

TYPES OF ANGLE AND ANGLES IN POLYGONS

Key Concepts

Regular polygons have equal lengths of sides and equal angles.

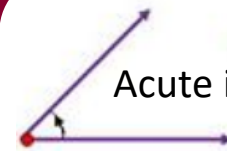
Angles in polygons

Sum of interior angles
 $= (\text{number of sides} - 2) \times 180$

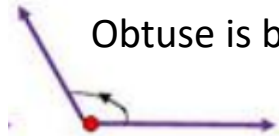
Exterior angles of **regular** polygons $= \frac{360}{\text{number of sides}}$

Types of angle

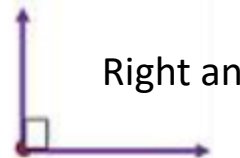
There are four types which need to be identified – acute, obtuse, reflex and right angled.



Acute is less than 90°



Obtuse is between 90° and 180°



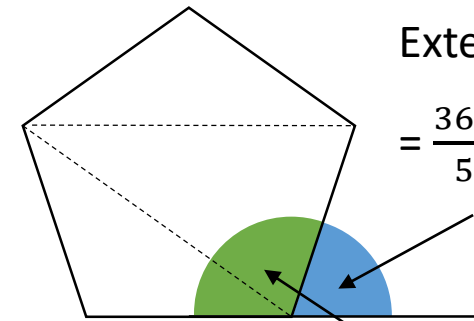
Right angled is 90°



Reflex is between 180° and 360°

Examples

Regular Pentagon



Exterior angles

$$= \frac{360}{5} = 72^\circ$$

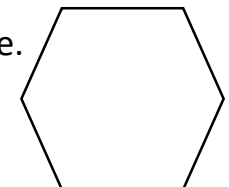
Sum of interior angles
 $= (5 - 2) \times 180$
 $= 540^\circ$

$$\text{angle} = \frac{540}{5} = 108^\circ$$

Interior

Questions

- 1) Calculate the sum of the interior angles for this regular shape.
- 2) Calculate the exterior angle for this regular shape.
- 3) Calculate the size of one interior angle in this regular shape.



sparx

M502

M679

M653

Key Words

Polygon
 Interior angle
 Exterior angle
 Acute
 Obtuse
 Right angle
 Reflex

ANGLE FACTS INCLUDING ON PARALLEL LINES

Key Concepts

Angles in a **triangle equal 180°**.

Angles in a **quadrilateral equal 360°**.

Vertically opposite angles are equal in size.

Angles on a **straight line equal 180°**.

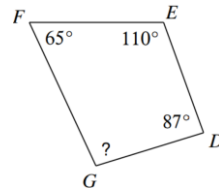
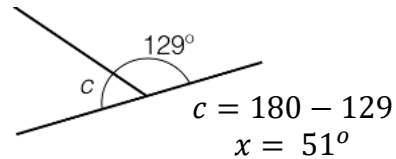
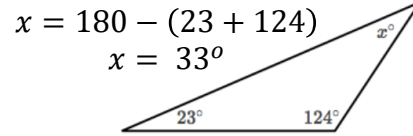
Base angles in an isosceles triangle are equal.

Alternate angles are equal in size.

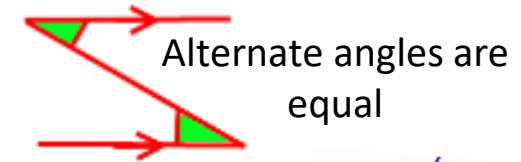
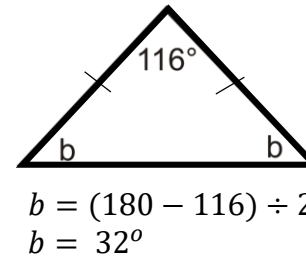
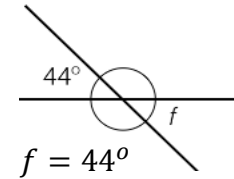
Corresponding angles are equal in size.

Allied/co-interior angles are equal 180°.

