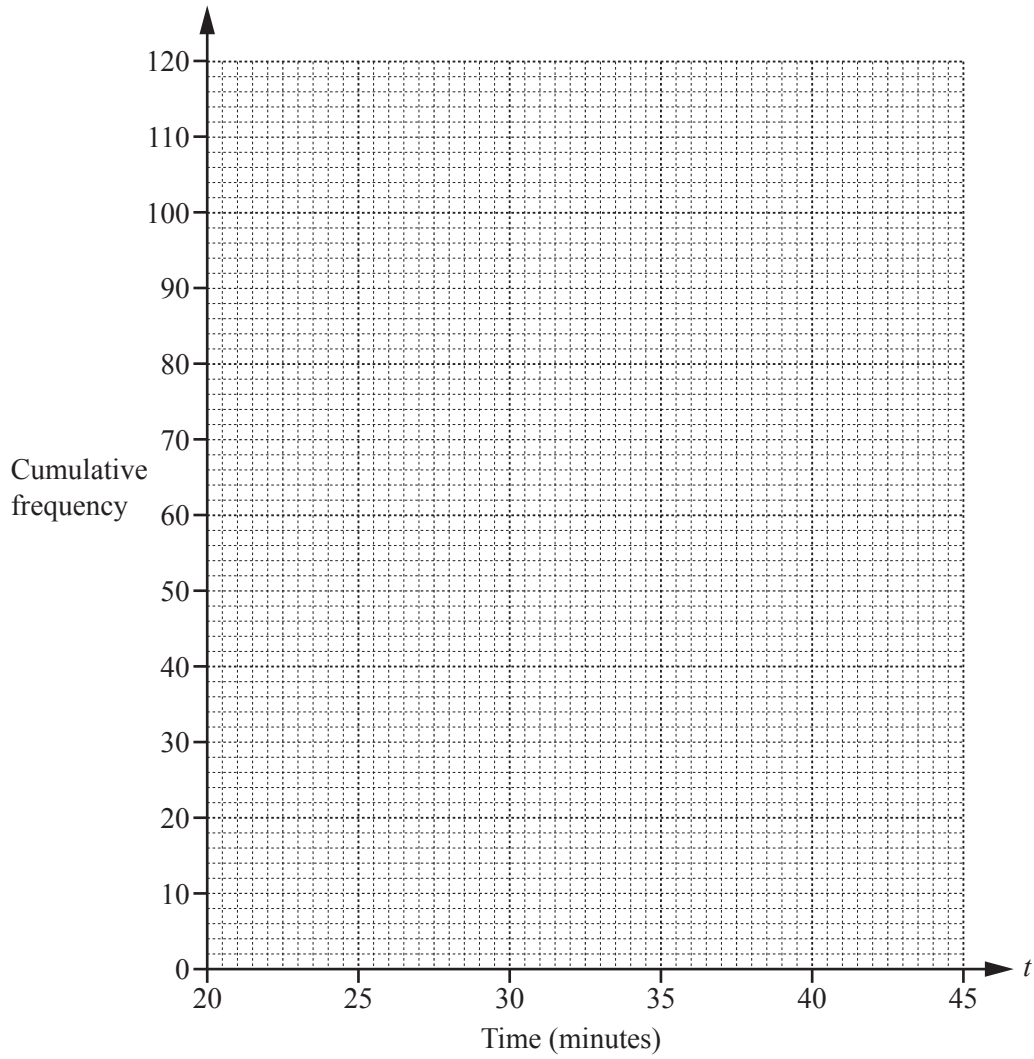
..... [1]

- (b) (i) Complete the cumulative frequency table.

Time ( $t$ minutes)	$t \leq 20$	$t \leq 25$	$t \leq 30$	$t \leq 35$	$t \leq 40$	$t \leq 45$
Cumulative frequency	0	44				

[2]

(ii) On the grid, draw a cumulative frequency diagram to show this information.



[3]

(iii) Find the median time.

