Unit 8: Transformations and Constructions
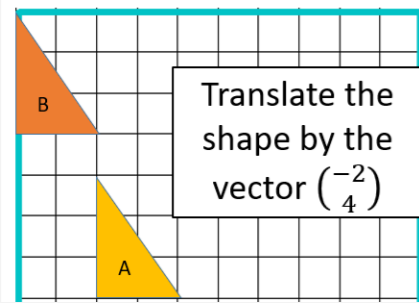
Transformations

Vectors and Translations

We perform translations using vectors

A vector is a quantity that has both **magnitude** (size) **and direction**.

$$\begin{pmatrix} x \\ y \end{pmatrix}$$

X = number of moves to the **right** or **left**
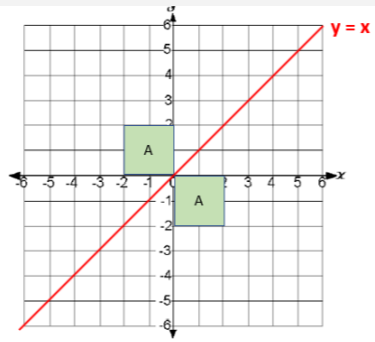Y = number of moves **up** or **down**

Translate the shape by the vector $\begin{pmatrix} -2 \\ 4 \end{pmatrix}$

Vector arithmetic

$$\begin{pmatrix} 5 \\ -2 \end{pmatrix} + \begin{pmatrix} -1 \\ -2 \end{pmatrix} = \begin{pmatrix} 4 \\ -4 \end{pmatrix}$$
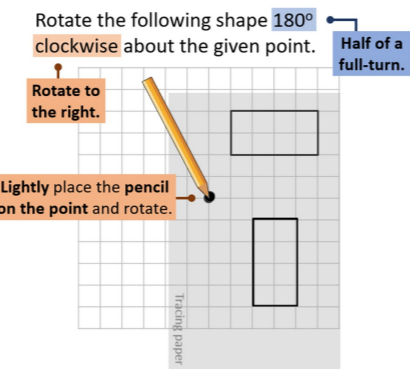
Reflections

Reflect the shape in the equation y = x
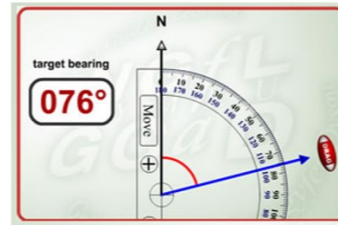
Plot the line y = x

Reflect the shape in the line

y = x

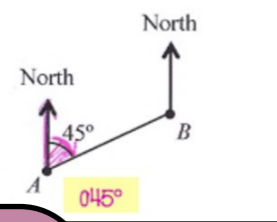### Rotations

Rotate the following shape 180° clockwise about the given point.

Half of a full-turn.

Rotate to the right.

Lightly place the **pencil** on the point and rotate.

Tracing paper
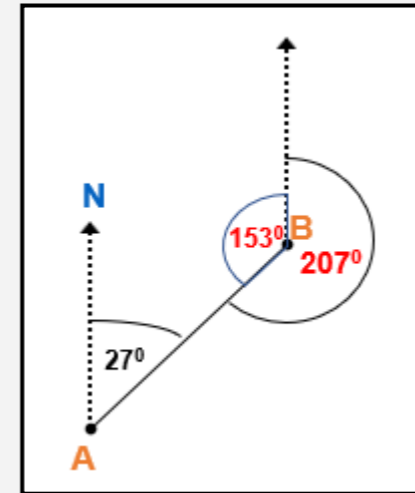
Bearings

Bearings checklist

1. Measured **FROM**
2. Measured from **North**.
3. In a **clockwise** direction.
4. Written as **3 figures**.

target bearing
076°
Move

My bearing from A to B is 027°. But what is my bearing from B to A?

$180 - 27 = 153$
(co-interior angles sum to 180°)

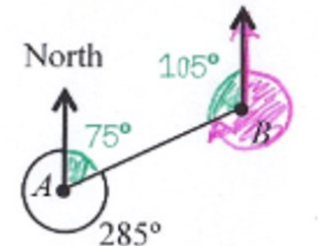$360 - 153 - 207°$
(angles around a point sum to 360°)

A from B = 207⁰

N **153⁰** B **207⁰**

27⁰

A

Find the bearing of *B* from *A*

North

North

45°

B

A   **045°**

Find the bearing of *A* from *B*

$360 - 105 = 255°$ North

North   105°

A   75°   B

285°

Enlargement

An **enlargement** is a type of transformation that involves making a shape larger or smaller.

