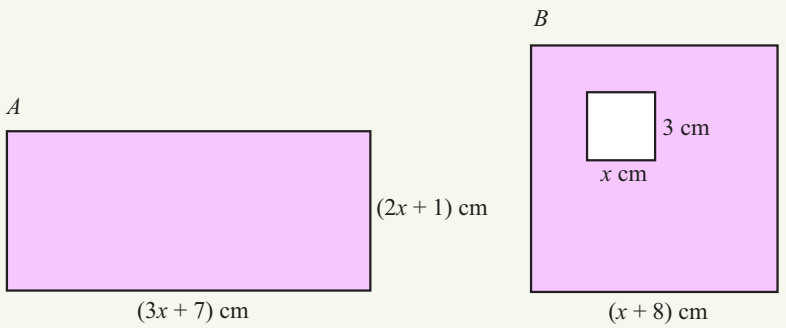
Examination practice: structured questions for Units 1–3

Exam-style questions

1 **a** Factorise the expression $5x^2 + 4x - 57$.

b The shaded regions in diagrams A (a rectangle) and B (a square with a section cut out) are equal in area.



i Show that the area of the shaded region in A is $6x^2 + 17x + 7$ cm^2.

ii Show that the area of the shaded region in B is $x^2 + 13x + 64$ cm^2.

iii Use your answers in (i) and (ii) to show that $5x^2 + 4x - 57 = 0$.

iv Hence find the dimensions of rectangle A.

2 A bag contains n white tiles and five black tiles. The tiles are all equal in shape and size. A tile is drawn at random and is replaced. A second tile is then drawn.

a Find:

i the probability that the first tile is white

ii the probability that both the first and second tiles are white.

b You are given that the probability of drawing two white tiles is $\frac{7}{22}$. Show that:

$3n^2 - 17n - 28 = 0$.

c Solve the equation, $3n^2 - 17n - 28 = 0$, and hence find the probability that exactly one white and exactly one black tile is drawn.

3 $p = 2^x$ and $q = 2^y$.

a Find, in terms of p and q:

i 2^{x+y}

ii 2^{x+y-2}

iii 2^{3x}.

b You are now given that:

$p^2q = 16$ and $\frac{q^2}{p} = 32$.

Find the values of x, y, p, and q.

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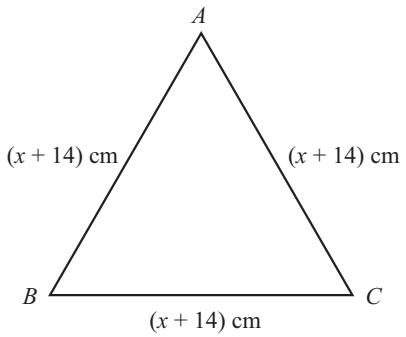
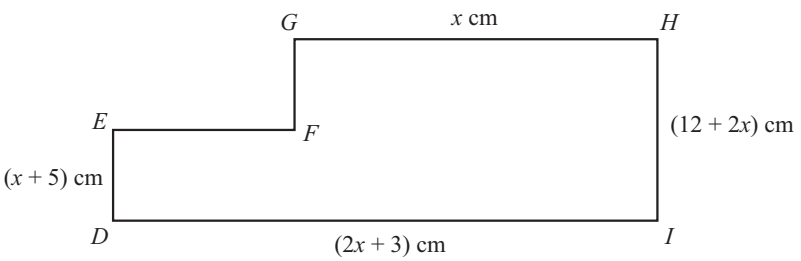
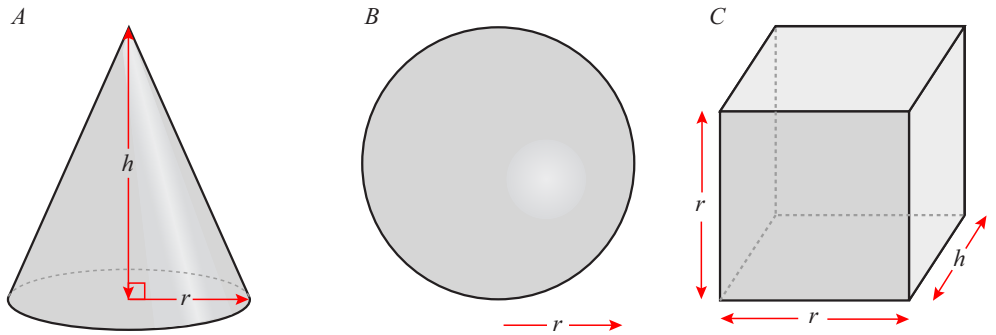




