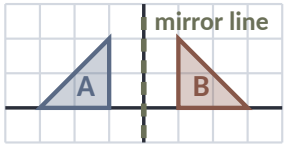
Transformations: fact sheet

Planner week 14 · Learn these facts

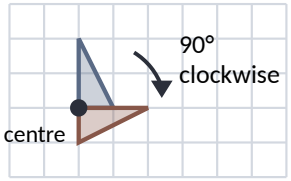
Reflection · flip



Each point is the **same distance** from the mirror line on the other side

Say: reflection in the line ...

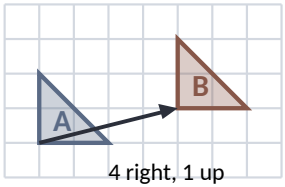
Rotation · turn



Turn the shape around a **centre**. Tracing paper helps

Say: angle, direction, centre

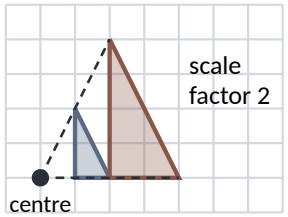
Translation · slide



Every point moves the **same way**. Same shape, same way up

Say: translation by the vector ...

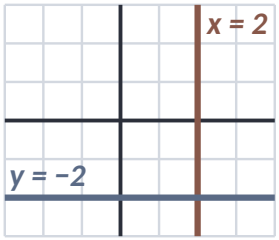
Enlargement · resize



Every length × the **scale factor**. Lines from the centre

Say: scale factor and centre

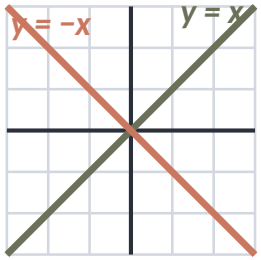
Vertical and horizontal lines



x = number is **vertical**; y = number is **horizontal**

$x = 2$ goes through 2 on the x-axis

Diagonal lines



Points on $y = x$: (1, 1), (2, 2) ...
On $y = -x$: (1, −1) ...

The x-axis is $y = 0$; the y-axis is $x = 0$

Column vectors

$\begin{pmatrix} 4 \\ 1 \end{pmatrix}$ top: **right +**, left −
bottom: **up +**, down −

$\begin{pmatrix} -3 \\ -2 \end{pmatrix}$ = 3 left, 2 down

Used to describe a translation

Top number across, bottom number up

"Describe fully": name it, then say ...

Reflection	+ the **equation** of the mirror line
Rotation	+ **angle** + **direction** + **centre**
Translation	+ the **column vector**
Enlargement	+ **scale factor** + **centre**

The details are the marks!

Which sheet do I need?

Reflection ▸
a mirror line

Rotation ▸
turning, with a centre and degrees

Translation ▸
sliding, with a vector

Enlargement ▸
a scale factor

Model answers

- **Reflection** in the line $y = 1$
- **Rotation** 90° clockwise about (0, 0)
- **Translation** by the vector $\begin{pmatrix} 5 \\ -4 \end{pmatrix}$
- **Enlargement**, scale factor 2, centre (0, 0)

Exam tips

- **"Single transformation"**: give **one** transformation only, never two.
- Only **enlargement** changes the size.
- **Scale factor** = new length ÷ old length.
- **Centre of enlargement**: draw lines through matching corners. They meet at the centre.
- Rotations: ask for **tracing paper**. Trace, pin the centre with your pencil, turn.
- Move **one corner at a time**, then join them up.
- **Clockwise** ↻ is the way clock hands go. **Anticlockwise** ↺ is the other way.

Reflection: fact sheet

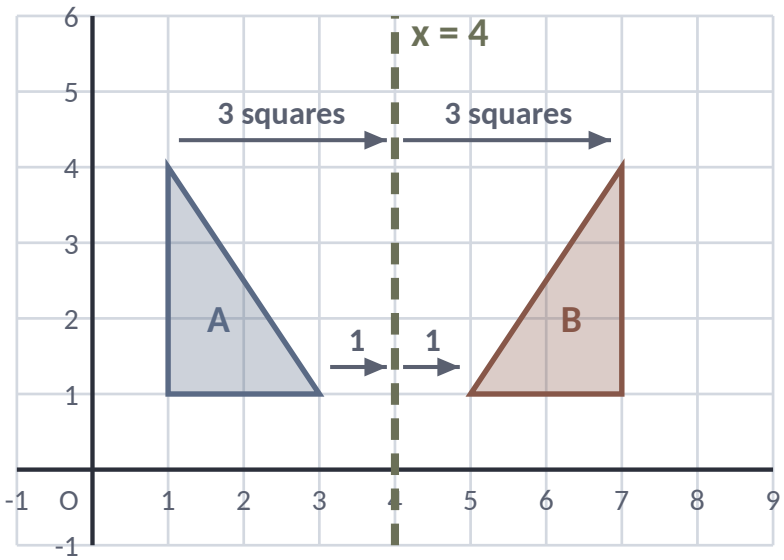
Transformations · Planner week 14 · Learn the method

Worked example

QUESTION

Reflect shape A in the line $x = 4$. Label the new shape B.