Enlargement by a positive integer scale factor

Steps:

1) Draw a point on each Vertex

2) Count the squares from the point to each vertex (do this one at a time)

3) **Multiply the distance by the Scale factor**

4) Draw on the new points and Join them up

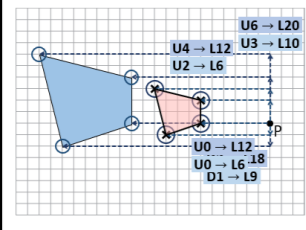#### Integer Scale Factor

On the grid, enlarge the shape, scale factor 3, centre P.

R6 → D1
R18 → D3
D1 → R2
D3 → R6
D3 → R4
D9 → R12
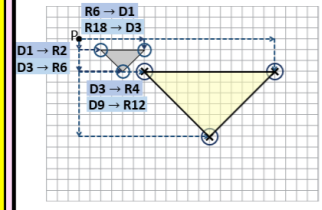
Fractional Scale Factor

On the grid, enlarge the shape, scale factor ½, centre P.

U6 → L20
U3 → L10
U4 → L12
U2 → L6
U0 → L12
U0 → L6 -18
D1 → L9

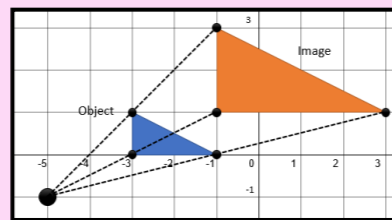### Enlargement by a negative scale factor

To **enlarge a shape by a negative scale factor**, we first **describe the movement from the centre** to a **point on the shape**.

Then we **reverse the movements** starting from the **centre** using the given scale factor.

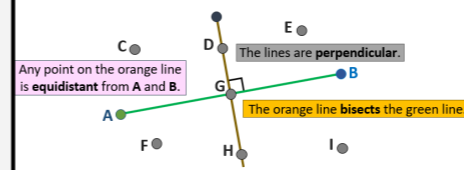On the grid, enlarge the shape by scale factor -3, centre A.

U4 → R5
D12 → L15
U1 → R2
D3 → L6
D1 → R6
U3 → L18
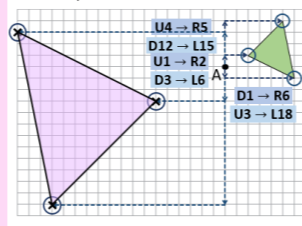
Describing an enlargement

Image

Object
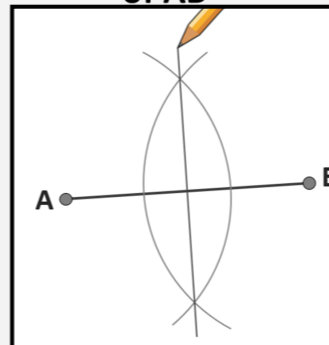
Steps:

1) Draw a point on each Vertex

2) Join up each point by A straight line

3) The point where all the Straight lines meet is the Point of enlargement

Enlargement of scale factor 2
About the point (-5, -1)

Constructions and Loci

How are these lines related?

C   E   D   The lines are perpendicular.
Any point on the orange line is **equidistant** from **A** and **B**.   G   B
A   The orange line **bisects** the green line.
F   H   I

Never erase your **construction lines!**

Construct the **perpendicular bisector of AB**

A   B

(1) Draw two equal arcs.

(2) Connect the intersections with a straight line.

**(3)** This line is the **perpendicular bisector** and contains all the points **equidistant** from **A** and **B**.

Angle Bisector

Draw an acute angle on your page. Construct its **angle bisector**.
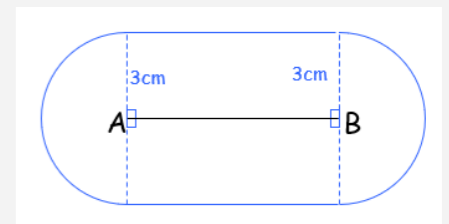
(1) Draw an arc from the vertex.

(2) Draw two more equal arcs from the intersections.

(3) Join the new intersection up to the vertex.

(4) This line is the **angle bisector** and contains all points **equidistant** from both **arms** of the angle.
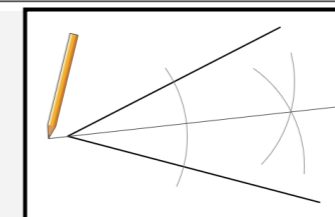
A **locus of points** is a set of points satisfying a certain condition.

Find the locus of points 3cm from AB

Draw a straight horizontal line

Open your compass to 3cm

Point the compass on the point A and draw an arc

Point the compass on the point B and draw an arc

Join them together with straight lines

3cm   3cm
A   B