a Find the perimeter of triangle *ABC*. Simplify your answer as fully as possible.
b Find the distance *EF* in terms of *x*.
c Find the distance *FG* in terms of *x*.
d Find the perimeter of shape *DEFGHI* in terms of *x*. Simplify your answer.
e You are given that the perimeters of both shapes are equal. Form an equation and solve it for *x*.
f Find the perimeters of both shapes and the area of *DEFGHI*.

5



The right cone, *A*, has perpendicular height *h* cm and base radius *r* cm.

The sphere, *B*, has a radius of *r* cm.

The cuboid, *C*, measures *r* cm × *r* cm× *h* cm.

a You are given that cone *A* and sphere *B* are equal in volume. Write down an equation connecting *r* and *h*, and show that $h = 4r$.

b The surface area of cuboid *C* is 98 cm^2. Form a second equation connecting *r* and *h*.

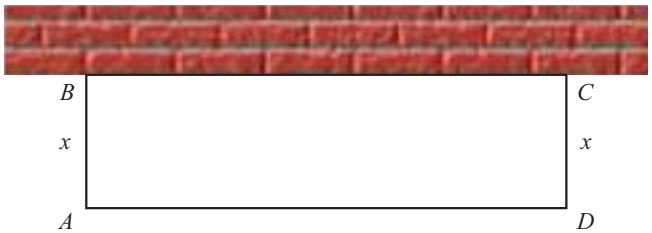
c Combine your answers to **(a)** and **(b)** to show that $r = \frac{7}{3}$.

d Find *h* and, hence, the volume of the cuboid.

6 **a** Express 60 and 36 as products of primes.
b Hence find the LCM of 60 and 36.
c Planet Carceron has two moons, Anderon and Barberon. Anderon completes a full orbit of Carceron every 60 days, and Barberon completes a full single orbit of Carceron in 36 days.
If Anderon, Barberon and Carceron lie on a straight line on 1 March 2010 on which date will this next be true?

7 **a** Factorise the expression $x^2 - 50x + 609$.
b Hence or otherwise solve the equation $2x^2 - 100x + 1218 = 0$.

A farmer wants to use 100 m of fencing to build three sides of the rectangular pen shown in the diagram:



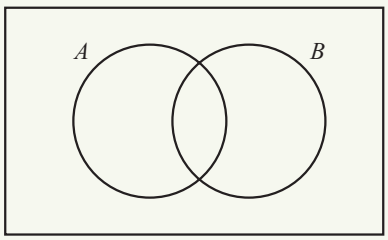
c Find an expression for the length AD in terms of x.
d Find an expression for the area of the pen in terms of x.
e The farmer wants the area of the pen to be exactly 1218 square metres. Using your answer to **(d)**, find and solve an equation for x and determine all possible dimensions of the pen.

E

8 If $\mathscr{E}$ = {integers}, $A = \{x : x \text{ is an integer and } -4 < x < 7\}$ and $B = \{x : x \text{ is a positive multiple of three}\}$:

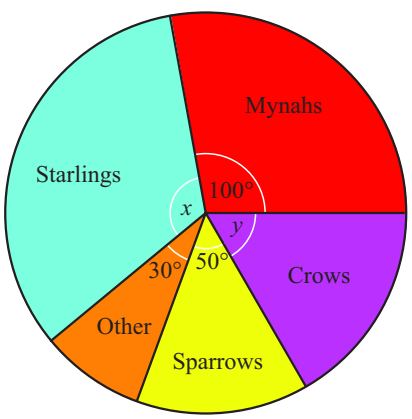
a list the elements of set A
b find $n(A \cap B)$
c describe in words the set $(A \cap B)'$.