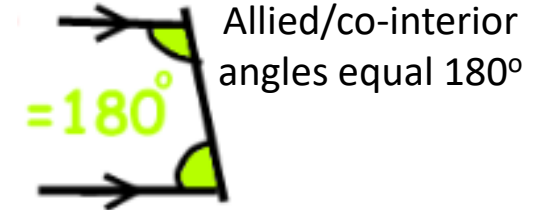
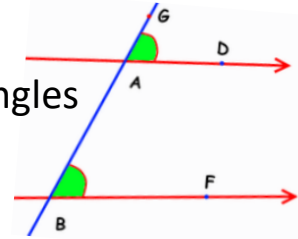
Examples



$? = 360 - (65 + 110 + 87)$
 $? = 98^\circ$



Corresponding angles are equal



sparx

M331

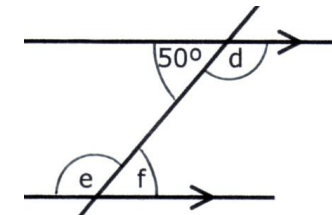
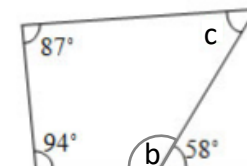
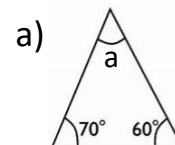
M606

Key Words

Angle
 Vertically opposite
 Straight line
 Alternate
 Corresponding
 Allied
 Co-interior

Questions

Calculate the missing angle:

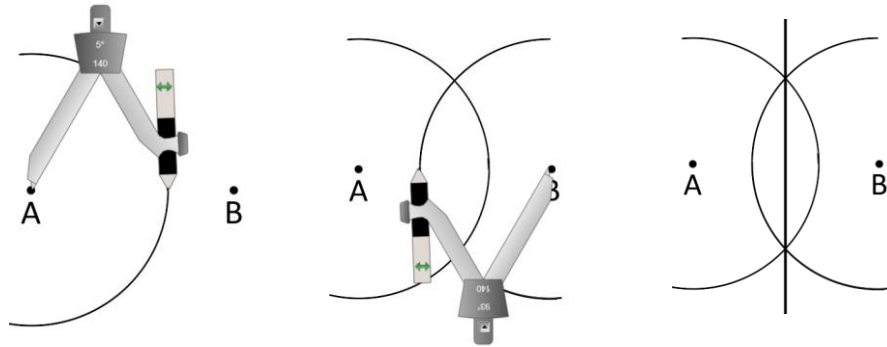


ANSWERS: 1) a=50° 2) b=122° c=57° 3) d=130° e=130° f=50°

CONSTRUCTIONS

Examples

Bisect the distance between two points.

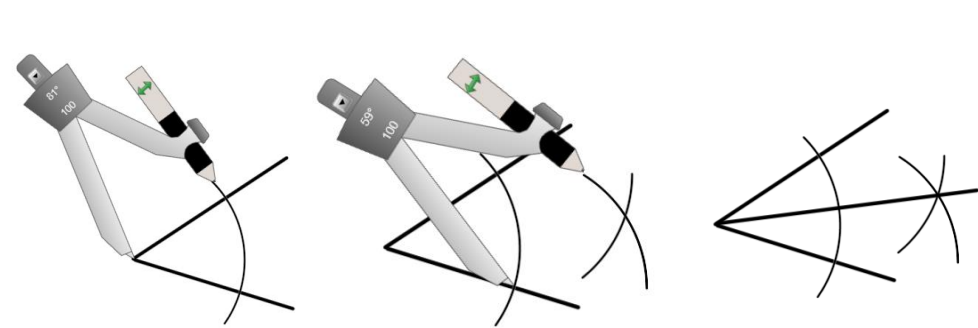


1) Open your compasses past halfway between the two points and draw an arc.

2) Keep your compasses at the same width and repeat from the other point.

3) Draw a line joining the two points where the arcs cross

Bisect an angle.



1) Open your compasses and draw an arc over both lines from the angle

2) Keep your compasses at the same width and draw two further arcs with the point of your compasses at the intersections.