ANSWER



Shape A is reflected in the line $x = 4$ to give shape B.

How to do it

1. **Where is the mirror line?** x = number is **vertical**; y = number is **horizontal**.
2. Pick a corner. Count the squares **straight across** to the mirror line.
3. Count the **same number** of squares out the other side. Mark the new corner.
4. Do this for **every corner**, then join them up.
5. Check: the image is the shape **flipped**, like in a mirror.

To describe it fully, write:

Reflection in the line $x = 4$

Watch out

- Mixing up x = … (vertical) and y = … (horizontal).
- Counting diagonally instead of straight across.
- Writing “reflected” without the equation of the line.

Rotation: fact sheet

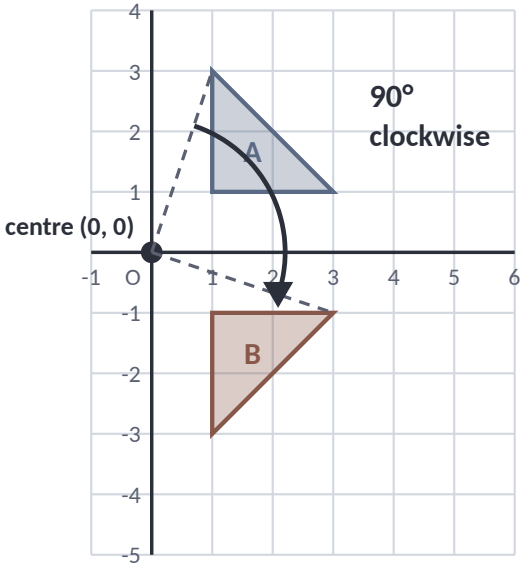
Transformations · Planner week 14 · Learn the method

Worked example

QUESTION

Rotate shape A 90° clockwise about (0, 0). Label the new shape B.

ANSWER



Shape A is rotated 90° clockwise about (0, 0) to give shape B.

How to do it

1. Ask for **tracing paper**. Trace the shape and mark the centre.
2. Put your pencil point on the **centre** to hold the paper still.
3. Turn the paper: **90°** is a quarter turn, **180°** is a half turn. Check the direction.
4. Draw the shape where the tracing now sits.
5. 180° clockwise and 180° anticlockwise give the same answer.

To describe it fully, write:

Rotation 90° clockwise about (0, 0)

Watch out

- Forgetting the **direction** (clockwise or anticlockwise).
- Forgetting the **centre**: all three details are needed.
- Turning about the wrong point: the shape must stay the same distance from the centre.

Translation: fact sheet

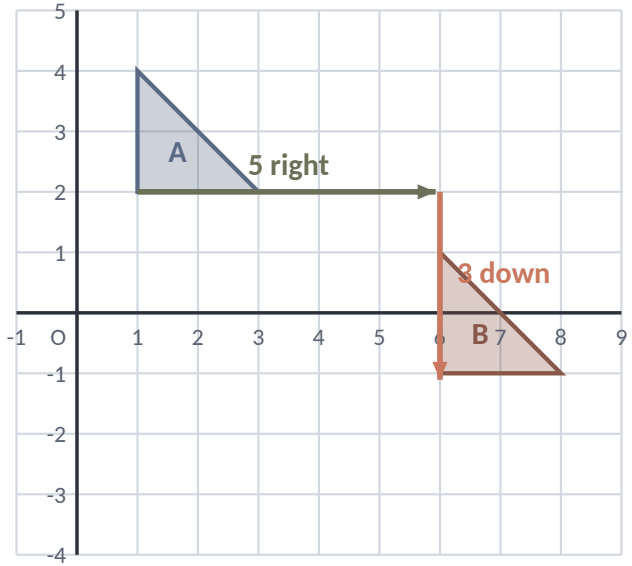
Transformations · Planner week 14 · Learn the method

Worked example

QUESTION

Translate shape A by the vector $\begin{pmatrix} 5 \\ -3 \end{pmatrix}$. Label the new shape B.

ANSWER



Shape A is translated by the vector $\begin{pmatrix} 5 \\ -3 \end{pmatrix}$ to give shape B.