9 Copy the diagram shown below twice and shade the sets indicated.



a $(A \cap B)'$
b $(A \cup B')' \cup (A \cap B)$

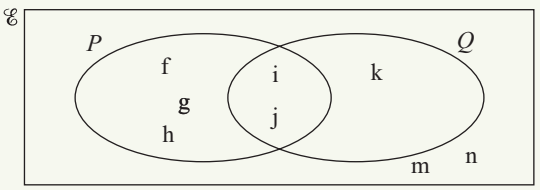
10 Mr Dane took a walk in the park and recorded the various types of birds that he saw. The results are shown in the pie chart below.



There were 30 Sparrows and 72 Starlings in the park.

a Calculate the number of Mynahs in the park.
b Calculate the angle x.
c Calculate the angle y.
d Calculate the number of Crows in the park.

Past paper questions

1 

a Use the information in the Venn diagram to complete the following

i $P \cap Q = \{ \ldots\ldots\ldots\ldots\ldots\ldots \}$ [1]

ii $P' \cup Q = \{ \ldots\ldots\ldots\ldots\ldots\ldots \}$ [1]

iii $n(P \cup Q)' = \{ \ldots\ldots\ldots\ldots\ldots\ldots \}$ [1]

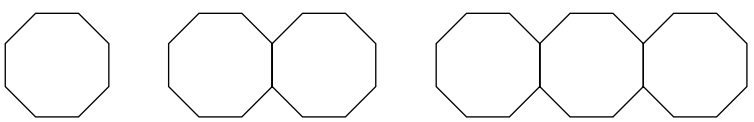
b A letter is chosen at random from the set Q.
Find the probability that it is also in the set P. [1]

c On the Venn diagram shade the region $P' \cap Q$. [1]

d Use a set notation symbol to complete the statement.
{f, g, h}.....P [1]

[Cambridge IGCSE Mathematics 0580 Paper 22 Q22 May/June 2014]

2 Here is a sequence of patterns made using identical polygons.



Pattern 1 Pattern 2 Pattern 3

a Write down the mathematical name of the polygon in Pattern 1. [1]

b Complete the table for the number of vertices (corners) and the number of lines in Pattern 3, Pattern 4 and Pattern 7. [5]

Pattern	1	2	3	4		7
Number of vertices	8	14				
Number of lines	8	15				

c **i** Find an expression for the number of **vertices** in Pattern n. [2]

ii Work out the number of vertices in Pattern 23. [1]

d Find an expression for the number of **lines** in Pattern n. [2]

e Work out an expression, in its simplest form, for
(number of lines in Pattern n) – (number of vertices in Pattern n). [2]

[Cambridge IGCSE Mathematics 0580 Paper 33 Q08 October/November 2013]

3 **a** Using only the integers from 1 to 50, find

i a multiple of both 4 and 7, [1]

ii a square number that is odd, [1]

iii an even prime number, [1]

iv a prime number which is one less than a multiple of 5. [1]

b Find the value of

i $\left(\sqrt{5}\right)^2$, [1]

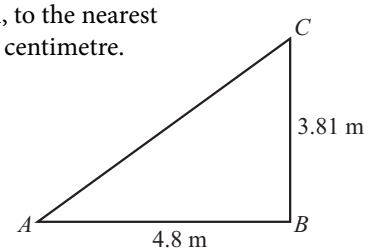
ii $2^{-3} \times 6^3$. [2]

[Cambridge IGCSE Mathematics 0580 Paper 33 Q03 October/November 2013]

Examination practice: structured questions for Units 4–6

Exam-style questions

1 The diagram shows a staircase. The height of the staircase is 3.81 m, to the nearest centimetre, and the horizontal distance AB is 4.62 m to the nearest centimetre.



a Find upper and lower bounds for:

i the height BC

ii the horizontal distance AB.

b Find the maximum possible distance AC.

c Find the maximum possible gradient of the line AC.

2 **a** Draw the graph of $y = x^2 - 6x + 8$ for $-1 \leq x \leq 6$ by creating a table and plotting points.

b On the same diagram draw the line $y = 6$ and hence solve the equation $x^2 - 6x + 2 = 0$.

c By drawing a suitable straight line on the same diagram solve the equation $x^2 - 8x + 13 = 0$.

3 The extension of a spring, x (measured in metres), is directly proportional to the mass, m (measured in kilograms), attached to the end. The extension of the spring is 30 cm when the mass is 5 kg.

a Find an equation connecting x with m.

b Find x if $m = 12$ kg.

c Find m if $x = 0.54$ m.

You are now given that the potential energy stored, E (measured in joules), in the spring is proportional to the square of the extension, x. When the extension is h metres, the energy stored is P joules.

d Find an equation connecting E and x (your answer will contain terms in P and h).

e Find the mass attached to the spring if the potential energy is $49P$ joules.

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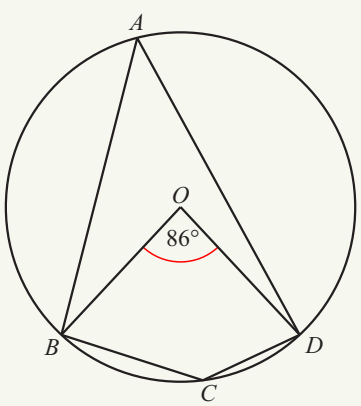


A, B, C and D are points on the circle, centre O. Angle $BOD = 86°$.

a **i** Work out the size of angle BAD.

ii Give a reason for your answer.

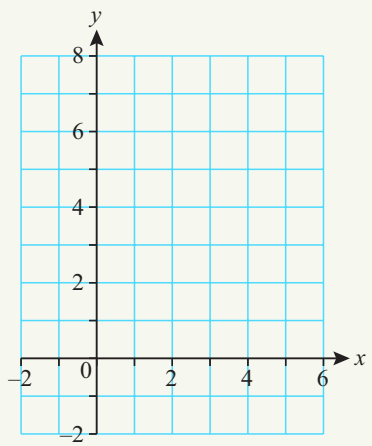
b **i** Work out the size of angle BCD.

ii Explain your answer fully.

5 **a** A pair of lines have equations:

$y = 2x - 1$ and $x + y = 5$.

Copy the axes shown below and draw both lines onto the same diagram.



b Hence solve the pair of simultaneous equations:

$y = 2x - 1$
$x + y = 5$

c By shading the **unwanted** region, illustrate the region which satisfies the three inequalities:

$y > 2x - 1$

$x + y < 5$

$x > 0$

6 A bag contains n white tiles and five black tiles. The tiles are all equal in shape and size. A tile is drawn at random and is *not* replaced. A second tile is then drawn.

a Find:

i the probability that the first tile is white
ii the probability that both the first and second tiles are white.

b You are given that the probability of drawing two white tiles is $\frac{7}{22}$.

Show that:

$3n^2 - 17n - 28 = 0$

c Solve the equation, $3n^2 - 17n - 28 = 0$, and hence find the probability that exactly one white and exactly one black tile is drawn.

Past paper questions

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? [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? [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. [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? [3]

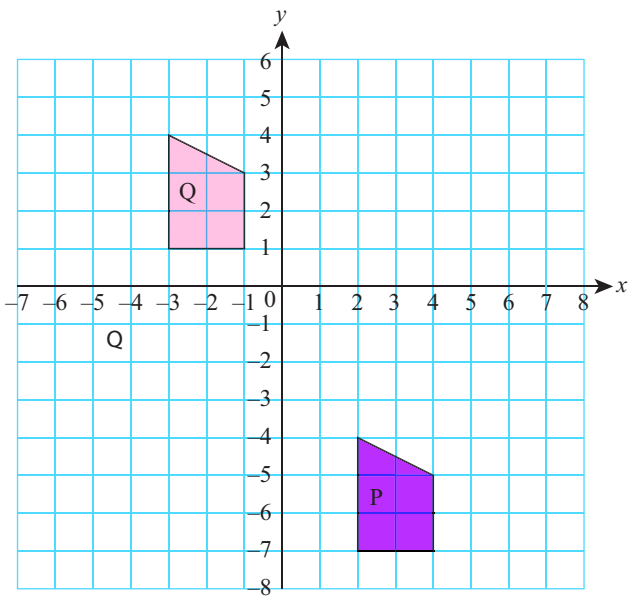
E

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? [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? [1]

