Year 8
Knowledge Organiser

Year 8 - RATIO AND SCALE

Key Words

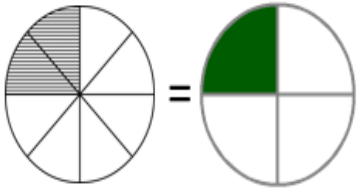
Ratio: Relationship between two numbers.
Part: This is the numeric value '1' of, would be equivalent to.
Simplify: Divide both parts of a ratio by the same number.
Equivalent: Equal in value.
Convert: Change from one form to another.

Key Concept

2 parts → 2:6 ← 6 parts

=

1:3



$= \frac{1}{4}$

Examples

Simplify 60 : 40 : 100

÷ 10

6 : 4 : 10

÷ 2

3 : 2 : 5

This could have been done in one step by dividing by 20.

Write 2: 5 in the form 1 : n

2 : 5

÷ 2 ÷ 2

1 : 2.5

Share £45 in the ratio 2 : 7

45 ÷ 9 = 5

£10 : £35

2 : 7

5	5
5	5
=10	5
	5
	5
	5
	5
	=35

Joy and Martin share money in the ratio 2 : 5. Martin gets £18 more than Joy. How much do they each get?

2 : 5

6	6
6	6
	6
	6
	6

18 ÷ 3 = 6

£12 : £30

=12 =30

Tip

Its often useful to write the letters above the ratio. This helps you keep the order the correct way round.

Questions

1) Simplify a) 45 : 63 b) 66 : 44 c) 320 : 440
2) Write in the form 1 : n a) 5 : 10 b) 4: 6 c) $x: x^2 + x$
3) Share 64 in the ratio 3 : 5 4) Write the ratio 1 : 4 as a fraction.

ANSWERS: 1) a) 5 : 7 b) 3 : 2 c) 8 : 11 2) a) 1 : 2 b) 1 : 1.5 c) $1 : x + 1$
3) 24 : 40 4) $^1/_5$

hegartymaths

Clip Numbers

328 – 335

Year 8 - MULTIPLICATIVE CHANGE

Key Words

Direct Proportion: When two quantities increase and decrease at the same rate.

Similar: Two shapes are mathematically similar if one is an enlargement of the other.

Exchange rate: The value of one currency for the purpose of conversion to another.

Scale: The ratio of the length in a drawing to the length of the real thing.

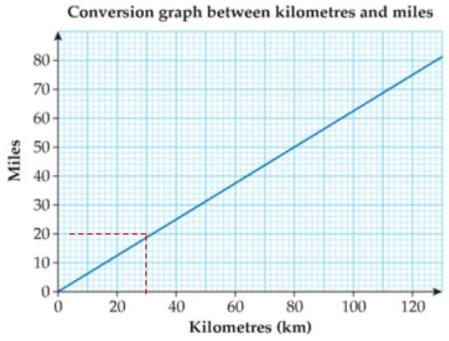
Key Concept

When two quantities are in direct proportion:

- Plotting them as a graph gives a straight line through the origin (0,0)
- When one quantity is zero, the other quantity is also zero.
- When one quantity doubles, so does the other.

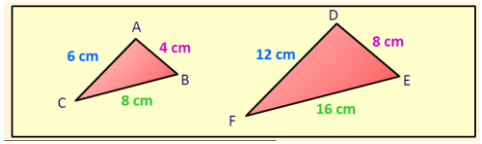
Examples

Conversion graphs



E.g. 30km = 20miles

Linear Scale Factor = $\frac{\text{side length of large shape}}{\text{corresponding side length of small shape}}$



$\frac{12}{6} = 2$ $\frac{8}{4} = 2$ $\frac{16}{8} = 2$ SF = 2

Cake recipe for 6 people.
3 eggs
300g flour
150g sugar
What would you need for 8 people?

÷ 3 ×4

	6	2	8
eggs	3	1	4
flour	300g	100g	400g
sugar	150g	50g	200g

hegartymaths

331-340, 707-708, 839-842, 864-871

Tip

Working with ratio or proportion requires multiplying or dividing the numbers. Do not add or subtract.

Questions

1) Pancakes for 4 people need 2 eggs, 120g flour and 60ml milk. How much for 6 people?
2) A triangle has side A of 25cm. A similar, smaller triangle has side A of 5cm. What is the scale factor?

