

Knowledge Organiser: Year 11 Foundation



Rules for rounding

4
or below → **ROUND Down**

5
or above → **ROUND Up**

Rounding to the nearest 10, 100 and 1000

Examples: 1) Round 674 to the nearest 10.



974
970

Draw a line after the tens.

Look at the digit to the right (units) and use the rules for rounding to decide whether the digit to the left (tens) should round up or down.

674 rounds down to 670.

2) Round 963 to the nearest 100.



963
1000

Draw a line after the hundreds.

Look at the digit to the right (tens) and use the rules for rounding to decide whether the digit to the left (hundreds) should round up or down.

963 rounds up to 1000.

3) Round 21 532 to the nearest 1000.



21 532
22 000

Draw a line after the thousands.

Look at the digit to the right (hundreds) and use the rules for rounding to decide whether the digit to the left (thousands) should round up or down.

21 532 rounds up to 22 000.

Rounding to 1 or 2 decimal places

Examples: 1) Round 5.623 to 1 d.p.



5.623
5.6

Draw a line after the tenths.

Look at the digit to the right (hundredths) and use the rules for rounding to decide whether the digit to the left (tenths) should round up or down.

2) Round 0.0392 to 2 d.p.



0.0392
0.04

Draw a line after the hundredths.

Look at the digit to the right (thousandths) and use the rules for rounding to decide whether the digit to the left (hundredths) should round up or down.

Rounding to the nearest whole number

Example: Round 12.8 to the nearest whole number.



12.8
13

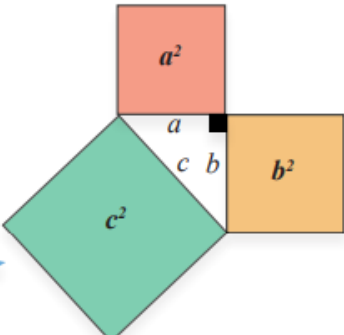
Draw a line after the units.

Look at the digit to the right (tenths) and use the rules for rounding to decide whether the digit to the left (units) should round up or down.

12.8 rounds up to 13.

Key words:

Rounding	Rounding means making a numbers simpler but keeping its value close to what is was
Pythagoras	Formula to calculate missing lengths in right angled triangles $a^2 + b^2 = c^2$
Bearings	A bearing is the direction of one point relative to another, expressed as an angle measured clockwise from north
Area	Area is the amount of space a two-dimensional shape occupies
Surface area	The total area of the surface of a three-dimensional object
Volume	Volume is the measure of the amount of three-dimensional space an object occupies



$$a^2 + b^2 = c^2$$

Where c is the hypotenuse, the longest side that lies opposite the right-angle, and a and b are either of the shorter sides.

1) Find the length of x .

$$a^2 + b^2 = c^2$$

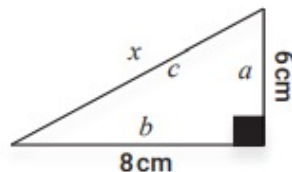
$$6^2 + 8^2 = x^2$$

$$36 + 64 = x^2$$

$$100 = x^2$$

$$\sqrt{100} = x$$

$$10\text{cm} = x$$



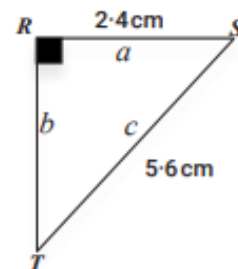
2) Find the length of RT .

$$c^2 - b^2 = a^2$$

$$5.6^2 - 2.4^2 = RT^2$$

$$\sqrt{(5.6^2 - 2.4^2)} = RT$$

$$5.1\text{ m (to 1 d.p.)} = RT$$



Speed

The formula for the speed of an object is:

$$\text{speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

The following diagram can be used to memorise the different relationships between speed, distance travelled, and time taken.

Density

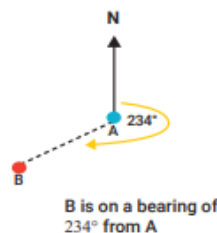
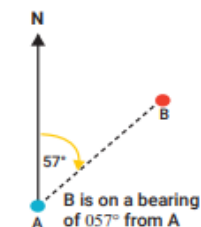
The density of an object or substance is a measure of how heavy it is (its mass) in relation to how much space it takes up (its volume).

The formula for the density of an object or substance is:

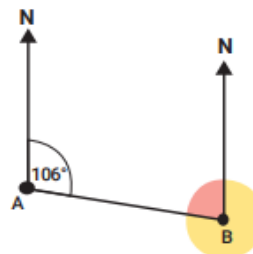
$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

The following diagram can be used to memorise the different relationships between density, mass and volume.

Bearings Bearings use angles to describe the direction of movement from one point to another. Bearings are measured by angles written in 3 figures, facing the direction of north and turning clockwise.

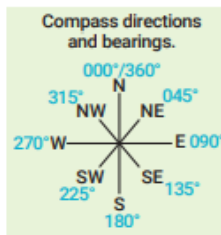


E.g. Find the bearing of A from B.



This angle is 74° because supplementary angles add to 180° (North lines are parallel to one another)

The bearing of A from B is 286° because angles at a point add to 360°
 $360 - 74 = 286^\circ$



Labelling the right-angled triangle

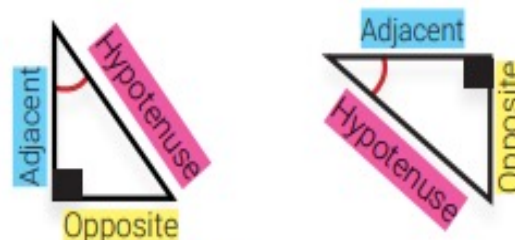
Each side of the triangle must be labelled.

Hypotenuse (H) – This is the longest side in a right-angled triangle.

Opposite (O) – This is the side that lies directly opposite the marked angle.

Adjacent (A) – This is the side that lies next to the marked angle.

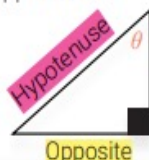
Once we know what sides and angles we know or are looking for we can then choose the correct ratio to use.



The sine ratio (SOH)

When working with the angle θ and the opposite and hypotenuse sides, we use the sine ratio.

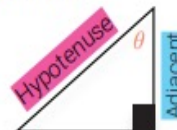
$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$



The cosine ratio (CAH)

When working with the angle θ and the adjacent and hypotenuse sides, we use the cosine ratio.

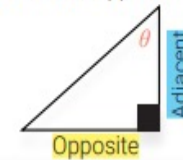
$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$



The tangent ratio (TOA)

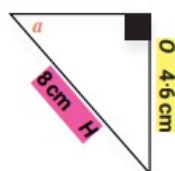
When working with the angle θ and the adjacent and opposite sides we use the tangent ratio.

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$



Finding an angle To find the size of an angle in a right-angled triangle you must know the length of two sides.

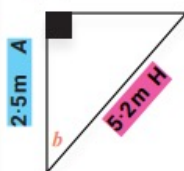
E.g. 1) Find the size of the angle a .



SOH CAH TOA

$$\begin{aligned} \sin \theta &= \frac{o}{h} & \sin a &= \frac{4.6}{8} \\ a &= \sin^{-1} \frac{4.6}{8} \\ a &= 35.1^\circ \text{ (to 1 d.p.)} \end{aligned}$$

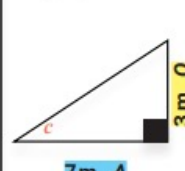
E.g. 2) Find the size of the angle b .



SOH CAH TOA

$$\begin{aligned} \cos \theta &= \frac{a}{h} & \cos b &= \frac{2.5}{5.2} \\ b &= \cos^{-1} \frac{2.5}{5.2} \\ b &= 61.3^\circ \text{ (to 1 d.p.)} \end{aligned}$$

E.g. 3) Find the size of the angle c .



SOH CAH TOA

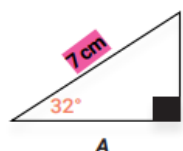
$$\begin{aligned} \tan \theta &= \frac{o}{a} & \tan c &= \frac{3}{7} \\ c &= \tan^{-1} \frac{3}{7} \\ c &= 23.2^\circ \text{ (to 1 d.p.)} \end{aligned}$$

Steps to success

1. Label the sides of the triangle **H** **O** and **A**. What side do you know and what side do you need?
2. Use **SOH CAH TOA** to determine the correct trig ratio to use.
3. Substitute your values into the correct equation.
4. Solve the equation and give your answer to an appropriate degree of accuracy.

Finding a side To find the length of a side in a right-angled triangle, you must know the length of one other side and the size of an angle (other than the right angle!)

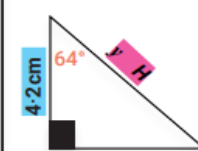
E.g. 1) Find the length of x .



SOH CAH TOA

$$\begin{aligned} \sin \theta &= \frac{o}{h} & \sin 32^\circ &= \frac{x}{7} \\ 7 \times \sin 32^\circ &= x \\ x &= 3.7 \text{ cm (to 1 d.p.)} \end{aligned}$$

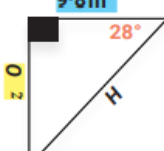
E.g. 2) Find the length of y .



SOH CAH TOA

$$\begin{aligned} \cos \theta &= \frac{a}{h} & \cos 64^\circ &= \frac{4.2}{y} \\ y &= \frac{4.2}{\cos 64^\circ} \\ y &= 9.6 \text{ cm (to 1 d.p.)} \end{aligned}$$

E.g. 3) Find the length of z .



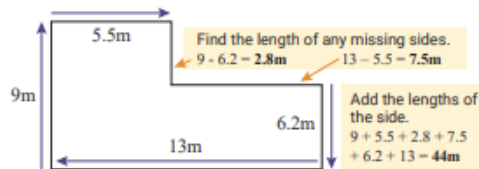
SOH CAH TOA

$$\begin{aligned} \tan \theta &= \frac{o}{a} & \tan 28^\circ &= \frac{z}{9.8} \\ 9.8 \times \tan 28^\circ &= z \\ z &= 5.2 \text{ m (to 1 d.p.)} \end{aligned}$$

Steps to success

1. Label the sides of the triangle **H** **O** and **A**. What side do you know and what side do you need?
2. Use **SOH CAH TOA** to determine the correct trig ratio to use.
3. Substitute your values into the correct equation.
4. Solve the equation and give your answer to an appropriate degree of accuracy.

Perimeter This measures the distance around the outline of a shape.



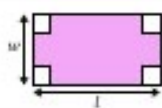
Perimeter is measured in units such as mm, cm, m...

Area Family Tree

The area of a shape is a measure of the 2-dimensional space that it covers.

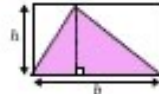
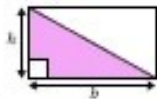
$$A = lw$$

A is the area of the rectangle
 l is the length of the rectangle
 w is the width of the rectangle



$$A = \frac{bh}{2} \quad A = \frac{1}{2}bh$$

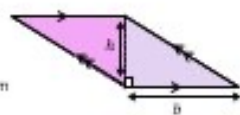
A is the area of the triangle
 b is the base length of the triangle
 h is the perpendicular height of the triangle



NOTE: $\div 2$ is the same as $\times \frac{1}{2}$
 Dividing by a number is the same multiplying by its reciprocal

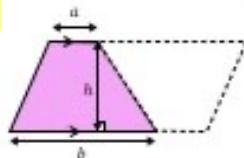
$$A = bh$$

A is the area of the parallelogram
 b is the base length of the parallelogram
 h is the perpendicular height of the parallelogram



$$A = \frac{(a+b) \times h}{2} \quad A = \frac{1}{2}(a+b)h$$

A is the area of the trapezium
 a and b are the parallel sides
 h is the perpendicular height of the triangle



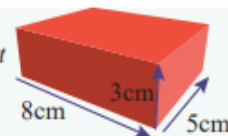
NOTE: $\div 2$ is the same as $\times \frac{1}{2}$
 Dividing by a number is the same multiplying by reciprocal

Volume This measures the amount of space within a 3D shape.

Volume of a Cuboid

$$\text{Volume of a cuboid} = \text{length} \times \text{width} \times \text{height}$$

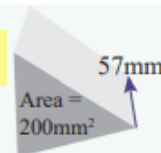
$$= 8 \times 3 \times 5 \\ = 120 \text{ cm}^3$$



Volume of a Prism

$$\text{Volume of a prism} = \text{area of cross-section} \times \text{length}$$

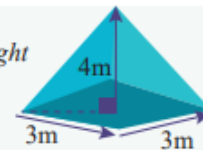
$$= 200 \times 57 \\ = 11\,400 \text{ mm}^3$$



Volume of a Pyramid

$$\text{Volume of a pyramid} = \frac{1}{3} \times \text{area of base} \times \text{height}$$

$$= \frac{1}{3} \times 3^2 \times 4 \\ = 12 \text{ m}^3$$

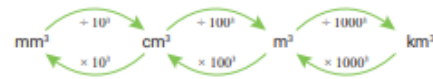


Volume is measured in units³ e.g. mm³, cm³, m³...

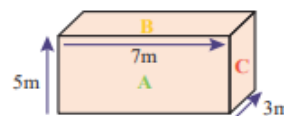
Converting between measurements of volume

E.g. Convert 5.5 m³ to cm³.

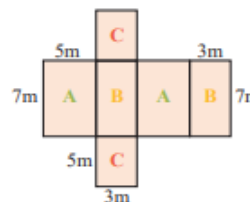
$$5.5 \times 100^3 = 5.5 \times 1\,000\,000 \\ = 5\,500\,000 \text{ cm}^3$$



Surface area This is the total area of every surface (face) of a 3D shape.



It is useful to consider the net of the 3D shape, to find the area of each face, in order to calculate the total surface area.



$$\text{Area of A} = 7 \times 5 = 35 \text{ m}^2$$

$$\text{Area of B} = 7 \times 3 = 21 \text{ m}^2$$

$$\text{Area of C} = 3 \times 5 = 15 \text{ m}^2$$

$$\text{Total surface area} = 2 \times (35 + 21 + 15) \\ = 142 \text{ m}^2$$

Key terms

Circumference

The distance around the outside of the circle.

Chord
A straight line that goes from one side of the circle to the other without passing through the centre.

Diameter
A straight line that goes from one side of the circle to the other and passes through the centre.

Radius
A straight line that goes from the centre to the circumference of the circle.

Tangent
A straight line that touches the circle at one point.

Arc
A part of the circle's circumference.

Sector
The area enclosed by two radii and an arc. It looks like a slice of pizza!

Segment
The area enclosed by a chord and an arc.

Circumference To find the circumference of a circle we use the formula: $C = \pi d$ or $C = 2\pi r$

E.g. Find the circumference of the following circles.

$$C = \pi d \\ = \pi \times 5 \\ = 5\pi \\ = 15.7 \text{ cm (to 1 d.p.)}$$

$$C = 2\pi r \\ = 2 \times \pi \times 5 \\ = 10\pi \\ = 31.4 \text{ cm (to 1 d.p.)}$$

Area To find the area of a circle we use the formula:

$$A = \pi r^2$$

E.g. Find the area of the following circles:

$$A = \pi r^2 \\ = \pi \times 10^2 \\ = 100\pi \\ = 314.2 \text{ cm}^2 \text{ (to 1 d.p.)}$$

If $d = 10\text{cm}$, then $r = 5\text{cm}$

$$A = \pi r^2 \\ = \pi \times 5^2 \\ = 25\pi \\ = 78.5 \text{ cm}^2 \text{ (to 1 d.p.)}$$



How do we use Knowledge Organisers in Mathematics

How can you use knowledge organisers at home to help us?

- **Retrieval Practice:** Read over a section of the knowledge organiser, cover it up and then write down everything you can remember. Repeat until you remember everything.
- **Flash Cards:** Using the Knowledge Organisers to help on one side of a piece of paper write a question, on the other side write an answer. Ask someone to test you by asking a question and seeing if you know the answer.
- **Mind Maps:** Turn the information from the knowledge organiser into a mind map. Then reread the mind map and on a piece of paper half the size try and recreate the key phrases of the mind map from memory.
- **Sketch it:** Draw an image to represent each fact; this can be done in isolation or as part of the mind map/flash card.
- **Teach it:** Teach someone the information on your knowledge organiser, let them ask you questions and see if you know the answers.

How will we use knowledge organisers in Mathematics?

Knowledge organisers will be used before I complete a Learning Check or Common Assessment. I will spend part of the lesson looking over each of the key topics of the half term before completing the Learning Check or Common Assessment.

I will also use these at home to complete my own independent learning and revision of these key topics.

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