3) Draw a line joining the two points where the arcs cross and the angle point

sparx

M239
M232

Key Words

Compass
Bisect
Angle
Arc

Try and recreate the above two constructions on paper using a pair of compasses and a pencil and ruler.

PYTHAGORAS AND TRIGONOMETRY

Key Concepts

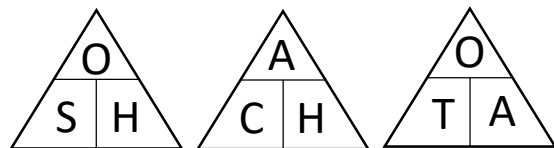
Pythagoras' theorem and basic trigonometry both only work with **right angled triangles**.

Pythagoras' Theorem – used to find a missing length when two sides are known
 $a^2 + b^2 = c^2$

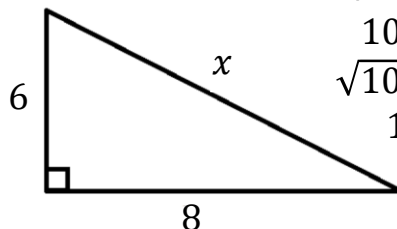
c is always the hypotenuse (longest side)

Basic trigonometry SOHCAHTOA –

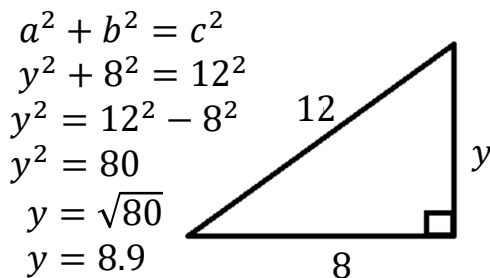
used to find a missing side or an angle



Pythagoras' Theorem

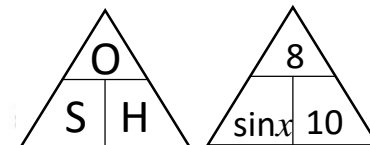
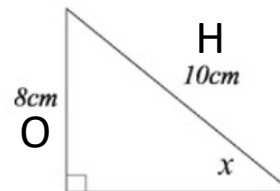


$$\begin{aligned} a^2 + b^2 &= c^2 \\ 6^2 + 8^2 &= x^2 \\ 100 &= x^2 \\ \sqrt{100} &= x \\ 10 &= x \end{aligned}$$

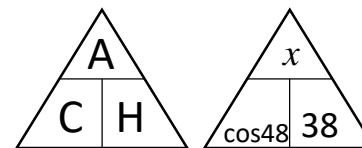


$$\begin{aligned} a^2 + b^2 &= c^2 \\ y^2 + 8^2 &= 12^2 \\ y^2 &= 12^2 - 8^2 \\ y^2 &= 80 \\ y &= \sqrt{80} \\ y &= 8.9 \end{aligned}$$

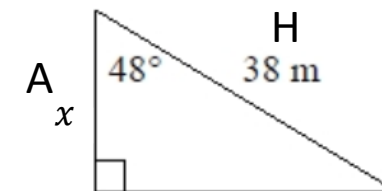
Examples



$$\begin{aligned} \sin x &= \frac{8}{10} \\ x &= \sin^{-1}\left(\frac{8}{10}\right) = 53.1^\circ \end{aligned}$$



$$\begin{aligned} \cos 48 &= \frac{x}{38} \\ x &= 38 \times \cos 48 = 25.4m \end{aligned}$$



sparx

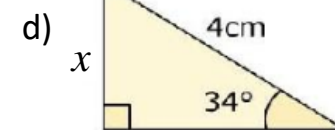
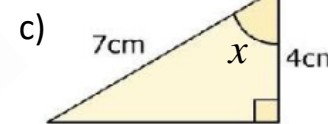
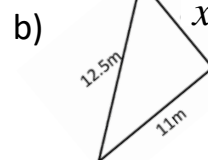
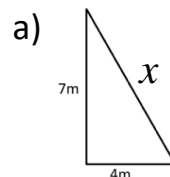
M677

Key Words

Right angled triangle
 Hypotenuse
 Opposite
 Adjacent
 Sine
 Cosine
 Tangent

Questions

Find the value of x.



ANSWERS: a) 8.06m b) 5.94m c) 55.15° d) 2.34cm

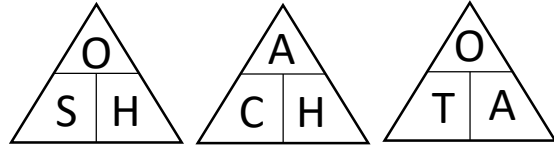
PYTHAGORAS AND TRIGONOMETRY

Key Concepts

Pythagoras' theorem and basic trigonometry both work with **right angled triangles**.

Pythagoras' Theorem – used to find a missing length when two sides are known
 $a^2 + b^2 = c^2$
 c is always the hypotenuse (the longest side)

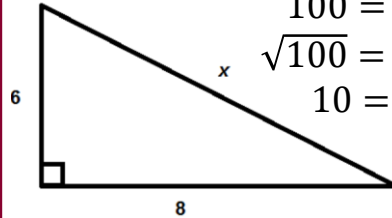
Basic trigonometry SOHCAHTOA – used to find a missing side or an angle



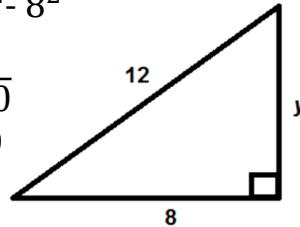
When finding the missing angle we must press **SHIFT** on our calculators first.

Pythagoras' Theorem

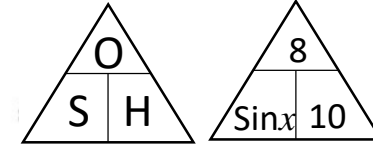
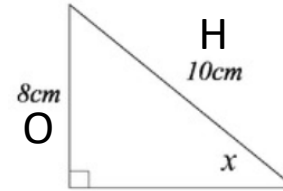
$$\begin{aligned} a^2 + b^2 &= c^2 \\ 6^2 + 8^2 &= x^2 \\ 100 &= x^2 \\ \sqrt{100} &= x \\ 10 &= x \end{aligned}$$



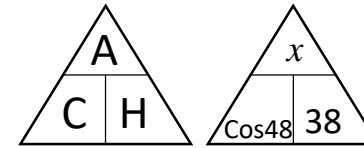
$$\begin{aligned} a^2 + b^2 &= c^2 \\ a^2 + 8^2 &= 12^2 \\ a^2 &= 12^2 - 8^2 \\ a^2 &= 80 \\ a &= \sqrt{80} \\ a &= 8.9 \end{aligned}$$



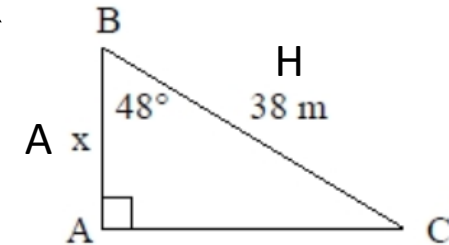
Examples



$$\begin{aligned} \sin x &= \frac{8}{10} \\ x &= \sin^{-1}\left(\frac{8}{10}\right) \\ x &= 53.1^\circ \end{aligned}$$



$$\begin{aligned} \cos 48 &= \frac{x}{38} \\ 38 \times \cos 48 &= x \\ x &= 25.4\text{m} \end{aligned}$$

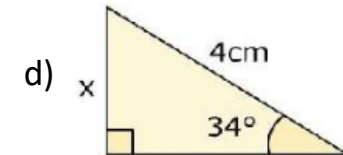
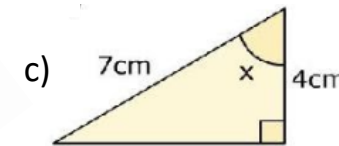
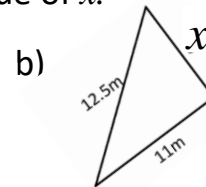
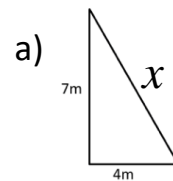


sparx
M677

Key Words

Right angled triangle
 Hypotenuse
 Opposite
 Adjacent
 Sine
 Cosine
 Tangent

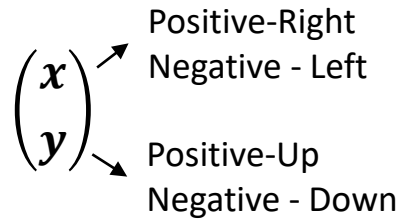
Find the value of x.



