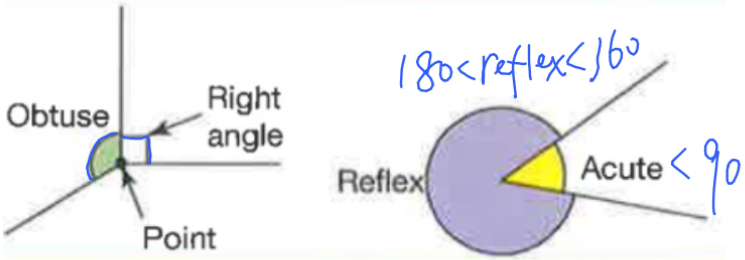
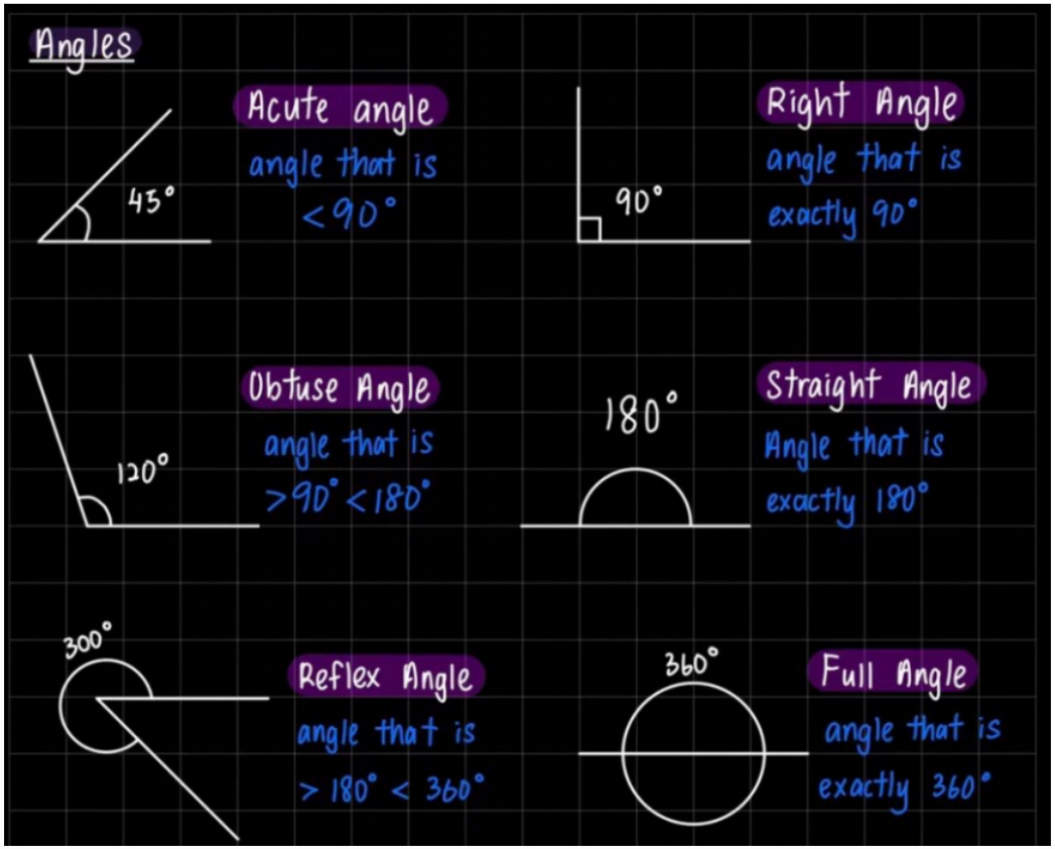
Vocabulary

Name	Translate	Name	Translate
Right angle	直角 =90	pentagon	五边形
Obtuse angle	钝角 90-180	hexagon	六边形
Acute angle	锐角 <90	heptagon	七边形
reflex angle	反射角 180-360	octagon	八边形
polygon	多边形	nonagon	九边形
congruent	全等的 similar	decagon	十边形
Alternative angles	内错角	quadrilateral	四边形
Parallelogram	平行四边形		

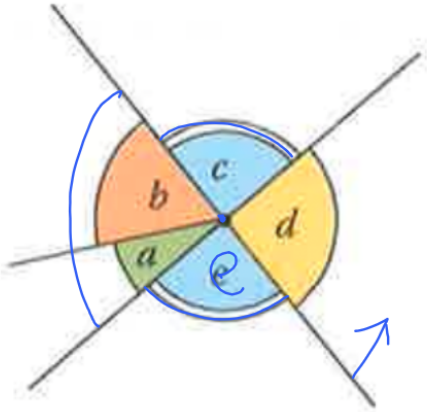
1. Angles and Lines

(1) basic types

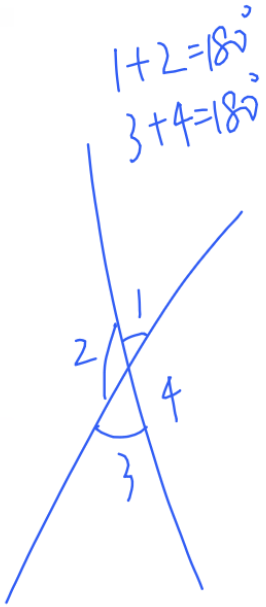




(2) Angles at different positions



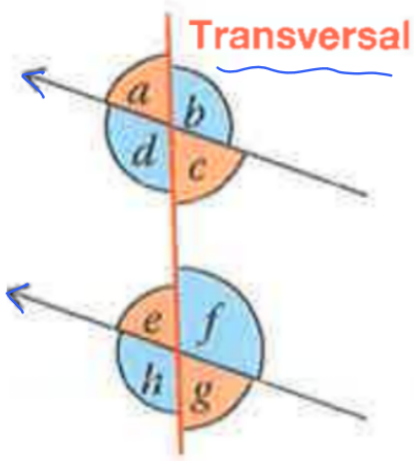
- Angles at a point
  $a + b + c + d + e = 360°$
- Angles on a straight line
  $a + b + c = 180°$, $d + e = 180°$
  $e + a + b = 180°$ and $c + d = 180°$
- Vertically opposite angles
  $c = e$ and $a + b = d$



(3) Types of angles

Arrows show that lines are parallel.

A **transversal** is a line that crosses parallel lines.

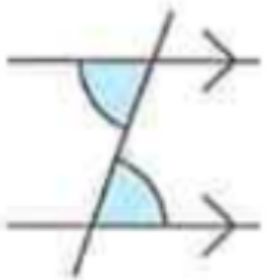


- Alternate angles 内错
  $d = f$ $c = e$
  Look for a Z or Σ shape.
- Corresponding angles 同位角
  $a = e$ $b = f$ $c = g$ $d = h$
  Look for a F or ㄱ shape.
- Interior angles 同旁内角
  $d + e = 180°$ $c + f = 180°$
  Look for a ㄷ or ㄱ shape.

- **Alternate** angles are equal.
- **Corresponding** angles are equal.
- **Interior** angles add up to 180°.

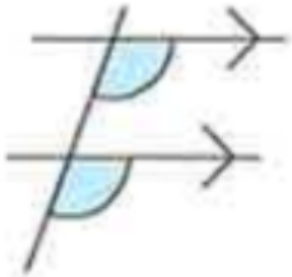
"Z"

Alternate angles



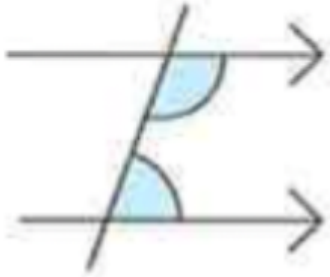
"F"

Corresponding angles



"L"

Interior angles



补角 ($\alpha+\beta=180°$)

(4) Supplementary angles VS complementary angles

余角 ($\alpha+\beta=90°$)

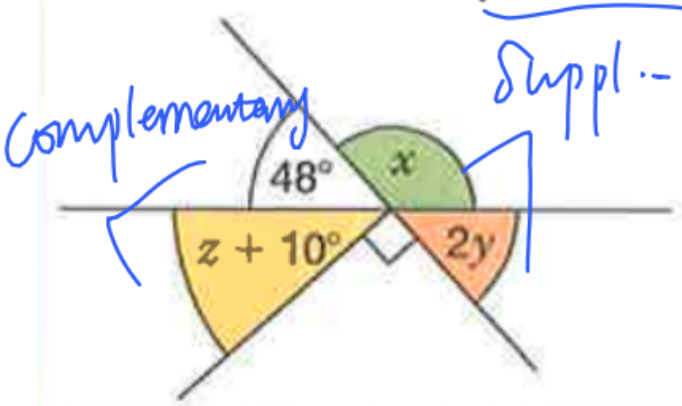
Angles that add up to 180° are said to be **supplementary**.

α β

Examples:

Work out the values of x, y and z.

Give reasons for your answers.



Complementary

Suppl....

$2y = 48° \Rightarrow y = 24°$

$x = 180° - 48° = 132°$

$z = 90° - 48° - 10° = 32°$

Q22N

x is a reflex angle. $180° < x < 360°$

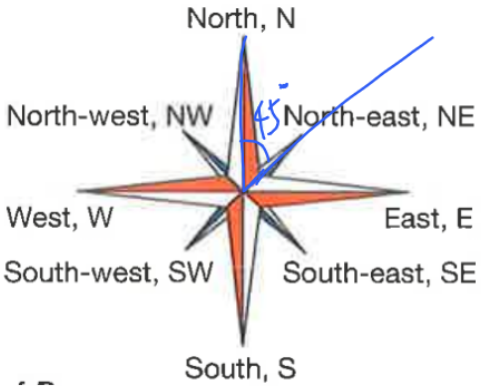
What type of angle is $\frac{1}{2}x$? $90° < \frac{1}{2} \cdot x < 180°$

Circle your answer.

acute | right angle | obtuse | reflex

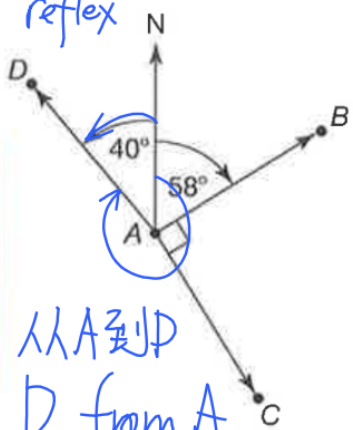
(Total 1 mark)

2. Bearing 方向角



Directions can be given using compass points or using angles.

- A three-figure **bearing** is
  - measured from North
  - measured clockwise
  - a 3-figure angle.



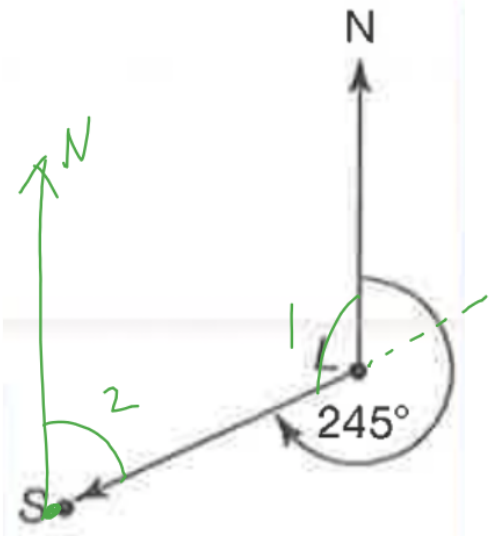
- The bearing of *B* *from A* is 058°.
- The bearing of *C* *from A* is $58° + 90° = 148°$.
- The bearing of *D from A* is $360° - 40° = 320°$.

Examples:

The bearing of a ship from a lighthouse is 245°.

a Find the bearing of the lighthouse from the ship.

b The ship moves so that its bearing from the lighthouse increases. What happens to the bearing of the lighthouse from the ship?



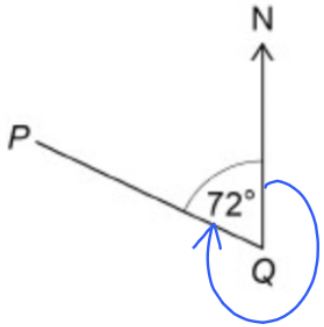
∠1 + ∠2 = 180°

∠1 = 360° − 245°

∠2 = 180° − ∠1

Q21N

P and *Q* are two points.



Not drawn accurately

360° − 72° =

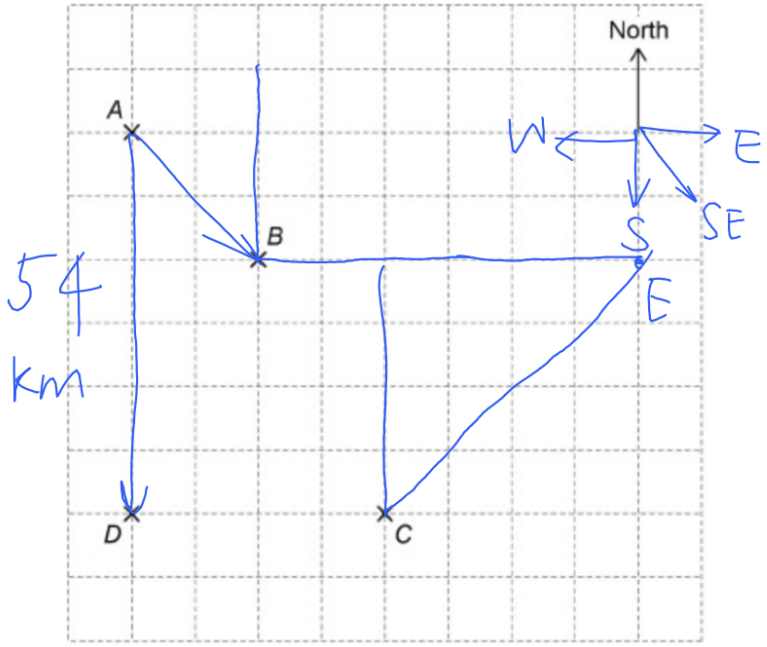
Circle the bearing of *P* from *Q*.

072° 108° 252° 288°

Q20N

Here is a map showing four towns, *A*, *B*, *C* and *D*.

It is drawn to scale on a square grid.



(a) Circle the direction of *B* from *A*.

North West North East South West South East

(b) The actual distance of *D* from A is 54 km

Work out the actual distance of *C* from *D*.

(c) *E* is a different town.

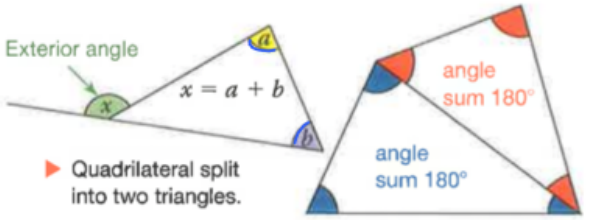
The bearing of *E* from *B* is 090°

The bearing of *E* from *C* is 045°

Mark the position of *E* on the diagram.

3. Triangles and quadrilaterals

- The sum of the angles of a triangle = 180°.
- The **exterior angle** of a triangle = the sum of the **interior opposite angles**.
- The sum of the angles of a quadrilateral = 360°



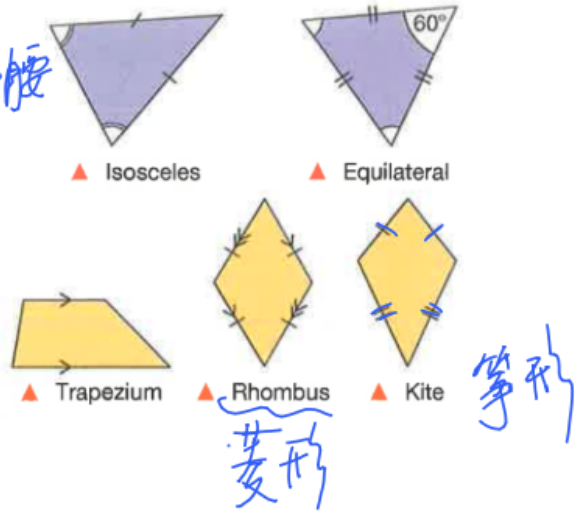
▶ Quadrilateral split into two triangles.

Triangles

In a **scalene** triangle, the sides and angles are all different.
An **isosceles** triangle has 2 equal sides and 2 equal 'base' angles.
An **equilateral** triangle has 3 equal sides. Each angle is 60°.

Quadrilaterals

In a **parallelogram** both pairs of opposite sides are parallel.
A **trapezium** has only 1 pair of parallel sides.
A **rhombus** is a parallelogram with 4 equal sides.
A **kite** has 2 pairs of equal adjacent sides.
A **rectangle** is a parallelogram whose angles are all right angles.
A **square** is a rectangle with 4 equal sides.



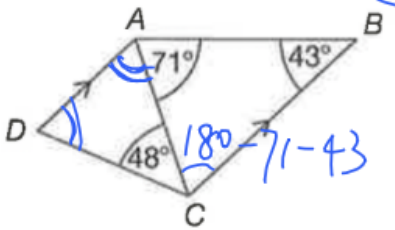
▲ Isosceles ▲ Equilateral

▲ Trapezium ▲ Rhombus ▲ Kite

Examples:

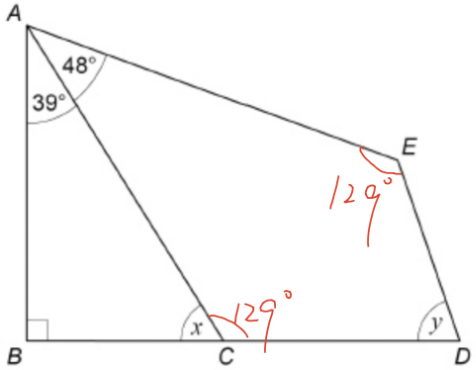
1.

a Find **i** $\angle ACB$ **ii** $\angle ADC$



b What special type of triangle is ADC?

Q18N



$360° - 129° \times 2 - 48°$

ABC is a right-angled triangle.

BCD is a straight line.

ACDE is a kite with $AC = AE$

(a) Show that $x = 51°$

(b) Work out the size of angle y.

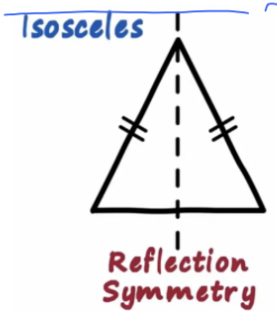
(a) $x = 180° - \angle B - \angle BAC = 180° - 90° - 39°$

$x = 51°$

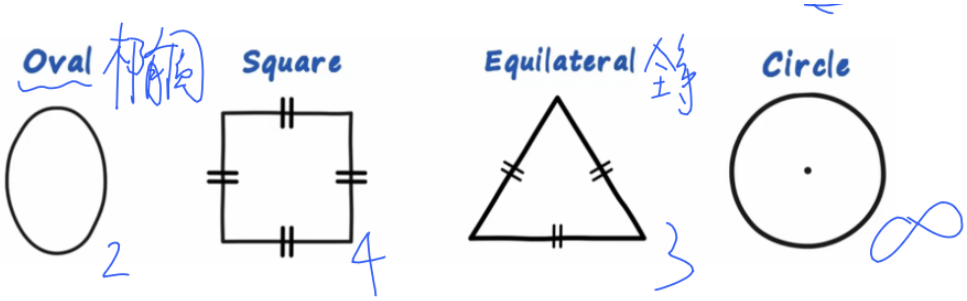
(b)

4. Symmetry

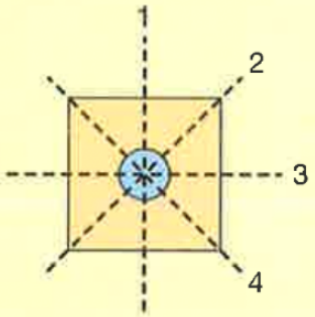
Reflection symmetry & Rotation symmetry



gives an identical-looking shape. The **order of rotation symmetry** is the number of ways a tracing of the shape would fit on top of it as the tracing is rotated through 360°.

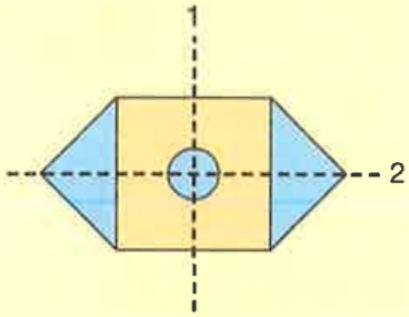


a 4 lines of symmetry



and rotation symmetry, order 4

b 2 lines of symmetry



and rotation symmetry, order 2

Q18N

Here is a shape.

(a) Circle the number of lines of symmetry of the shape.

0 1 2 4

(1)

(b) Circle the order of rotational symmetry of the shape.

0 1 2 4

(1)

Q21N

Rectangle (R)

Parallelogram (P)

Equilateral triangle (E)

Isosceles triangle (I)

Put the letter of each shape into **one** box in the table.

One has been done for you.

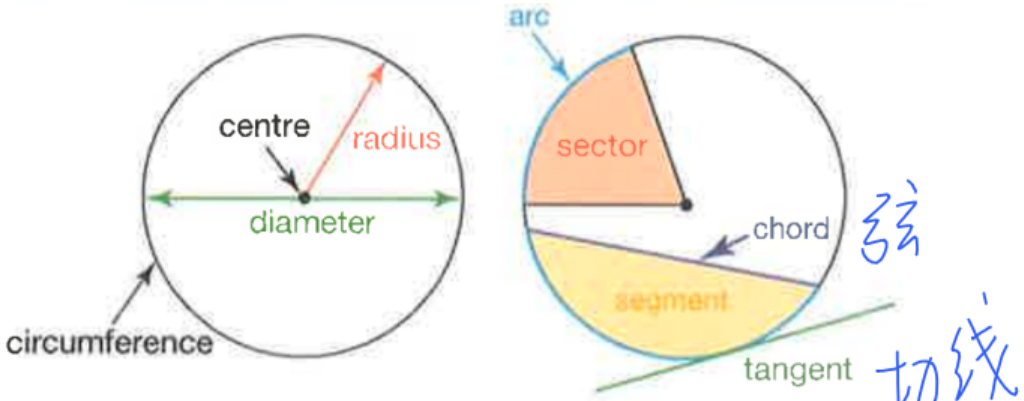
Order of rotational symmetry \ Lines of symmetry	0	1	2	3	4
1		I			
2	P		R		
3				E	
4					S

Circle:

The diagrams show the names of parts of a circle.

Every diameter of a circle is a line of symmetry.

The order of rotation symmetry is infinite.

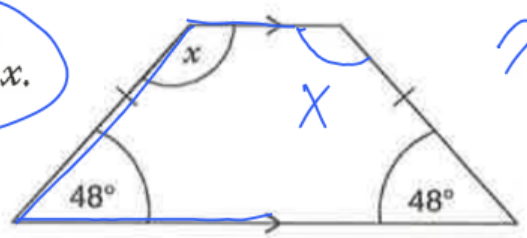


弦
切线

Examples:

Two angles of this **isosceles trapezium** are equal to 48°.

Find x.



$x + 48^\circ = 180^\circ$

$x =$

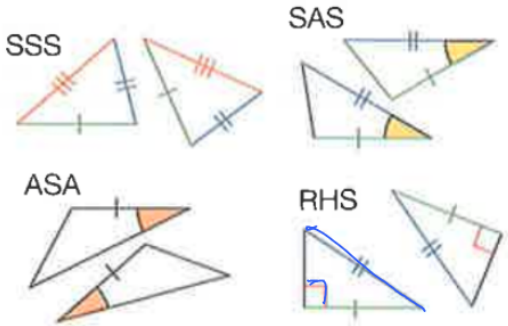
5. Congruence and similarity

(1) Congruent

Congruent shapes are exactly equal in size and shape: equal sides and equal angles.

Triangles are congruent if these measurements are equal

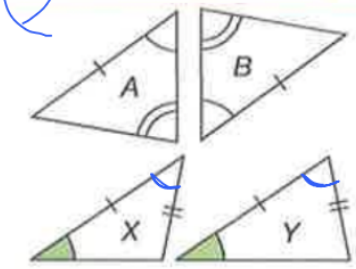
- SSS 3 sides
- SAS 2 sides and the angle between them
- ASA 2 angles and a corresponding side
- RHS a right angle, the hypotenuse and 1 other side.



Example:

a Is triangle A congruent to triangle B?

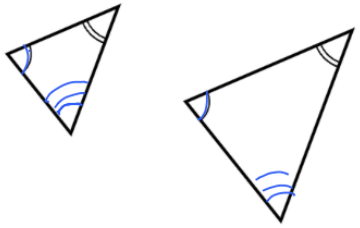
b Is triangle X congruent to triangle Y?



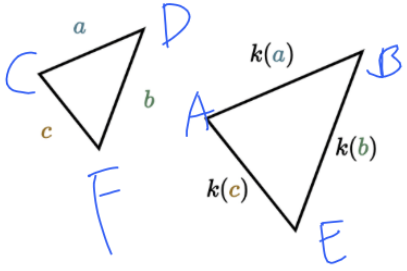
(2) Similar

Similar shapes are the same shape but different in size.
Their angles are equal.

AA: Two pairs of corresponding angles are equal.

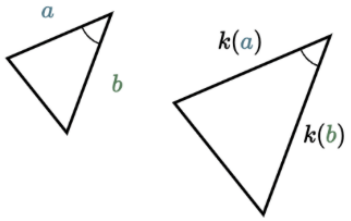


SSS: Three pairs of corresponding sides are proportional.

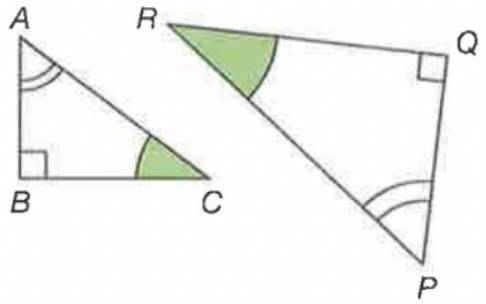


$$\frac{AB}{CD} = \frac{AE}{CF} = \frac{BE}{DF} = k$$

SAS: Two pairs of corresponding sides are proportional and the corresponding angles between them are equal.



Linear scale factor



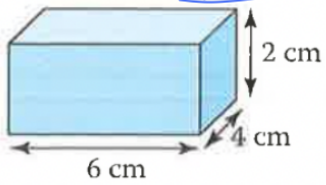
- The linear scale factor $= \frac{PQ}{AB} = \frac{QR}{BC} = \frac{RP}{CA}$ in similar shapes

For the area and volume of similar 2D and 3D shapes:

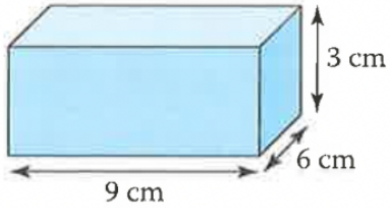
- **area scale factor** = (linear scale factor)^2
- **volume scale factor** = (linear scale factor)^3.

E.g.

Similar cuboids



2x4x6



3x6x9

Linear scale factor $= 1.5 = \frac{6}{4}$

Surface Area scale factor $= 1.5^2$

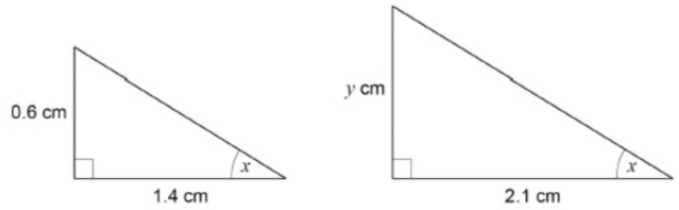
Volume scale factor $= 1.5^3$

Practice:

Q18N

Here are two similar triangles.

Not drawn accurately



$\frac{1.4}{2.1} = \frac{0.6}{y} \Rightarrow y = 0.9$

Circle the value of y.

0.4 0.9 1.3 1.5

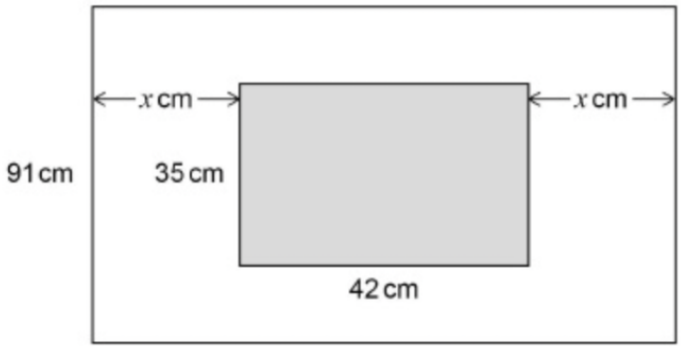
(Total 1 mark)

Q22N

The shorter sides of a rectangular wall are each 91 cm

A rectangular mirror is 42 cm by 35 cm

The mirror is placed on the wall as shown.



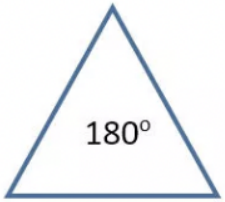
$\frac{35}{91} = \frac{42}{y}$

$\Rightarrow y = 2(x) + 4(x) 2$

The rectangles are similar shapes.

Work out the value of x.

6. Polygon angles

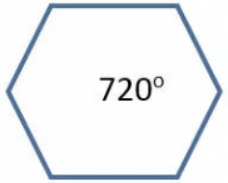


Triangle

Square

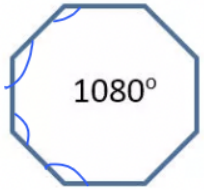
Rectangle

Pentagon

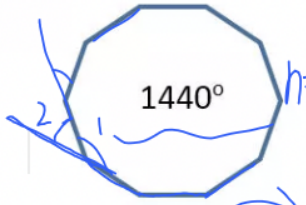


Hexagon

Heptagon



Octagon



Decagon

- The sum of the interior angles of *any* polygon
  = (number of sides − 2) × 180°
- The sum of the exterior angles of *any* polygon = 360°
- Exterior angle of a *regular* polygon = 360° ÷ number of sides.
- At each vertex: interior angle + exterior angle = 180°