How to do it

1. Read the column vector: the **top** number is right (+) or left (−).
2. The **bottom** number is up (+) or down (−).
3. Move **every corner** the same way, then join them up.
4. To describe one: pick one corner and count across, then up or down, to the matching corner.

To describe it fully, write:

Translation by the vector $\begin{pmatrix} 5 \\ -3 \end{pmatrix}$

Watch out

- Writing the vector as coordinates (5, −3): use a **column** vector.
- Swapping the numbers: across goes on **top**.
- Counting from a corner to a **different** corner.

Enlargement: fact sheet

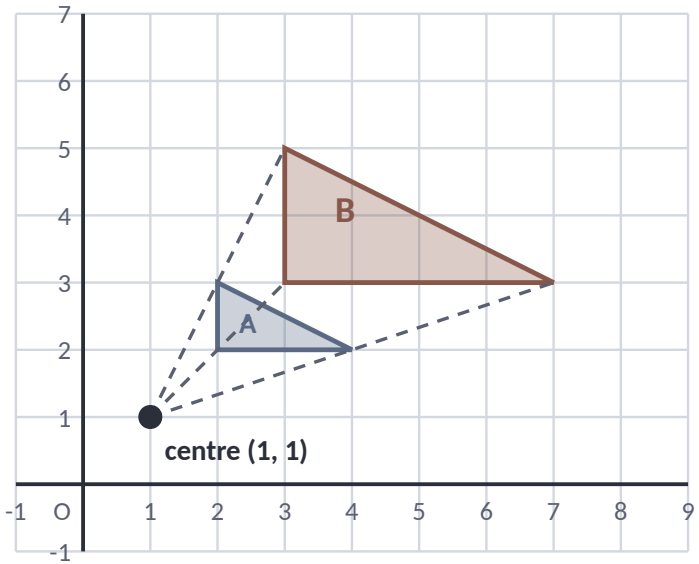
Transformations · Planner week 14 · Learn the method

Worked example

QUESTION

Enlarge shape A by scale factor 2, centre (1, 1). Label the new shape B.

ANSWER



Shape A is enlarged by scale factor 2, centre (1, 1), to give shape B.

How to do it

1. **Scale factor** = new length ÷ old length. Here B's bottom side is 4 squares and A's is 2: 4 ÷ 2 = **2**.
2. No centre given? Just multiply **every length** by the scale factor.
3. With a centre: count from the centre to a corner, multiply by the scale factor, and count again from the centre.
4. To **find** the centre: **join up the corners**. Draw lines through matching corners of A and B; where they cross is the centre.
5. Check: same shape, every side the right size.

To describe it fully, write:

Enlargement, scale factor 2, centre (1, 1)

Watch out

- Adding instead of multiplying (a side of 2 becomes 4, not 3).
- Only enlarging some of the sides.
- Forgetting the **centre** when describing.

Transformations: key words

Planner week 14 · Learn what each word means, then use it in your answers

Transformation

Moves or changes a shape. The four are **reflection**, **rotation**, **translation** and **enlargement**.

e.g. Rotation 90° clockwise about (0, 0)

Object and image

The **object** is the shape you start with (A). The **image** is the shape after the transformation (B).

Shape A is mapped onto shape B

Congruent

Exactly the **same shape and size**. Reflections, rotations and translations give congruent images.

A and B: every side and angle matches

Similar

The **same shape**, a **different size**. An enlargement gives a similar image.

Lengths × 2, angles stay the same

Mirror line

The line a shape is reflected in. Give its equation, e.g. $y = 1$ or $x = -2$.

$x = 2$ is vertical; $y = 1$ is horizontal

Centre of rotation

The fixed point the shape **turns around**, e.g. (0, 0). It is the only point that doesn't move.

Tracing paper: pin the centre, then turn

Clockwise and anticlockwise

Clockwise ↻ is the way clock hands go; **anticlockwise** ↺ is the other way. 90° is a quarter turn, 180° a half turn.

90° anticlockwise = 270° clockwise

Column vector

How far to slide: top number **right +** or **left −**, bottom number **up +** or **down −**. $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ = 3 right, 2 down.

$\begin{pmatrix} -4 \\ 1 \end{pmatrix}$ = 4 left, 1 up

Scale factor

How many times bigger: **new length ÷ old length**. Scale factor 2 doubles every length.

3 cm → 6 cm: scale factor 6 ÷ 3 = 2

Centre of enlargement

The point the enlargement is measured from. Lines through **matching corners** meet there.

Count from the centre, then multiply

Vertex (vertices)

A **corner** of a shape. Move one vertex at a time, then join them up.

A triangle has 3 vertices

Orientation

Which way round a shape faces. Reflection and rotation change it; a **translation** doesn't.

A translated shape faces the same way