TRANSLATION AND ENLARGEMENT

Key Concepts

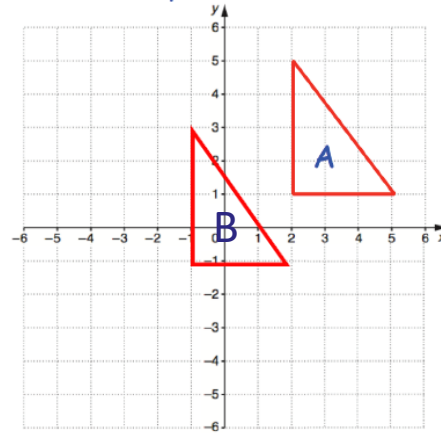
A **translation** moves a shape on a coordinate grid. Vectors are used to instruct the movement:



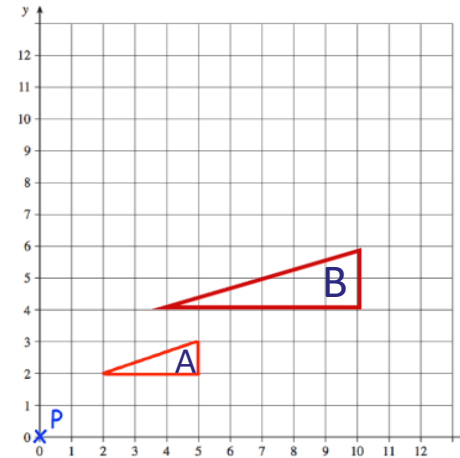
An **enlargement** changes the size of an image using a scale factor from a given point.

Examples

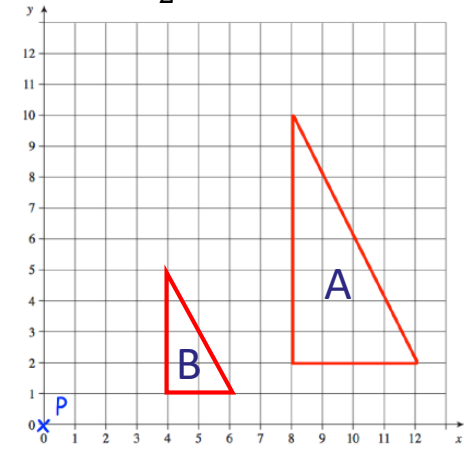
Translate shape A by $\begin{pmatrix} -3 \\ -2 \end{pmatrix}$.
Label it B



Enlarge shape A by scale factor 2 from point P.



Enlarge shape A by scale factor $\frac{1}{2}$ from point P.

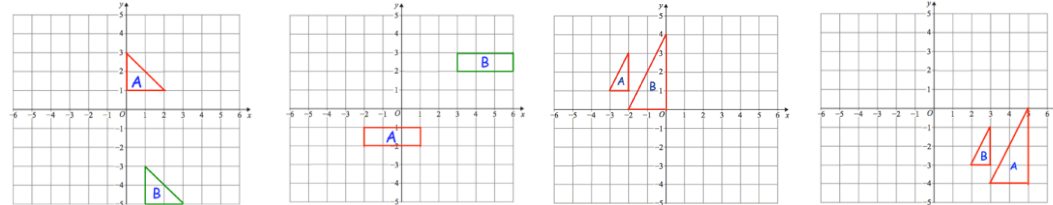


sparx

U196
U519
U134

Key Words
Translation
Enlargement
Scale factor
Centre
Positive
Negative

Describe the **single** transformation you see on each coordinate grid from A to B:



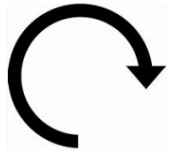
ANSWERS: a) translation $\begin{pmatrix} 2 \\ 2 \end{pmatrix}$ b) translation $\begin{pmatrix} 2 \\ 2 \end{pmatrix}$ c) enlarge, centre $(-4,2)$ scale factor 2 d) enlarge, centre $(1,-2)$ scale factor $\frac{1}{2}$

REFLECTION AND ROTATION

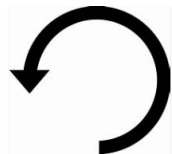
Key Concepts

A **reflection** creates a mirror image of a shape on a coordinate graph. The mirror line is given by an equation eg. $y = 2$, $x = 2$, $y = x$. The shape does not change in size.

A **rotation** turns a shape on a coordinate grid from a given point. The shape does not change size but does change orientation.



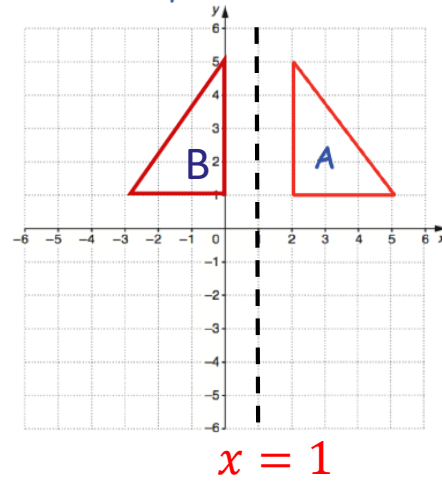
Clockwise



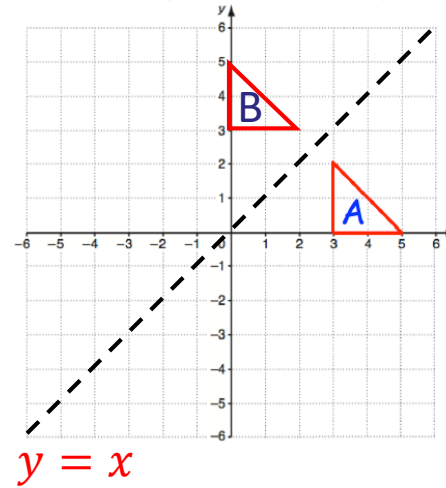
Anticlockwise

Examples

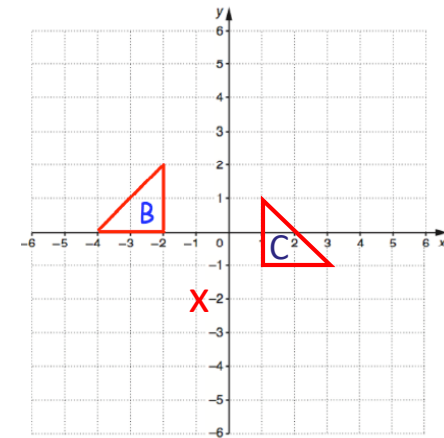
Reflect shape A in the line $x = 1$. Label it B.



Reflect shape A in the line $y = x$. Label it B.



Rotate shape B from the point $(-1, -2)$



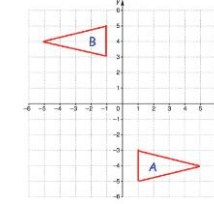
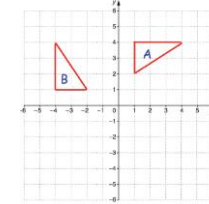
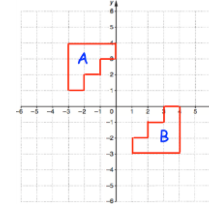
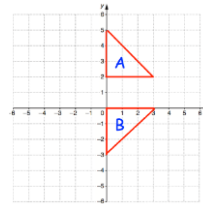
sparx

U799
U696

Key Words

Rotate
Clockwise
Anticlockwise
Centre
Degrees
Reflect
Mirror image

Describe the **single** transformation you see on each coordinate grid from A to B:



ANSWERS: a) reflection, $y = 1$ b) reflection $y = x$ c) rotation, centre $(0,0)$, 90° anticlockwise
d) rotation, centre $(0,0)$, 180°