

Transformations and combining them

About 50 minutes No calculator 39 marks



Hints online, answers free with an account:
mathswariz.uk/worksheets/gcse-transformations-and-combinations/

Date _____

A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

A1 Needed today [2 marks] **A2** Last lesson [2 marks]

Find the distance between the points $(-2, 4)$ and $(-11, -8)$.

Answer

Triangles ABC and PQR are congruent, with A matching P , B matching Q and C matching R . $BC = (4x + 1)$ cm and $QR = (7x - 8)$ cm. Find the length of BC .

Answer

A3 From chapter 5 [2 marks] **A4** Key Stage 3 [2 marks]

A machine bought for £4900 loses 20% of its value each year. Work out its value after 2 years.

Answer

Write $\frac{7^4 \times 7^8}{7^9}$ as a single power of 7.

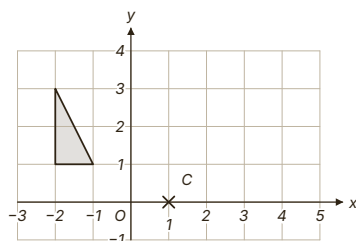
Answer

B Example, then your turn

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

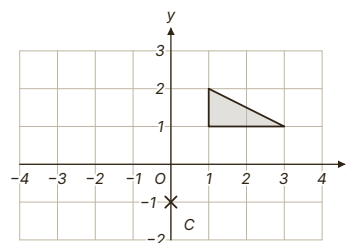
Rotate the triangle 90° clockwise about $C(1, 0)$.



Hint Turn each line from C to a corner a quarter turn.

B1 [2 marks]

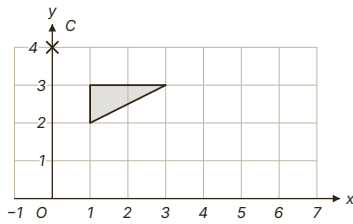
Rotate the triangle 90° anticlockwise about $C(0, -1)$. Give the new vertices.



Answer

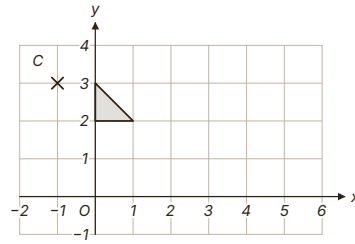
EXAMPLE 2

Enlarge the triangle by scale factor 2, centre $C(0, 4)$.



Hint Multiply each step from C to a corner by 2.

B2 Enlarge the triangle by scale factor 3, centre $C(-1, 3)$. Give the new vertices. [2 marks]



Answer

c Practice

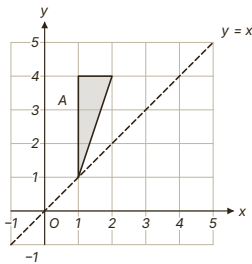
C1 Shape X has rotational symmetry of order 8. Work out the smallest turn that maps X onto itself. Shape Y first fits onto itself after 40° . Give its order. [2 marks]

Answer $^\circ$ order

C2 A translation maps $P(4, -1)$ onto $P'(-2, 3)$. Write down its column vector. The same translation maps Q onto $Q'(1, -5)$. Find Q . [2 marks]

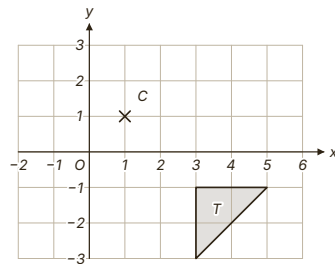
Answer vector $Q(\text{.....}, \text{.....})$

C3 Reflect triangle A in the line $y = x$. Give the vertices of the image. Which vertex of A is invariant? Why? [3 marks]



Answer ; invariant

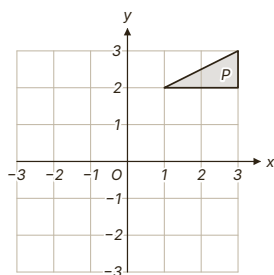
C4 Enlarge triangle T by scale factor $-\frac{1}{2}$, centre $C(1, 1)$. Write down the coordinates of the vertices of the image. [3 marks]



Answer

D Exam-style questions

D1 Triangle P is shown on the grid.



- (a) Rotate triangle P 90° clockwise about $(0, 0)$. Label the image Q . Write down the coordinates of the vertices of Q . [2 marks]

Answer

- (b) Reflect triangle Q in the y -axis. Label the image R . Write down the coordinates of the vertices of R . [2 marks]

Answer

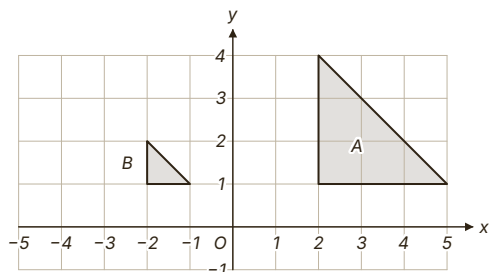
- (c) Describe fully the single transformation that maps triangle P onto triangle R . [2 marks]

Answer

Total for D1: 6 marks

D2 Sam says, "Triangle B is an enlargement of triangle A with scale factor 3."

Triangles A and B are shown on a grid of centimetre squares.



- (a) Explain why Sam is wrong, and say which enlargement does have scale factor 3. [2 marks]

- (b) Describe fully the single transformation that maps triangle A onto triangle B . [3 marks]

Answer

- (c) Triangle A is enlarged by scale factor -2 , centre $(0, 0)$, to give triangle C . Work out the area of triangle C . [2 marks]

Answer

Total for D2: 7 marks

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1** A rotation of 90° clockwise maps the point $P(2, 1)$ onto $P'(5, -2)$. Find the coordinates of the centre of the rotation. Then find the image of $(0, 0)$ under the same rotation. [4 marks]

Answer centre (.....,) image (.....,)

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** The centre is the same distance from P as from P' , and the turn about it is a quarter turn.
- Hint 2** Call the centre (a, b) . The step from the centre to P is $(2 - a, 1 - b)$. A quarter turn clockwise makes a step (u, v) into $(v, -u)$.
- Hint 3** So $P' = (a + 1 - b, b - 2 + a) = (5, -2)$. That gives $a - b = 4$ and $a + b = 0$.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

I can rotate, reflect, translate and enlarge a shape, and describe each one fully. ☐ ☐ ☐

I can enlarge by a fractional or a negative scale factor from any centre. ☐ ☐ ☐

I can replace two transformations by one, and find invariant points. ☐ ☐ ☐