ANSWERS: 1) 3 eggs, 180g flour, 90 ml milk 2) SF = 5

Year 8- MULTIPLYING AND DIVIDING FRACTIONS

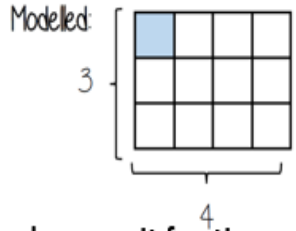
Key Concepts

Repeated addition = **multiplication by an integer**

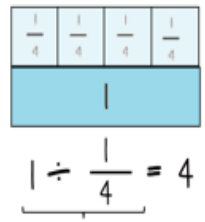
$4 \times \frac{2}{5} \rightarrow \frac{2}{5}+\frac{2}{5}+\frac{2}{5}+\frac{2}{5}=\frac{8}{5}=1\frac{2}{5}$

Multiplying unit fractions

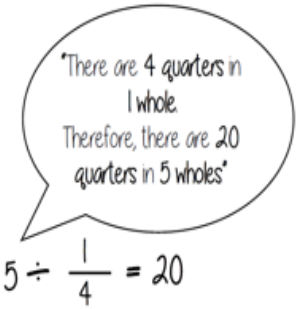
$\frac{1}{4} \times \frac{1}{3}=\frac{1}{12}$



Dividing an integer by an unit fraction



How many quarters are in 1?



Examples

$4 \times \frac{2}{5}$

$= \frac{4}{1} \times \frac{2}{5}$ (× above, × below)

Multiplying numerators
Multiplying denominators

$= \frac{8}{5}$

$= 1\frac{3}{5}$

Convert back into a mixed number and/or simplify

$\frac{1}{3} \times \frac{3}{4}$

$= \frac{2}{3} \times \frac{3}{4}$ (× above, × below)

$= \frac{6}{12}$

$= \frac{1}{2}$

$5 \div \frac{1}{4}$

Find the reciprocal of the second fraction....

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

$= \frac{20}{1}$

$=20$

A **reciprocal** when you multiply a number by its reciprocal the answer is 1

E.g.

$\frac{1}{8}$ is the reciprocal of 8.

$\frac{2}{5}$ is the reciprocal of $\frac{5}{2}$

$\frac{1}{3} \div 5$

$= \frac{1}{3} \times \frac{5}{1}$

$= \frac{5}{3}$

$= 1\frac{2}{5}$

Key Words

Fraction
Equivalent
Reciprocal
Numerator
Denominator
Improper/Top heavy
Mixed number

Tip- Dividing Fractions

Keep (the first fraction the same)

Flip (the second fraction over)

Change (the divide to a multiply)

Calculate:

1) $\frac{2}{3} \times 2$

2) $\frac{3}{4} \times \frac{2}{3}$

3) $3 \div \frac{2}{3}$

4) $\frac{3}{5} \div \frac{7}{10}$

ANSWERS 1) $4\frac{1}{3}$ 2) $\frac{1}{2}$ 3) 6 4) $\frac{6}{7}$

hegartymaths
Clip Numbers
68-70

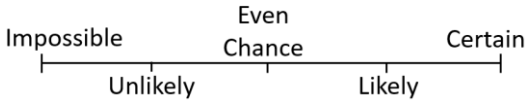
Year 8 - PROBABILITY

Key Words

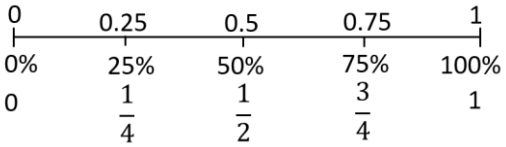
Probability: The chance of something happening as a numerical value.
Impossible: The outcome cannot happen.
Certain: The outcome will definitely happen.
Even chance: The are two different outcomes each with the same chance of happening.
Event: A set of outcomes.
Sample Space: the list of all possible outcomes of an experiment

Key Concept

Chance



Probability



Probabilities can be written as:
- Fractions
- Decimals
- Percentages

Examples

1) Mrs Davies has 5 dresses and 10 pairs of shoes. How many different ways can she wear them?

5 x 10 = 50 ways

• *If there are **m** ways of doing one task and for each of these, there are **n** ways of doing another task, then the total number of ways the two tasks can be done is **m** × **n** ways*

2) Use the table to answer the following:
A female officer is chosen at random. What is the probability they are an Inspector? $\frac{4}{6} = \frac{2}{3}$

	Male	Female	TOTAL
Constable	56	23	79
Sergeant	8	5	13
Inspector	2	4	6
Chief Inspector	1	1	2
TOTAL	67	33	100

$$Probability = \frac{Number\ of\ favourable\ outcomes}{Total\ number\ of\ outcomes}$$

Tip

Probabilities always add up to 1.

Formula

$$Expectation = Probability \times no.of\ trials$$

Question:
Using the table above, find: a) P(Male sergeant)
b) P(Chief inspector) c) P(Female constable) d) P(Male)

ANSWERS: a) $\frac{8}{13}$ b) $\frac{2}{100}$ c) $\frac{23}{79}$ d) $\frac{67}{100}$

hegartymaths

Clip Numbers
349 - 359

Year 8 – Expressions and Equations

Algebraic Expressions

When simplifying expressions, write numbers first and then letters in alphabetical order e.g.:

$$y \times 2 \times x = 2xy$$

$$2m \times 5n = 2 \times m \times 5 \times n$$
$$2 \times 5 \times m \times n = 10mn$$

When using indices:

$$a \times a \times a = a^3$$

$$n \times 5n = 5n^2$$

Equations

An equation contains an unknown number (letter) and an = sign.

Solve an equation means to work out the value of the unknown number.

The **solution** is the value of the unknown.

$3(c + 5) = 3c + 15$

$-5(2 - s) = -10 + 5s$

151 – 153, 160-162, 167-171, 179 - 185

Expanding Brackets - Examples

$$3(c + 5) = 3c + 15$$

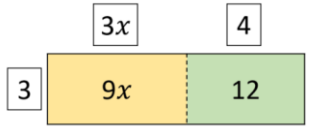
$$-5(2 - s) = -10 + 5s$$

Factorising Brackets - Examples

$$9x + 12$$

Look for the factors of $9x$ and 12. Sometimes this will be a number, other times a letter, sometimes both! HCF = 3. So, take the 3 outside of the bracket and divide $9x$ and 12 by 3.

$$= 3(3x + 4)$$



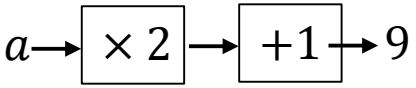
$$9x + 12 \equiv 3 \times 3x + 3 \times 4$$
$$\equiv 3(3x + 4)$$

Key Words

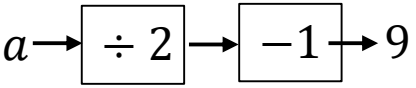
Index form, expression, variables, evaluate, expand, factorise, equation, substitute

Equations – Examples

Solve the equation $2a + 1 = 9$



Using the priority of operations, multiply a by 2 then add 1.



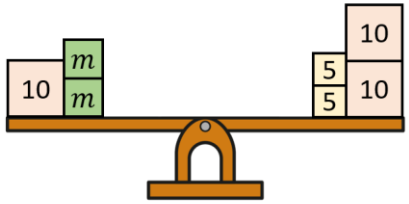
Reverse the function machine to find the input a.

$9 - 1 = 8$ $\quad 8 \div 2 = 4$ $\quad a = 4$

Check by substituting $a = 4$ back into $2a + 1$

Balancing Method – Examples

The scales are balanced.
Work out the value of m.



$$2m + 10 = 30$$
$$-10 \quad -10$$
$$2m = 20$$
$$\div 2 \quad \div 2$$
$$m = 10$$

Year 8 - Number

Key Concepts

- A **deposit** is a sum of money that is part of a full price.
- An **installment** is one of several sums of money, paid over an agreed amount of time until the full payment has been made.
- An **overdraft (negative bank balance)** is an amount owed to the bank.
- When you take money out, this is a **withdrawal.**

Negative Calculations

$+ + = +$	$+ \times + = +$
$- - = +$	$- \times - = +$
$+ - = -$	$+ \times - = -$
$- + = -$	$- \times + = -$

hegartymaths 1-12, 18-24, 25,36, 37-44, 101-102.

Multiplication & Division – Written Methods

63 x 27? = 1,701

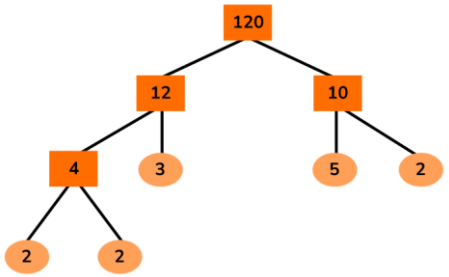
$$\begin{array}{r} {}^{2}6\,3 \\ \times\ 2\,7 \\ \hline 441 \\ 1260 \\ \hline 1,701 \end{array}$$

Evaluate $\frac{725}{5}$

$$5\overline{)725} = 145$$

$\frac{725}{5} = 145$

Prime Factorisation - Example



1) Find a factor pair of 120.
2) Are either of these prime?
3) Find another factor pair of 12 and 10.
4) Continue until you reach a prime number.

Powers and Roots Examples

$3^3 = 3 \times 3 \times 3 = 27$

$7^2 = 7 \times 7 = 49$

$2^4 = 2 \times 2 \times 2 \times 2 = 16$

$\sqrt[3]{27} = 3$

$\sqrt{49} = 7$

$\sqrt[4]{16} = 2$

Powers and roots are the **inverse** of each other.

Key Words

Product
Sum
Difference
Evaluate
Divisible
Integer
Positive
Negative
Inverse

Mental Methods for Calculations

Doubling
Halving
Partitioning
Round and adjust
Bridging

Calculator Buttons

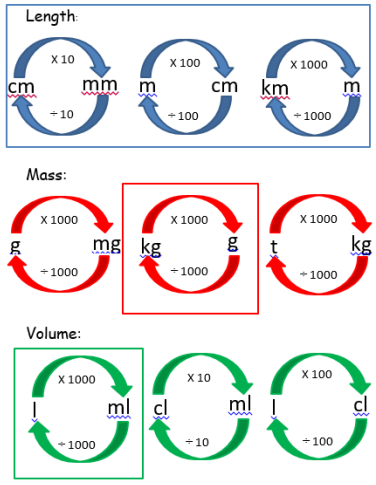
Year 8 – Area and Volume

Key Concepts

Parallel means two lines that remain the same distance apart, no matter how much they are extended.
Perpendicular means where two line segments meet at a right angle.

You are expected to learn and know the formulas for the area of a triangle, parallelogram and trapezium in your GCSE exam.

Key Conversions



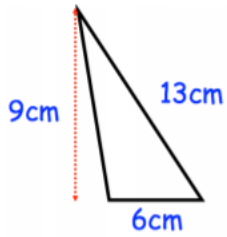
Key Words

Units
Plan
Elevation
Surface area
Volume
Area
Formula
Triangle
Parallelogram
Trapezium

hegartymaths

554-559, 567-570, 584-585, 691-699, 829-834, 837-838.

Area of Triangle, Parallelogram & Trapezium Examples

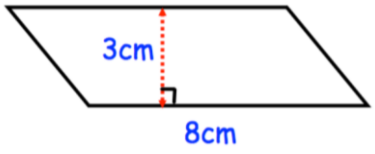


$$a = \frac{1}{2}bh$$

$$a = \frac{1}{2} \times 6 \times 9 = 27$$

$$\text{Area} = 27\text{cm}^2$$

NB: Height is **always** perpendicular!

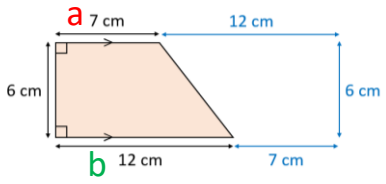


$$a = bh$$

$$a = 8 \times 3 = 24$$

$$\text{Area} = 24\text{cm}^2$$

NB: Height is **always** perpendicular!



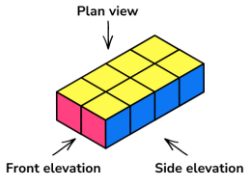
$$a = \frac{1}{2}(a + b) \times h$$

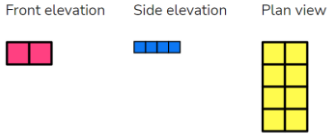
$$a = \frac{1}{2}(7 + 12) \times 6$$

$$\text{Area} = 77\text{cm}^2$$

NB: Height is **always** perpendicular!
NB: a and b are the **parallel** sides.

Plans Example





We have three different views of a 3D shape:

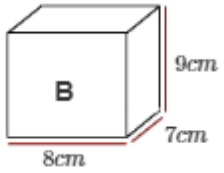
- From the **front** of the shape, called the **front elevation.**
- From the **side** of the shape, called **side elevation.**
- From above **looking down** on the shape, called the **plan view.**

Volume/Surface Area Example

Surface Area

$(8 \times 9) \times 2 = 144\text{cm}^2$
$(7 \times 9) \times 2 = 126\text{cm}^2$
$(7 \times 8) \times 2 = 112\text{cm}^2$

$144 + 126 + 112 = 382\text{cm}^2$



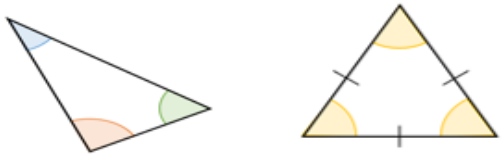
Volume

$v = lwh$
$v = 8 \times 6 \times 7$
$v = 336cm^3$

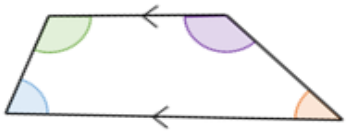
Year 8 – Lines and Angles

Key Concepts

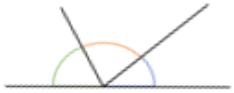
Angles inside a triangle sum to 180°.



Angles inside a quadrilateral sum to 360°.



Angles on a straight line sum to 180 °.

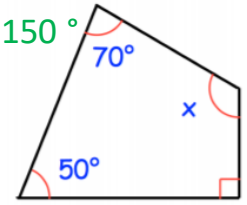


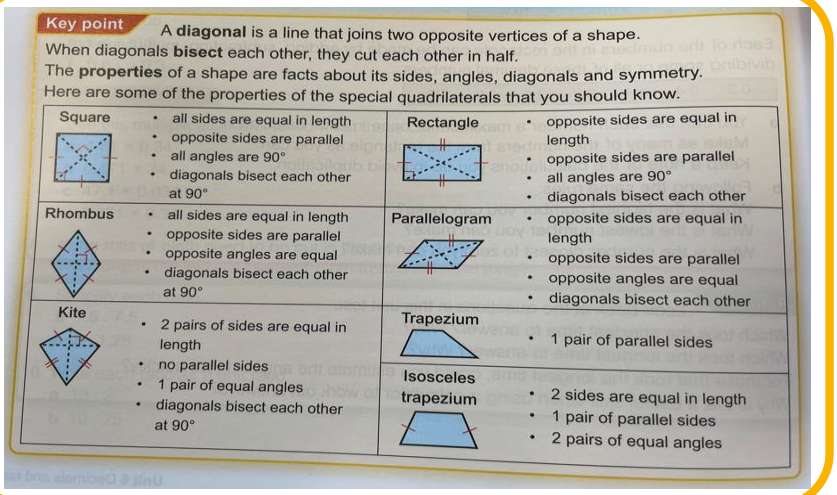
Quadrilateral Example

50 + 70 + 90 = 210°

360 - 210 = 150 °

x = 150 °





Formula- Interior Angles

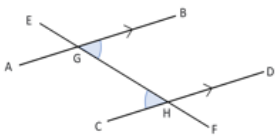
Sum of interior angles =

(n-2) x 180°

n is the number of sides the polygon has

Key Concept- Angles in parallel lines

Alternate Angles

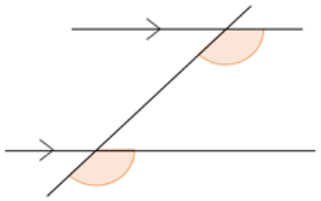


Angles BGH and CHG are both 68°

Angles BGH and CHG are alternate angles.

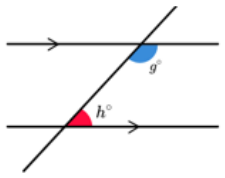
Alternate angles are equal.

Corresponding Angles



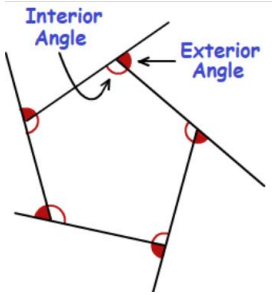
Corresponding angles are equal.

Co-interior Angles



Co-interior angles sum to 180°

Key Concept- