AddvanceMaths.com

Year 8
Mathematics
Revision guide

Designed and written by

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The online Addvance Maths year 8 revision guide contains resources and activities to revise better!

https://addvancemaths.com/year8/

Note

This revision guide is comprehensive and contains plenty of practice activities. Every sub-topic has a linked Addvance maths YouTube video that will help you understand clearly with worked examples and more practice. It is important to note that the guide is based on the standard British curriculum, and you might not be studying the topics in the same order, or you may not even be studying some topics at all. If your school doesn't follow the same syllabus, just use this guide as a reference and use it to study the topics that are relevant.

Also, don't depend on this guide to make up your whole revision. Make sure you use your notes, maybe your textbook, and ask your teacher questions. Rather than just reading the guide, you need to engage with it in a deeper level for good retention. For more guidance, read the 'Guide to Effective Revision' at www.addvancemaths.com/revision for effective revision strategies.

Exam Advice

Ensure that you copy down numbers **correctly** and your **handwriting** is **neat**.

Be prepared with your **pen, pencil, rubber, ruler, compass and protractor** for the exam.

Ensure that your **working out is clear** and in steps. That way, even if your final answer is wrong, you will be awarded marks for using the **correct method**.

Remember to **simplify** your answer, add **units** and add **two decimal places** for **currency.**

Spend an adequate amount of **time** on each question depending on the **number of marks** available.

Remember to **RTQF** (Read The Question Fully). Look for **specific details** such as the required **unit**, and ensure your answer is **exactly** what the **question requires**.

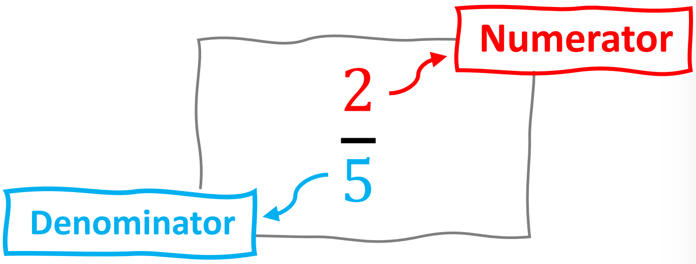
Ensure that you **check your answers** as many times as you can, leaving time for this. Read each question carefully, and **circle** or **underline** key words before attempting questions.

Table of contents

Topic 1- Fractions

RECAP

- ✓ A fraction is a number that represents parts of a whole. All parts of a whole are of **equal** size in a fraction.
- ✓ Every fraction contains a **numerator** and a **denominator**. The numerator is the number on top, and the denominator is the number on the bottom. For example:



- ✓ A fraction is at its **simplest form**, or **simplified** if the only common factor of the numerator and the denominator is 1.

Example

$\frac{2}{7}$ is fully simplified

$\frac{4}{14}$ is not simplified

- ✓ Fractions with different denominators and numerators but equal when simplified are known as **equivalent** fractions.

Classification

Fractions can be classified into **proper fractions** and **improper fractions**. In proper fractions, the denominator is greater than the numerator. In improper fractions, the denominator is smaller than the numerator. Improper fractions can also be written as **mixed numbers**, which contain a whole number and a fraction.

Proper: $\frac{9}{16}$

Improper: $\frac{17}{9}$

Mixed number: $3\frac{1}{9}$

Equivalent fractions examples

$$\frac{2}{7} \underset{*2}{\overset{*2}{=}} \frac{4}{14} \qquad \frac{2}{7} \underset{*3}{\overset{*3}{=}} \frac{6}{21} \qquad \frac{2}{7} \underset{*5}{\overset{*5}{=}} \frac{10}{35}$$

Write in each box an equivalent to the red fraction in the row

$\square = \square = \square = \frac{9}{54}$

$\square = \square = \square = \frac{4}{16}$

Equivalent fractions video

Simplify the fractions

$\frac{7}{63}$ = ——

$\frac{3}{6}$ = ——

$\frac{15}{45}$ = ——

Mixed numbers and improper fractions video

Conversions

- ✓ Fractions express equal parts of a whole, but they are not the only way to do so. **Decimals** and **percentages** also represent parts of a whole and can all be used interchangeably with the same value.

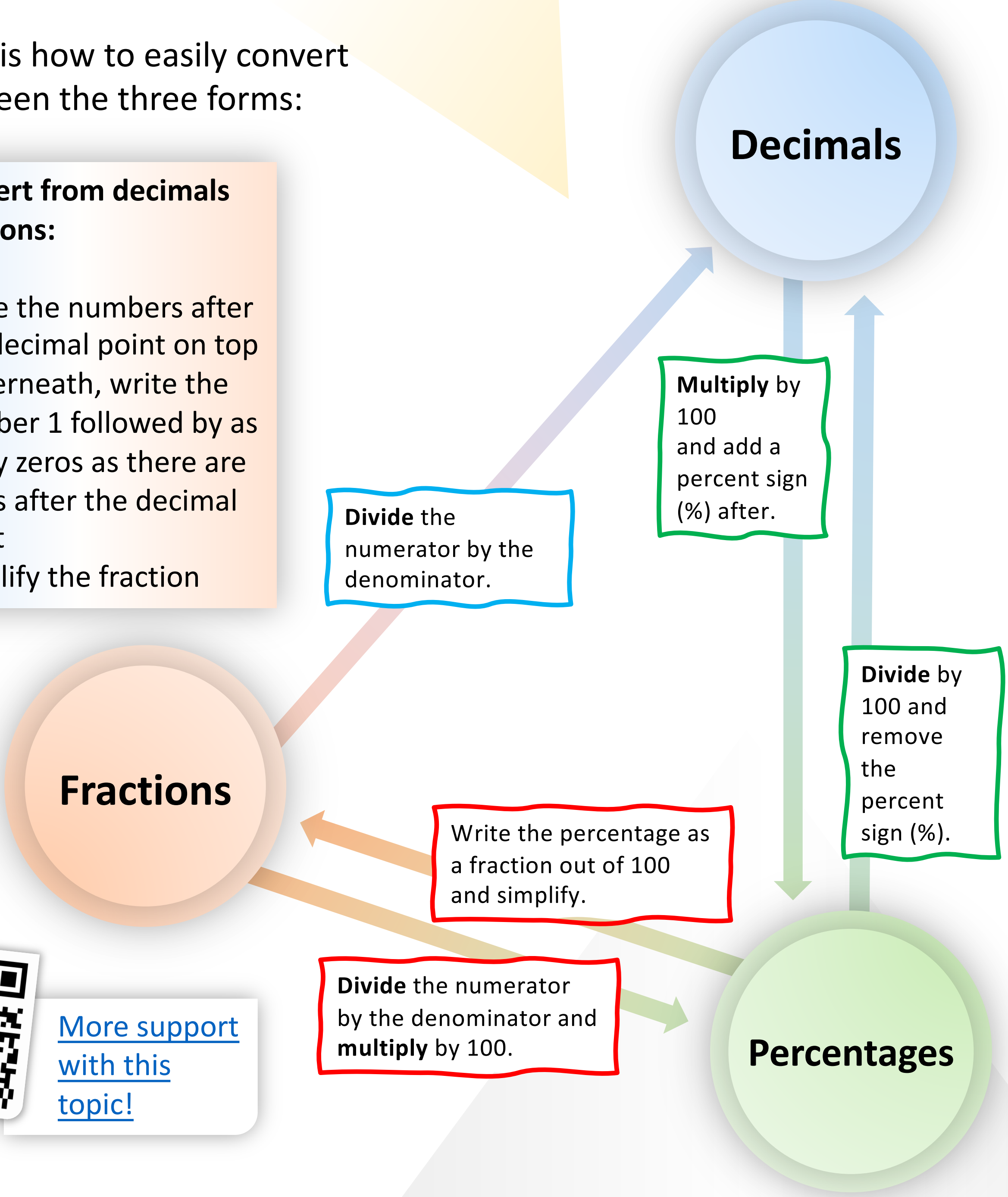
- ✓ A percentage is equal to a fraction with the denominator equalling 100. For example, $\frac{61}{100}$ as a fraction is equal to 61%.

- ✓ A decimal includes a whole number and decimal numbers after a point. A decimal is the exact value of a fraction when the numerator is divided by the denominator. For example, $\frac{61}{100}$ as a fraction is equal to 0.61.

- ✓ Here is how to easily convert between the three forms:

To convert from decimals to fractions:

1. Write the numbers after the decimal point on top
2. Underneath, write the number 1 followed by as many zeros as there are digits after the decimal point
3. Simplify the fraction



Decimals

Multiply by 100 and add a percent sign (%) after.

Divide by 100 and remove the percent sign (%).

Divide the numerator by the denominator.

Fractions

Write the percentage as a fraction out of 100 and simplify.

Divide the numerator by the denominator and **multiply** by 100.

Percentages

More support with this topic!

Conversions

Example: Convert 0.72 to a fraction

Step 1: $\frac{72}{\square}$

Write the numbers after the decimal on top (72)

Step 2: $\frac{72}{100}$

Two decimal digits, so 00 follow 1.

Step 3: $\frac{\mathbf{18}}{\mathbf{25}}$ ✓

Simplify (HCF=4)

Example: Convert 5/8 to a percentage

Step 1:
$5 \div 8 = 0.625$

Divide the numerator by the denominator

Step 2:
$0.625 * 100 = \mathbf{62.5\%}$ ✓

Multiply by 100

Example: Convert 64% to a fraction

Write 64 as a fraction out of 100.

Step 1: $64\% = \frac{64}{100}$

Simplify (HCF=4)

Step 2: $\frac{\mathbf{16}}{\mathbf{25}}$ ✓

Common conversions

Fraction	Decimal	Percent
1/10	0.1	10%
1/5	0.2	20%
1/4	0.25	25%
1/3	0.3333..	33.33..%
1/2	0.5	50%
3/4	0.75	75%

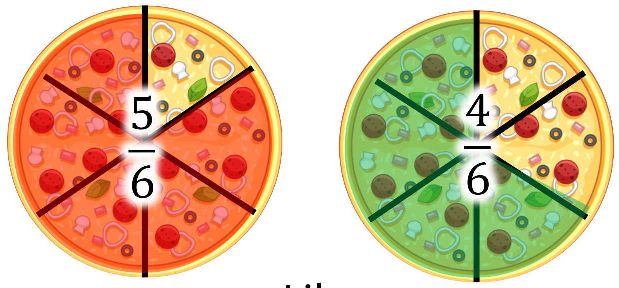
Match the fractions, decimals and percentages

$\frac{7}{25}$	0.8	$\frac{19}{25}$
67%	76%	80%
0.76	$\frac{67}{100}$	0.28
$\frac{4}{5}$	28%	0.67

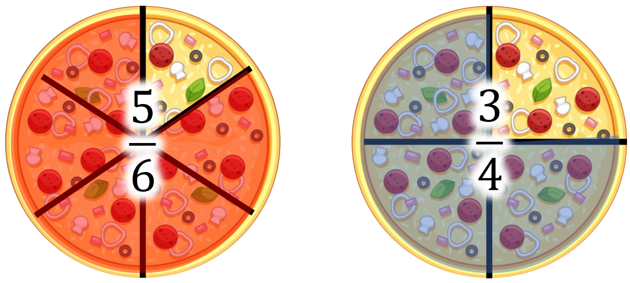
[More practice activities!](#)

Like and Unlike Fractions

- ✓ When comparing groups of fractions, they can either be classified as **like** or **unlike**.
- ✓ Like fractions have the same denominator, whereas unlike fractions have different denominators. For example:



Like



Unlike

- ✓ To convert two or more fractions from like to unlike, the fractions need to share a common denominator. In order to do this, there are two main steps:

1.Identify a Common Denominator: Calculate the **lowest common multiple (LCM)** of the two denominators. This is the number that will become the new denominator for all the fractions.

2.Make the Denominators the Same: To make the denominators the same as the common denominator, you need to scale the fractions appropriately. For both the fractions, multiply both the numerator and the denominator by the same number in order to make the denominators equal.

Example: convert $\frac{3}{4}$ and $\frac{5}{6}$ to like fractions

Step 1:

LCM of 4 and 6

16	12
20	18
28	24
32	30
36	36

∴ 36 is the common denominator.

Identify the common denominator

Step 2:

$$4 * 9 = 36 \qquad \frac{3}{4} \underset{*9}{\overset{*9}{=}} \frac{27}{36}$$

$$6 * 6 = 36 \qquad \frac{5}{6} \underset{*6}{\overset{*6}{=}} \frac{30}{36}$$

Scale to make the denominators the same

$$\frac{27}{36} \; \& \; \frac{30}{36}$$

Adding and Subtracting

- ✓ In order to **add** or **subtract** fractions, the first step is ensuring the fractions are like. If you are dealing with mixed numbers, convert them to improper fractions prior to this.

- ✓ Then, simply add the numerators, or subtract the second numerator from the first.

- ✓ After that, simplify your answer by finding the HCF (highest common factor) of the numerator and denominator. If your answer is an improper fraction, ensure to convert it to mixed number unless the question asks otherwise.

Example: Subtract 3/5 from 3/4

Convert $\frac{3}{4}$ and $\frac{3}{5}$ to like fractions

Step 1:

LCM of 4 and 5

4	5
8	10
12	15
16	20
20	

∴ 36 is the common denominator.

Identify the common denominator

Step 2:

$4 * 5 = 20$ $\underset{* 5}{\overset{* 5}{\frac{3}{4} = \frac{15}{20}}}$

$5 * 4 = 20$ $\underset{* 4}{\overset{* 4}{\frac{3}{5} = \frac{12}{20}}}$

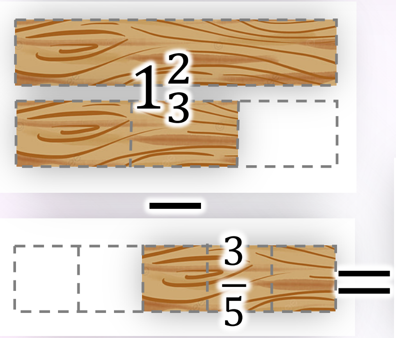
Scale to make the denominators the same

$$= \frac{15}{20} - \frac{12}{20}$$

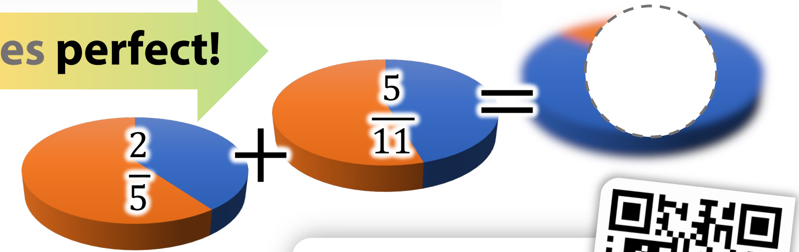
Subtract the second numerator

$$\frac{15}{20} - \frac{12}{20} = \frac{15 - 12}{20} = \frac{3}{20}$$

$$= \frac{3}{20}$$ ✓



Practice makes perfect!



More support with this topic!

Multiplying and Dividing

- ✓ There are two important notes that apply to both **multiplying** and **dividing** fractions. Firstly, if a whole number is involved, make the number 1 as the denominator. Secondly, if mixed numbers are involved, the first step is to convert them to improper fractions.

- ✓ Multiplying fractions is straightforward. To multiply two fractions, multiply both the numerators, then multiply both the denominators. Finally, simplify your answer and convert it to a mixed number if it is an improper fraction.

- ✓ Dividing a fraction is essentially the same as multiplying the **reciprocal** of a fraction. The reciprocal of a fraction is the numerator and denominator swapped. For example, 5/9 and 9/5 are reciprocal fractions.

Example: Multiply 4/5 by 6

$$\frac{4}{5} \times \frac{6}{1} = \frac{4 \times 6}{5 \times 1} = \frac{24}{5} = 4\frac{4}{5}$$

- ✓ To divide a fraction by another, flip the second fraction, and multiply the two. To remember it better, use the acronym **KCF** (**Keep** the first fraction, **Change** the dividing sign to the multiplying sign, **Flip** the second fraction).

Example: Divide 2/3 by 1/6

$$\frac{2}{3} \div \frac{1}{9} \quad \boxed{\textbf{Keep Change Flip}} \quad = \frac{2}{3} \times \frac{9}{1} = \frac{2 \times 9}{3 \times 1} = \frac{18}{3} = 6$$

The first row has been done for you!

a	b	$a \times b$	$a \div b$
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{6}$	$1\frac{1}{2}$
$\frac{1}{3}$	$\frac{4}{5}$		
$\frac{5}{6}$		$\frac{5}{8}$	
	$\frac{7}{12}$		$\frac{24}{35}$
$\frac{1}{2}$			4

PRACTICE makes perfect!

More support with this topic!

Fraction of an Amount

Finding the fraction of a number

- ✓ To find the fraction of a number (for example, 2/3 of 60), divide the number by the denominator of the fraction. Then, multiply by the numerator.
- ✓ If the denominator is not a factor of the number, then multiply the numerator by the number first, and then, divide your answer by the denominator. The answer will likely include decimals.

Example 1: Find 3/5 of $80

$$\frac{3}{5} \times \$80 = 3 \times \frac{\$80}{5} = 3 \times \$16 = \$48$$

More support with this topic!

Example 2: Find 3/7 of $80

$$\frac{3}{7} \times \$80 = \frac{3 \times \$80}{7} = \frac{\$240}{7} = \$34.29$$

Fractions: checklist

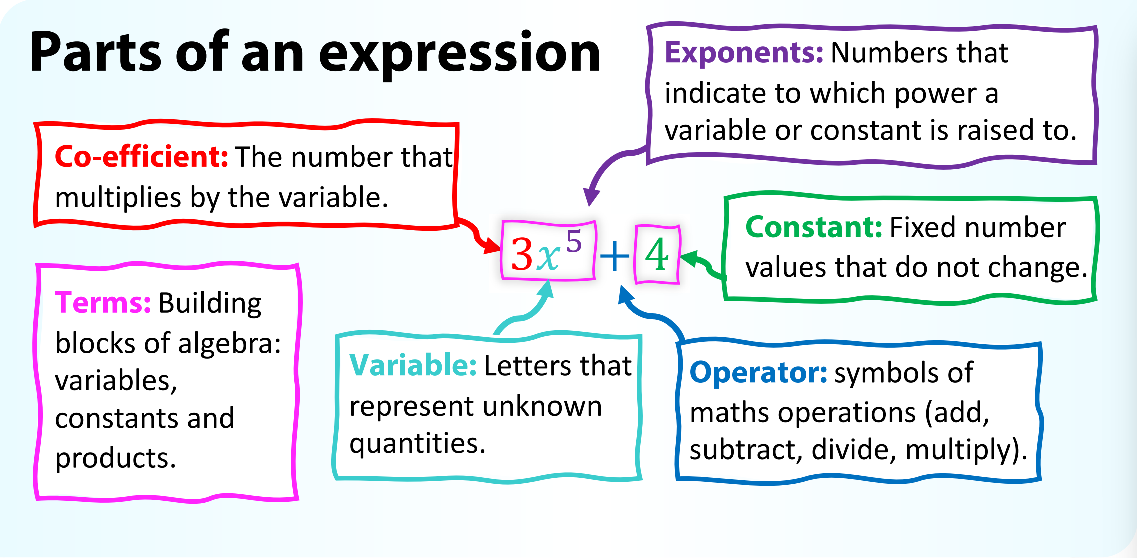
I can classify a fraction is proper, improper or mixed number.	
I can state that fractions, decimals, and percentages all represent parts of a whole.	
I can convert between fractions, decimals and percentages.	
I am able to add and subtract fractions and mixed numbers by finding a common denominator.	
I am able to Multiply and Divide Fractions, including mixed numbers.	
I am able to calculate fractions of an amount.	
I can confidently apply fractions.	

Topic 2- Manipulating expressions

RECAP

- ✓ An **algebraic equation** is a statement that shows two expressions are equal and helps us find the value of the variable that makes the equation true. For example, $\boxed{3x+4=10}$ is an equation that has a solution. In this case, the value of the variable x is 2.

- ✓ An **algebraic expression** is a math phrase with numbers, letters (**variables**), and math symbols that we use to calculate or describe **quantities** and **relationships**. For example, if a taxi ride costed \$2.23 per mile, and \$3.45 on tips, it can be expressed as: $\boxed{2.23m+3.45}$ where m is the number of miles.



Parts of an expression

Exponents: Numbers that indicate to which power a variable or constant is raised to.

Co-efficient: The number that multiplies by the variable.

$$3x^5+4$$

Constant: Fixed number values that do not change.

Terms: Building blocks of algebra: variables, constants and products.

Variable: Letters that represent unknown quantities.

Operator: symbols of maths operations (add, subtract, divide, multiply).

Identify…

$2x-5$

Variable:

_ _ _ _ _ _ _ _ _ _

Co-efficient:

_ _ _ _ _ _ _ _ _ _

Operator:

_ _ _ _ _ _ _ _ _ _

Constant:

_ _ _ _ _ _ _ _ _ _

- ✓ When dealing with algebraic expressions, it is important to leave them in their **simplest form**, which is essentially making it concise and easy to work with, while maintaining the same value. Here are some examples of non-algebraic expressions in their original and simplified forms.

$$-1(2-3) \rightarrow 1$$

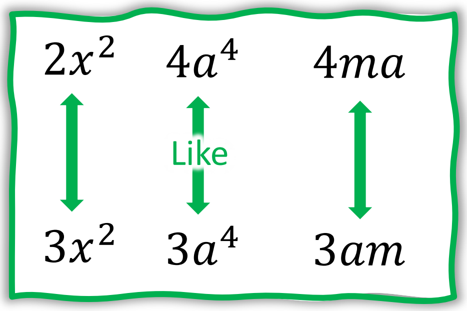
$$6 \div (2+1) \rightarrow 2$$

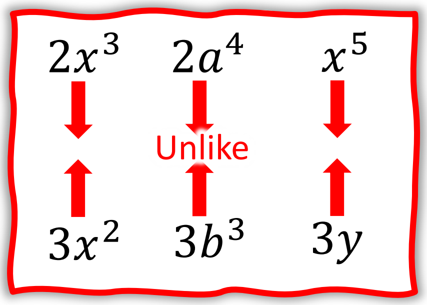
$$2+1+3\times 0 \rightarrow 3$$

- ✓ In order to simplify algebraic expressions, **like terms** must be collected. Like terms are terms that contain the same variable raised to the same power. Here are some examples of like and unlike terms.

Simplifying Expressions

- ✓ When dealing with expressions, separate the like terms, along with the operator before them.





- ✓ Then, add or subtract the coefficients of the like terms, according to the operators. After that, you should have one co-efficient and variable, with the same value.

- ✓ Do this for all the groups of like terms in the expression. When there are none left, the expression is in its simplest form.

Video to support topic

Example: $4x^2 + 4 - 2x + 3x^2 + 3x - 9$

$\overbrace{4x^2}\underbrace{+4}\underline{-2x}\overbrace{+3x^2}\underline{+3x}\underbrace{-9}$ Label the like terms

$4x^2 + 3x^2 + 4 - 9 - 2x + 3x$ Re-arrange the expression

$(4+3)x^2 + 4 - 9 + (-2+3)x$ Add/ subtract the coefficients

$7x^2 - 5 + x$ ✓ Simplify

Practice

$2m + m + 4m$

$4x + 3 + x$

$4a^2 + 3a^2 + 4$

$3 - 4x + 5 + x$

$4x + x^2 + 2x + 3x^2 - 9$

$6 - 3am + 9x - 5ma + 1$

Perfection!

Expanding Brackets

- ✓ **Brackets** (), also known as **parenthesis**, are frequently used in algebra.
- ✓ Expanding brackets is straightforward. Multiplying every term outside the bracket by every term inside the bracket will give you an expanded result. For example, if you have $5(2x + 3)$, multiply the 5 by everything inside the bracket: $5 \times 2x + 5 \times 3$, which equals $10x + 15$.
- ✓ Note that you should only multiply the terms on the outside that are directly next to the bracket. For example, if you have $5 + 3(x + 1)$, multiply the 3 by everything in the bracket. Then, you will have $5 + 3x + 3$, which you can then simplify to $3x + 8$.
- ✓ If there is an additional multiplication term outside the bracket, multiply the two first and then multiply individually by every term inside the bracket. For example, $5 \times 4(x + 1)$ should be written as $5 \times 4 \times x + 5 \times 4 \times 1$. Then, simplify it: $20x + 20$.

Example: $4 - 3x(x + 3)$

$4 - 3x \times x - 3x \times 3$

$4 - 3x^2 - 9x$ ✓

$3x^2(x^2 + 2)$

Expand the Brackets

$5 + 4(2 + 3x)$

$3 \times 4(2x + 4)$

$4tm(3x + m)$

Note: Double brackets are in the video, but are not covered until year 9.

[Expanding brackets video]

Factorising

✓ **Factorising** an expression is essentially the inverse of expanding brackets. In other words, to 'factorise' is to 'put in brackets.' Factorising is a little more complicated than expanding and can be put into a few steps.

Step 1: Identify common factors in the terms. These can be numbers or variables. For example, in $2x^2 + 4x$, $2x$ is the highest common factor as it can be divided by both terms.

Example: $5x^3 + 15x^4$

HCF: $5x^3$

$5x^3 + 15x^4$

$5x^3(1 + 3x)$ ✓

Step 2: Place the highest common factor outside the bracket, and the terms inside the bracket. If a term is the HCF, replace it inside the brackets with '1'.

Step 3: Remember to check your answer by expanding the brackets!

Factorising brackets video

Factorised form		Expanded form
$4x(x + 2d)$	⇨	
	⬅	$4x^2 + 6x$
$5 - 12(x + 7)$	⇨	
	⬅	$15x^3 + 10x + 45xy$
$4 \times 9(x^2 + 3)$	⇨	
	⬅	$am^2 + a^2 + am$
$2 + 4mn(2mn - 5)$	⇨	
	⬅	$12x^2 + 44x + 10amx$

Practice makes perfect!

Transum practice activities

Substitution

✓ One of the reasons algebra is used is to calculate different outcomes by **substituting** different values for a variable. Substituting a value in for a variable is essentially replacing the variable with the number and calculating.

Example: Evaluate $2x^2 + 3$ when $x = 5$.

$2(5)^2+3$ Re-write by replacing the variable

$2(25) + 3$ Always calculate powers first

$50 + 3$ Simplify the expression

53 ✓

Substitution video

$5x^3(1 + 3x)$: $x = 2$

$4am + 6a^2$: $a = 3, m = 4$

$\frac{2}{3}ax^2 + 6$:
$a = 2$ $x = 3$

Manipulating Expressions: checklist

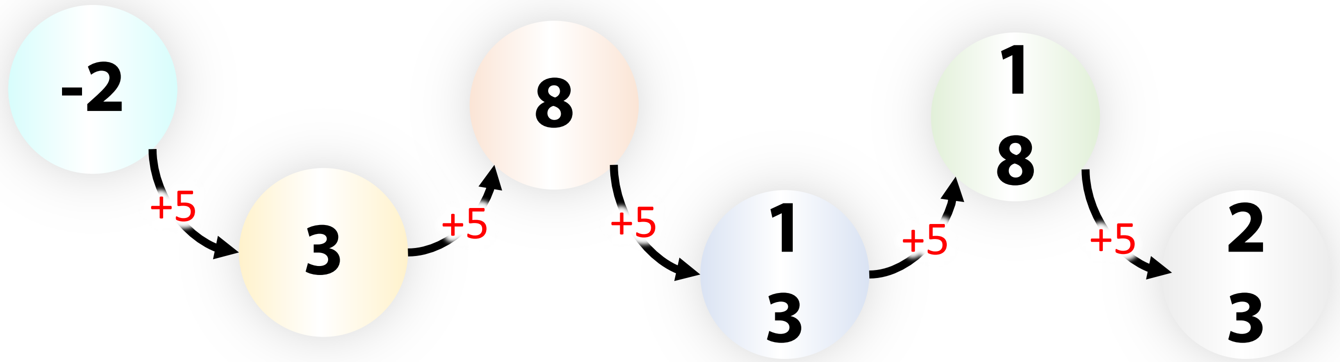
I understand the difference between an equation and an expression.	
I can identify the parts of an algebraic expression.	
I can simplify an algebraic expression by collecting like terms.	
I can confidently expand brackets.	
I can identify the Highest Common Factor (HCF) of algebraic terms.	
I can use the HCF to factorise equations into brackets.	
I can substitute values into expressions and calculate.	

Topic 3- Sequences: n$^{\text{th}}$ term

RECAP

- ✓ A **<u>sequence</u>** is an orderly set of numbers or algebraic terms. Each number is called a ‘**<u>term</u>**’, and the location of a term in the sequence is called the ‘**<u>position</u>**’. Sequences follow a pattern to get from one term to the next.

- ✓ Each term of an **<u>arithmetic</u>** sequence is equal to the previous term plus a constant. The constant is called the **<u>common difference</u>**. Here is an example of a sequence.



- ✓ In sequences, the variable ‘n’ is used to identify the position of a term. For example, the fifth term of a sequence can be denoted as $n = 5$. Similarly, if $n = 45$, that indicates the forty-fifth term of the sequence. In the sequence below, if $n = 8$, the term is 50.

Sequence	78	74	70	66	62	58	54	50	46
n	1	2	3	4	5	6	7	8	9

- ✓ The **<u>n^{th} term</u>** is a formula to a specific sequence that will facilitate calculating a term in the sequence using the n value, and without having to find any of the terms before it.

- ✓ If the n^{th} term of a sequence is $\boxed{5n + 2}$ each term can be calculated by substituting the n value into the formula. For example, find the

Thousandth term:

$5n + 2$
$5(1000) + 2$
$5000 + 2$
50002 ✓

Fourth term:

$5n + 2$
$5(4) + 2$
$20 + 2$
22 ✓

Calculating Nth Term

✓ Calculating the nth term of an arithmetic sequence is fairly straightforward and can be broken down into a few steps.

Step 1: Identify the Common Difference, or the constant by which the terms change. Add this number before ‘n’.

Example: $5, 7, 9, 11, 13$

$$D = 2$$

$$N^{th}\ term = 2n\ ...$$

Step 2: Subtract the Common Difference from the first term, which is essentially finding the term before the first term. Place that after the ‘n’.

$$3, 5, 7, 9, 11, 13$$

$$N^{th}\ term = 2n + 3$$

If the term before the first is negative, ensure you add a – sign before it in the nth term.

First 6 terms	nth term	100th term	1000th term
55, 58, 61, 64, 67, 70			
	$1.5n + 42$		
109, 105, 101, 97, 93, 89			
	$-3n - 4$		

Sequences revision video

Sequences: checklist

I understand and can define ‘arithmetic sequence’.	
I am able to find terms of a sequence given the nth term.	
I am able to calculate the nth term of a sequence of numbers.	

Practice Assessment 1

Calculators not allowed

Section	Score
1. Year 7 recap	/9
2. Fractions	/11
3. Manipulating Algebra	/18
4. Sequences: nth term	/12
Total:	/50

Section 1: Year 7 recap

1. (a) $-4+9=$

(b) $-1-(-9)=$ 2

(c) $-4\times(-6)=$

(d) $-2+(-32)\div(-8)=$ 4

2. (a) $15^2=$

(b) $13^2=$

(c) $\sqrt{196}=$ 3

Section 2: Fractions

3. (a) $\frac{3}{5}+\frac{1}{3}=$

2

(b) $1\frac{1}{2}-1\frac{3}{8}=$

3

(c) $2\frac{2}{3}\times\frac{6}{7}=$

3

(d) $3\frac{1}{5}\div 4=$

3

Practice Assessment 1

Section 3: Manipulating Algebra

4. Expand the brackets and simplify the following

(a) $3(x+1)$

2

(b) $5-3(1-x)$

3

(c) $3(x+1)+4(7+2x)$

3

(d) $x(x+5)-7(2x-1)$

3

5. (a) If $x = 3(y - 2z)$ find the value of x when $y = 2$ and $z = 0.5$.

3

(b) If $n = t^2 + xy$ find the value of n when $t = -2$, $x = 2$ and $y = -3$.

4

Section 4: Sequences- nth term

6. (a) Find the next three terms in the sequence: 1, 4, 9, 16 ...

3

(b) Write the first three terms in the sequence $2n + 3$

3

(c) State the nth term rule for the sequence: 92, 89, 86 ...

3

(d) Is 405 in the sequence 22, 26, 30 ...?

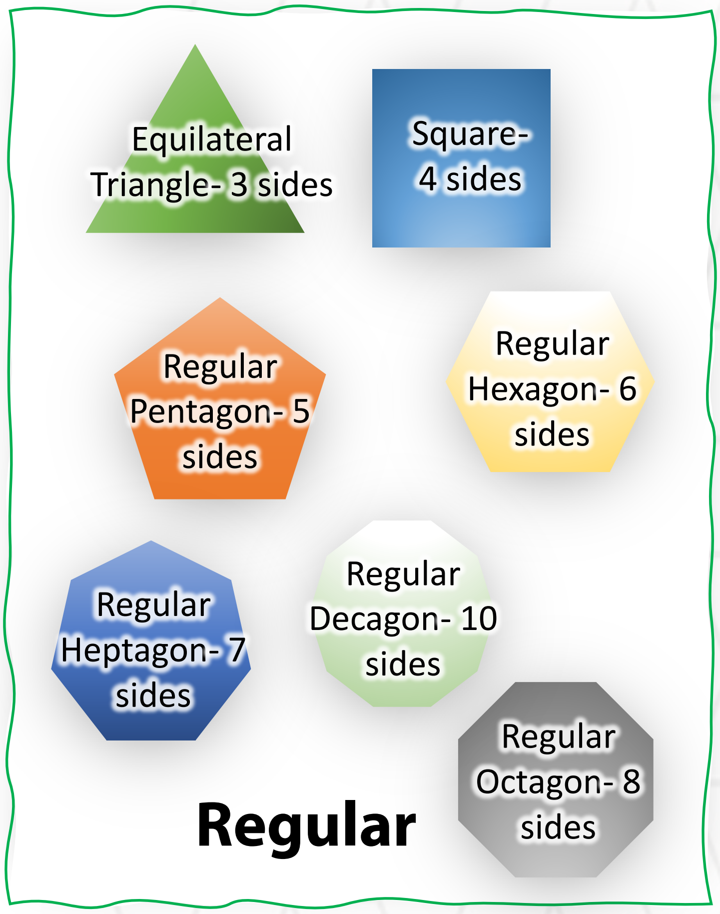
3

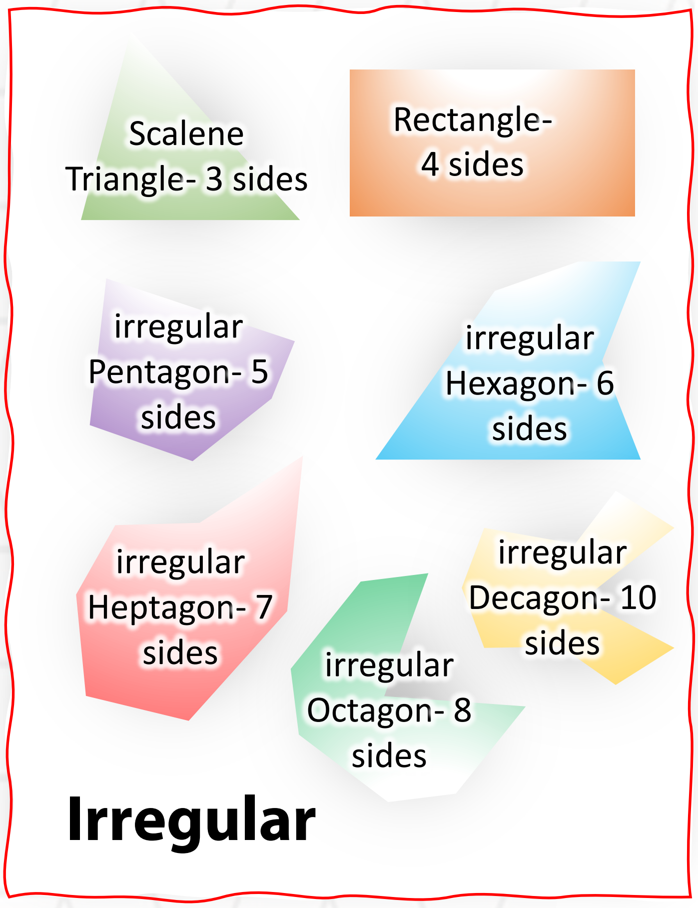
Topic 4- Labelling polygons

RECAP

- ✓ A **polygon** is a **2-dimensional (2D)** shape with three or more straight sides. A 2D shape has 2 dimensions (such as length and width), but no depth (thickness).

- ✓ If all the sides and angles of a polygon are equal, it is called a **regular polygon**. If the sides and (or) angles are not equal, it is classed as an **irregular polygon**.





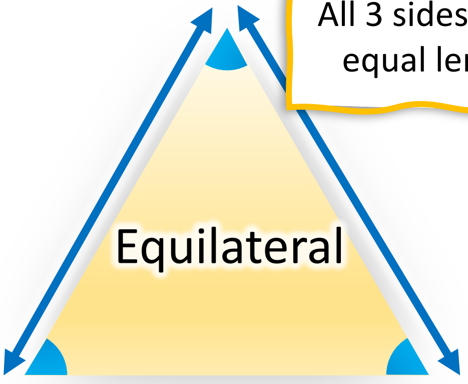
- ✓ Polygons can be classified according to the number of sides regardless of whether or not they are regular. All 3-sided shapes are '**triangles**', and all 4-sided shapes are '**quadrilaterals**', all 5-sided polygons are '**pentagons**', and so on. A **nonagon** has 9 sides, and a **dodecagon** has 12.

- ✓ Triangles and Quadrilaterals can be further classified depending on their **properties**. These properties consist of angles and side lengths. Parallel sides are also used to classify quadrilaterals.

Classifying Triangles

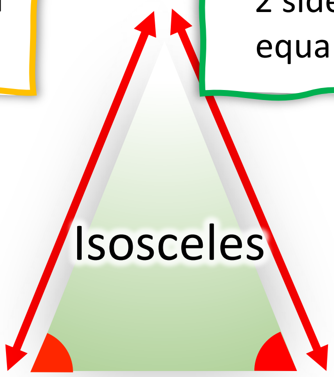
Based on side lengths:

All 3 sides are of equal length.



All 3 angles are equal to 60˚.

2 sides are of equal length.



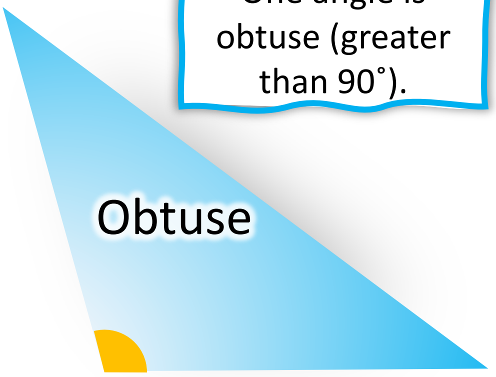
Two angles are equal.

All 3 sides are of different lengths

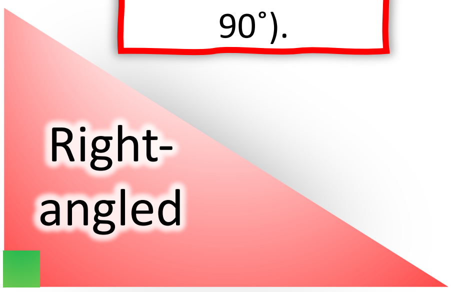
All 3 angles are not equal.

Based on angles:

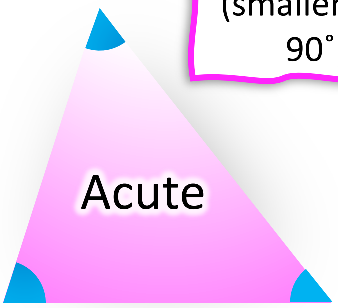
One angle is obtuse (greater than 90˚).



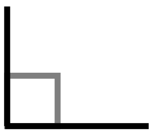
One angle is right (equal to 90˚).



All 3 angles are acute (smaller than 90˚).



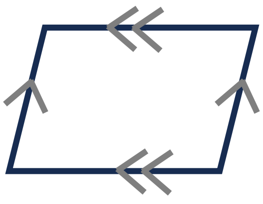
Labelling conventions

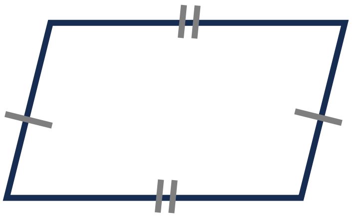


Right- angles

Sets of equal angles

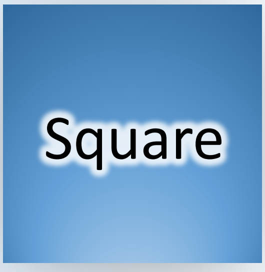
Sets of parallel sides





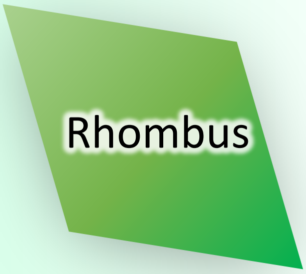
Sets of sides with equal lengths.

Classifying Quadrilaterals



Square

- All four sides are equal
- All four angles are equal to 90˚
- There are two pairs of parallel sides



Rhombus

- All four sides are equal
- Two pairs of opposite angles are equal
- There are two pairs of parallel sides

Parallelogram

- Two pairs of opposite sides are of equal length
- Two pairs of opposite angles are equal
- There are two pairs of parallel sides

Trapezium

- There is one pair of parallel sides
- Angles are not necessarily equal
- Known in the US as a trapezoid.

Kite

- Two pairs of adjacent sides are equal
- One pair of opposite angles is equal.
- There are no parallel sides

Rectangle

- Two pairs of opposite sides are equal
- All four angles are equal to 90˚
- There are two pairs of parallel sides

Isosceles Trapezium

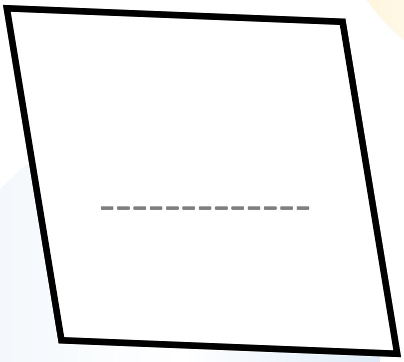
- There is one pair of parallel sides
- There are two sides of equal length
- There are two pairs of equal adjacent angles.

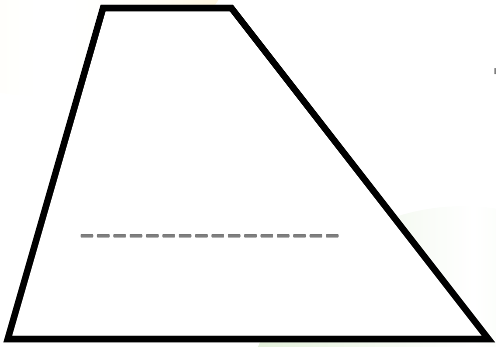
Certain quadrilaterals share properties and can belong to multiple categories; for instance, a square can be classified as a rectangle. Categorize based on the closest matching properties.

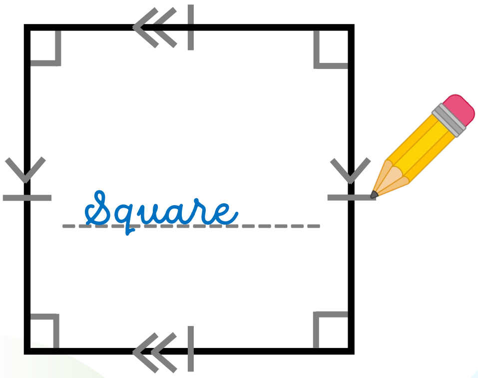
Labelling Polygons

Identify and label the polygons

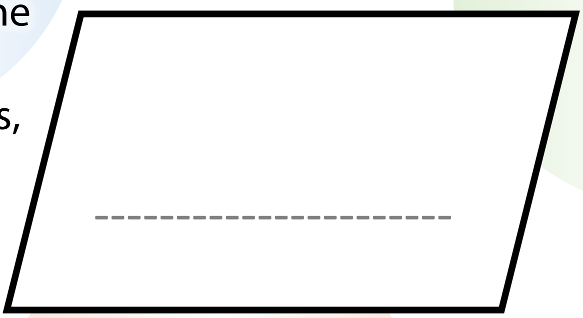
An example has been done for you!

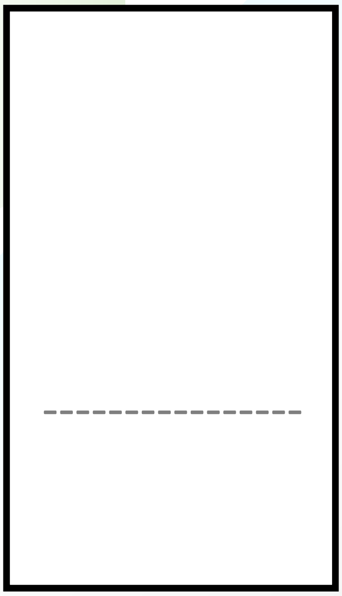


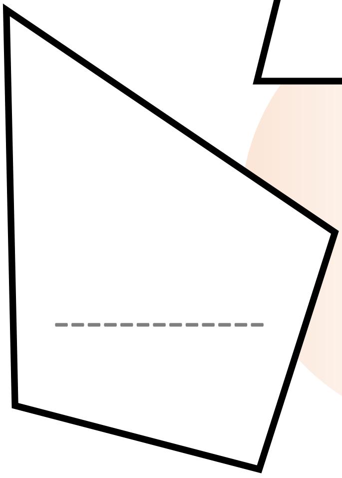


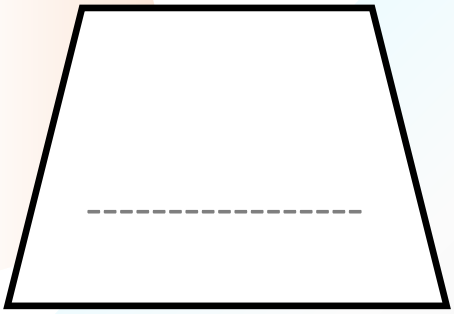


Hint: Include all the labels (parallel sides, equal angles, equal lengths).









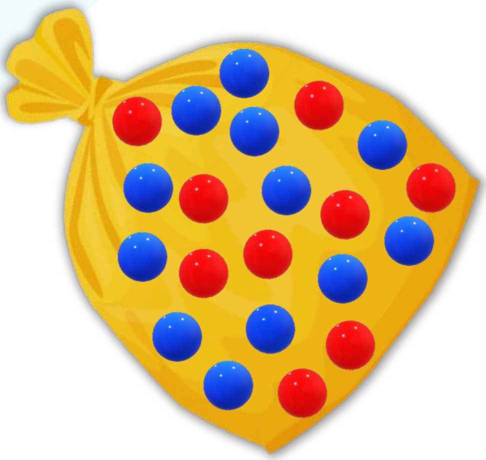
Labelling polygons: checklist

I can identify a parallelogram, trapezium, isosceles trapezium, rhombus, square, rectangle and kite.	
I know and am able to use the conventions for labelling the sides of polygons including parallel sides and equal lengths.	
I know and am able to use the conventions for labelling equal angles and right angles in polygons.	

Topic 5- Ratio and proportion

RECAP

✓ **Ratios** express the relationship between two or more quantities. They are expressed like a fraction, with a colon. For example, 2 to 3 is written as 2:3. In the bag below, there are 21 marbles (12 blue and 9 red). This can be expressed as a ratio of 3:4, meaning that for three red marbles, there are four blues.



✓ Ratios are always given in their **simplest form**, and like fractions, to compare ratios, at least one part must be equal. For example, if you are comparing Black: Yellow: Green as 3:4:6, and Green: Red: Blue as 3:5:8, you need to multiply the second ratio by 2, hence making Black: Yellow: Green: Red: Blue as 3:4:6:10:16.

✓ **Sharing in a ratio** involves dividing a **total quantity** into **parts** as specified by the given ratio. For example, if you were to split 30 apples between John and Adam in a ration of 2:3, for every two apples John gets, Adam gets 3. This would mean a total of 12 apples for John, and 18 for Adam. In order to share in a ratio:

1. Add up the ratio to find the total number of parts.
2. Divide the total amount by the number of parts.
3. Multiply this number by each part of the ratio. This will give you the total amount shared in the ratio.

Revision video

Example: Share $480 in a ratio of 3:5

Step 1: $Total\ number\ of\ parts = 3 + 5 = 8$

Step 2: $\$480 \div 8 = \$60$

Step 3: $\$60 \times 3, \$60 * 5$

$\$180, \$300$ ✓

Share $720 in a ratio of …

7:5

9:11

5:1

Unitary Method

✓ The **Unitary method** is a technique to calculate quantities based on relationships and units. The method involves determining a unit (which can be any quantity, example 1l, 1g, 1m etc), and using this information to calculate values or quantities. Once you know the unit, you can multiply or divide it to get the answer, while ensuring the ratio stays the same.

1. Determine the value of one unit by division through context.
2. Calculate the desired quantity by multiplying.

Example: If 5 pens cost $15, how much will 8 pens cost?

Step 1: $\$15 \div 5 = \$3 \therefore 1\text{pen costs } \$3$

Step 2: $8 * \$3 = \$24$

If 150 water bottles cost $90, how many bottles can you buy for $60?

_ _ _ _ _ _ _ _ _ _ _ _ bottles

If you can buy 15 pencils for 90p, how many pencils can you buy for 48p?

_ _ _ _ _ _ _ _ _ _ _ _ _ pencils

If 200 grams of butter can make 50 cookies, how many grams of butter do you need for 30 cookies?

_ _ _ _ _ _ _ _ _ _ _ _ _ _ grams

Unitary method revision video

Ratio and proportion: checklist

I am able to share a quantity in a given ratio.	
I am able to solve problems using ratio.	
I can use the unitary method to solve problems using proportion.	

Topic 6- Basic statistics

RECAP

✓ **Statistics** is the field of maths and science that deals with **data**. It includes organizing, presenting, and interpreting data. An important skill includes being able to calculate the **mean**, **median**, **mode**, and **range** of a data set.

Mean

The mean is a measure that represents the **average** value of a set of numbers. To find the mean, follow these steps:

1. **Add Up the Numbers:** Add all the numbers together.
2. **Count the Numbers:** Count how many numbers are in the set.
3. **Calculate the Mean:** Divide the sum of the numbers by the count.

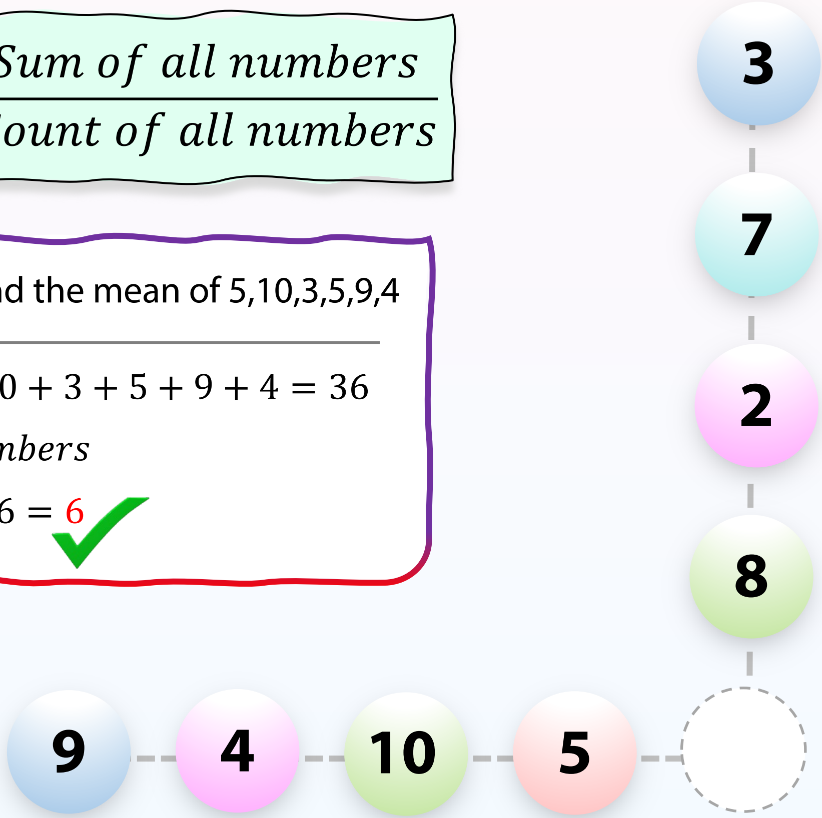
$$Mean = \frac{Sum\ of\ all\ numbers}{Count\ of\ all\ numbers}$$

Example: Find the mean of 5,10,3,5,9,4

Step 1: $5 + 10 + 3 + 5 + 9 + 4 = 36$

Step 2: $6\ numbers$

Step 3: $36 \div 6 = 6$ ✓



Challenge:

Find the 9th number, which is also the mean of all 9 numbers!

Median

RECAP

Median

The median is a measure that represents the **central** value of a set of numbers. To find the median, follow these steps:

1. **Arrange the Numbers:** Arrange the numbers in ascending order (from smallest to largest).
2. **For Odd Data Sets:** If the data set count is odd, the middle number is the median.
3. **For Even Data Sets:** . If the data set count is even, identify the middle two numbers, and calculate the mean of them. This is the median.

Example: Find the median of 5,10,3,7,4

Step 1: 3,4,5,7,10

Step 2: 3,4, **5**, 7,10 $median = 5$ ✓

Example: Find the median of 12,4,6,3,9,8

Step 1: 3,4,6,8,9,12

Step 3: 3,4, **6**, **8**, 9,12 $\frac{6+8}{2} = 7$ ✓

7 - 4 - 9 - 5 - 2 - 3 Median: _ _ _ _ _ _ _

Median: _ _ _ _ _ _ _ 3 - 0 - 8 - 6 - 9

1.6 - 0.4 - 5.7 - 2.4 - 6.8 Median: _ _ _ _ _ _ _

An **Outlier** is a piece of data that is an extreme- a piece of data that is nowhere near the value of all other pieces of data. For example, in the set 5,6,100,9,3, 100 is an outlier as it is not comparable to the other numbers. Note that the **mean** will be affected by outliers, but the **median** is less likely to be affected.

Mode and Range

RECAP

Mode

- ✓ The mode is the most **frequently** occurring (or most common) number in a data set. To find the mode, just look for the number that repeats the most.
- ✓ If there are no repeating numbers, then there is no mode.
- ✓ If more than one number repeats the same number of times, it is a **bimodal** data set. List all the modes you find.

Range

- ✓ The range is the difference between the largest and smallest number.
- ✓ To find the range, subtract the smallest number from the largest number.

Example: Find the range of 5,10,3,5,9,4

$Range = 10 - 3 = 7$ ✓

Mean, Median, Mode and Range video

5	7	2	6	3	9

Mean:

Median:

Mode:

Range:

Transum Activities

7	2	1	5	8

Mean:

Median:

Mode:

Range:

Frequency Tables

✓ A **Frequency** table is a way to organize and display a data set, and their frequencies. They are used when values are repeated several times. The left column is known as the **variable** and the right is the **frequency**. For example, observe the data set, and the frequency table below. Notice how the frequency table makes it easier to understand the data set.

Variable	Frequency
4	3
5	4
6	3
7	2
8	3

Mode

To calculate the mode of a frequency table, simply identify the value with the highest frequency. In the frequency table above, the mode is 5, because its frequency (4) is the highest.

Mean

Variable	Frequency	fx
4 *	3	= 12
5 *	4	= 20
6 *	3	= 18
7 *	2	= 14
8 *	3	= 24
Total:	15	88

Step 1: Add a column to the right (fx). Multiply the Variable by the Frequency in each row.

Step 2: Add a row at the bottom and add up the frequency and fx columns.

Step 3: Divide the fx total by the total of frequencies.

$$\frac{88}{15} = 5.867$$ ✓

Frequency Tables Practice

15 students in a class score the following in their Maths assessment:

Score	Frequency
10	2
20	4
30	5
40	3
50	1

1. List all the scores:

Frequency tables revision video

Ignore the grouped data example; it will come later in year 9.

Frequency tables Transum activity

2. Calculate the Mode of the table:

3. Calculate the Mean of the table:

Basic Statistics: checklist

I understand the uses of statistics with real life context.	
I am able to calculate the mean, mode and range of a data set.	
I am able to calculate the median of data sets that have both odd and even counts.	
I can convert between a data set and a frequency table.	
I am able to calculate the mean, median, mode and range of a frequency table.	

Practice Assessment 2

Calculators not allowed

Section	Score
1. Year 8 Topics 1-3 Recap	/24
2. Labelling Polygons	/9
3. Ratio and Proportion	/5
4. Basic Statistics	/12
Total:	/50

Section 1: Year 8 Topics 1-3 Recap

1. (a) $\frac{2}{3}+\frac{1}{4}=$

2

(b) $1\frac{3}{5}-1\frac{2}{9}=$

2

(c) $4\frac{1}{3} \times \frac{4}{9} =$

(d) $3\frac{1}{4} \div 3 =$ 3

2. Expand and Simplify the expressions: 3

(a) $5 - 4(y + 4)$

2

(b) $2(x + 4) + 4(3 + 4x)$

3

3. (a) Find the next three terms in the sequences:

(i) 56, 58, 60 ...

2

(ii) 97, 93, 89 ...

2

(b) Write the first three terms in the sequence $3n + 5$

3

(c) State the nth term rule for the sequence: 90, 86, 82 ...

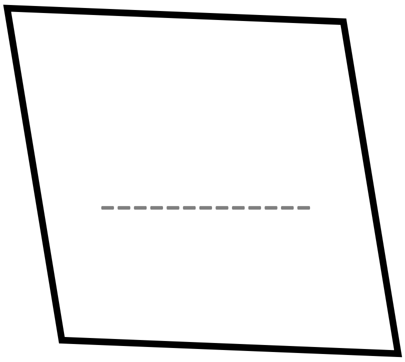
2

Practice Assessment 2

Section 2: Labelling polygons

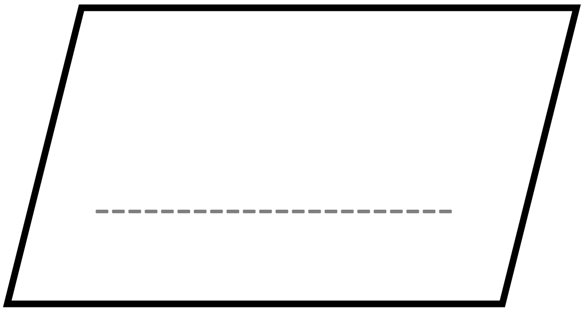
4. Identify the following polygons and label angles, side lengths, and parallel sides using the correct symbols.

(a)



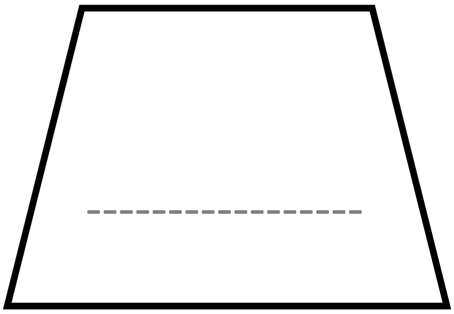
2

(b)



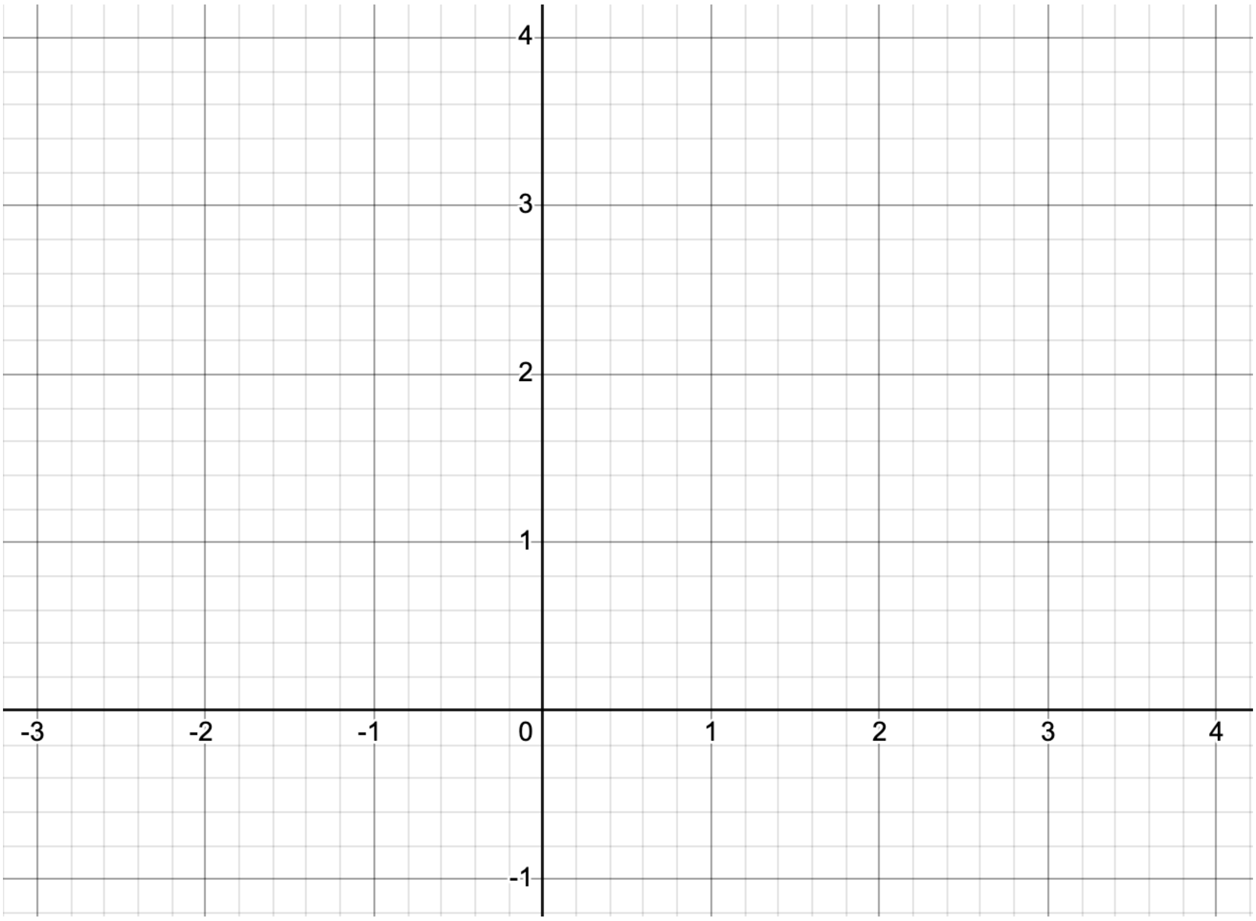
2

(c)



2

5. Use the following co-ordinates to construct a shape on the graph:
(1,3), (1,2), (3,1), (2,3)



(a) Identify the polygon on the graph above

______________________________ 1

(b) Does the polygon have parallel sides?

______________________________ 1

(c) Does the polygon have pairs of sides of equal length?

______________________________ 1

Section 3: Ratio and Proportion

6. (a) There are 40 students in a class. 16 of the students are boys. Find the ratio of the number of boys to the number of girls in the form $1:n$, where n is a mixed number.

2

(b) John, Hamad and Paul went shopping. The amounts spent by John, Hamad and Paul were in the ratios $4:3:7$.

John and Paul spent a total of $440 between the two of them. Work out the amount of money Hamad spent.

3

Section 4: Basic Statistics

7. Find the mean, median, mode and range of the following data sets:

(a) 5, 9, 4, 3, 5, 8, 5, -3, 0

Mean: _ _ _ _ _ _ _ _ _ _ _

Median: _ _ _ _ _ _ _ _ _ _

Mode: _ _ _ _ _ _ _ _ _ _ _

Range: _ _ _ _ _ _ _ _ _ _ _

4

(b) 2, 3, 4, 2, 8, 5

Mean: _ _ _ _ _ _ _ _ _ _ _

Median: _ _ _ _ _ _ _ _ _ _

Mode: _ _ _ _ _ _ _ _ _ _ _

Range: _ _ _ _ _ _ _ _ _ _ _

4

8. Calculate the mean and mode of the frequency table below

Age	Frequency
10	4
11	3
12	0
13	3
14	1
15	2

Mode: _ _ _ _ _ _ _ _ _ years

1

Mean: _ _ _ _ _ _ _ _ _ years

3

Topic 7- Linear equations

RECAP

- ✓ An **algebraic equation** is a statement that shows two expressions are equal and helps us find the value of the variable that makes the equation true.
- ✓ Solving an equation involves manipulating both sides of the equal sign (=) until the variable is isolated on one side, and the other side is the answer.

Remember, whatever you do to an equation, do it to BOTH sides.

Solving one-step equations

- ✓ One-step equations are simple equations that require only one step to solve them. To get the variable isolated, you must do the inverse of any constant or co-efficient. For example, if the variable is multiplied by 3, to solve the equation, divide both sides by 3. Here are some examples:

Addition

$$x - 4 = 6$$

Step 1: $+4 \qquad +4$

$$x = 6 + 4$$

$$x = \mathbf{10}$$ ✓

Subtraction

$$3 + x = 10$$

Step 1: $-3 \qquad -3$

$$x = 10 - 3$$

$$x = \mathbf{7}$$ ✓

Multiplication

$$\frac{x}{7} = 3$$

Step 1: $\times 7 \qquad \times 7$

$$x = 3 \times 7$$

$$x = \mathbf{21}$$ ✓

Division

$$5x = 25$$

Step 1: $\div 5 \qquad \div 5$

$$x = 25 \div 5$$

$$x = \mathbf{5}$$ ✓

Solving One-Step Equations

Match the equations with the answer. The first has been done for you.

$x - 5 = 3$

$2 + 4 = x$

$-4 + x = 1$

6 4 8 5 3 1 2 7

Video support

$\frac{x}{2} = 2$

$3x = 9$

$1 = \frac{x}{2}$

$7x = 49$

Two-Step Equations

✓ A two-step equation is a slightly more complicated equation that requires two steps to find the answer. Such equations **usually** require one division/ multiplication, and one addition/ subtraction.

Solving two-step equations

$$3x + 7 = 19$$

Step 1: $-7 \quad -7$

$$3x = 12$$

Step 2: $\div 3 \quad \div 3$

$$x = 4$$

✓

$$\frac{3 + x}{2} = 10$$

Step 1: $\times 2 \quad \times 2$

$$3 + x = 20$$

Step 2: $-3 \quad -3$

$$x = 17$$

✓

$17 = 4x + 1$

$21 = 3(x + 4)$

$\frac{2x + 4}{6} = 12$

Challenge: Can you solve the 3-step equation?

Solving **harder** equations

✓ These kinds of equations start with the same variable on both sides, and the technique is to bring the variables to one side and the numbers to the other. You can do this by adding, subtracting, multiplying and dividing. Here are some examples, and how to solve them.

$$2x + 5 = 3x - 2$$

$$-2x \qquad -2x$$

$$5 = x - 2$$

$$+2 \qquad +2$$

$$7 = x$$ ✓

Expand the brackets first. Refer to topic 2 for more guidance.

$$3(2 - x) = 2(6 - x)$$

$$6 - 3x = 12 - 2x$$

$$+3x \qquad +3x$$

$$6 = x + 12$$

$$-12 \qquad -12$$

$$-6 = x$$ ✓

Solving Harder Equations Video

Note that only example one applies to year 8.

Your turn:

$4(1 - a) = 2(a + 5)$

$4m + 6 = 2(m + 5)$

$6x = 5x + 1$

Always substitute in your answer into the equation to see if it is correct!

Linear Equations: checklist

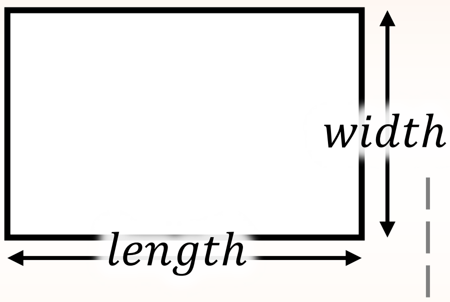
I am able to solve one and two step linear equations.	
I am able to solve harder equations with the variable on both sides.	

Topic 8- Area and perimeter

RECAP

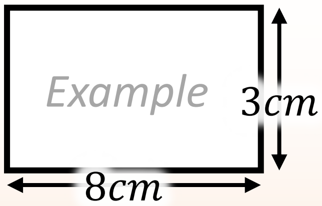
✓ The **area** of a shape is the amount of space occupied by it and the **perimeter** of a shape is its boundary.

Rectangles



$$Area = length \times width$$

$$Perimeter = 2(length + width)$$



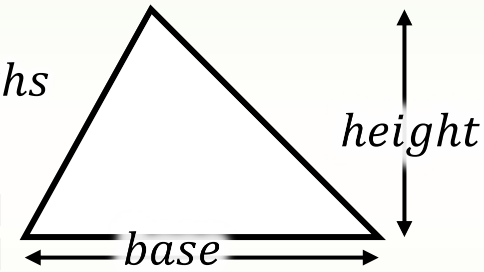
$$A = 3 \times 8 = \mathbf{24} cm^2$$

$$P = 2(8 + 3) = \mathbf{22} cm$$

Triangles

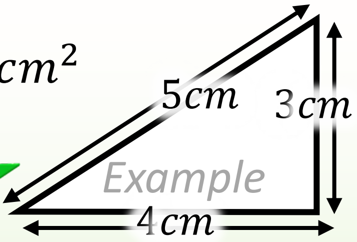
$$Area = \frac{1}{2} \times base \times height$$

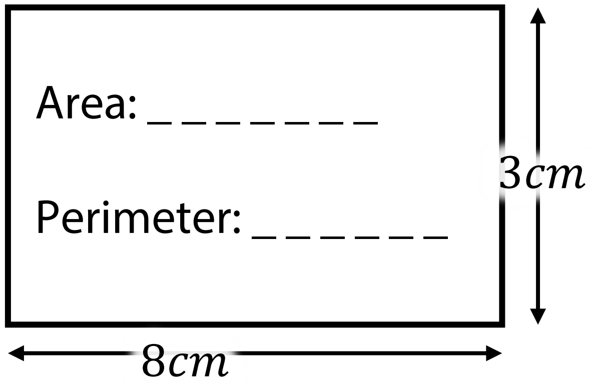
$$Perimeter = sum\ of\ side\ lengths$$



$$A = \frac{1}{2} \times (4 \times 3) = \mathbf{6} cm^2$$

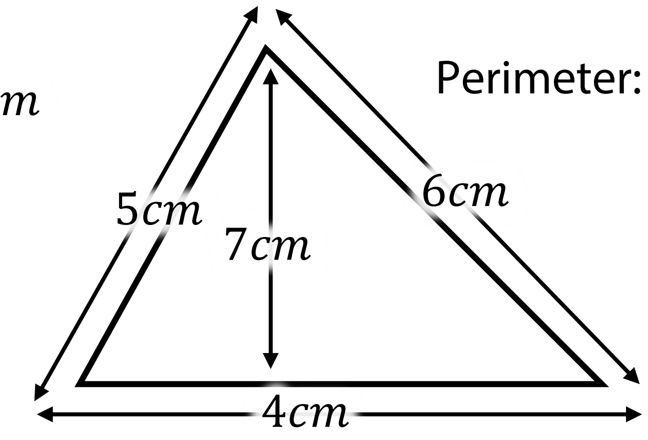
$$P = 3 + 4 + 5 = \mathbf{12} cm$$





Area: ________

Perimeter: _______



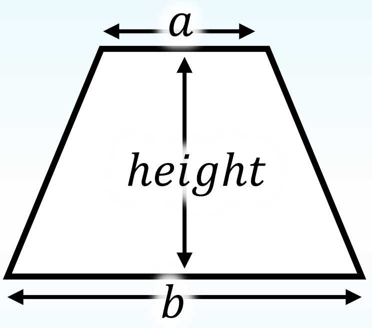
Area: ________

Perimeter: _______

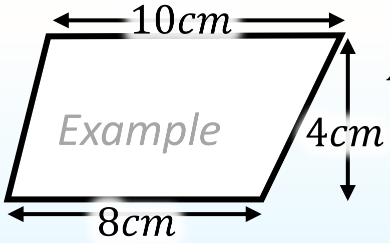
Video support

Area of Harder Shapes

Trapeziums



$$Area = \frac{1}{2} \times (a + b) \times height$$

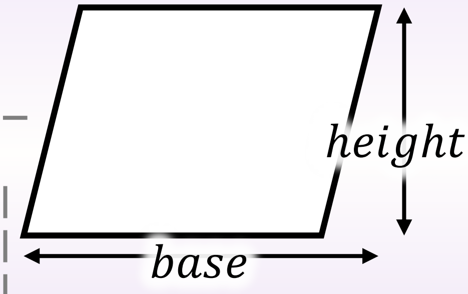


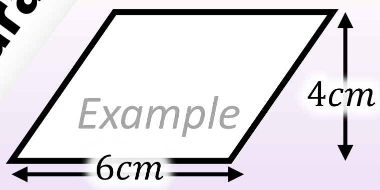
$$A = \frac{1}{2}(10 + 8) \times 4$$

$$A = \frac{1}{2}(72) = \mathbf{36}cm^2$$

Parallelograms

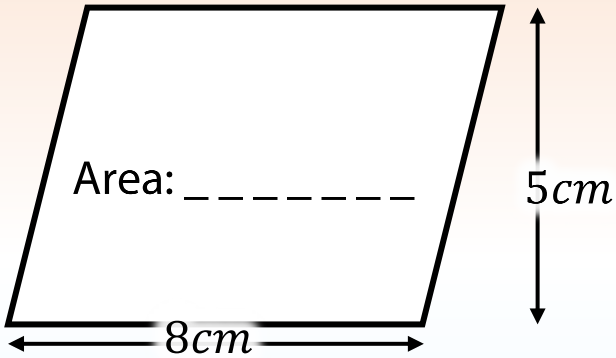
$$Area = base \times height$$



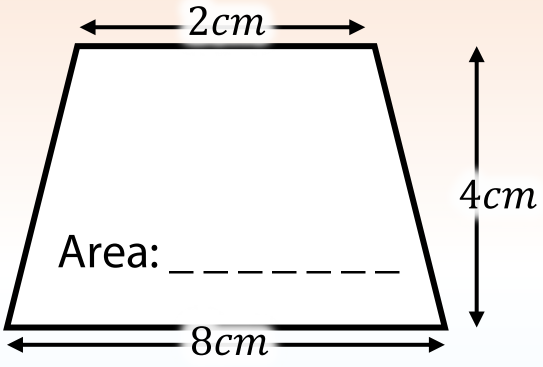


$$A = base \times height$$
$$= 6 \times 4$$
$$= \mathbf{24}cm^2$$

Video support



Area: ________



Area: ________

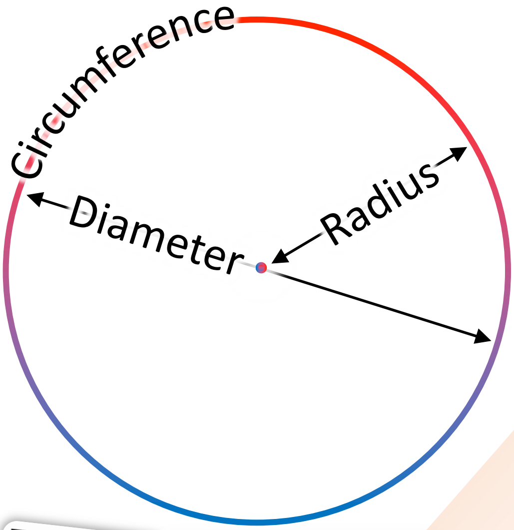
Tip: Always add square units when writing down the area measurement. For example: cm^2, m^2.

Circles- Area and Circumference

- ✓ A circle is a shape, but not a polygon as it doesn't have any straight sides. The perimeter of a circle is known as the **circumference**. Calculating the area or circumference of a circle requires a special number- π (pi).

$$\pi \approx 3.14159265358979323846264338327950288$$

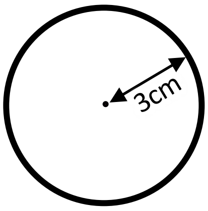
- ✓ That is the value of Pi to 35 digits, but you only need to memorise 3.14. These are the formulas to calculate the area and circumference using the **radius**, or the length between the centre and any point on the circumference, half of the **diameter**.



$$A = \pi r^2$$

$$C = 2\pi r$$

Area | Radius | Circumference



$A = 3.14 \times (3)^2 = 3.14 \times 9$

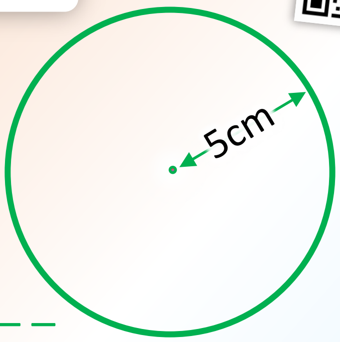
$= \mathbf{28.26} cm^2$ ✓

$C = 3.14 \times 3 \times 2 = 3.14 \times 6$

$= \mathbf{18.84} cm^2$ ✓

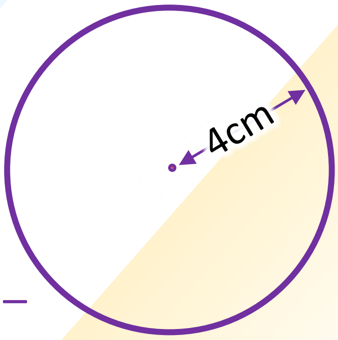
Video support

Multiplying by pi



Area: _______

Circumference: _____



Area: _______

Circumference: _____

Area and Perimeter: checklist

I can calculate the area and perimeter of rectangles and triangles	
I can calculate the area of trapeziums and parallelograms	
I can calculate the radius and circumference of a circle	

Topic 9- Powers and roots

Powers

RECAP

- ✓ A **power** is a number that is written in superscript (example: x^2) and tells how many times a number should be multiplied by itself. For example, a number with a 3 (cube) sign should be multiplied by itself 3 times. A number to the power of 1 should remain the same.

- ✓ Powers can also be called exponentials or indices and are very useful across mathematics. You can also do the opposite by taking the **root** of a number. For example, take 81. If you want to find the **square root**, or which number multiplies by itself to make 81, you can write it like this: $\sqrt[2]{81}$

$$m^1 = m$$
$$a^2 = a \times a$$
$$y^3 = y \times y \times y$$

- ✓ Note that for square roots, and only square roots, you don’t need to write the 2 before the symbol. For example, the square root of 49 can be written as $\sqrt{49}$. You **cannot** do this with any other roots.

- ✓ Here are the the numbers 1-10, with their squares, and cubes. You should memorise this.

Number	**Square**	**Cube**
1	1	1
2	4	8
3	9	27
4	16	64
5	25	125

Number	**Square**	**Cube**
6	36	216
7	49	343
8	64	512
9	81	729
10	100	1000

Important: Any number to the power of 0 equals 1, except for 0 itself. $0^0$is undefined. Different calculators will give different results.

Laws of Indices

✓ There are five main laws of indices that are rules you follow to solve equations and expressions. The rules are given with variables such as x, y, z but you can use these with numbers. Read this page very carefully.

$$x^y \times x^z = x^{y+z}$$

When the same number or variable with different powers is multiplied, it equals the original variable to the power of the sum of the powers.

Examples: $t^5 \times t^7 = t^{5+7} = \mathbf{t^{12}}$ ✓ | $6^2 \times 6^8 = 6^{2+8} = \mathbf{6^{10}}$ ✓

When the same number or variable with different powers is divided, it equals the variable to the power of the difference between the powers.

$$x^y \div x^z = x^{y-z}$$

Examples: $a^8 \div a^7 = a^{8-7} = a^1 = \mathbf{a}$ ✓ | $7^{16} \div 7^9 = 7^{16-9} = \mathbf{7^7}$ ✓

$$(x^y)^z = x^{yz}$$

If a number or variable is raised to a power inside a bracket that is itself raised to a power, multiply the two powers and remove the brackets.

Examples: $(m^2)^8 = m^{2 \times 8} = \mathbf{m^{16}}$ ✓ | $(8^4)^3 = 8^{4 \times 3} = \mathbf{8^{12}}$ ✓

$$x^1 = x$$

Any number to the power of 1 is equal to itself.

Examples:

$5^1 = \mathbf{5}$ | $\pi^1 = \boldsymbol{\pi}$ | $0^1 = \mathbf{0}$ ✓

Any number to the power of 0 is equal to 1, except 0 itself.

$$x^0 = 1$$

Examples:

$5^0 = \mathbf{1}$ | $\pi^0 = \mathbf{1}$ | $2^0 = \mathbf{1}$ ✓

Laws of Indices- Harder Examples

✓ There are some harder questions that will appear on exams, and you need to be prepared for this. Using the laws of indices is all about adapting them to meet what the questions requires. Always think outside the box.

$$\frac{x^2 \times x^8}{x^4}$$

In this question, you need to do the multiplication first, and then the division.

$$\frac{x^2 \times x^8}{x^4} = \frac{x^{2+8}}{x^4} = \frac{x^{10}}{x^4} = \boldsymbol{x^6}$$

$$\frac{a^7}{a^4 \times a^5}$$

Again, you need to do the multiplication first, and then the division.

$$\frac{a^7}{a^4 \times a^5} = \frac{a^7}{a^{4+5}} = \frac{a^7}{a^9} = \boldsymbol{a^{-2}}$$

$$(4x^2)^3$$

To solve this question, you need to take both the variable and the co-efficient and raise them to the power outside the bracket.

$$(4x^2)^3 = 4^3 \times x^{2 \times 3} = \boldsymbol{64x^6}$$

Laws of indices revision video

Tip: Remember to always use the **BIDMAS** order of operations (Brackets, Indices, Division, Multiplication, Addition, Subtraction).

Powers- Practice

✓ These questions go from easy to challenging, and practice is the only way to perfect the skill.

Practice makes perfect!

$a \times a \times a \times a =$

$m^2 \times m^5 =$

$6^7 \div 6^5 =$

$12^0 =$

$21^1 =$

$b^8 \times b^3 \times b^9 =$

$x^2(x^7 \times x^5)$

$(y^2)^8$

$(xy^2)^3$

$(5+6)^2$

$\frac{g^4 \times g^2}{g^7}$

$\frac{l^9}{l^7 \times l^8}$

Challenge!

$(2x)^3 \times 8x^{-3}$

Prime factorisation

- ✓ Every number can be divided by certain numbers, which are its **factors**. Every **prime** number has only 2 factors: 1 and itself. **Composite** numbers have more than 2 factors. For example, 5 is a prime number because it can only be divided by 1 and 5, and 6 is a composite number, because it can be divided by 1, 2, 3 and 6.

- ✓ Composite numbers can be written as factor pairs, with the 2 numbers in a pair multiplying to make the number. For example, here are the factor pairs of 12.

1 x 12 **2 x 6** **3 x 4**

- ✓ Another example, here are the factor pairs of 36.

1 x 36 **2 x 18** **3 x 12** **4 x 9** **6^2**

- ✓ **Prime factorization** is the process of writing all the **prime** factors of a number. This can be more than 2. For example, if you prime factorize 12, you will get: 2 x 2 x 3. These are the factors of 12 that cannot be divided further.

- ✓ To prime factorize a number, you need to keep dividing the numbers by prime numbers until the result is 1. This can be obvious at times, or it can be hard to notice. If it is hard to identify, keep testing with prime numbers from small to large. Try to use the tests of divisibility to check if a number is divisible by a prime. Here are some examples:

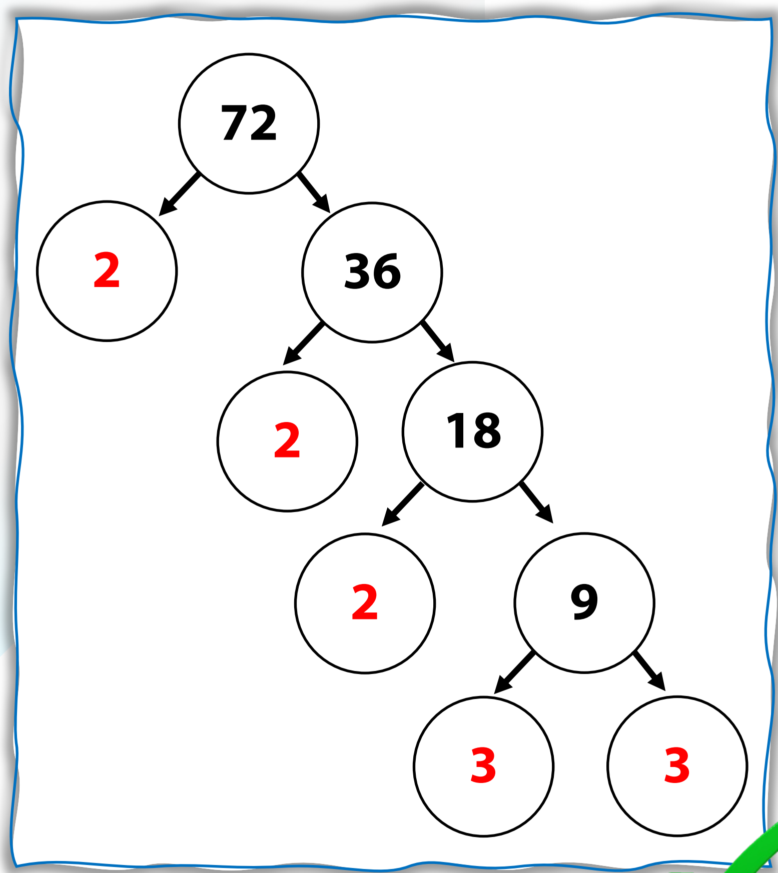
2	The number is even (ends with 0,2,4,6,8).
3	The sum of all the digits of the number is a multiple of 3.
5	The number ends with 0 or 5.

Prime factorisation

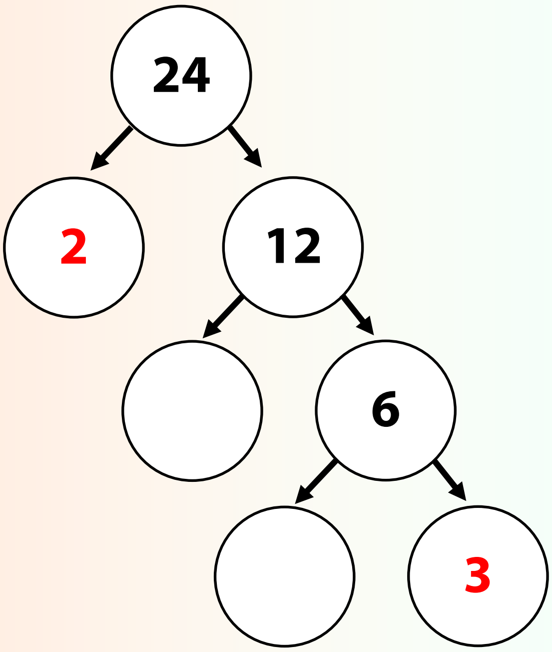
- ✓ You can write prime factors as factor trees to make it easier to understand. Write the number at the top, and then split them into factor pairs, with a prime number on the left side, until the bottom two numbers are primes. Here is an example:

- ✓ All the prime numbers on the left and the bottom are the prime factors of the number.

- ✓ When you are writing your answer, and you have a number that is multiplied by itself two or more times (for example 72= 2 x 2 x 2 x 3 x 3), you should write them as powers. $72 = 2^3 \times 3^2$.



Fill in the factor tree:



Prime factorise the numbers:

75:

____

Challenge! 216:

____

- ✓ When comparing two numbers, there is the **HCF (Highest Common Factor)** and **LCM (Lowest Common Multiple)**. The HCF is the greatest factor that is shared by two numbers.

HCF and LCM

Step 1: Prime factorize both numbers, and place all the numbers in a Venn diagram, with common factors in the middle.

Step 2 (For HCF): Multiply all the numbers in the middle section. That is the Highest Common Factor.

Step 3 (For LCM): Multiply the HCF with the left and right sections. This is the Lowest Common Multiple.

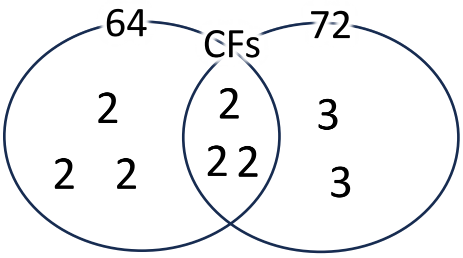
Example: 64 and 72

Step 1:

$64 = 2^6 = 2\times2\times2\times2\times2\times2$

$72 = 2^3\times 3^2 = 2\times2\times2\times3\times3$

Highlight the common factors



Step 2:

$HCF = 2\times2\times2 = 2^3 = \mathbf{8}$

Step 3:

$LCM = 8\times2\times2\times2\times3\times3$

$= \mathbf{576}$

It's your turn now!

40,54
HCF:
LCM:

81,21
HCF:
LCM:

16,24
HCF:
LCM:

48,56
HCF:
LCM:

Video Support

Powers and Roots: checklist

I know the laws of indices and can use them to simplify expressions.	
I can prime factorize a number.	
I can calculate the HCF and LCM of two numbers.	

Practice Assessment 3

Calculators not allowed

Section	Score
1. Year 8 Topics 1-6 Recap	/23
2. Linear Equations	/8
3. Area and Perimeter	/18
4. Powers and Roots	/11
Total:	/60

Section 1: Year 8 Topics 1-6 Recap

1. (a) $1\frac{3}{5}+\frac{1}{4}=$

2

(b) $4\frac{3}{7}\div 1\frac{4}{9}=$

2

2. Expand and simplify the expressions:

(a) $6-4(x+1)$

2

(b) $2(a+5)-5(1-4a)$

3

3. Find the nth term value for the following sequences:

(a) 58, 50, 42 ...

2

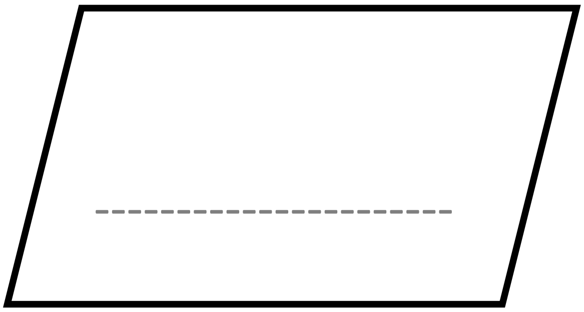
(b) 81, 91, 101 ...

2

Practice Assessment 3

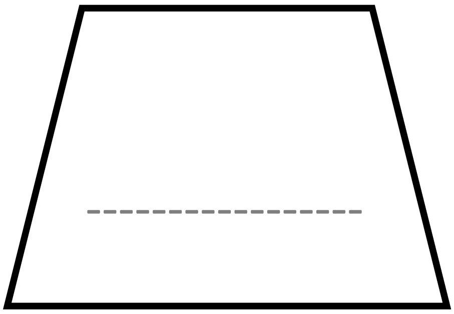
4. Identify the following polygons and label angles, side lengths, and parallel sides using the correct symbols.

(a)



2

(b)



2

5. Sarah and Tina spend $450, in a ratio of 7: 2. Calculate the difference in their spendings.

2

6. Calculate the mean and mode of the frequency table below

Goals	Number of Matches
0	3
1	5
2	9
3	1
4	2

Mode: _ _ _ _ _ _ _ _ _

1

Mean: _ _ _ _ _ _ _ _ _

3

Section 2: Solving Linear Equations

7. Solve the following equations to calculate x.

$(a)\quad 3x + 5 = 11$

2

$(b)\quad \dfrac{x+2}{7} = 9$

2

$(c)\quad 4x + 6 = -2 + 3x$

2

$(d)\quad 6x - 2 = x + 7$

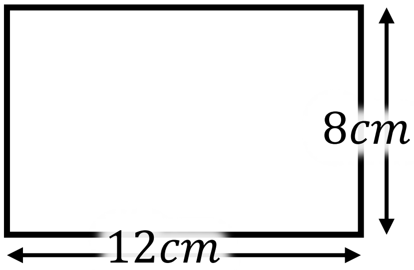
2

Practice Assessment 3

Section 3: Area and Perimeter

8. Find the area and perimeter of the following shapes.

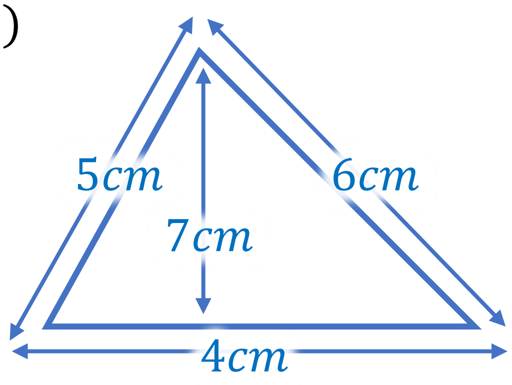
(a)



Area: _ _ _ _ _ _ _ _ _ cm^2

Perimeter: _ _ _ _ _ cm 3

(b)

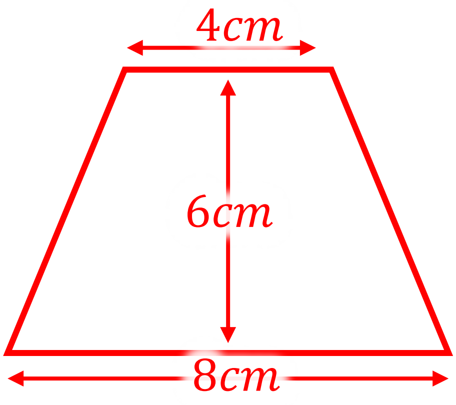


Area: _ _ _ _ _ _ _ _ _ cm^2

Perimeter: _ _ _ _ _ cm

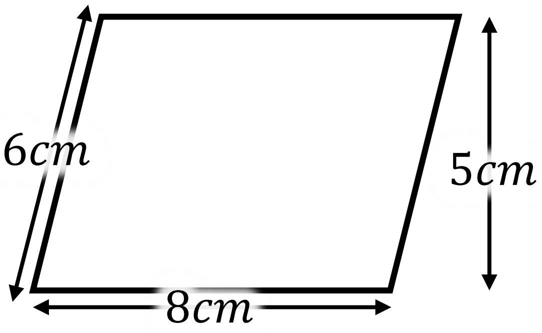
3

(c)



Area: _ _ _ _ _ _ _ _ _ cm^2 2

(d)

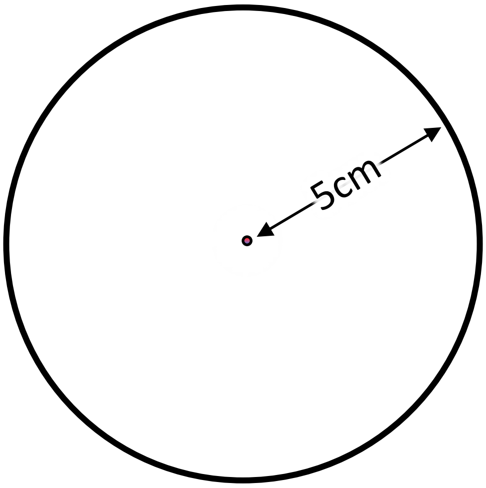


Area: _ _ _ _ _ _ _ _ _ cm²

Perimeter: _ _ _ _ _ cm

3

9. Find the area and circumference of the circle, with π being 3.14.



Area: _ _ _ _ _ _ _ _ _ cm²

Circumference: _ _ _ _ _ cm 5

Practice Assessment 3

Section 3: Powers and Roots

10. Simplify the following expressions as much as possible.

(a) $(2xy^5)^2$

2

(b) $\dfrac{x^5 \times x^2}{x^0}$ $(x > 0)$

2

(c) $\dfrac{y^2abx}{x^3ya^2}$

3

(d) $2(4x)^2$

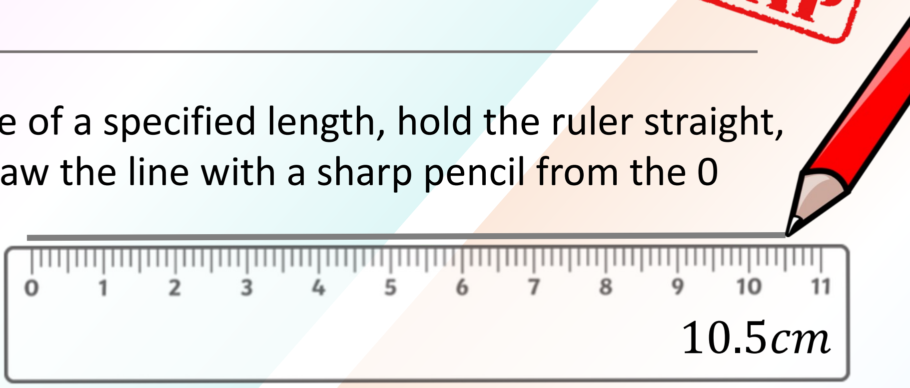
4

Topic 10- Constructions and bearings

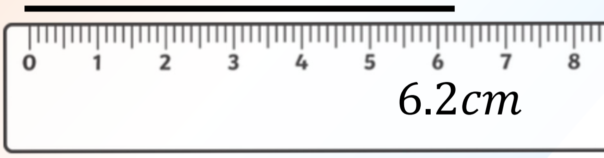
RECAP

Using a Ruler

✓ To use a ruler to construct a line of a specified length, hold the ruler straight, and look down straight at it. Draw the line with a sharp pencil from the 0 mark to where you want it.



✓ To measure the length of a line, place the 0 mark of the ruler at the start of the line, holding it exactly against the line. Find out at which mark the line ends and include the millimetre measurement.



Using a Protractor

✓ To measure an angle:

1

Find the vertex of the angle: This is the point where the two lines that form the angle meet.

2

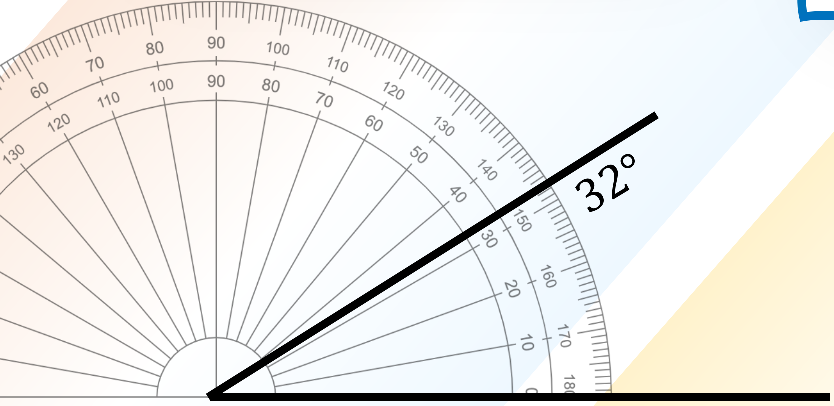
Place the centre point of the protractor on the vertex: Make sure the line going through 0 degrees on the protractor lines up with one of the lines of the angle.

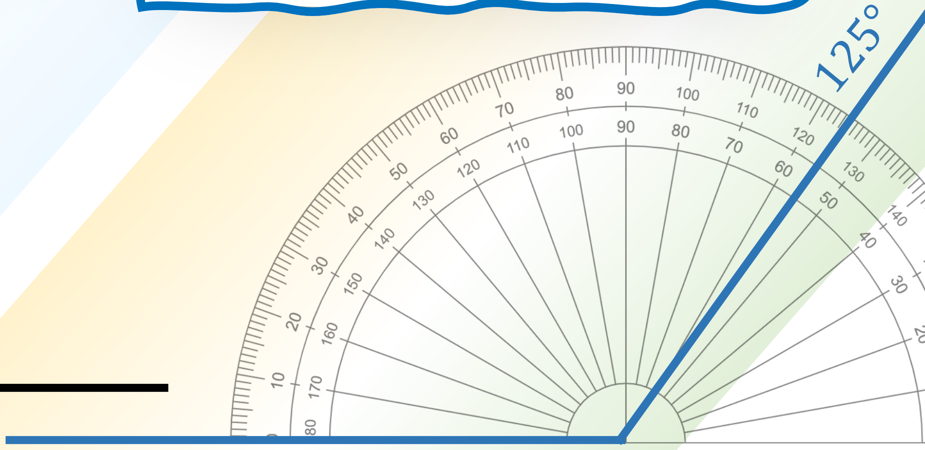
3

Align the protractor's baseline with one of the angle's sides: Choose the scale (inner or outer) that aligns with the side you chose in step 2.

4

Read the angle measurement where the other side of the angle crosses the scale: Look at the number on the scale where the other line of the angle intersects it. This is the angle in degrees.





Constructing angles

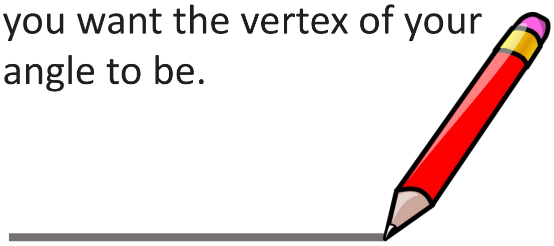
RECAP

✓ To construct an angle with a protractor:

1

Start with a straight line:

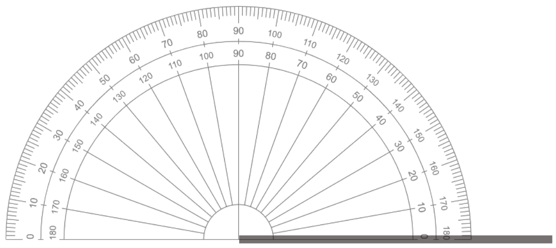
- Use a ruler to draw a straight line on a piece of paper. This will be one side of your angle.
- Mark a point on the line where you want the vertex of your angle to be.



2

Position the protractor:

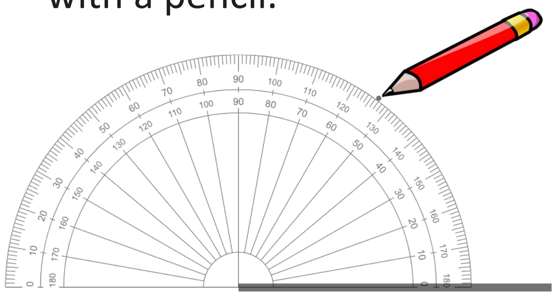
- Place the centre point of the protractor on the vertex you marked on the line.
- Align the baseline of the protractor (the line that goes through 0 degrees) with the line you drew in step 1.



3

Find your desired angle measurement:

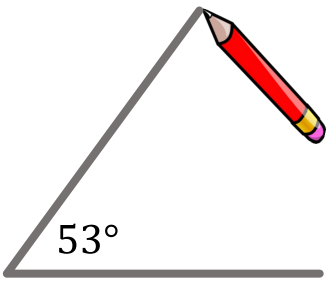
- Look for the degree marking on the protractor that corresponds to the angle you want to create.
- Mark the angle's second side with a pencil.



4

Draw the second side:

- Carefully remove the protractor.
- Use a ruler to draw a straight line from the vertex to the mark you made in step 4.
- This second line completes your angle.



Sometimes it can be confusing to use two scales but use common sense. If you see an acute angle and you read 150 from the protractor, you are probably using the wrong scale.

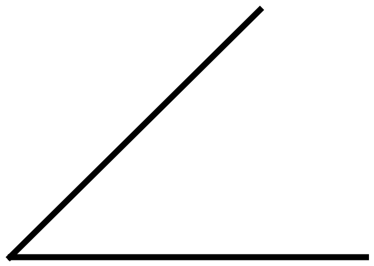
[Using a protractor-video](#)

Angles and lines practice

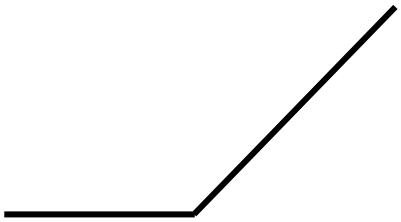
✓ Measure the following lines and angles

cm

cm



°



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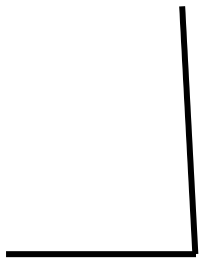


°

✓ Construct the following lines and angles.

6.2 *cm*

9.8 *cm*

Practice makes perfect!

56°

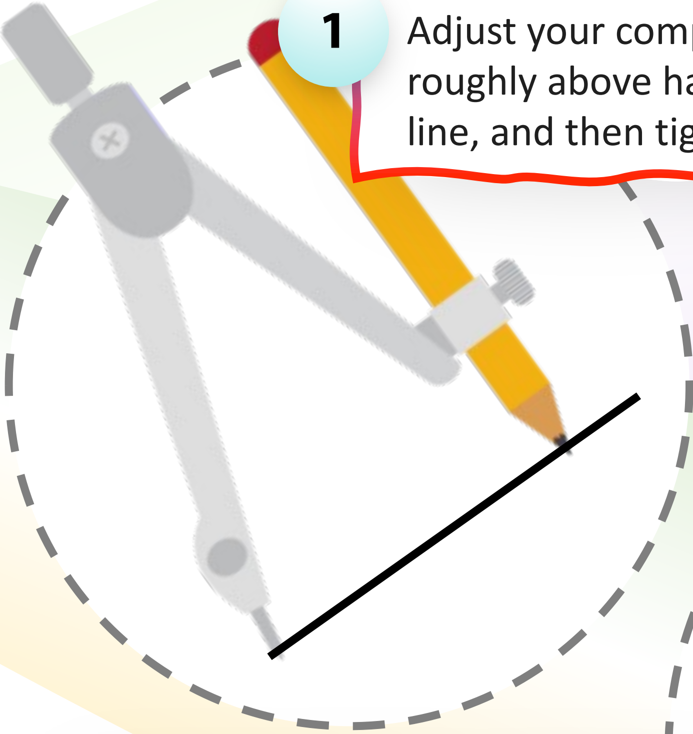
173°

90°

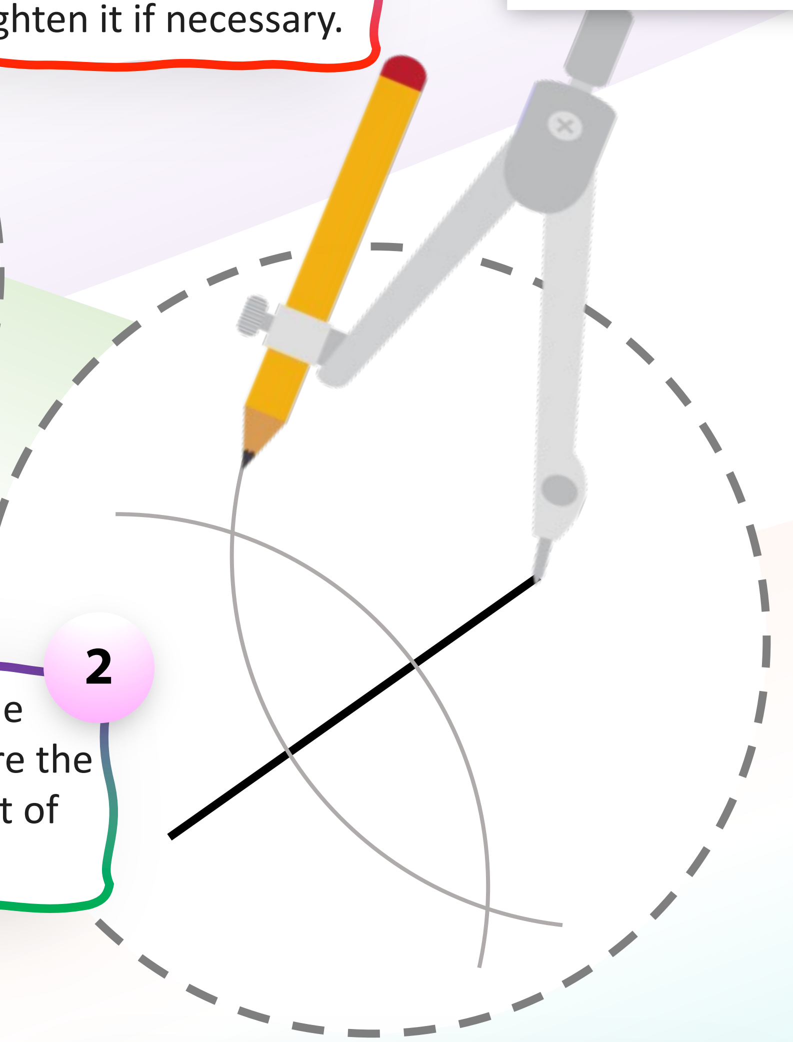
Perpendicular bisectors

✓ A **perpendicular bisector** is a line that is at a 90-degree angle to another line, and **bisects** it (divides it in half). Here are the steps:

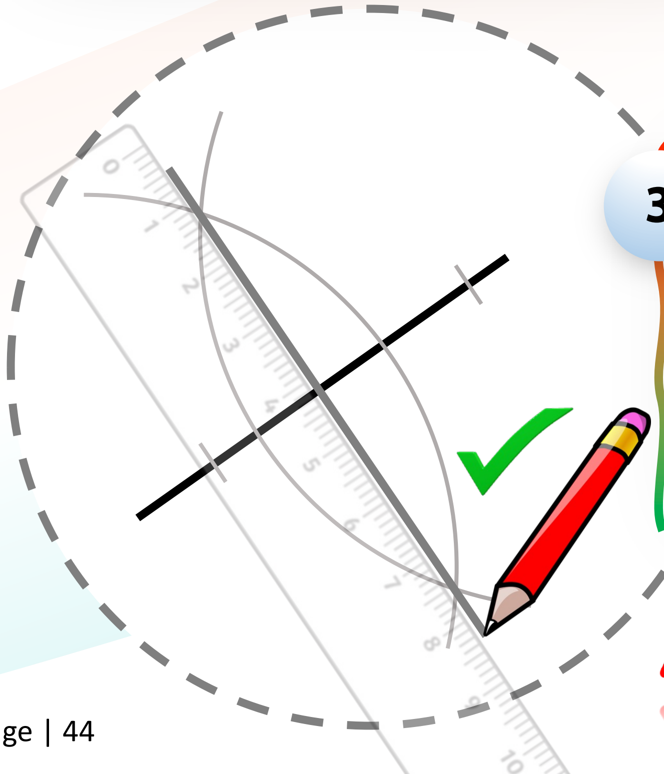
Perpendicular bisectors video



1 Adjust your compass width to be roughly above half the length of the line, and then tighten it if necessary.



2 Draw an arc from each end of the line with the same compass width. Ensure the arc extends longer than the midpoint of the line on both sides.



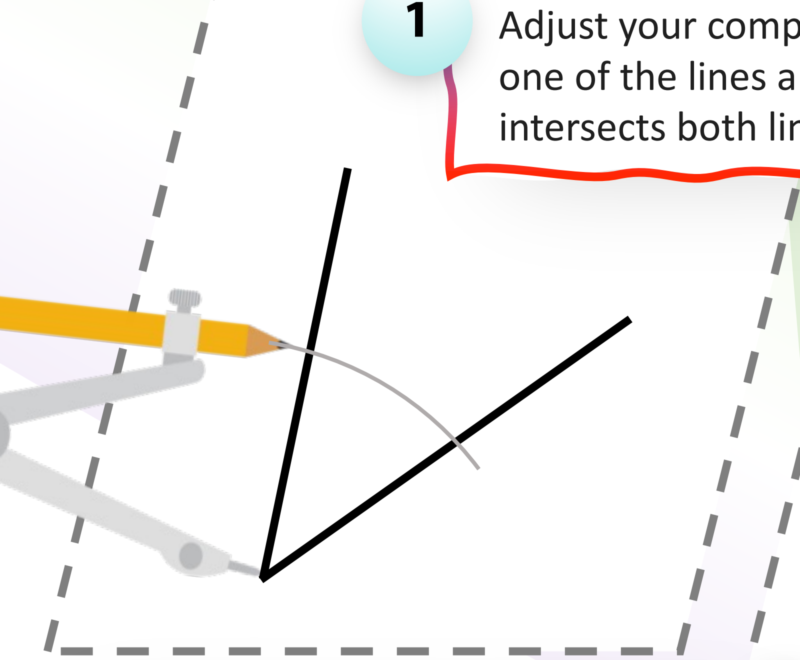
3 Draw a line between the two points where the arcs intersect. Draw this firmly and bold. This is the perpendicular bisector. Leave your construction lines (the arcs) and label the two sides of the bisected line with standard labelling conventions.

Make sure you check that both halves are equal, with a ruler, and that the line is perpendicular- with a protractor.

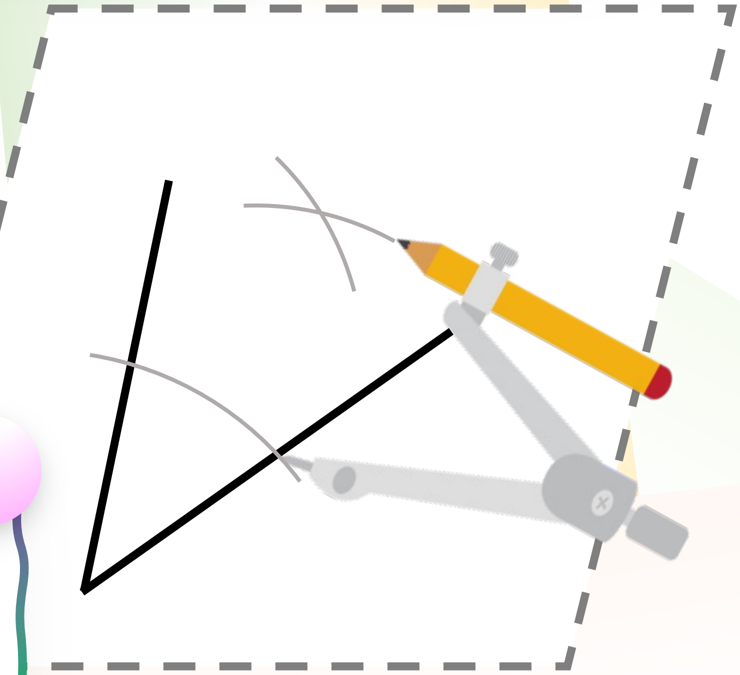
Angle bisectors

- ✓ An **angle bisector** is a line that **intersects** the **vertex** of an angle and splits it in half. The construction process is somewhat similar to a perpendicular bisector. Use a compass, ruler and sharp pencil.

1 Adjust your compass width to be roughly above half of one of the lines and draw an arc from the vertex that intersects both lines.

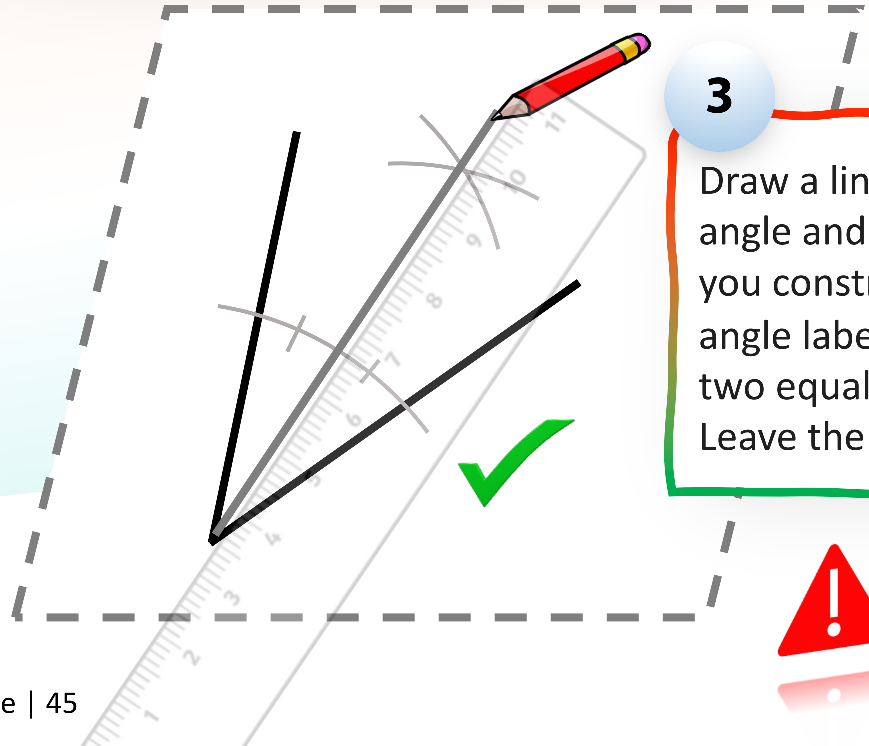


2 Draw an arc from each intersection between the first arc and the angle lines. Make sure you draw them long enough to intersect, and don't change the compass width at any point.



[Angle bisectors video]

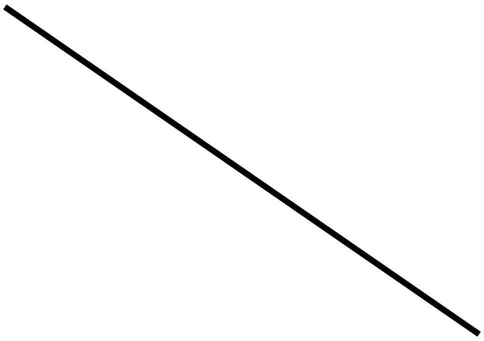
3 Draw a line between the vertex of the angle and the intersection of the two arcs you constructed in step 2. Use standard angle labelling conventions to label the two equal halves of the original angle. Leave the construction lines.

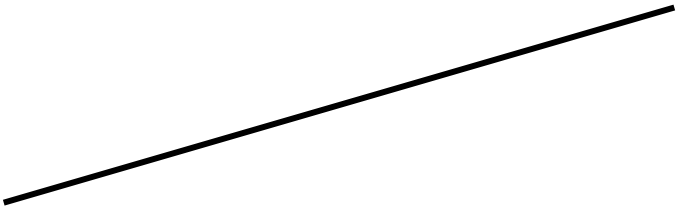


Make sure you check that both halves are equal, with a protractor.

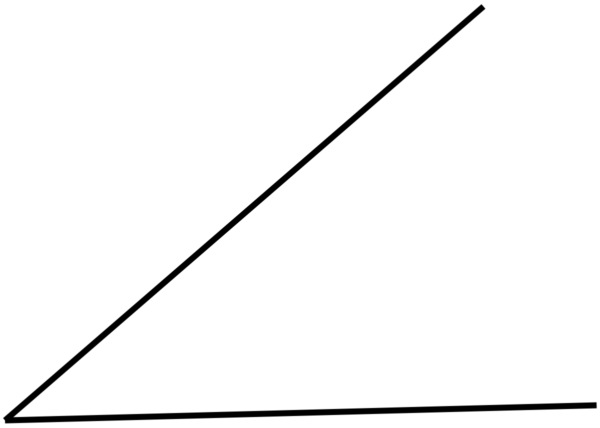
Bisectors practice

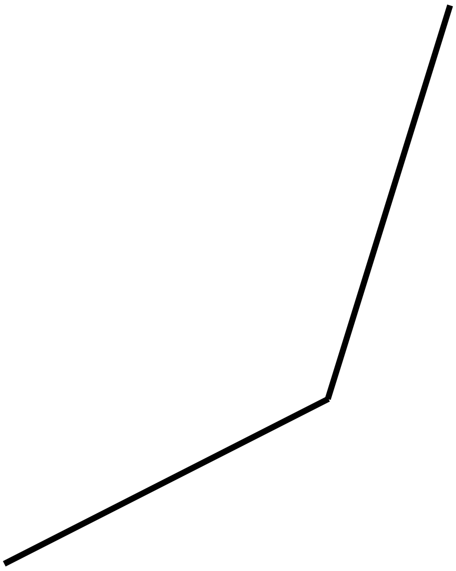
- ✓ Construct the perpendicular bisectors to the lines below.





- ✓ Construct the angle bisectors to the angles below.

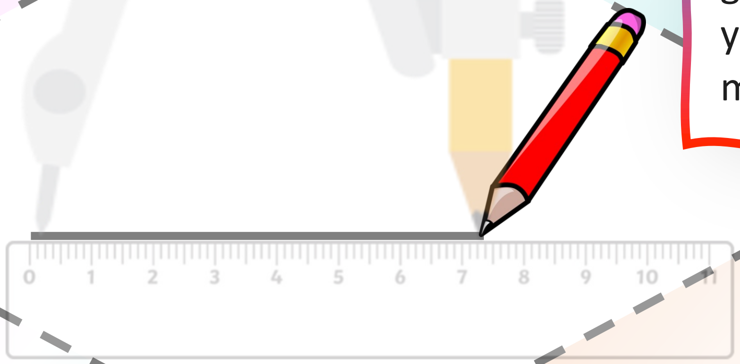




Equilateral triangles

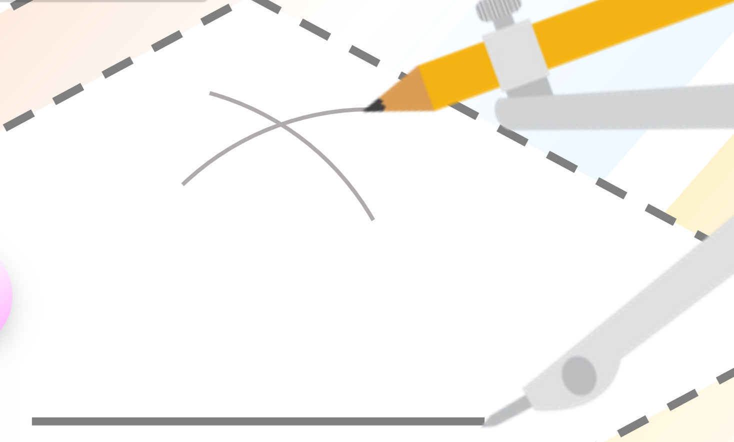
✓ An **equilateral triangle** is a triangle that has 3 sides of equal length. To construct an equilateral triangle:

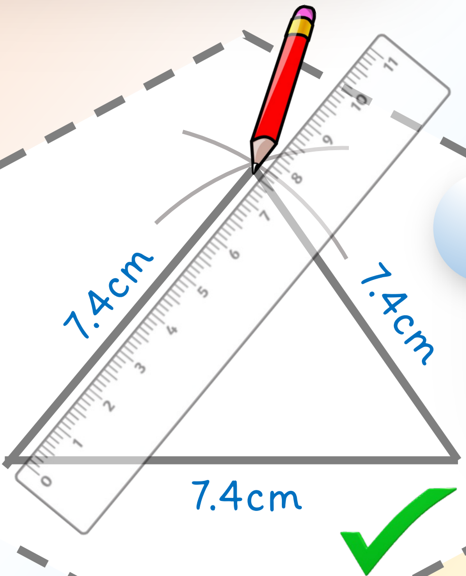
1 Draw a straight line to the given measurement. Set your compass width to this measurement.



Equilateral Triangles Video

2 Draw an arc from each end of the line with the same compass width. Draw both arcs long enough to intersect.





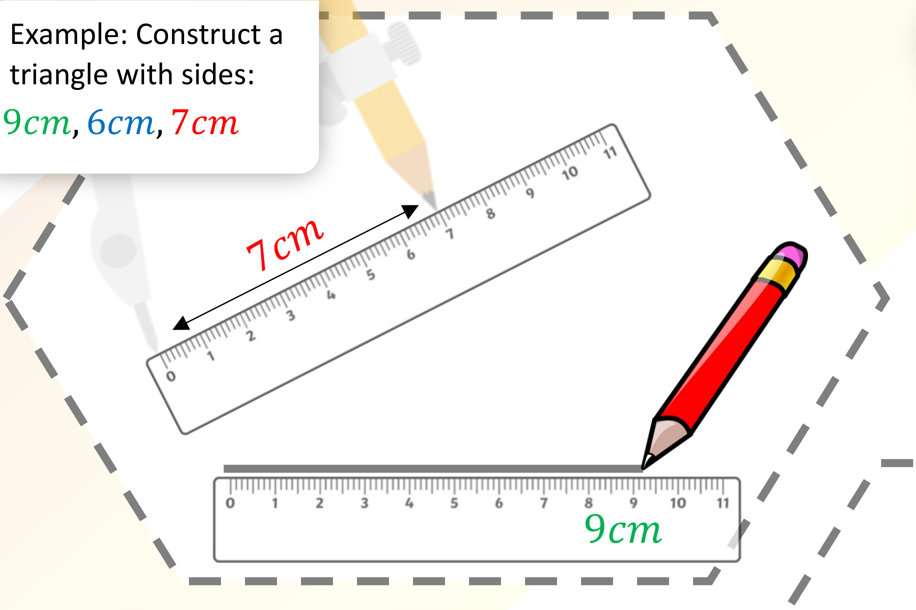
3 Draw a line from each endpoint of the original line to the intersection of the two arcs. Write down the measurement of each side.

Make sure you check with a ruler that all three sides are equal and are exactly the specified length.

SSS- Side, Side, Side

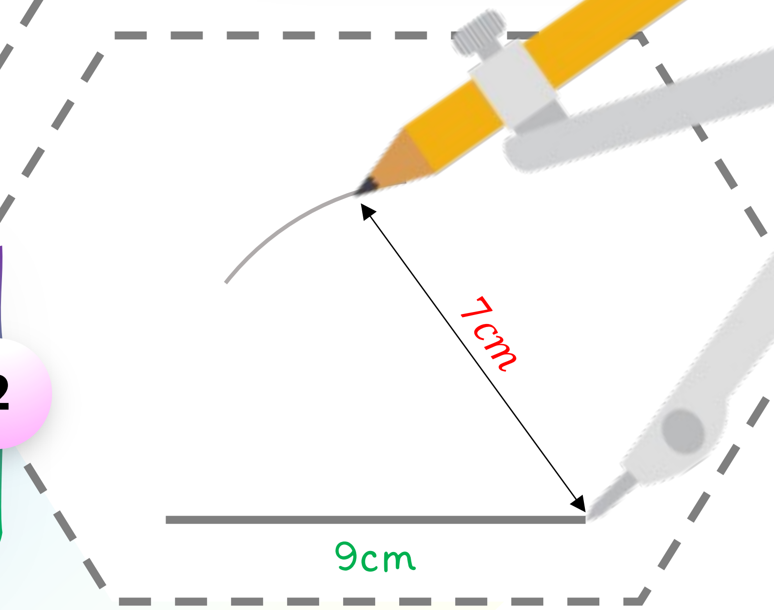
- ✓ The construction process is similar. You will be given 3 side lengths.

Example: Construct a triangle with sides:
$9cm, 6cm, 7cm$



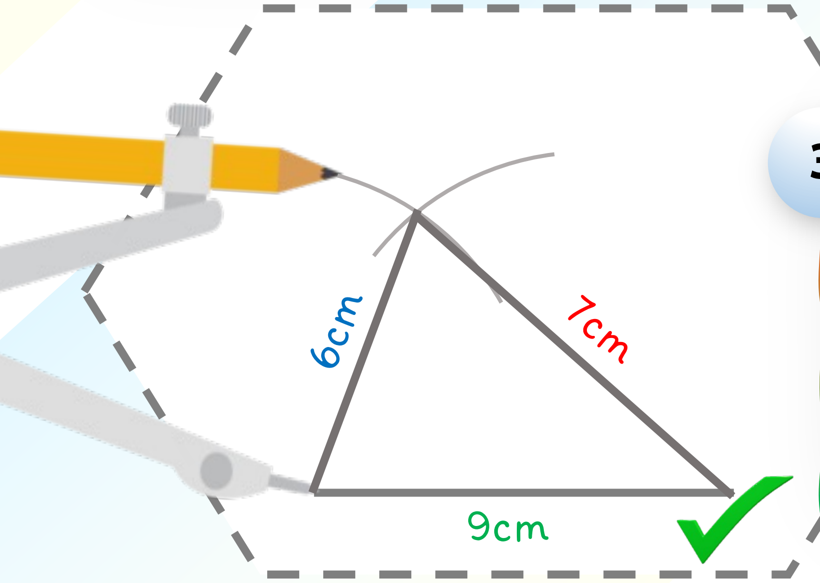
1

Draw a straight line to the given measurement of the longest side length. Set the compass width to the second side length.



Draw an arc from one endpoint of the first line with the second side length. Change the compass width to the measurement of the third line, in this example 6cm.

2



3

Draw an arc from the other endpoint with the compass width being the length of the third line. Draw a line from each endpoint of the base to the intersection of the arcs. Write down the side lengths.

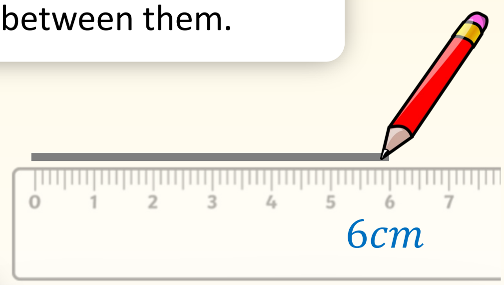
[Constructing triangles- watch till 2:15]

⚠ Make sure you check with a ruler that all three sides are exactly the specified lengths.

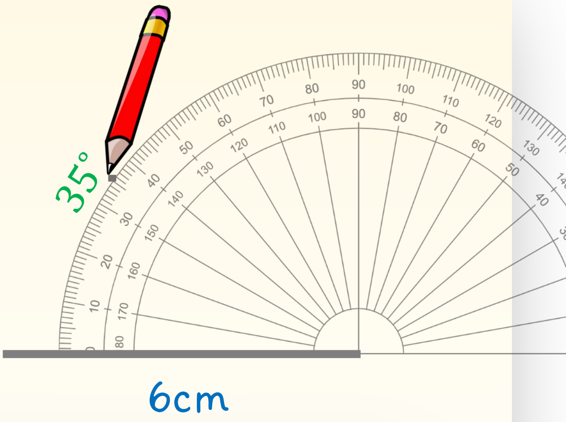
SAS- Side, Angle, Side

✓ SAS questions provide two sides and an angle in between. You need a pencil, ruler and protractor.

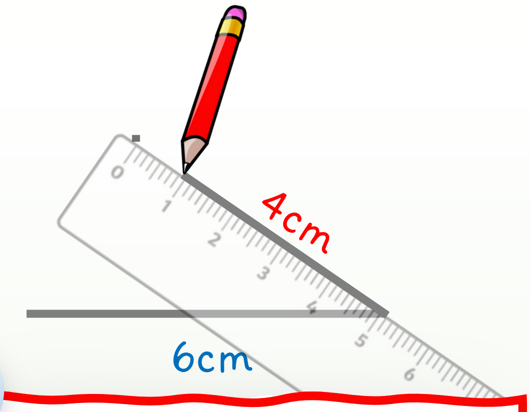
Example: Construct a triangle with sides 4cm and 6cm, with an angle of 35° between them.



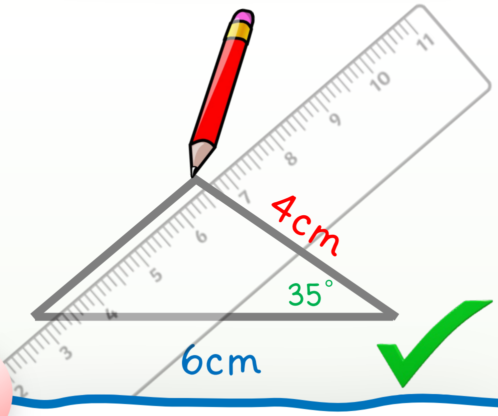
1 Draw a straight line that is one of the side lengths provided.



2 Place your protractor on the end and put a dash at the specified angle.



3 Align your ruler with both the endpoint of the line and the dash you put earlier. Construct a line with the second provided length.



4 Connect the two endpoints and write down the side and angle measurements.

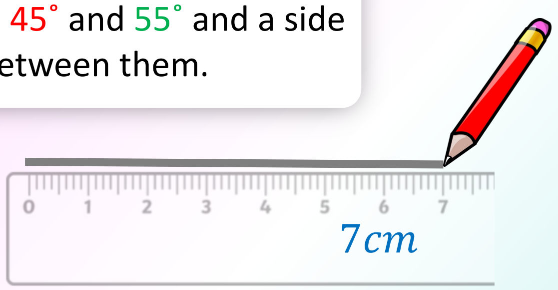
Constructing triangles- watch from 2:15 to 3:34

Make sure you check with a ruler that both side lengths match what the question asks, and that the angle is correct (with a protractor).

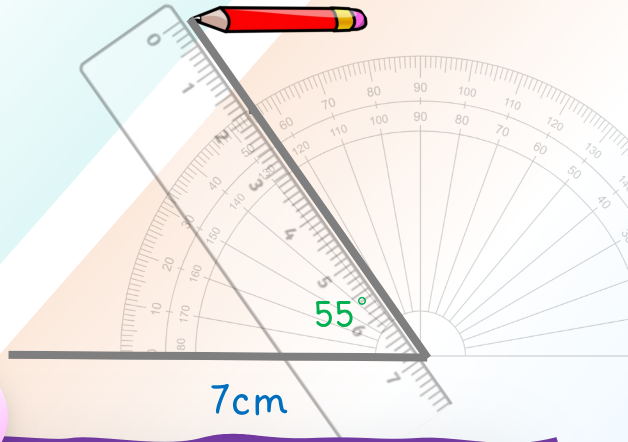
ASA- Angle, Side, Angle

- ✓ These questions provide two angle measurements and the length of the side in between.

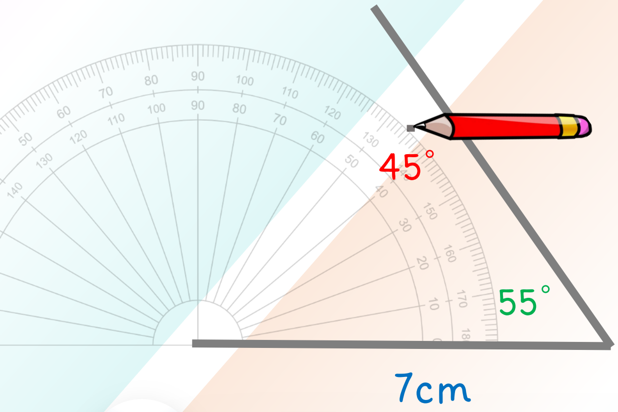
Example: Construct a triangle with angles 45° and 55° and a side of 7cm in between them.



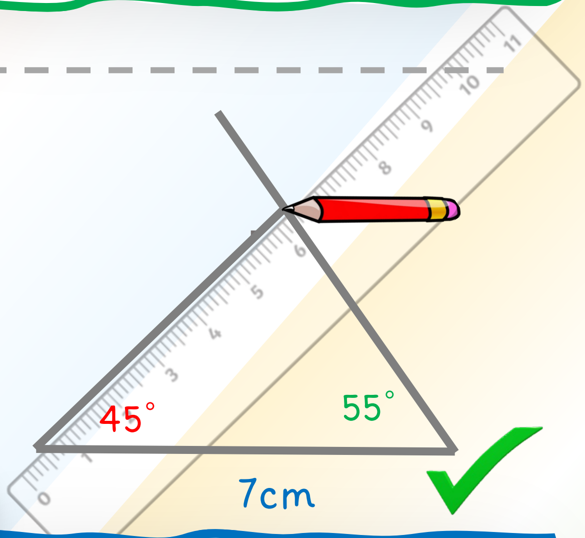
1 Draw a straight line of the length specified.



2 Place your protractor on the end and put a dash at one of the specified angles. Construct a line from the endpoint, passing the dash and beyond.



3 Align the protractor with the other endpoint and mark a dash at the second provided angle.



4 Line up the ruler with the endpoint of the base line and the second dash in step 3. Draw a line until you reach the line you constructed in step 2.

Constructing triangles- watch from 3:35

Make sure you check with a protractor that both angles are correct, and with a ruler that the side length is correct.

Constructing triangles- practice

✓ Construct an equilateral triangle with side lengths of 5cm.

✓ Construct an equilateral triangle, with one side given.

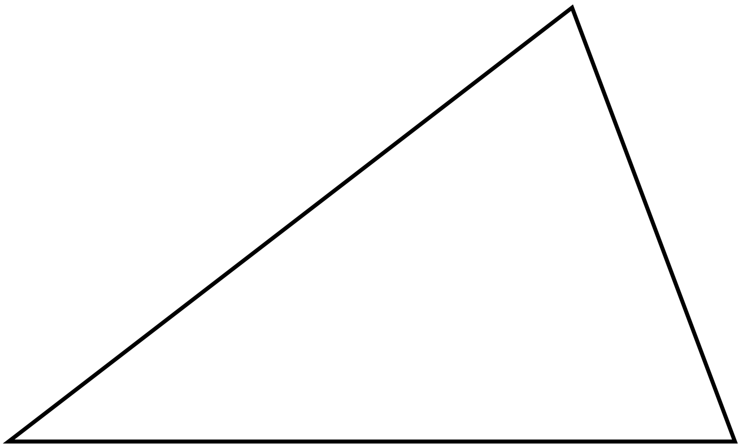
✓ Construct a triangle with side 8cm, 7cm, and 10cm.

Constructing triangles- practice

✓ Construct a triangle with a 7cm side, a 5cm side and a 32˚ angle in between them.

✓ Construct a triangle with angles 60˚ and 35˚ with a side length of 5cm in between

✓ Using methods of your choice, replicate the triangle below in the space provided.

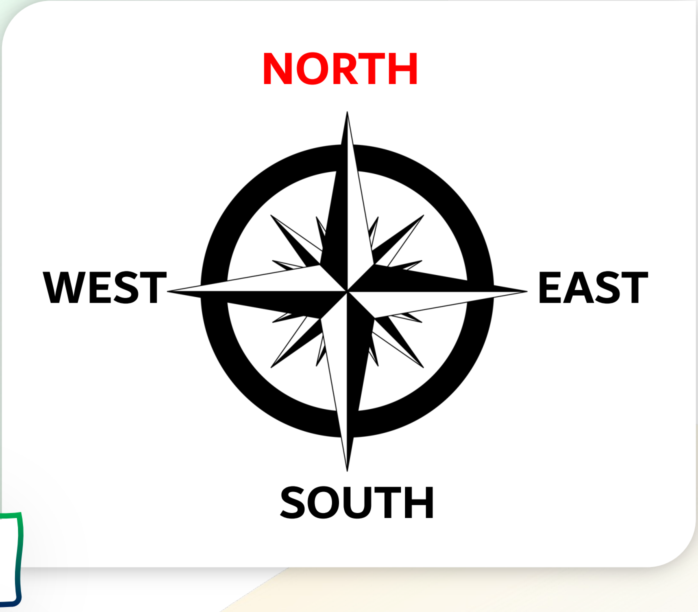


Think about which method (SSS/ ASA/ SAS) is your weakest, and apply that to this question.

Bearings

- ✓ Bearings are angles that provide **directions**. They are measured **clockwise** from the north. If you are not familiar with directions, study the compass below.

- ✓ Bearings are always given in 3 digits, so if the angle is less than 100, add a leading 0. Here are some of the main bearings:



North: 000˚

East: 090˚

West: 270˚

South: 180˚

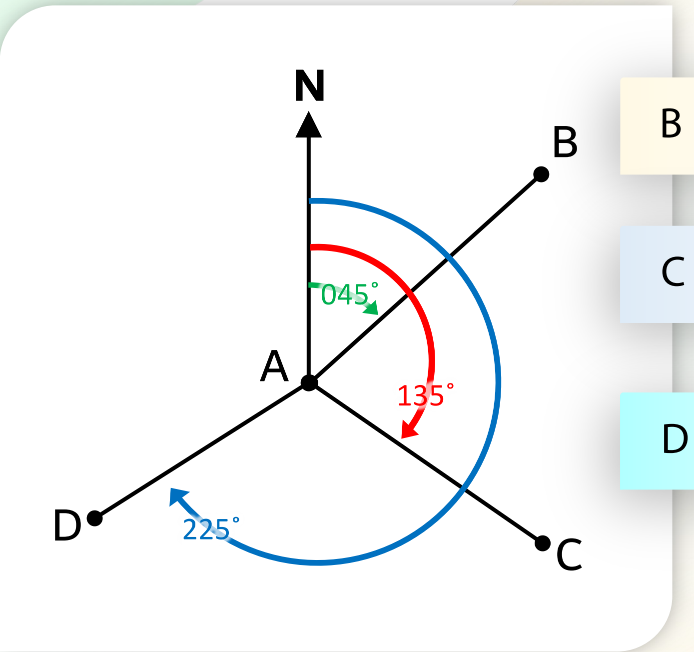
Northeast: 045˚

Southeast: 135˚

Northwest: 315˚

Southwest: 225˚

- ✓ Take a look at the diagram below and observe the bearings.



B is at a bearing of 045˚ from A

C is at a bearing of 135˚ from A

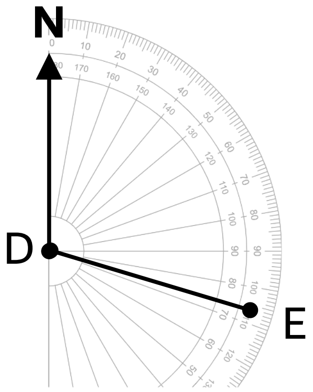
D is at a bearing of 225˚ from A

- ✓ In exams, you might be required to measure the bearing of one point from another. Usually, the north arrow is provided. See the next page on how to calculate bearings of points.

Measuring Bearings

✓ To calculate a bearing between 0 and 180, follow the steps below.

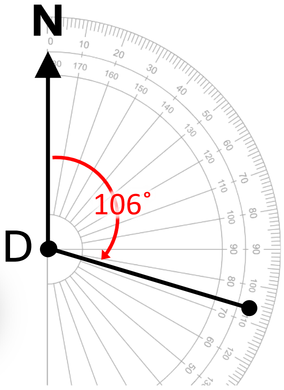
Example: Measure the bearing of E from D.



1 Place your the centre point of your protractor exactly over the point you are taking the bearing from, and the left baseline aligned with the north line.

Carefully check the wording of the question. “Bearing of D from E” is **NOT** the same as ”Bearing of E from D”.

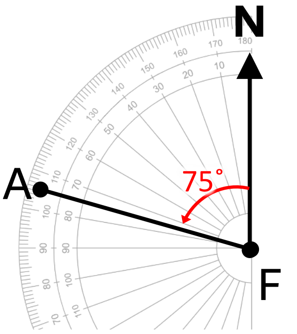
2 Take the measurement of the second point from the corresponding scale. If it is lower that 100, add a leading 0. This is the final answer.



The bearing of E from D is 106˚ ✓

✓ To calculate a bearing between 181 and 359, follow the steps below.

Example: Measure the bearing of A from F.



1 Align the right baseline of your protractor with the north line, and the centre point with the point you are taking the bearing from. Take the measurement from the corresponding scale (probably the inner scale).

2 Calculate 360 minus the measurement in step 1. This is the final answer.

$$360^\circ - 75^\circ =$$

$$285^\circ$$

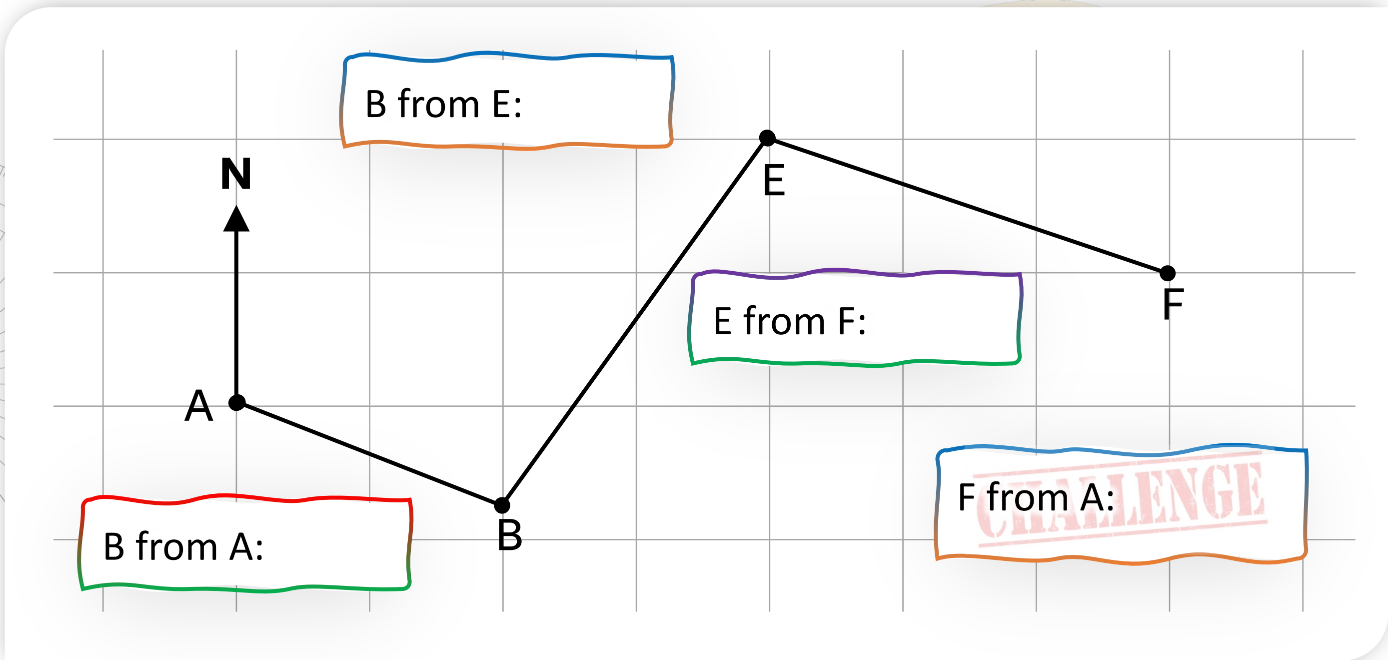
The bearing of A from F is 285˚ ✓

Bearings video

Note that the video goes into much more detail than this guide. If you are fully confident with pages 53-54, go ahead and watch the video. If you are not, only focus on this guide.

Bearings Practice

- ✓ Observe the diagram below carefully and measure the bearings.



Constructions and Bearings: Checklist

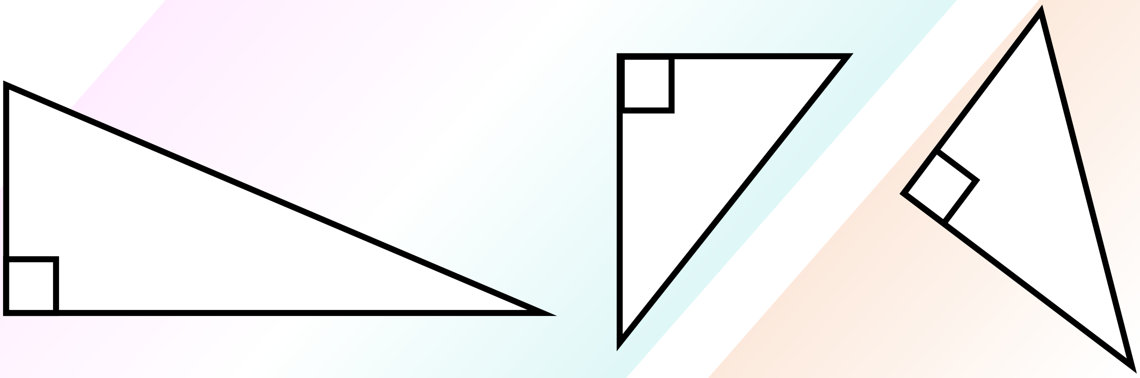
I can accurately use a ruler to measure and draw lines within 1mm accuracy.	
I can accurately use a protractor to measure and construct angles within 1° accuracy.	
I can use a ruler and compass to construct the perpendicular bisector to a line.	
I can confidently use a ruler and compass construct the bisector to an angle.	
I can successfully construct an equilateral triangle with a given side length measurement.	
I can construct triangles from descriptions (including Angle-Side-Angle, Side-Side-Side, and Side-Angle-Side).	
I understand the basic concept of a bearing.	
I can use a protractor to measure bearings of points and apply this knowledge to questions.	

Topic 11- Pythagoras theorem

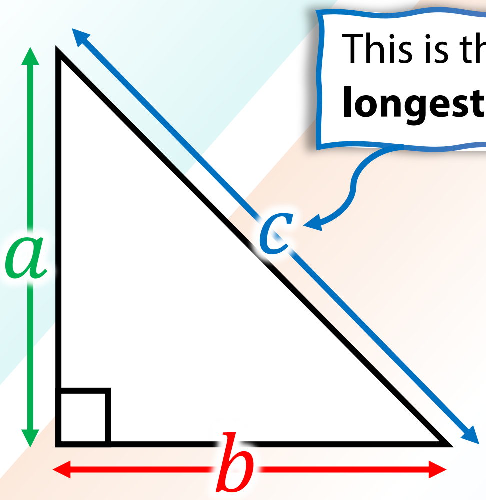
Labelling Right-angle triangles

RECAP

- ✓ A right-angle triangle has 3 sides, with two of the sides **perpendicular** to each other. Here are some examples of right-angled triangles.



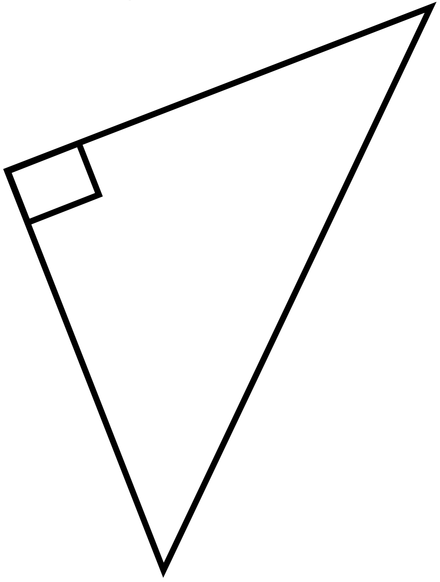
- ✓ Two of the sides will be labelled a and b, and the third will be labelled c. C is the **hypotenuse**, which is always the longest side of the triangle, and the side opposite to the right angle. It doesn't matter which order you put a and b. Here is it visualised:



This is the **hypotenuse**- or side C. It is always the **longest** side and is opposite to the right angle.

- ✓ To be able to use Pythagoras theorem, you need to be able to substitute numerical values for a, b and c. Make sure you are thorough with BIDMAS and substituting before proceeding (Topic 2- Manipulation and Topic 9- Powers and Roots).

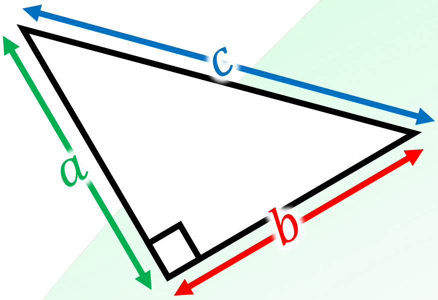
Practice: Try labelling the triangle below.



The Pythagoras Formula

Addvance

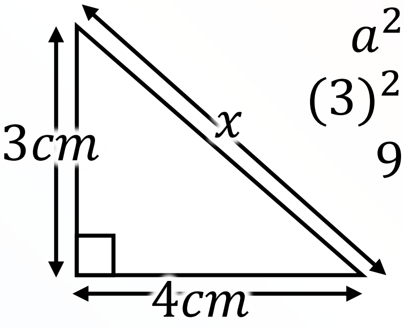
- ✓ The formula for Pythagoras' Theorem is one of the most important formulas you will learn in school, so make sure you memorise it thoroughly.



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

Hypotenuse

Examples: *Diagram NOT to scale*



$$a^2 + b^2 = c^2$$
$$(3)^2 + (4)^2 = c^2$$
$$9 + 16 = c^2$$
$$25 = \sqrt{c}$$
$$x = 5cm$$

A right-angled triangle has a hypotenuse of 13cm and a side of length 5cm. Calculate the length of the other side.

$$a^2 + b^2 = c^2$$
$$(5)^2 + (b)^2 = (13)^2$$
$$25 + b^2 = 169$$
$$b^2 = 169 - 25$$
$$b^2 = 144$$
$$b = \sqrt{144}$$
$$x = 12cm$$

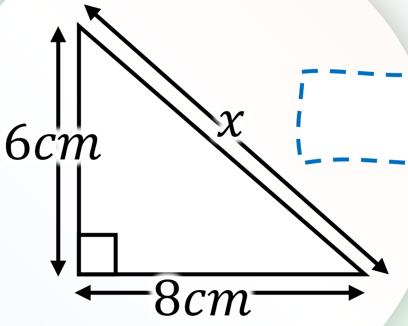
Pythagoras Theorem video

Practice- cover up the solutions and solve the questions!

Pythagoras Practice

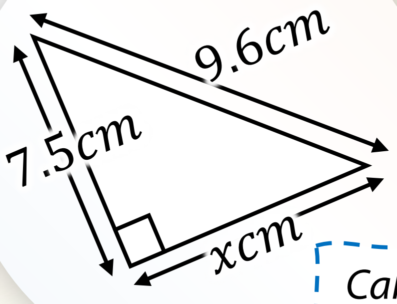
- ✓ Some questions might require a calculator, make sure you are familiar with using the square root function (for support, visit www.addvancemaths.com/blog/classwizz).

Practice makes perfect!



A right-angled triangle has a hypotenuse of 8.9cm and a side of length 7cm. Calculate the length of the other side.

If I place a 9m tall ladder, 5m away from the wall, leaning against it, how high can I climb up?



Calculate the AREA:

Pythagoras Theorem: Checklist

I can successfully label a right-angled triangle with side lengths a, b and c.	
I understand the. meaning of ‘hypotenuse’ and can identify it in any right-angled triangle	
I have fully memorised the Pythagoras Theorem ($a^2 + b^2 = c^2$).	
I can substitute side lengths into the Pythagoras Theorem formula to calculate missing side lengths.	

Topic 12- Conversions

Currency Conversions

- ✓ A **currency** is a system of money. Different countries have different currencies. Some examples of different currencies include:

Switzerland: Franc (CHF)
India: Rupee (₹)
China: Yuan (¥)
USA: Dollar ($)
UAE: Dirham (AED)
Japan: Yen (¥)
UK: Pound (£)

- ✓ Different currencies have different **values** in relation to each other. This is known as the **exchange rate**. The exchange rate between different currencies constantly changes.

- ✓ To convert from one currency to another, just multiply the given amount with the exchange rate. For example:

Exams and worksheets will always provide the currency rate.

Example:

1. Convert $50 to AED, with the exchange rate being $1= AED 3.7

$1 = AED 3.7
$50 = AED 3.7 x 50
$50 = AED 185 ✓

2. Convert AED 555 to $, with the exchange rate being $1= AED 3.7

AED 3.7 = $1
AED 555 = $(555/3.7)
AED 555 = $150 ✓

Practice:

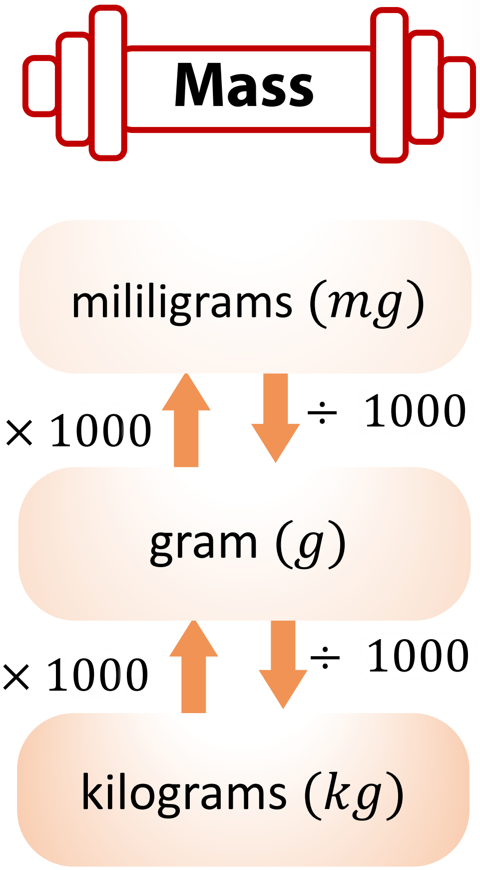
1. Convert £120 to $, with the exchange rate being £1= $1.3

2. Convert £390 to $, with the exchange rate being £1= $1.3

Metric Conversions

✓ The **Metric** and **Imperial** measurement systems are commonly used today, with Imperial being mostly used in America. Metric measurements are recognized in most places and are **scientifically** considered valid.

✓ The main measurements used in Year 8 include: **time**, **distance** (or **length**), **mass** and **volume**. Although there are many more measurements (especially in physics), and SI (standard) units, the following are the most important to memorise for year 8.

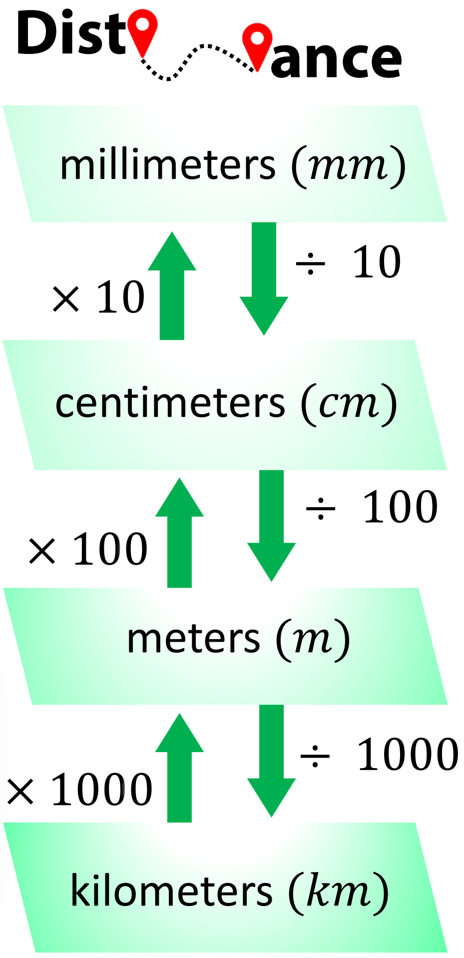


Convert 50mg to g:

Covert 900kg to mg:

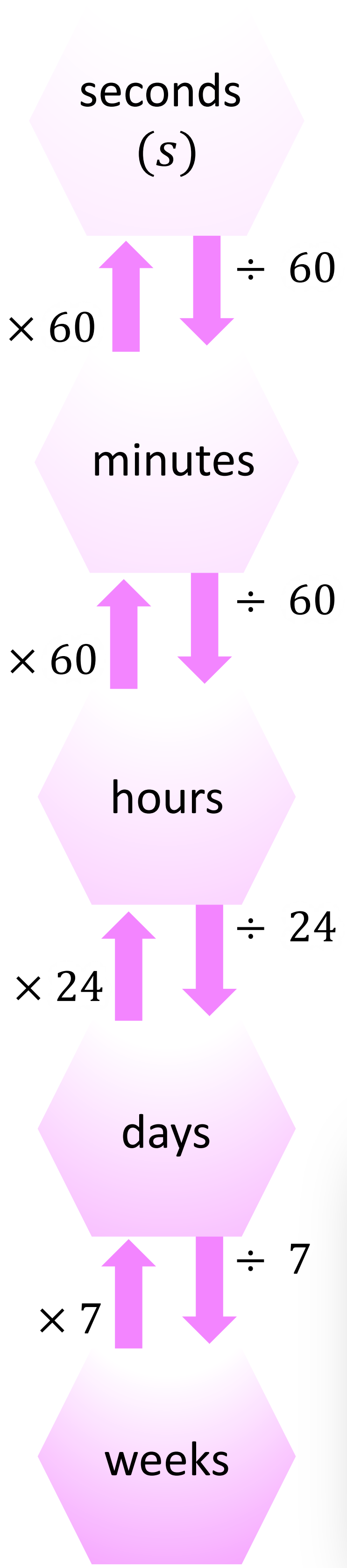
Convert 4.5km to cm:

Convert 500mm to m:

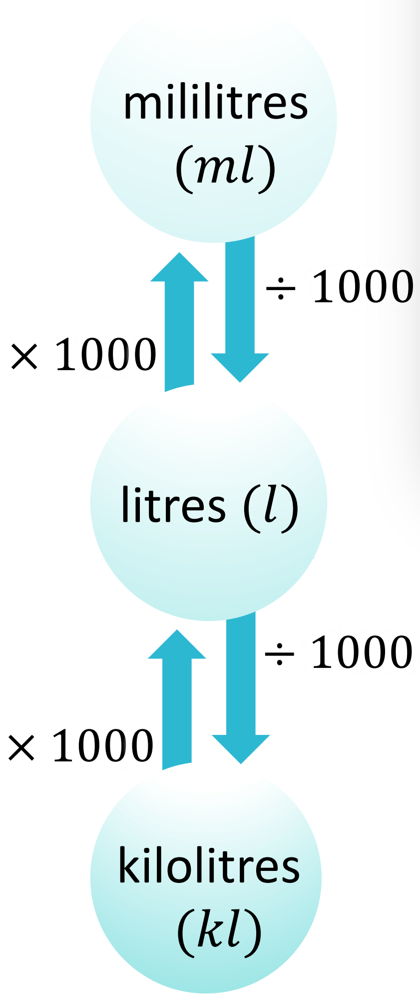


Metric Conversions

Time



Volume



Convert 700ml to kl:

Convert 5l to ml:

CHALLENGE!
Convert 0.8l to kl:

[Metric Conversions Video]

Convert 560 seconds to hours:

Convert 5 weeks to minutes:

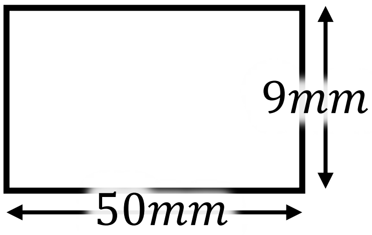
CHALLENGE! Convert 80 years to weeks!

Area and Volume conversions

✓ When converting between different units for area and volume, it is important to first convert the length or radius measurements. For example:

If you convert the final area or volume measurements directly (for example 40cm^2 = 400mm^2, the answer will be completely wrong.

Example: Convert 450mm^2 to cm^2



$$9mm \times 50mm = 450mm^2$$

$$\div 10 \qquad \div 10$$

$$0.9cm \times 5cm = \mathbf{4.5}cm^2$$

✓

Convert 34cm^2 to mm^2

✓ If there are no lengths provided, you need to change the scale factor by the power of the unit.

LENGTH $Scale\ Factor: x$

AREA $Scale\ Factor: x^2$

VOLUME $Scale\ Factor: x^3$

Example: cm to mm

4cm $\xrightarrow{\times 10}$ 40mm

4cm^2 $\xrightarrow{\times 10^2}$ 400mm^2

4cm^3 $\xrightarrow{\times 10^3}$ 4000mm^3

Conversions: Checklist

I understand that different countries have different currencies.	
I can confidently convert currencies with an exchange rate.	
I can convert between metric units.	
I can correctly convert area and volume measurements to different square and cube units.	

Practice Assessment 4

Calculators not allowed

Section	**Score**
1. Year 8 Topics 1-9 Recap	/28
2. Construction	/12
3. Pythagoras Theorem	/5
4. Conversions	/5
Total:	/50

Section 1: Year 8 Topics 1-9 Recap

1. (a) $1\frac{4}{7} + 2\frac{3}{4} =$

2

(b) $3\frac{2}{9} \div 2\frac{2}{5} =$

3

2. Expand and simplify the expressions:

(a) $5 - 4x(2x + 3)$

3

(b) $6(a - 5) - 7(6 - 7a)$

3

3. Find the nth term value for the following sequences:

(a) 78, 85, 92...

2

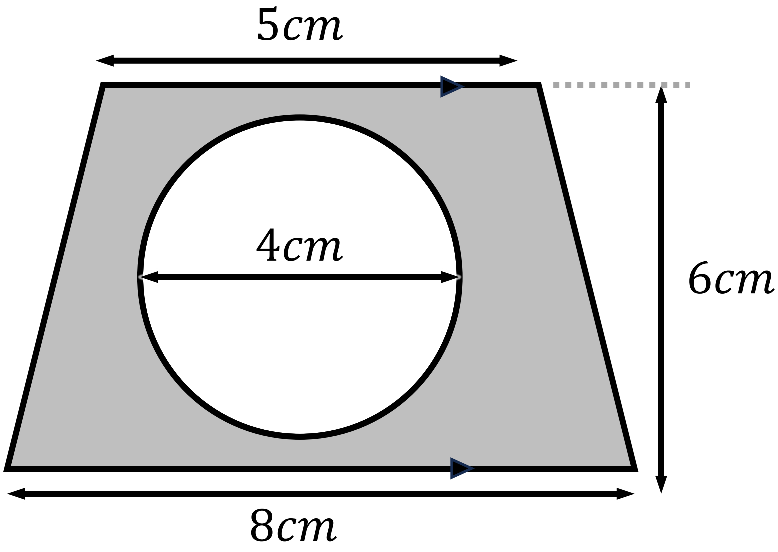
(b) 23, 20, 17 ...

2

4. The interior angles of a quadrilateral are in the ratio 3:4:5:6. Calculate the size of the largest angle.

3

5. Calculate the shaded area in the shape below:



5

6. Calculate the mean and mode of the frequency table below

Number of Siblings	**Frequency**
0	4
1	10
2	6
3	2
4	2

Mode: _ _ _ _ _ _ _ _

1

Mean: _ _ _ _ _ _ _ _

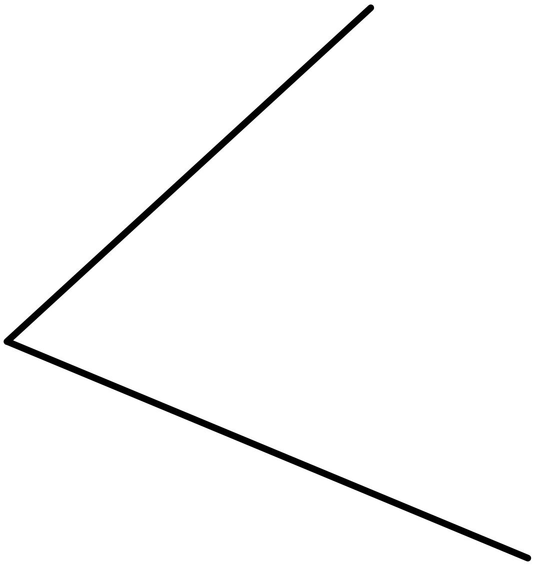
4

Practice Assessment 4

Section 2: Constructions and Bearings

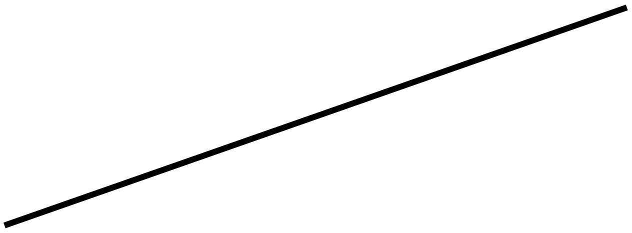
7. Using a ruler and compass, bisect the following.

(a)



3

(b)



3

8. In the space below, construct a triangle with sides:

(a) 4cm, 6cm and 5 cm.

3

(b) 6cm, 8cm and 9cm.

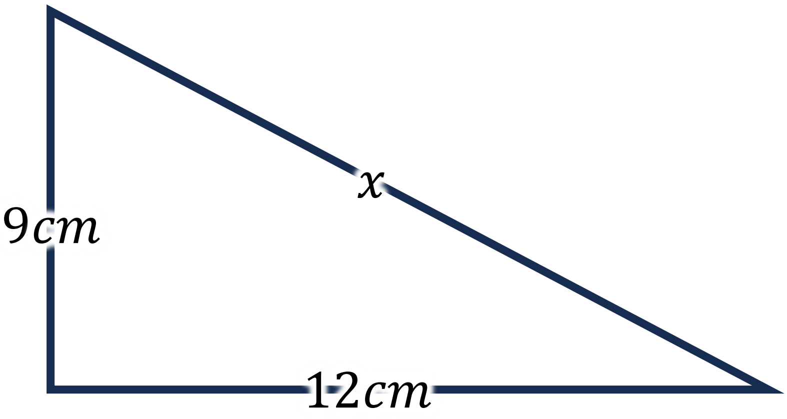
3

Practice Assessment 4

Section 3: Pythagoras Theorem

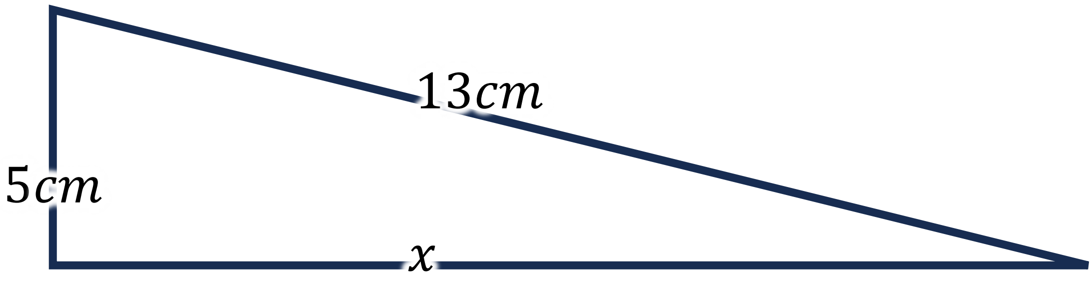
9. Calculate the missing side length $x$cm on the right-angled triangles below.

(a)



2

(b)



3

Section 4: Conversions

10. Paul is travelling to the US, and he is taking AED 7200 to spend, the exchange rate is $1=3.6 AED.

(a) How much money is he taking in Dollars?

2

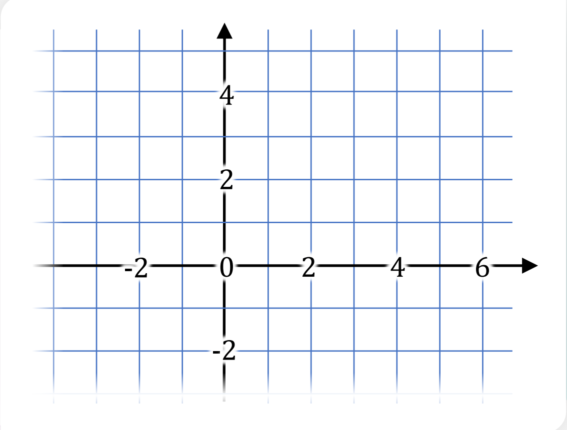
(b) He spends $1500, how many Dirhams does he have remaining?

3

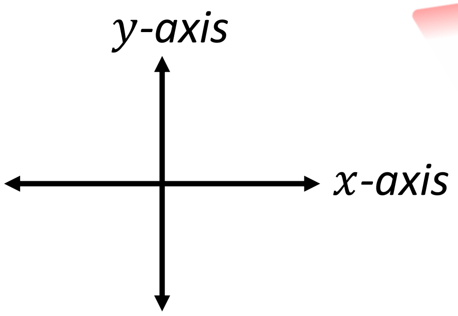
Topic 13- Transformations

Year 7 Recap

- ✓ Before proceeding to learn transformations, it is really important that you are fully confident with basic **graph** skills from year 7. A **four-quadrant** graph looks like this:



IMPORTANT!
You need to remember that the x axis is **horizontal,** and the y axis is **vertical**.



Co-Ordinates

- ✓ **Co-ordinates** are numbers that indicate a **specific** and accurate point on a graph. They are always written in a specific format.

Formatting Co-ordinates

Parentheses: Parentheses (indicate that it is a co-ordinate.

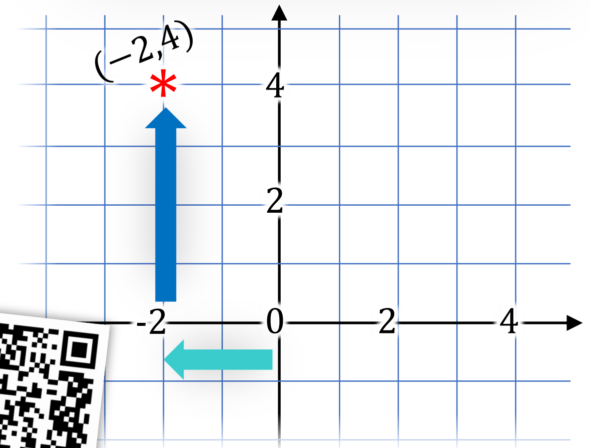
x- coordinate: This **always** comes on the left and indicates where the point is horizontally.

y- coordinate: This **always** comes on the right and indicates where the point is vertically.

$(-2,4)$

Comma: Commas are important to differentiate between the x and y co-ordinates.

To plot the co-ordinate $(-2,4)$, first you need to go to -2 on the **x**-axis, then go 4 lines up on the **y**-axis. Make a clear and bold x or *.



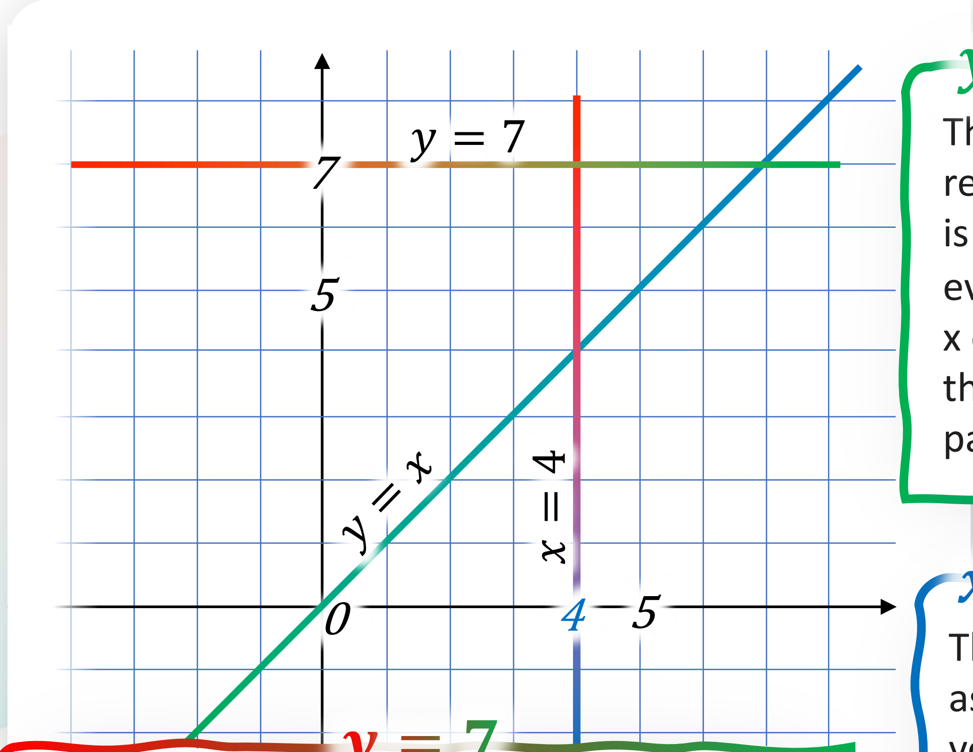
Introduction to Co-Ordinates

Lines on graphs

Addvance

RECAP

✓ For this topic, it is important to understand how to draw certain lines.



$y = x$

This is a common line for reflections. $y = x$ or $x = y$ is an **uphill** line where in every point on the line, the x co-ordinate is equal to the y-co-ordinate. The line passes through (0,0).

$y = 7$

These kinds of lines, such as y $= 4$, or $x = 7$ require you to draw a **horizontal** line from the specified mark. In every point on the line, the y co-ordinate will always be the same.

$x = 4$

These kinds of lines, such as $x = 4$, or $x = 7$ require you to draw a **vertical** line from the specified mark on the x-axis. In every point on the line, the x co-ordinate will always be the same.

Practice

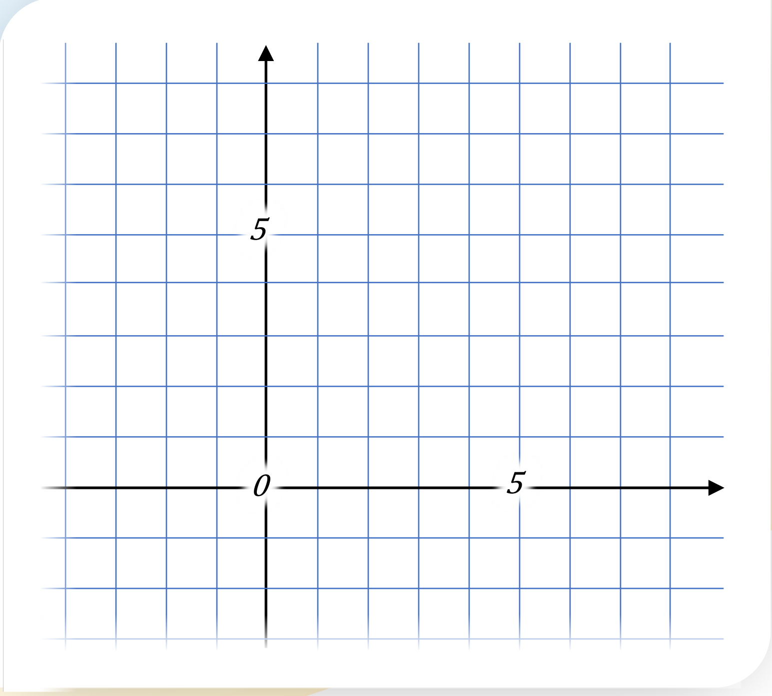
Draw the following lines on the graph!

$y = 4$

$x = 8$

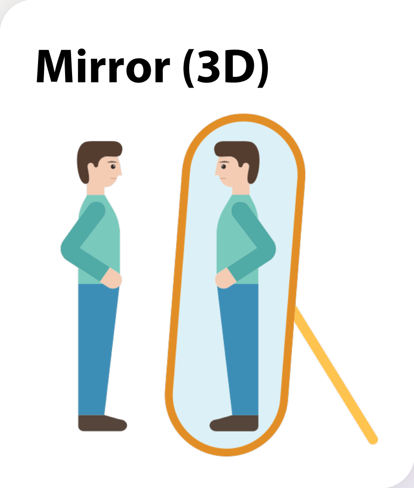
$y = x$

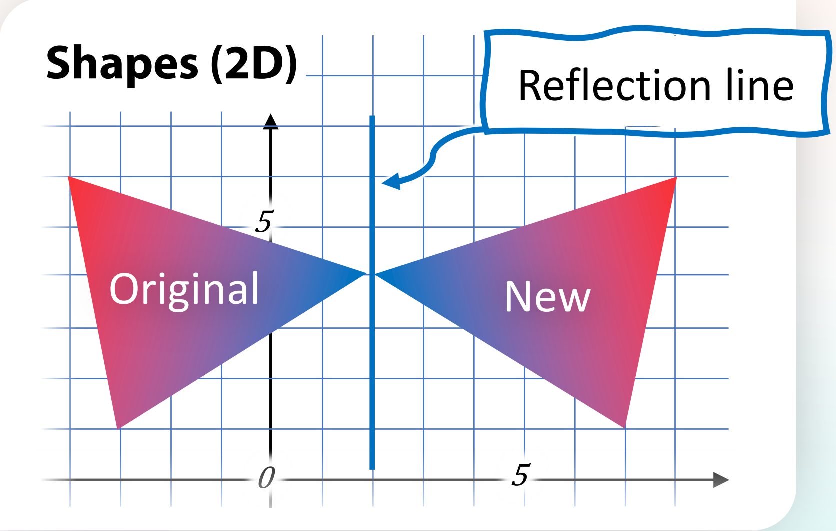
$y = -x$



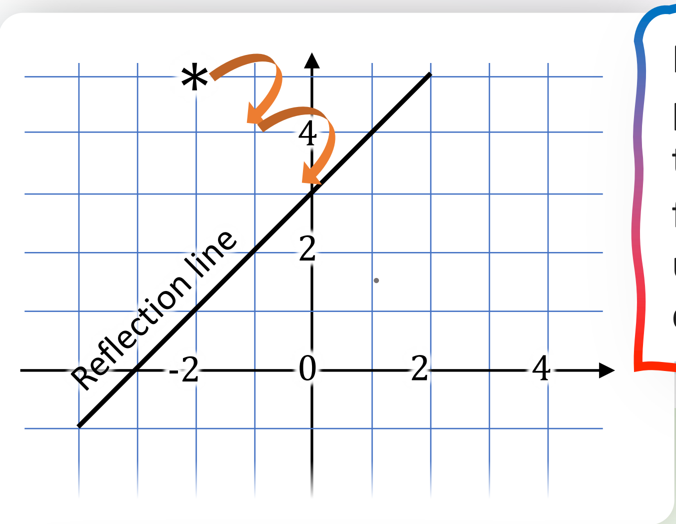
Reflections

✓ If you put an object in front of a mirror, the mirror will show the exact same object, except it will be **flipped**. The same principle applies to **reflecting** shapes on graphs.





✓ To reflect a polygon on a graph, you will be given the line, or the equation to draw it. Mark a point on each **vertex** of the polygon and reflect all the points. Then, connect the points with lines. To reflect a **point**:



1

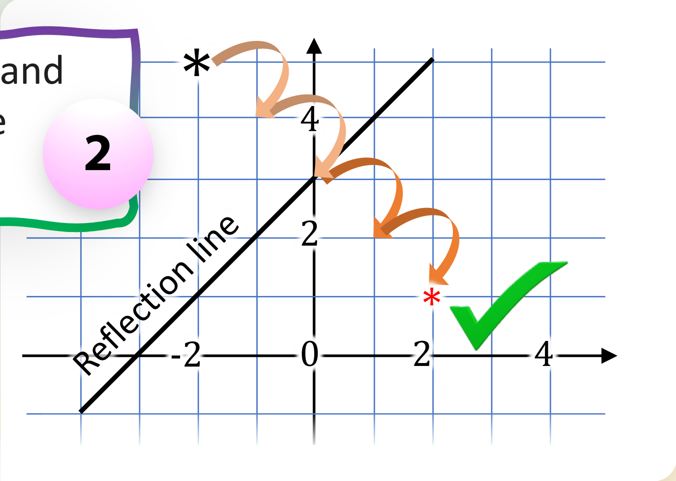
Find the shortest distance between the point and the reflection line. You need to keep this in your short-term memory for a few seconds. This can be straight unit lines, or diagonals (the exact length doesn't matter).

In this example, there are 2 diagonals between the point and the reflection line.

2

Keep going in the same direction as step 1 and mark the reflected point the same distance apart, but on the other side of the line.

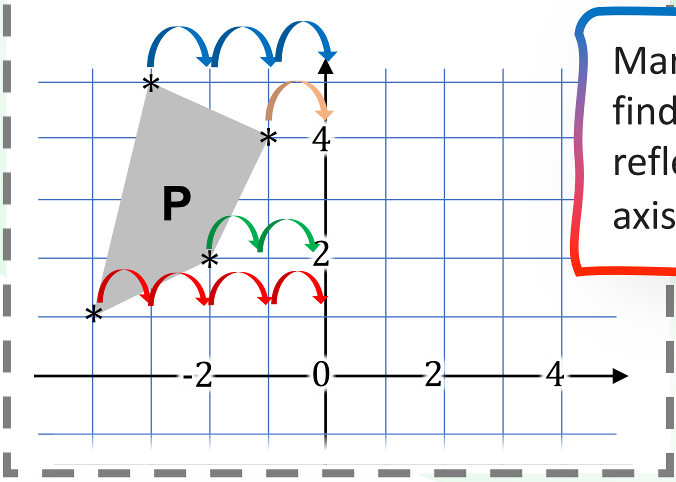
From step 1, the point is 2 diagonals apart from the line. Draw a new point 2 diagonals apart from the line on the other side.



Reflections

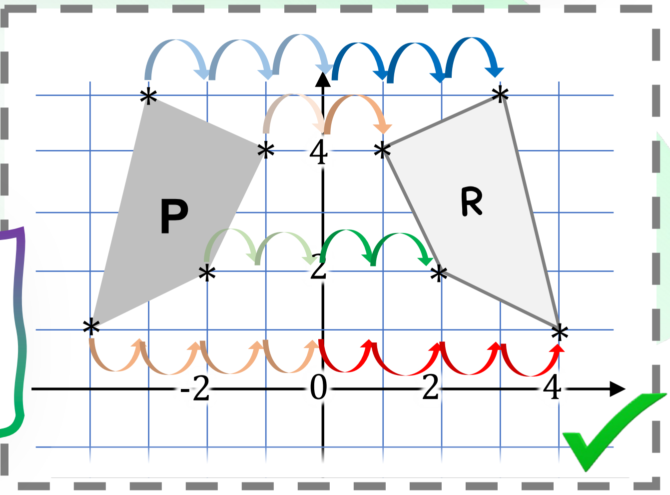
✓ Here is an example of reflecting a shape on a graph.

Example: Reflect shape P on the y-axis. Label the new shape R.

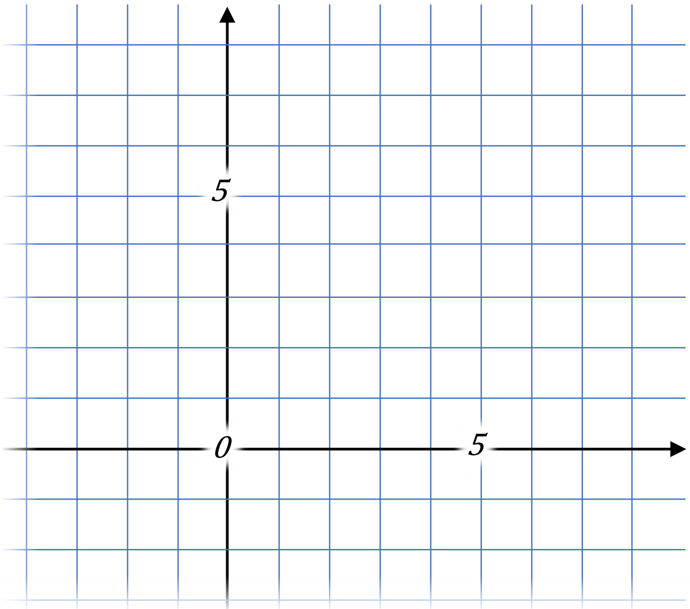


Mark all the vertices of the polygon and find the distances from each point to the reflection line, in this example the y-axis.

Plot the reflected points on the other side of the reflection line. Connect the points and label the shape.



Practice: Construct shape S and reflect it on the line $y = x$.



Co-Ordinates of shape S:

$(-1,7)$

$(0,2)$

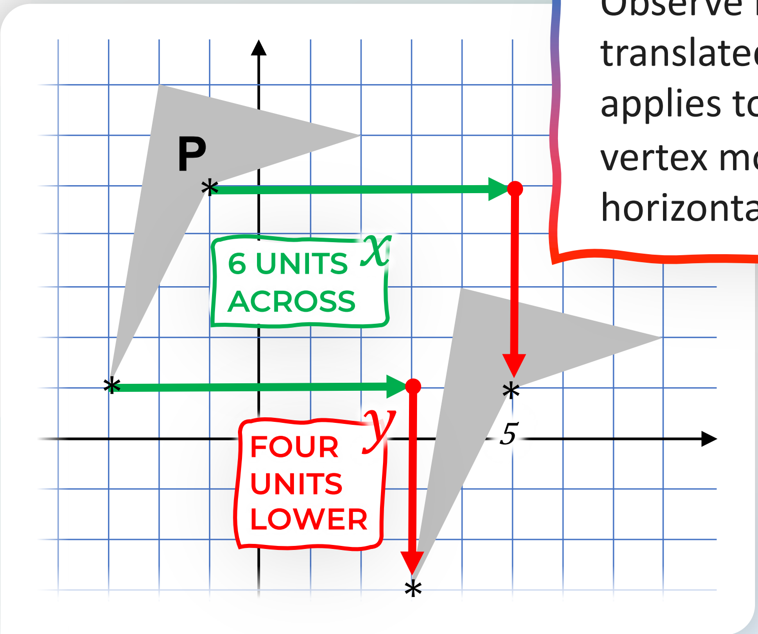
$(3,3)$

$(5,8)$

[Reflections video (watch till 6:09)]

Translations

✓ A **translation** is a type of transformation when a shape or point is moved from one location to another. Look at the example below, in this case shape P is translated six units higher on the x-axis and four units lower on the y-axis.



Observe how every vertex of the shape is translated by the **same** amount. This applies to **all** shape translations: every vertex moves the same distance horizontally and vertically.

Translations **never** change the size, angle or shape. Translation only moves the shape from one position on the graph to another.

✓ Translations are always expressed as a **vector**. A vector is expressed in a specific format and indicates exactly how much the point(s) move on both the x and y axes.

$\begin{pmatrix} -3 \\ 6 \end{pmatrix}$ 3 to the left, 6 up

$\begin{pmatrix} 5 \\ 8 \end{pmatrix}$ 5 to the right, 8 up

x- axis translation: This **always** comes on top. A negative indicates left movement. A positive number means right movement.

Negative ← → Positive

Parentheses: Parentheses indicate that it is a vector.

$$\begin{pmatrix} 6 \\ -4 \end{pmatrix}$$

y- axis translation: This **always** comes on the bottom. A negative indicates downward movement, and a positive indicates upwards movement.

↑ Positive

↓ Negative

Your Turn!

$\begin{pmatrix} -4 \\ -9 \end{pmatrix}$ ………………………………
………………………………

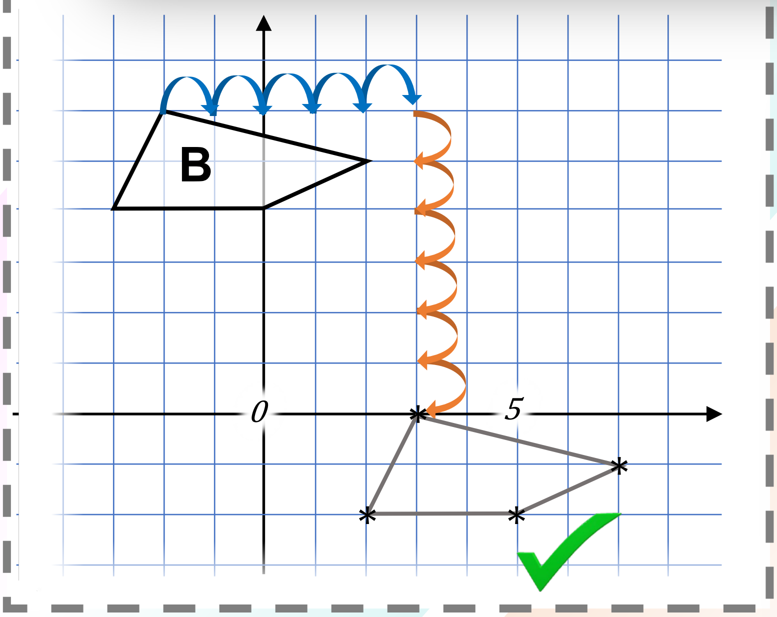
$\begin{pmatrix} 8 \\ -0.5 \end{pmatrix}$ ………………………………
………………………………

There is no line between the top and bottom numbers.

Translations

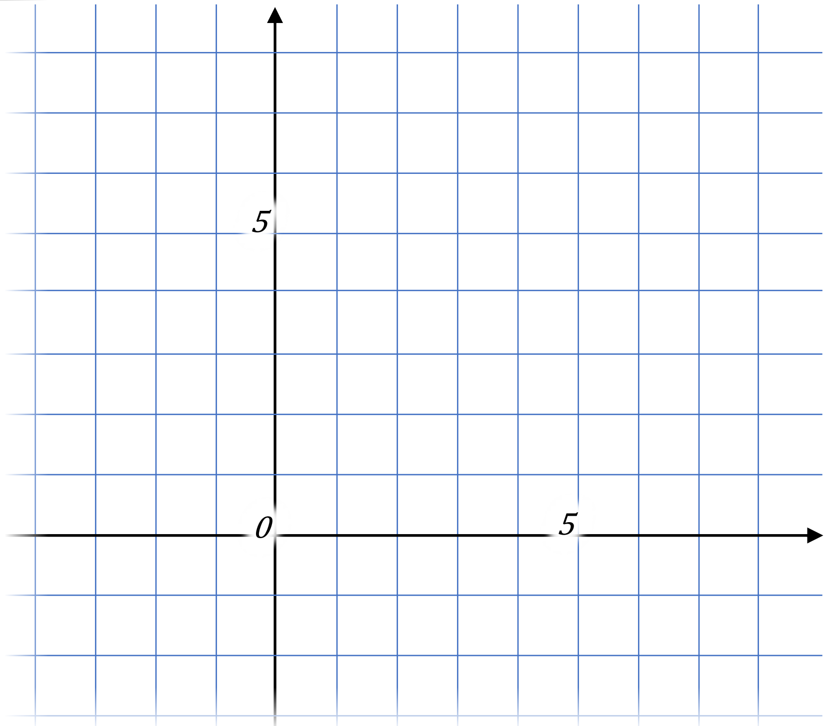
✓ To translate a shape, translate each point from by the vector and connect the points. For example:

Example: Translate shape B by vector $\begin{pmatrix} 5 \\ -6 \end{pmatrix}$



To **identify** a translation, simply find a point on the original shape, and the corresponding point on the translated shape. Then find the number of units you need to go on the x-axis to reach the new point, and after that, how many units you need to reach the point on the y-axis.

Practice: Construct the shape with the given co-ordinates and translate it by the vector $\begin{pmatrix} -4 \\ 7 \end{pmatrix}$



$(3,1)$

$(7,1)$

$(5,-2)$

$(2,-1)$

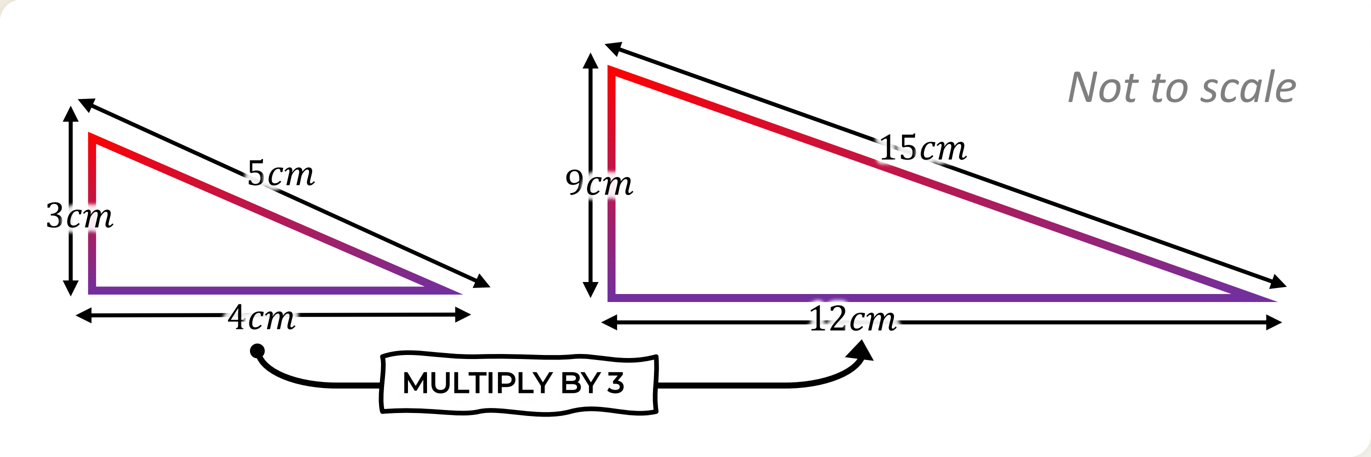
Translation video (watch till 2:06)

Enlargements

- ✓ An **enlargement** is when you change the size of a shape by a specific **scale factor** without altering the shape. The scale factor of the shape is the number by which the lengths of the shape are reduced or increased by. The formula for scale factor is:

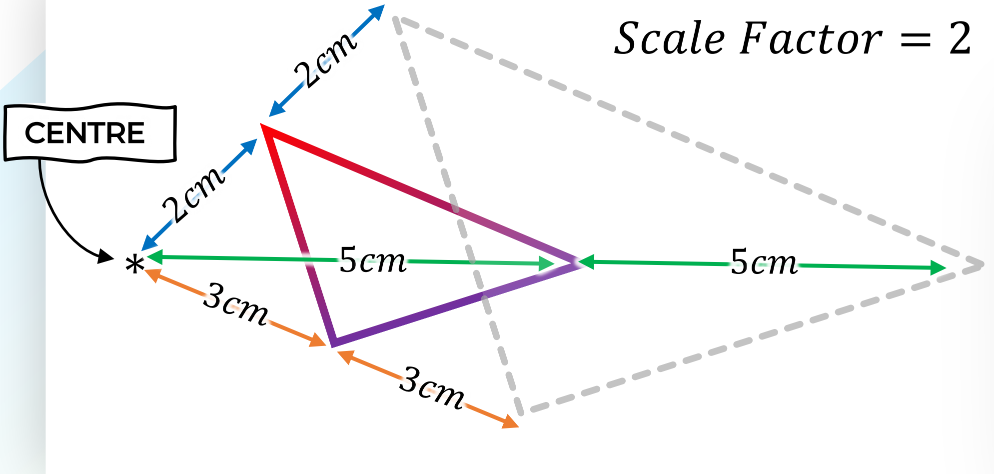
$$S\ Factor = \frac{New\ length}{Original\ length}$$

- ✓ Here is an example of a shape, and an enlargement of it. The scale factor is 3, because every side on the enlargement is thrice as long.



- ✓ Enlargements always require a co-ordinate called the **centre of enlargement**, which is the point from which the shape is enlarged.

- ✓ Every point of a shape is a certain distance away from the centre of enlargement. **That distance should be multiplied by the scale factor to find the point of the same (corresponding) vertex on the enlarged shape.**



In this case, the scale factor is 2, so the distance between each vertex and the centre of enlargement is **doubled** to give the location of the corresponding vertex on the enlarged shape (which is in grey dotted lines).

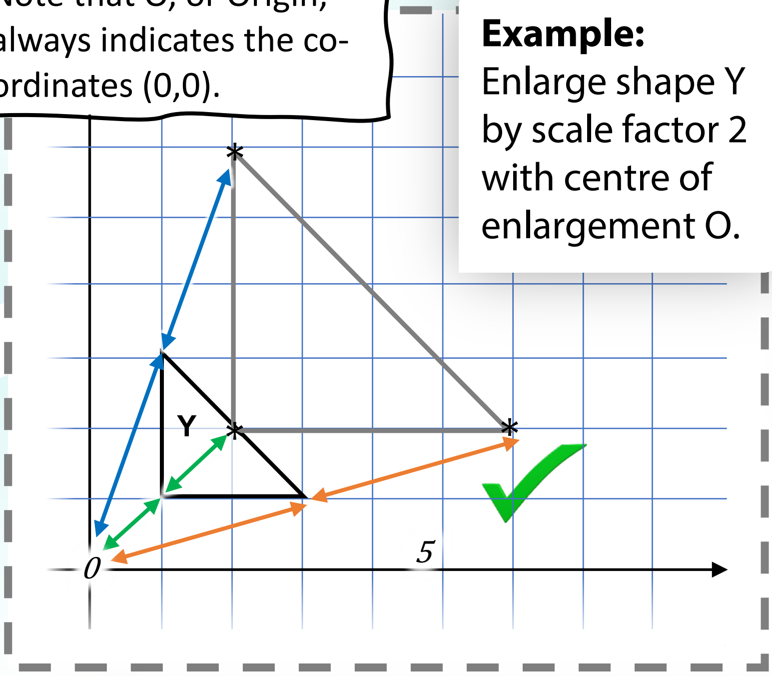
Enlargements

✓ To enlarge a shape, follow the steps below, and observe the example:

1 Mark the **centre of enlargement** on the graph and find the distances between each vertex and the centre of enlargement.

Note that O, or Origin, always indicates the co-ordinates (0,0).

Example: Enlarge shape Y by scale factor 2 with centre of enlargement O.

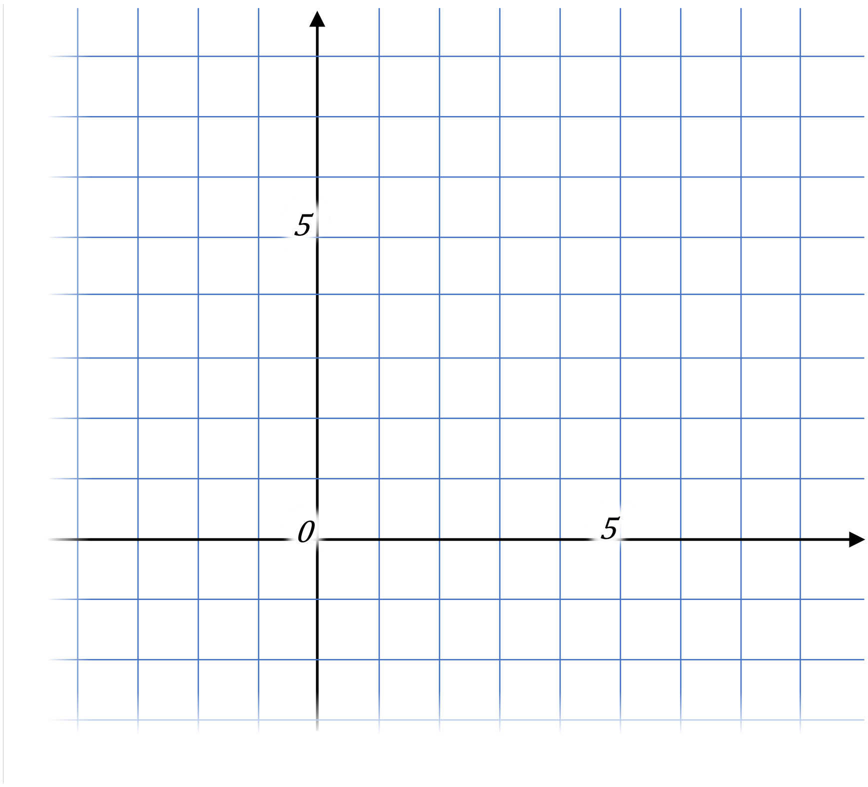


2 Multiply all the distances by the scale factor and construct the points.

3 Connect the vertices with a ruler and sharp pencil.

[Enlargements (watch till 3:39)]

Practice: Construct and enlarge the shape by scale factor 3 and centre (-4,-2)



$(0,1)$

$(-2,1)$

$(-2,-1)$

$(0,-1)$

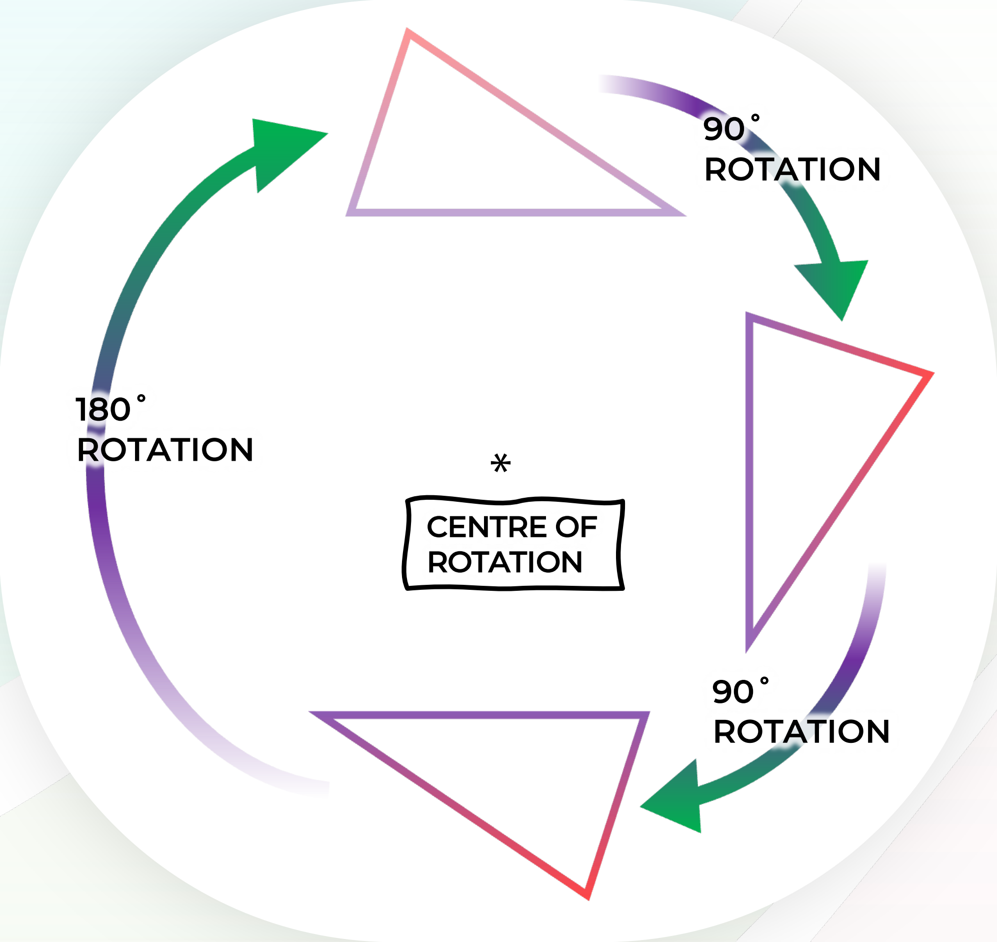
Rotations

- ✓ A **rotation** is when a shape is rotated based on a given **angle**, **direction** and **centre of rotation**. Rotations do not change the shape or size.

- ✓ The diagram on the right shows a shape rotated by 90˚ and 180˚ around a given centre of rotation.

- ✓ A 360˚ rotation brings the shape back to its original position.

- ✓ **Top Tip:** Use tracing paper to help you with rotations.



Directions

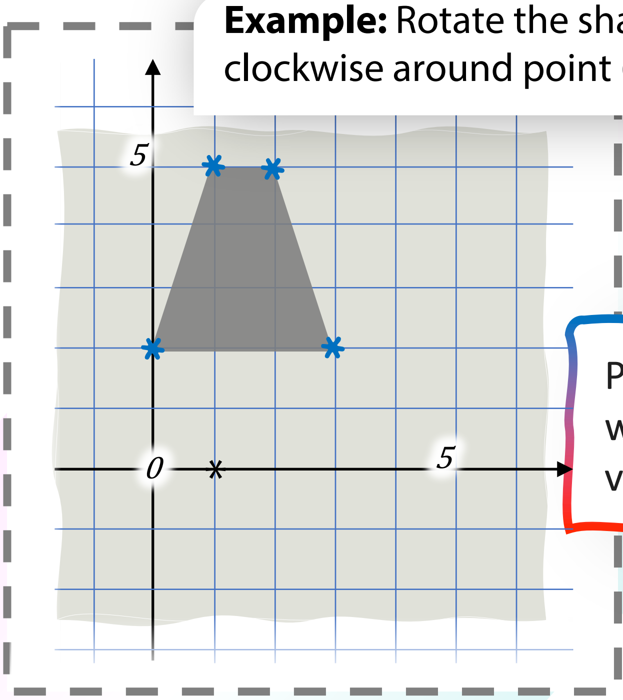
- ✓ There are two directions for rotation, clockwise and anti-clockwise. If you are not familiar with these, it is worth taking time to memorise.

A 180˚ rotation does not require a direction, because the result will be the exact same regardless of which direction you rotate in.

Rotations on Graphs

Addvance

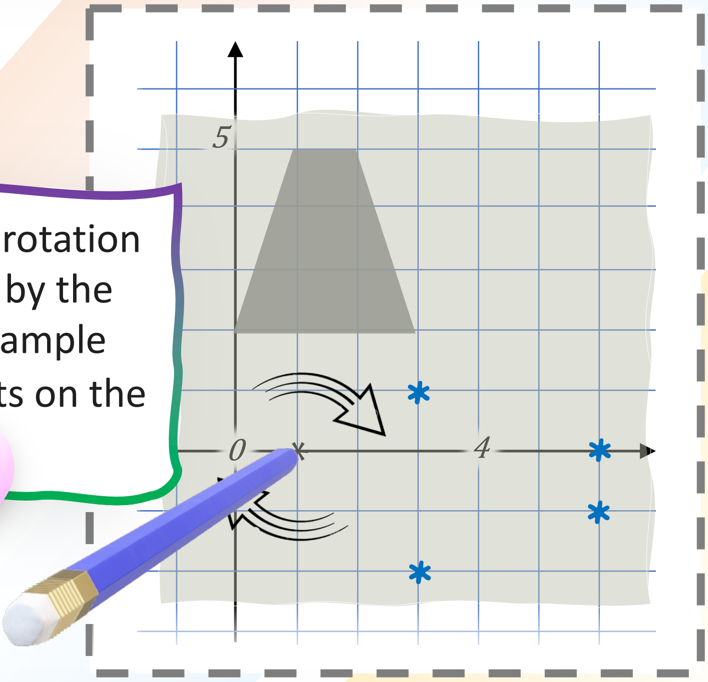
Example: Rotate the shape 90˚ clockwise around point (1,0).



For rotations, you need to have **tracing paper**, which is thin, translucent paper. This will be provided to you in exams, but for practice at home you can use baking paper.

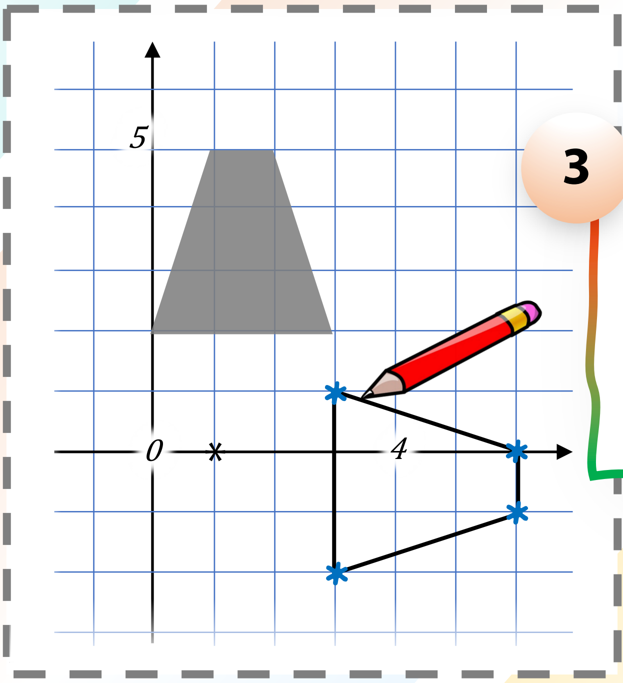
1

Place the tracing paper over the graph, and while holding it carefully, mark all the vertices of the shape on the tracing paper.



Hold a pencil firmly over the centre of rotation and smoothly rotate the tracing paper by the required angle and direction, in this example 90˚ clockwise. Carefully mark the points on the graph under the tracing paper.

2



3

Remove the tracing paper and connect the points on the graph. If you want, put the tracing paper back on and double check that the new shape is in the right place.

Rotations video

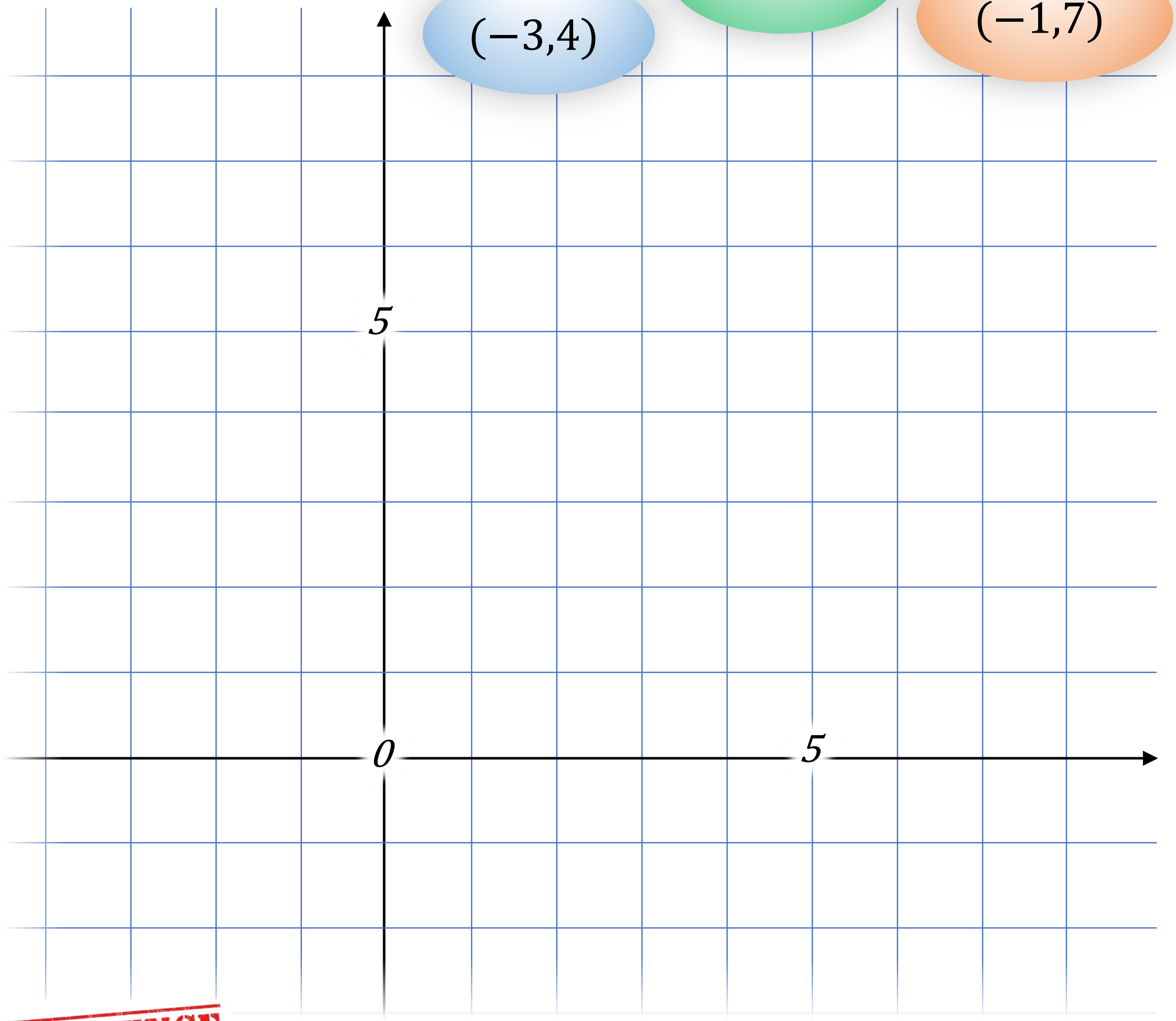
Rotations Practice

Practice: Construct the shape and rotate the it 270° anti-clockwise around point (1,1).

(−3,4)

(−1,3)

(−1,7)



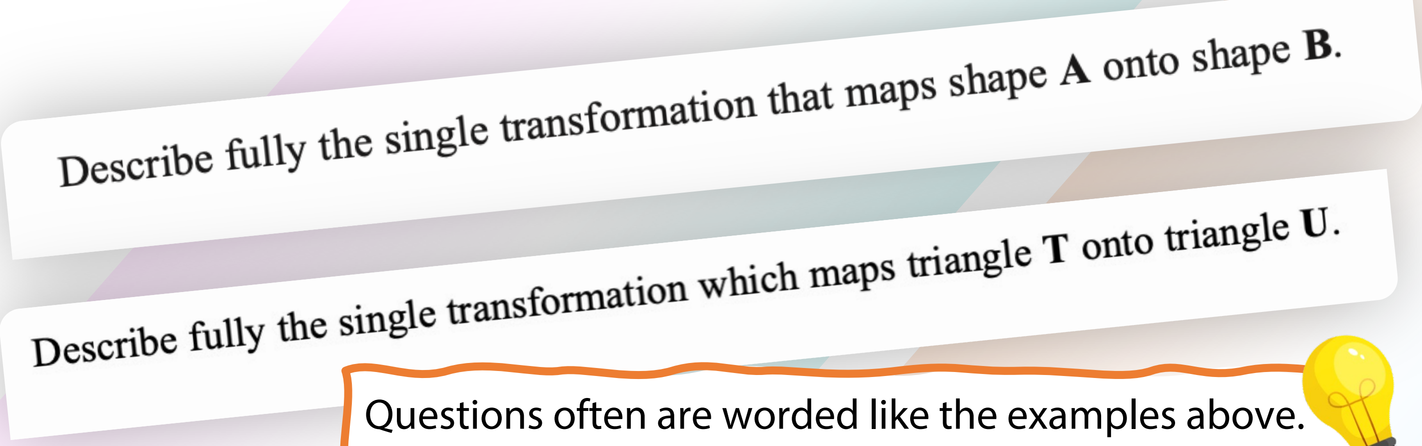
CHALLENGE

Think: is there a simpler rotation that gives the same result?

Small changes in holding the paper on the centre of rotation can massively alter the final placement of the shape, so be slow, careful and precise.

Describing Transformations

- ✓ There are often questions in Year 8, 9 and GCSE that show a shape and its transformation, asking you to describe it.



Describe fully the single transformation that maps shape **A** onto shape **B**.

Describe fully the single transformation which maps triangle **T** onto triangle **U**.

Questions often are worded like the examples above.

- ✓ The first step is to identify the **type** of transformation. Look for the following signs:

ENLARGEMENT: The orientation stays the same, but the size of the shape changes.

TRANSLATION: The size and orientation are the same, but the position changes.

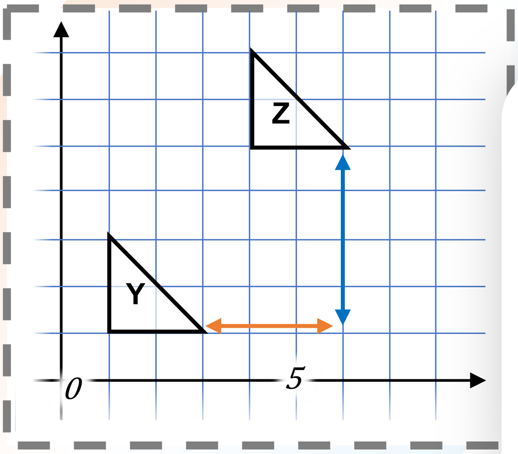
ROTATION: The size stays the same, but it is at a different angle.

REFLECTION: The size stays the same, but the shape is flipped.

Translations

- ✓ In your answer, you need to mention 'translations' and the vector, in this format:

"Translation by vector ..."



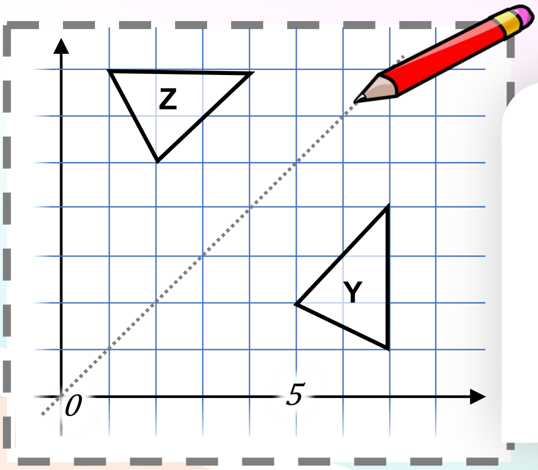
Example: Describe fully the single transformation which maps triangle Y onto triangle Z.

Translation by vector $\begin{pmatrix}3\\4\end{pmatrix}$.

Describing Transformations

Reflections

- ✓ The first step is to determine whether the reflection is vertical, horizontal or diagonal. After that, you need to identify the reflection line. Your answer should look like this: "Reflection with mirror line of ..."



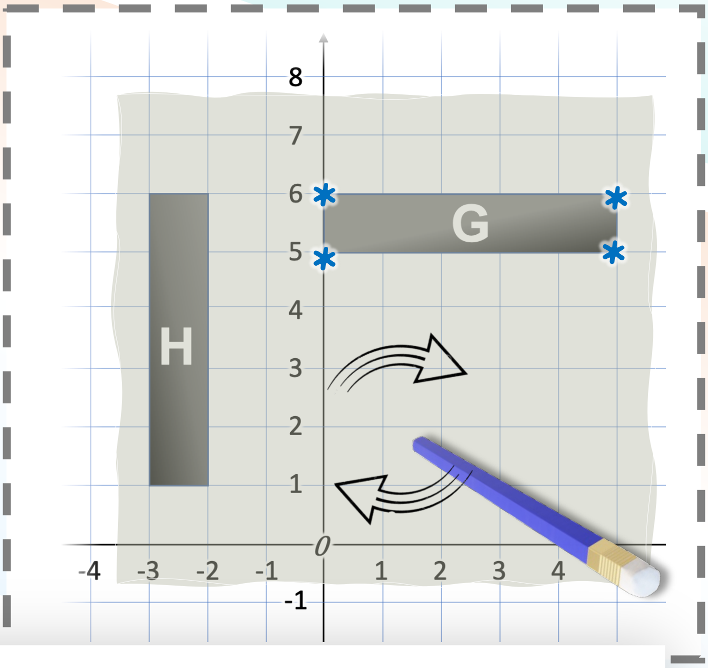
Example: Describe fully the single transformation which maps triangle Y onto triangle Z.

Reflection with a mirror line of y=x. ✓

Rotations

- ✓ You need to draw the vertices of the shape on the tracing paper and do a bit of trial and error with the centre of rotation until you reach the right one.
- ✓ Your answer should include 'rotation', the centre of rotation, angle and direction, like this:

  "Rotation by ... degrees ... around centre ... "



Example: Describe fully the single transformation which maps shape H onto shape G.

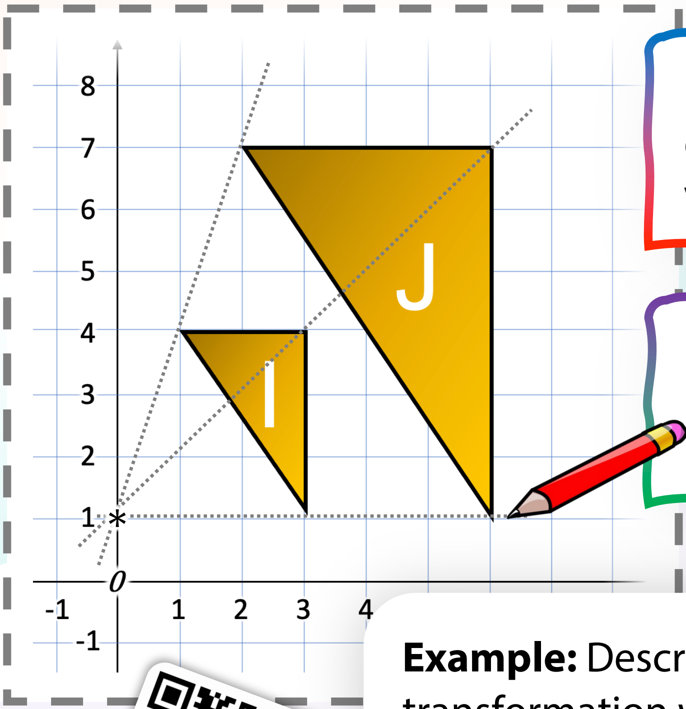
Rotation by 90° clockwise around centre (1,2). ✓

Describing Transformations

Addvance

Enlargements

✓ With enlargements, you need to have the centre of enlargement and the scale factor in your answer. "Enlargement around centre ... by scale factor ..."



1 Identify the centre of rotation by connecting the corresponding vertices and extending the lines.

2 Find two corresponding lengths, and divide the longer one by the shorter one, to find the scale factor.

Describing transformations

Example: Describe fully the single transformation which maps triangle Y onto triangle Z.

Enlargement around centre (0,1) by scale factor 2. ✓

Transformations: Checklist

I can confidently plot and identify co-ordinates and lines on graphs.	
I can translate a shape by a given vector.	
I can rotate a shape with a given centre, angle and direction.	
I can enlarge a shape with a given scale factor and centre.	
I can reflect a shape with a given reflection line.	
I can fluently identify and describe transformations.	

Topic 14- Introduction to Probability

✓ In simple terms probability is the , **chance** or **likelihood** of something happening.

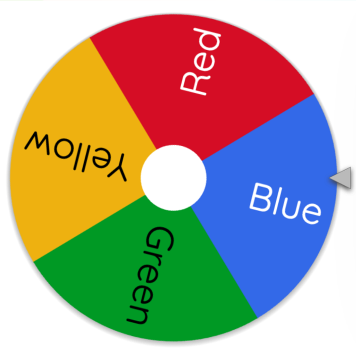
✓ For example, if you have a dice, there are six possible **outcomes**.

Probabilities are always expressed as:
- Decimals or fractions between 0 and 1.
- Percentages between 0% and100%.

✓ The probability of something happening can be calculated as a fraction, with the formula below.

$$Probability = \frac{Number\ of\ times\ it\ occurs}{Total\ number\ of possible\ results}$$

✓ For example, if you have a spinner with red, green, blue and yellow, we can use the formula to calculate the probability of getting a blue. Blue is only one section on the spinner, so the number of favourable outcomes is one. There are 4 total possible outcomes (Red, Blue, Green and Yellow).



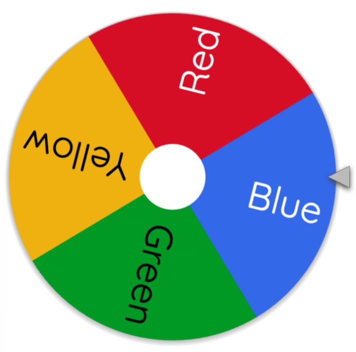
$$Probability = \frac{Number\ of\ times\ it\ occurs}{Total\ number\ of possible\ results}$$

$$Probaility = \frac{1}{4} \text{ or } 0.25$$ ✓

✓ Similarly, the probability of getting a yellow is also 0.25, the probability of getting red is 0.25, and the probability of getting a green is 0.25.

Introduction to Probability

✓ With the same spinner, if you are looking for the probability of getting a **RED OR BLUE**, then there are two favorable outcomes, and four total possible outcomes. Remember to simplify the answer.



$$Probability = \frac{Number\ of\ times\ it\ occurs}{Total\ number\ of possible\ results}$$

$$Probaility = \frac{2}{4} = \frac{1}{2} \text{or } 0.5$$ ✓

Practice: Calculate the probability of getting a **RED, BLUE OR YELLOW**

Introduction to Probability

✓ Note that probability is always expressed in the format:

$P(something\ happening)$ such as P(Blue) or P(Red & Green).

KEY FACT: Probabilities always add up to 1, or 100%.

$$P(pass) + P(Fail) = 1$$

$$P(heads) + P(tails) = 1$$

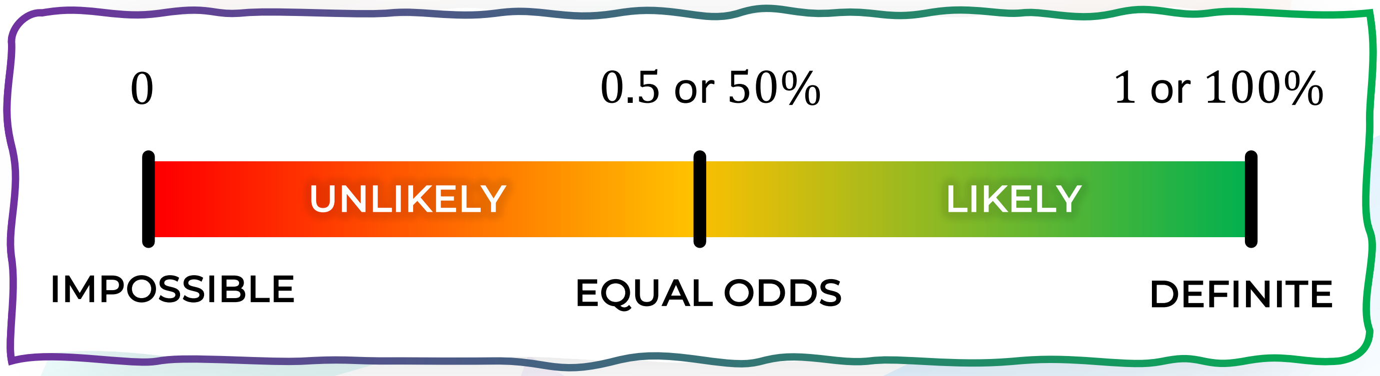
$$P(happening) + P(not\ happening) = 1$$

$$P(rain) + P(no\ rain) = 1$$

$$P(win) + P(loss) = 1$$

Probability scale

- ✓ Probabilities are always between 0 and 1, and within the range there are different likelihoods or events occurring.



- ✓ Observe carefully the diagram above. Note that apart from 0 or 1, probability is never certain. You can flip a coin 20 times and despite being unlikely, end up with all of them being heads.

Impossible: Seeing someone older than 500 years.

Unlikely: Acing an exam without revising.

Equal odds: Getting a tails when flipping a coin.

Likely: Sunshine during a summer day.

Definite: The sum of two even numbers is even.

Match the probabilities with results from a dice.

Impossible

Unlikely

Equal Odds

Likely

Definite

3 or higher

Even number

2

9

Less than 7

Expected successes

✓ With probability, you can calculate the expected number of success with a number of trials. To do this, simply do: $\boxed{probability \times number\ of\ trials}$

Example: A biased spinner can land on different colours. The probabilities are displayed on the table below:

RED	BLUE	YELLOW	ORANGE	GREEN
0.2	0.1	0.3	x	$3x$

1. Calculate the probability of scoring an orange.

$$0.2 + 0.1 + 0.3 + x + 3x = 1$$
$$0.6 + 4x = 1$$
$$4x = 0.4$$
$$x = 0.1$$ ✓

We can set up an equation (because all probabilities add to 1).

2. The spinner is spun 80 times. How many times would you expect it to land on blue?

$$\text{expected success} = \text{probability} \times \text{trials}$$
$$\text{expected success} = 0.1 \times 80$$
$$\text{expected success} = 8 \text{ times}$$ ✓

Practice:
Calculate the probability of scoring a green.

The spinner is spun 360 times. Calculate how many times you would expect it to land on each colour.

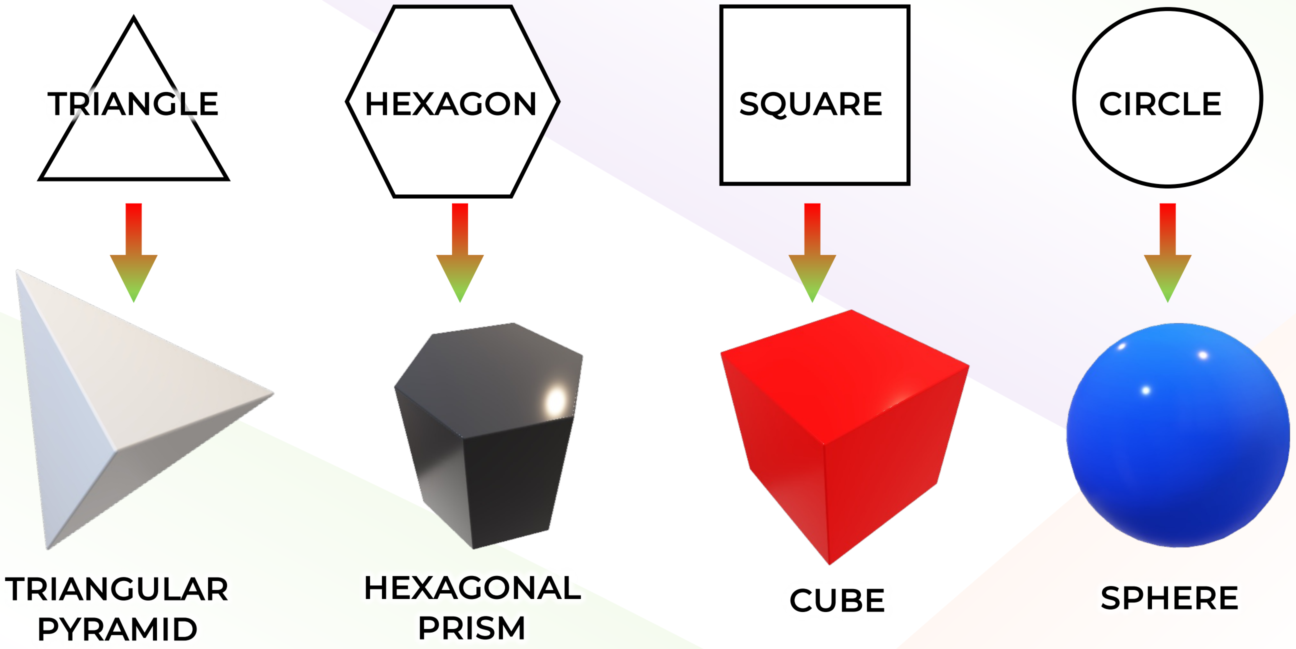
YELLOW:

Introduction to Probability: Checklist

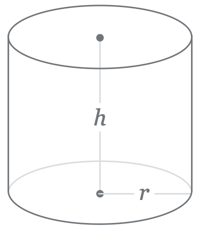
I understand the probability scale and can determine from probability how likely it is for an event to occur.	
I can easily calculate the probability of an event occurring, and the probability of an event not happening.	
I can calculate the expected successes based on the probability.	

Topic 15- 3D Shapes

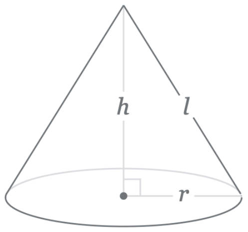
✓ A 2D shape has only two **dimensions**, such as a length and width. A 3D shape has 3 dimensions, such as length, width and height. Here are some examples of 2D shapes and their matching 3D shapes.



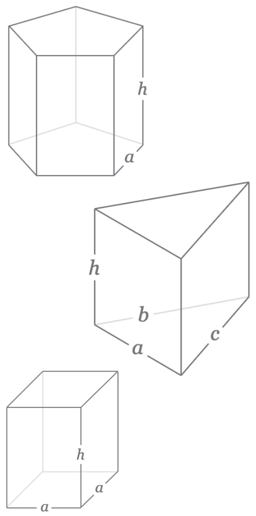
✓ Here are some common 3D shapes:



A cylinder is a solid that holds two parallel aligned circular bases that are joined with one curved surface.

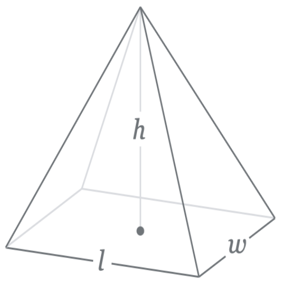


A cone has a flat circular base, and a curved surface that is pointed towards the top.



A prism is a shape with two congruent (same) parallel and aligned bases that are connected. Examples include:

- Cuboid
- Triangular prism
- Pentagonal prism.



A pyramid has a flat base (a polygon), and triangular faces that all meet at one point that that is pointed towards the top. A pyramid can be triangular, square-based, pentagonal and so on.

Surface area

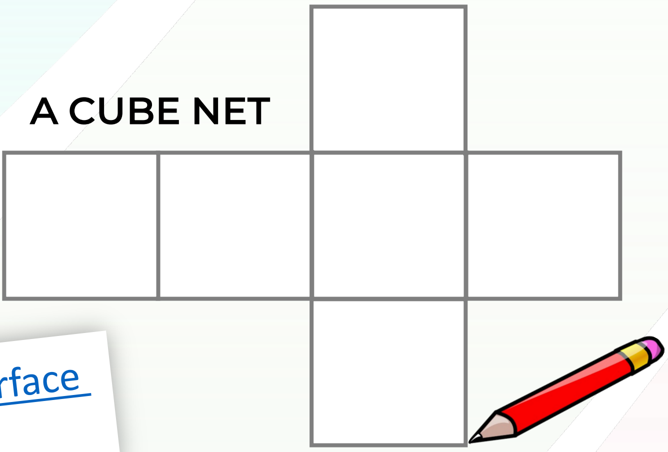
- ✓ While 2D shapes have **area** and **perimeter**, 3D shapes have **volume** and **surface area**.

The surface area is the sum of the areas of all the faces of the shape, while the volume is the space taken up by a 3D shape (or its capacity)

- ✓ Note that most 3D shapes (excluding spheres) can be constructed as a 2D **net** on paper. Watch the Addvance Maths video to understand how to construct nets, but essentially a net is an unfolded 3D shape, so all the flat surfaces are connected. Here is an example of a net of a cube.

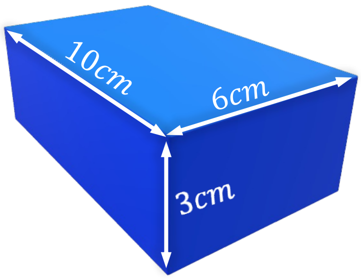
Nets and Surface Area Video

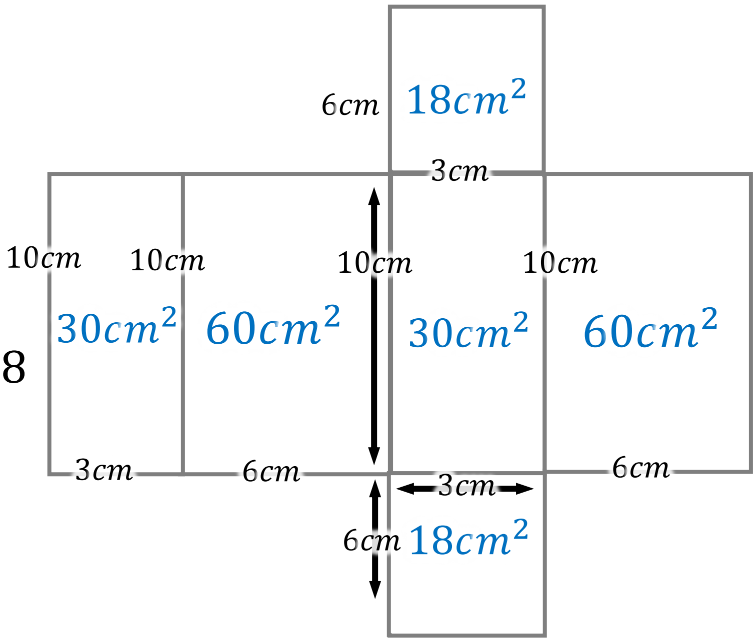
A CUBE NET



- ✓ Once you have the net, you can calculate the areas of the different faces and add them up to calculate the surface area of the 3D shape.

Example: Calculate the surface area of the cuboid.





$30 + 60 + 30 + 60 + 18 + 18$

$90 + 90 + 36$

$180 + 36$

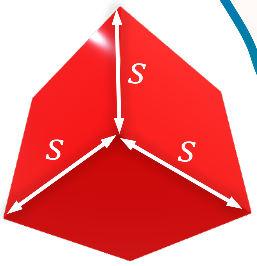
$216cm^2$ ✓

Cubes and Cuboids

Cubes

Practice square and cube numbers- it will help a lot!

$\boxed{Surface\ Area = 6s^2}$ $\boxed{Volume = s^3}$



Example: Volume and surface area of a cube with edges 4cm.

$$V = s^3$$
$$V = (4)^3$$
$$V = \mathbf{64cm^3}$$ ✓

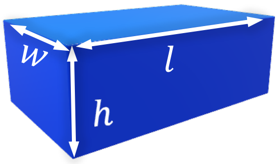
$$S_A = 6s^2$$
$$S_A = 6(4)^2$$
$$S_A = 6(16)$$
$$S_A = \mathbf{96cm^2}$$ ✓

Note that units for volume are cubed (example cm^3), and for surface area they are squared (such as cm^2).

Volume video

Cuboids

$\boxed{Volume = lwh}$ $\boxed{S_A = 2(lh + wh + lw)}$



Example: Volume and surface area of a cuboid with length 5cm, width 7cm and height 2cm.

$$V = lwh$$
$$V = (5)(7)(2)$$
$$V = \mathbf{70cm^3}$$ ✓

$$S_A = 2(lh + wh + lw)$$
$$S_A = 2[(5 \times 2) + (7 \times 2) + (5 \times 7)]$$
$$S_A = 2(10 + 14 + 35)$$
$$S_A = 2(10 + 14 + 35)$$
$$S_A = \mathbf{59cm^2}$$ ✓

Practice: Calculate the surface area and volume of...

Cube with edges 8cm:

Cube with edges 3m:

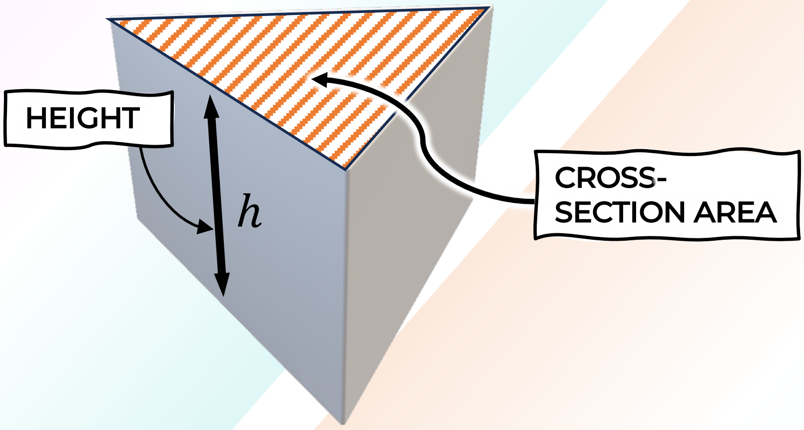
Cuboid with length 8cm, width 6cm and height 9cm:

Cuboid with length 10m, width 4m and height 30cm:

Prisms

- ✓ Continuing from page 81, a prism is a shape with two congruent (same) parallel and aligned faces that are connected.

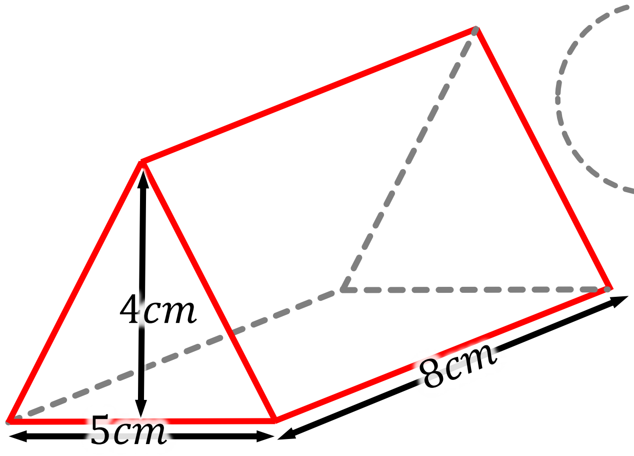
- ✓ Every prism has a **cross – section**, or a shape that runs through it. For example, in a triangular prism, the triangle is the cross section.

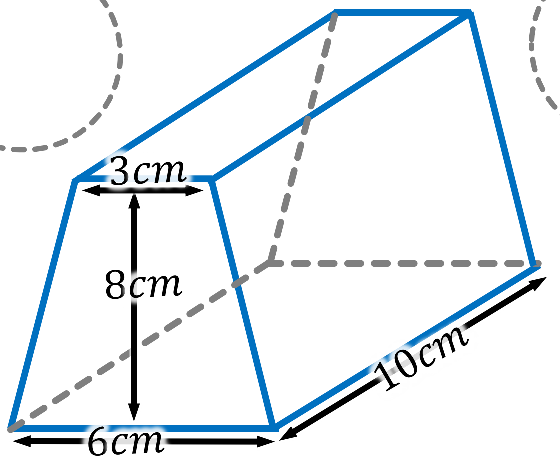


- ✓ You can easily calculate the volume of any prism with the formula:

$$Volume = Height \times Cross\ Section\ Area$$

Practice: Calculate the volume of the following prisms:





3D Shapes: Checklist

I can list and understand the properties of common 3D shapes such as cubes, cuboids, pyramids, cones, cylinders, prisms and spheres.	
I can fluently calculate the volume of cubes, cuboids and prisms, and surface area of cubes and cuboids.	
I can construct a net of a given 3D shape.	

Practice Assessment 5

Calculators not allowed

Section	**Score**
1. Year 8 Topics 1-12 Recap	/35
2. Transformations	/8
3. Probability	/12
4. 3D shapes	/11
Total:	/66

Section 1: Year 8 Topics 1-12 Recap

1. (a) $5\frac{4}{5} + 3\frac{7}{9} =$

2

(b) $4\frac{2}{9} \div 1\frac{3}{5} =$

3

2. Expand and simplify the expressions:

(a) $6(x-3)+5(9-x)$

3

(b) $5x(x+4)-4(x-5)$

3

3. Dean and Saif went shopping and spent \$40 in a ratio of $4{:}\,n$. Dean spent \$16. Calculate n.

2

4. Calculate the mean and median of the following frequency table :

Number of Hours	**Frequency**
0	4
1	5
2	3
3	5
4	6
5	8
6	5

Mode: _ _ _ _ _ _ _ _ _

1

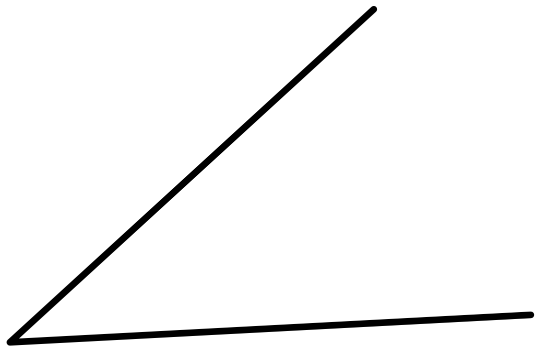
Mean: _ _ _ _ _ _ _ _ _

4

Section 2: Constructions and Bearings

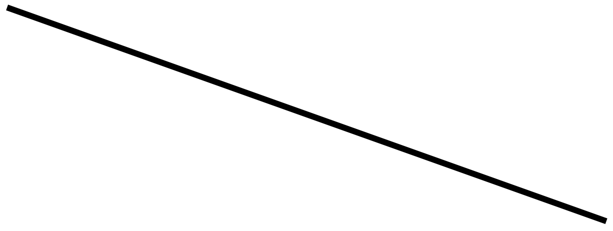
5. Using a ruler and compass, bisect the following.

(a)



3

(b)



3

6. Simplify the following expressions as much as possible.

(a) $(4xa^7)^3$

2

(b) $\dfrac{x^7 \times x^5}{x^2}$ $(x > 0)$

2

(c) $\dfrac{y^2ac^2y}{y^0a^3}$

3

(d) $3 + a(x)^2$

4

Practice Assessment 5

Section 2: Transformations

7. On the graph below, construct shape Q with co-ordinates (1,3), (1,4) and (2,3). 2

(a) Reflect the shape on the line $y = x$. Label the new shape R.

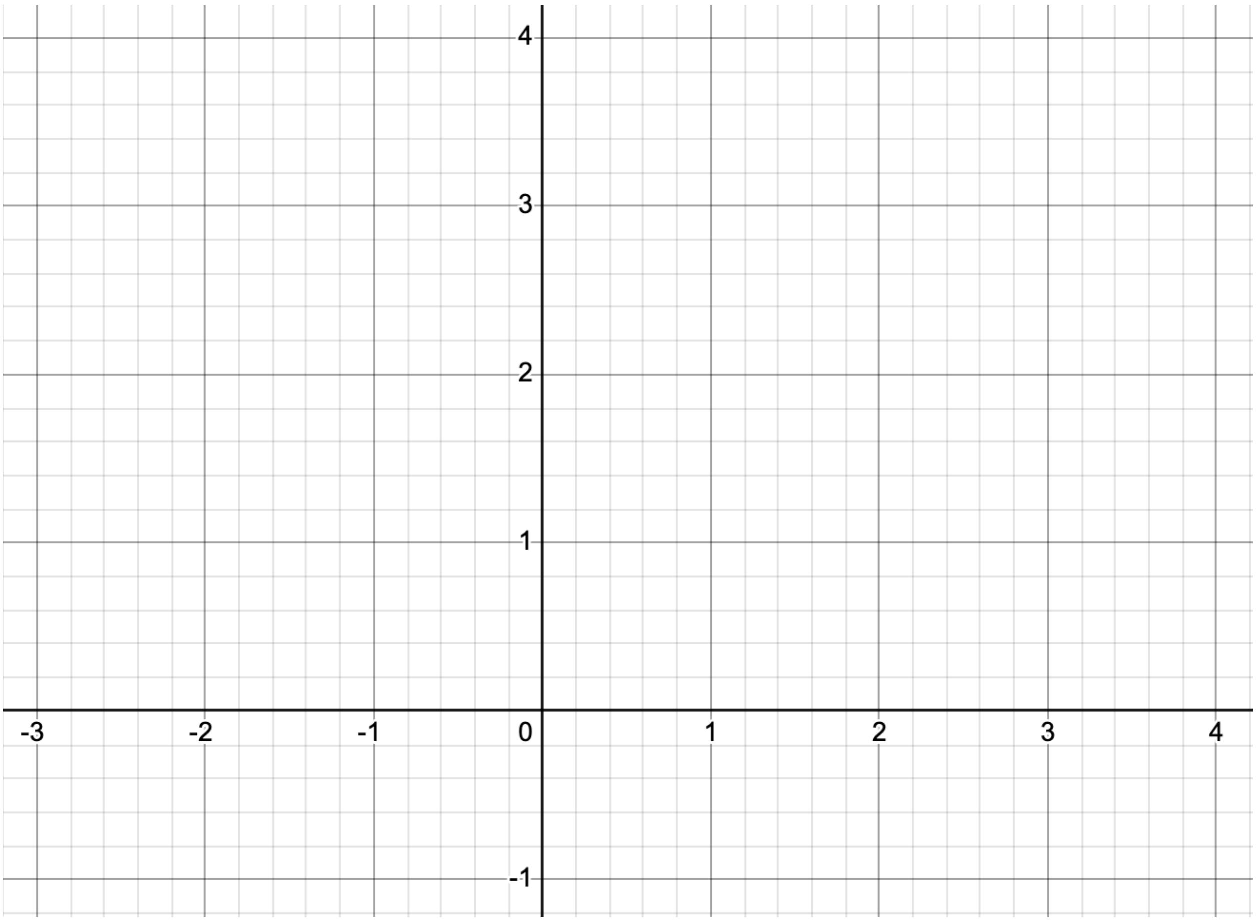
2

(b) Translate shape R by vector $\binom{-2}{0}$. Label the new shape S.

2

(c) Enlarge shape S by scale factor 2 around centre O. Label the new shape T.

2



Section 3: Probability

8. A fair six-sided dice is rolled. Calculate:

(a) The probability of getting a 6.

2

(b) The probability of getting an odd number.

2

(c) The probability of getting an 8.

2

(d) If a dice is rolled 240 times, calculate how many times you would expect to get:

(i) 3

3

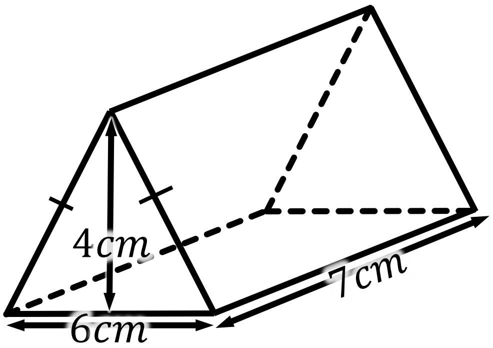
(ii) A number greater than 2.

3

Practice Assessment 5

Section 4 : 3D shapes

9. Calculate the Surface area of the triangular prism. The cross section is an isosceles triangle.



6

10. Calculate the volume and surface area of a cuboid with edges 4cm, 5cm and 9cm.

5

✓ This section has 10 questions from different UKMT Junior Maths Challenge papers. The addvancemaths.com/UKMT page links to UKMT past papers.

One of these is the largest two-digit positive integer that is divisible by the product of its digits. Which is it?

12 24 36 72 96

What is the difference between the largest two-digit multiple of 2 and the smallest three-digit multiple of 3?

What is the value of $1 - 2\times3 + 4 \div 5$?

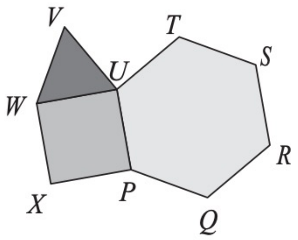
One afternoon, Brian the snail went for a slither at a constant speed. By 1:50pm he had slithered 150 centimetres. By 2:10pm he had slithered 210 centimetres. When did Brian start his slither?

Adding four of the five fractions $\frac{1}{2}, \frac{1}{3}, \frac{1}{6}, \frac{1}{9}, \frac{1}{18}$ gives a total of 1. Which of the fractions is not used?

$\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{6}$ $\frac{1}{9}$ $\frac{1}{18}$

UKMT Practice

The diagram shows a regular hexagon PQRSTU, a square PUWX and an equilateral triangle UVW. What is the angle TVU?

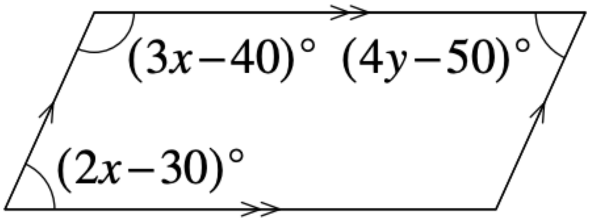


Billy has three times as many llamas as lambs. Milly has twice as many lambs as llamas. They have 17 animals in total. How many of the animals are llamas?

How many of the following knaves are lying?

Knave of Hearts: "I stole the tarts."
Knave of Clubs: "The Knave of Hearts is lying."
Knave of Diamonds: "The Knave of Clubs is lying."
Knave of Spades: "The Knave of Diamonds is lying."

The diagram shows a parallelogram. What is the value of y?



Flori's Flower shop contains fewer than 150 flowers. All the flowers are purple, yellow, red or white. The ratio of purple flowers to yellow flowers is 1 : 2, the ratio of yellow flowers to red flowers is 3 : 4 and the ratio of red flowers to white flowers is 5 : 6. How many flowers are there in Flori's shop?

Useful Addvance Links

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The reflection page has some useful questions that you can use as a framework for your reflection, and a printable exam reflection sheet to identify your strengths and weaknesses and improve next time!

AddvanceMaths.com/Guides

The guides page links to the online revision guides from Year 6 to 13, which you can use to challenge yourself by studying higher level topics, or recap and revisit topics from your previous years.

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