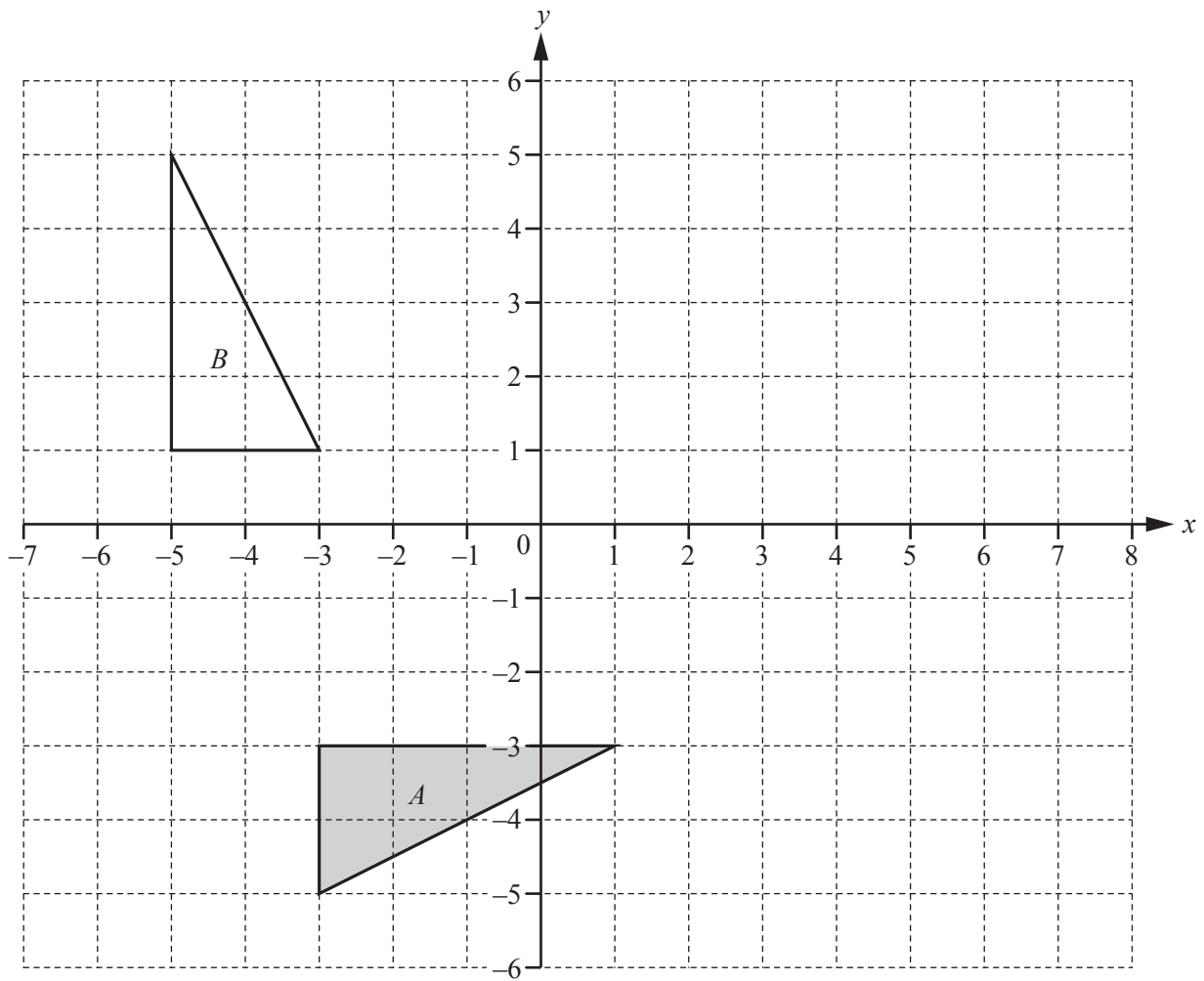
..... min [1]

(iv) Find the interquartile range.

..... min [2]

(v) Find the number of students who took more than 37 minutes to complete the cooking challenge.

..... [2]



(a) (i) Draw the image of triangle  $A$  after a reflection in the line  $x = 2$ . [2]

(ii) Draw the image of triangle  $A$  after a translation by the vector  $\begin{pmatrix} -2 \\ 4 \end{pmatrix}$ . [2]

(iii) Draw the image of triangle  $A$  after an enlargement by scale factor  $-\frac{1}{2}$ , centre  $(3, 1)$ . [3]

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

..... [3]

(c) Describe fully the **single** transformation represented by the matrix  $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$ .

..... [2]

4 (a) Simplify.

(i)  $(3p^2)^5$

..... [2]

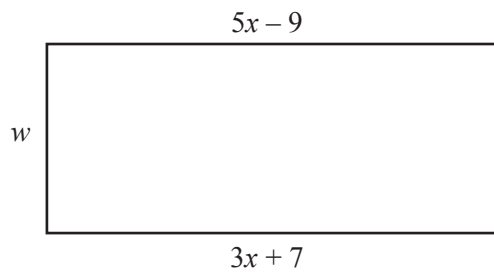
(ii)  $18x^2y^6 \div 2xy^2$

..... [2]

(iii)  $\left(\frac{5}{m}\right)^{-2}$

..... [1]

(b) In this part, all measurements are in metres.



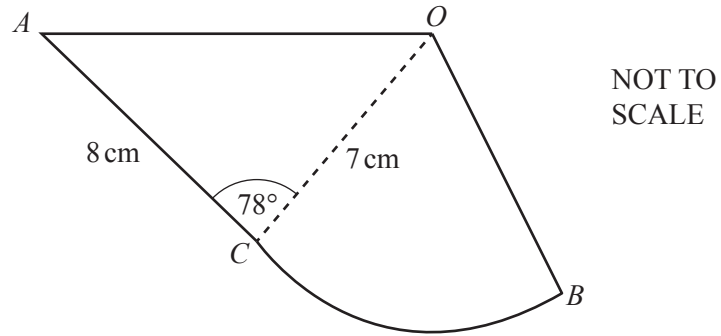
NOT TO  
SCALE

The diagram shows a rectangle.  
The area of the rectangle is  $310\text{ m}^2$ .

Work out the value of  $w$ .

$w =$  ..... [4]

5



The diagram shows a design made from a triangle  $AOC$  joined to a sector  $OCB$ .  
 $AC = 8$  cm,  $OB = OC = 7$  cm and angle  $ACO = 78^\circ$ .

- (a) Use the cosine rule to show that  $OA = 9.47$  cm, correct to 2 decimal places.

[4]

- (b) Calculate angle  $OAC$ .

Angle  $OAC = \dots\dots\dots$  [3]



(c) The perimeter of the design is 29.5 cm.

Show that angle  $COB = 41.2^\circ$ , correct to 1 decimal place.

[5]

(d) Calculate the total area of the design.

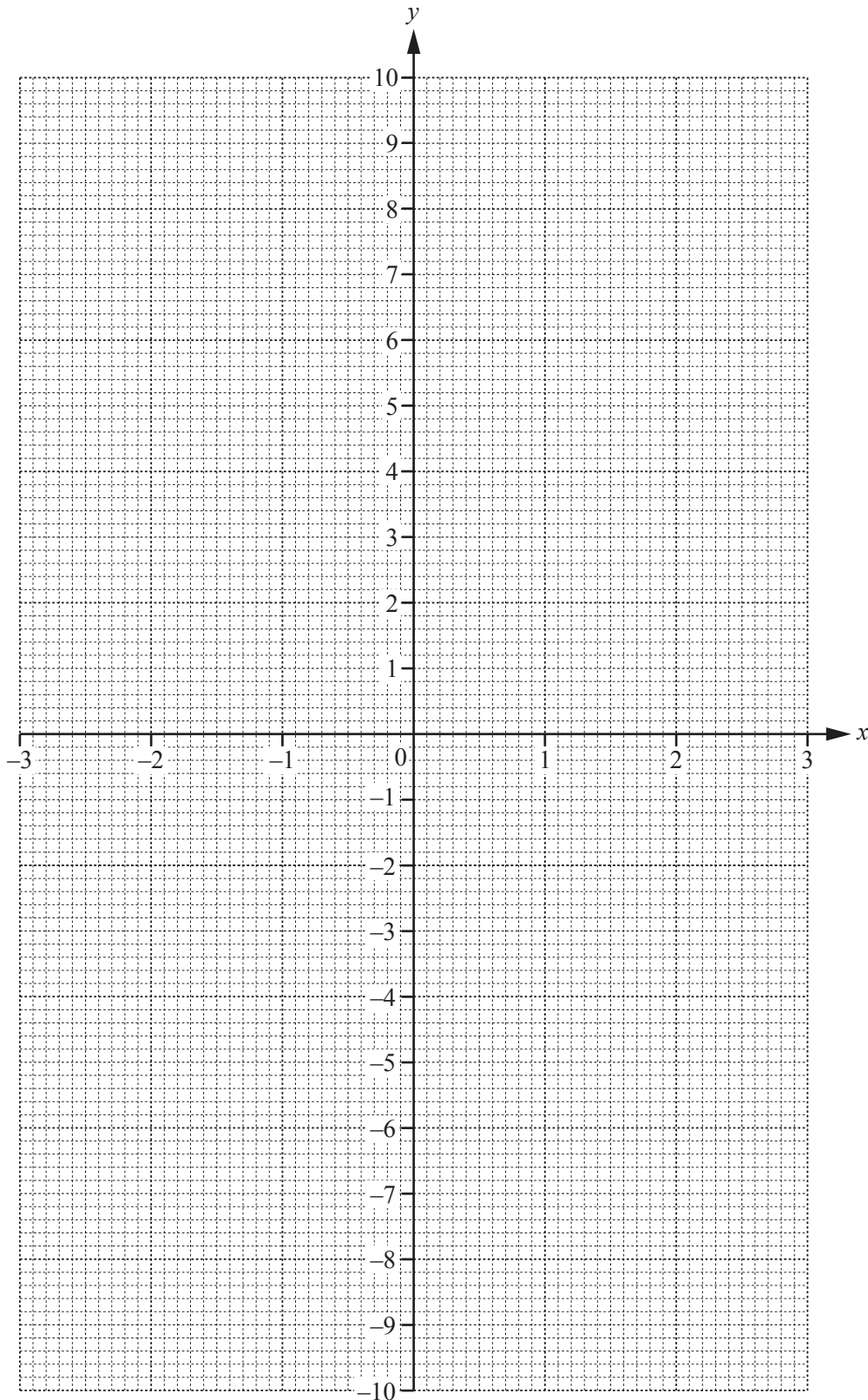
..... cm<sup>2</sup> [4]

- 6 (a) Complete the table of values for  $y = \frac{x^3}{3} - \frac{1}{2x^2}$ ,  $x \neq 0$ .

$x$	-3	-2	-1	-0.5	-0.3		0.3	0.5	1	2	3
$y$	-9.1	-2.8	-0.8		-5.6		-5.5	-2.0			8.9

[3]

- (b) On the grid, draw the graph of  $y = \frac{x^3}{3} - \frac{1}{2x^2}$  for  $-3 \leq x \leq -0.3$  and  $0.3 \leq x \leq 3$ .



[5]

(c) (i) By drawing a suitable tangent, find an estimate of the gradient of the curve at  $x = -2$ .

..... [3]

(ii) Write down the equation of the tangent to the curve at  $x = -2$ .  
Give your answer in the form  $y = mx + c$ .

$y =$  ..... [2]

(d) Use your graph to solve the equations.

(i)  $\frac{x^3}{3} - \frac{1}{2x^2} = 0$

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

(ii)  $\frac{x^3}{3} - \frac{1}{2x^2} + 4 = 0$

$x =$  ..... or  $x =$  ..... or  $x =$  ..... [3]

(e) The equation  $\frac{x^3}{3} - \frac{1}{2x^2} + 4 = 0$  can be written in the form  $ax^n + bx^{n-3} - 3 = 0$ .

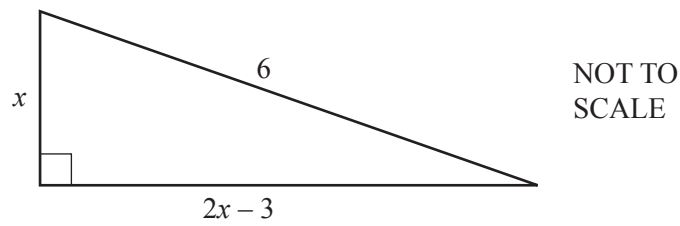
Find the value of  $a$ , the value of  $b$  and the value of  $n$ .

$a =$  .....

$b =$  .....

$n =$  ..... [3]

7 In this question, all measurements are in metres.



The diagram shows a right-angled triangle.

(a) Show that  $5x^2 - 12x - 27 = 0$ .

[3]

(b) Solve  $5x^2 - 12x - 27 = 0$ .  
Show all your working and give your answers correct to 2 decimal places.

$x = \dots\dots\dots$  or  $x = \dots\dots\dots$  [4]

(c) Calculate the perimeter of the triangle.

$\dots\dots\dots$  m [2]

(d) Calculate the smallest angle of the triangle.

$\dots\dots\dots$  [2]

8  $f(x) = 8 - 3x$        $g(x) = \frac{10}{x+1}, x \neq -1$        $h(x) = 2^x$

(a) Find

(i)  $hf\left(\frac{8}{3}\right)$ ,

..... [2]

(ii)  $gh(-2)$ ,

..... [2]

(iii)  $g^{-1}(x)$ ,

$g^{-1}(x) =$  ..... [3]

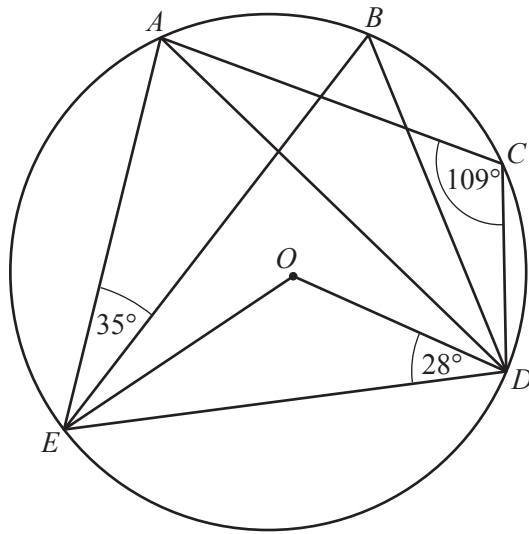
(iv)  $f^{-1}f(5)$ .

..... [1]

(b) Write  $f(x) + g(x)$  as a single fraction in its simplest form.

..... [3]

9 (a)



NOT TO SCALE

$A, B, C, D$  and  $E$  lie on the circle, centre  $O$ .  
 Angle  $AEB = 35^\circ$ , angle  $ODE = 28^\circ$  and angle  $ACD = 109^\circ$ .

(i) Work out the following angles, giving reasons for your answers.

(a) Angle  $EBD = \dots\dots\dots$  because  $\dots\dots\dots$   
 $\dots\dots\dots$   
 $\dots\dots\dots$  [3]

(b) Angle  $EAD = \dots\dots\dots$  because  $\dots\dots\dots$   
 $\dots\dots\dots$  [2]

(ii) Work out angle  $BEO$ .

Angle  $BEO = \dots\dots\dots$  [3]

(b) In a regular polygon, the interior angle is 11 times the exterior angle.

(i) Work out the number of sides of this polygon.

..... [3]

(ii) Find the sum of the interior angles of this polygon.

..... [2]

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