[Cambridge IGCSE Mathematics 0580 Paper 42 Q01 October/November 2012]

2



i Describe **fully** the single transformation which maps shape *P* onto shape *Q*. [2]

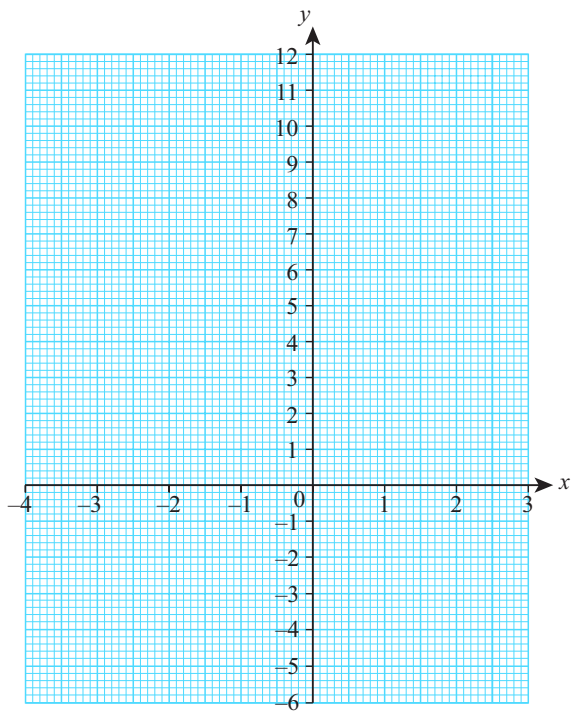
ii On the grid above, draw the image of shape *P* after reflection in the line $y = -1$. [2]

[Cambridge IGCSE Mathematics 0580 Paper 42 Q02 a May/June 2013]

3 **a** Complete the table of values for $y = x^2 + 2x - 4$. [3]

x	−4	−3	−2	−1	0	1	2	3
y	4		−4		−4			11

b On the grid, draw the graph of $y = x^2 + 2x - 4$ for $-4 \leqslant x \leqslant 3$. [4]



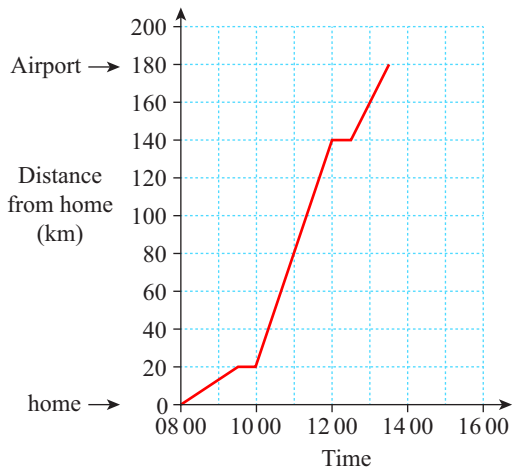
c **i** Draw the line of symmetry on the graph. [1]

ii Write down the equation of this line of symmetry. [1]

d Use your graph to solve the equation $x^2 + 2x - 4 = 3$ [2]

[Cambridge IGCSE Mathematics 0580 Paper 33 Q09 October/November 2012]

4 **a** The travel graph shows Helva's journey from her home to the airport.



i What happened at 09 30? [1]

ii Work out the time taken to travel from home to the airport.
Give your answer in hours and minutes. [1]

iii Calculate Helva's average speed for the whole journey from home to the airport. [2]

iv Between which two times was Helva travelling fastest? [1]

v Helva's husband left their home at 11 00 and travelled directly to the airport.
He arrived at 15 30. Complete the travel graph for his journey. [1]

b Helva and her husband are flying from Finland to India.
Their plane takes off at 17 00 and arrives in India 7 hours 25 minutes later.

The time in India is $3\frac{1}{2}$ hours ahead of the time in Finland.

i What is the local time in India when the plane arrives? [2]

ii The temperature is –3°C in Finland and 23°C in India.
Write down the difference between these two temperatures. [1]

c Helva exchanged 7584 rupees for euros (€).
The exchange rate was 1€ = 56 rupees.
How many euros did Helva receive?
Give your answer correct to 2 decimal places. [2]

[Cambridge IGCSE Mathematics 0580 Paper 33 Q02 October/November 2012]

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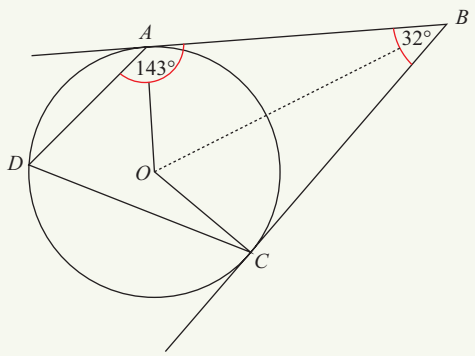

NOT TO SCALE

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

i Calculate angle *AOC* in quadrilateral *AOCB*. [2]

ii Calculate angle *ADC*. [1]

iii Calculate angle *OCD*. [2]

iv **a** *OA* = 6 cm.
Calculate the length of *AB*. [3]

[Cambridge IGCSE Mathematics 0580 Paper 42 Q04 a October/November 2012]

6 a i Factorise completely the expression $4x^2 - 18x - 10$. [3]

ii Solve $4x^2 - 18x - 10 = 0$. [1]

b Solve the equation $2x^2 - 7x - 10 = 0$.
Show all your working and give your answers correct to two decimal places. [4]

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

[Cambridge IGCSE Mathematics 0580 Paper 42 Q03 October/November 2012]

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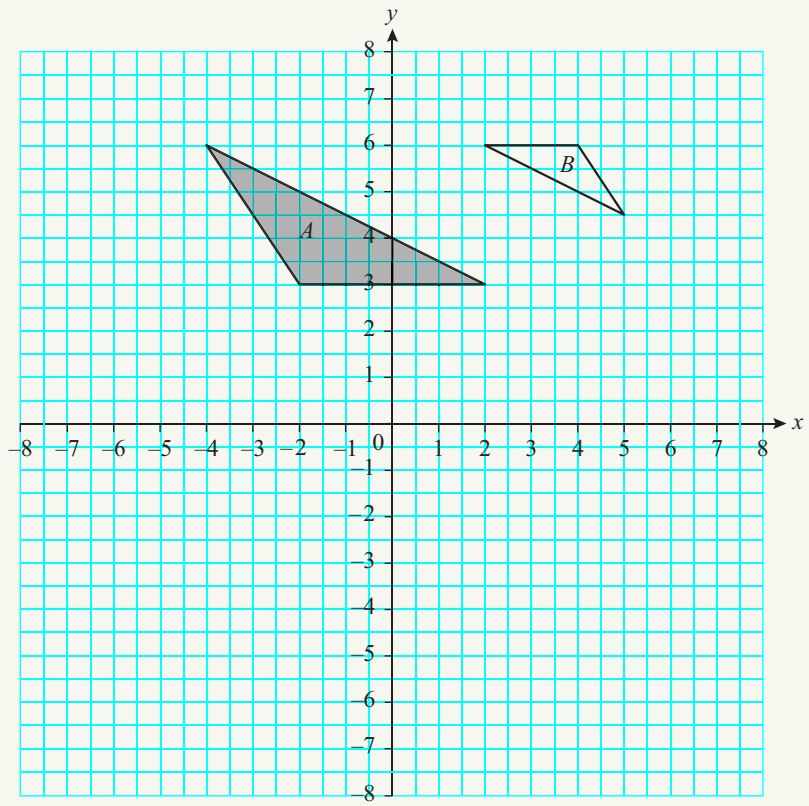

a Describe fully the **single** transformation that maps triangle *A* onto triangle *B*. [3]

b On the grid, draw the image of

i triangle *A* after a reflection in the line $x = -3$, [2]

ii triangle *A* after a rotation about the origin through 270° anticlockwise, [2]

iii triangle *A* after a translation by the vector $\begin{pmatrix} -1 \\ -5 \end{pmatrix}$. [2]

[Cambridge IGCSE Mathematics 0580 Paper 42 Q4 October/November 2014]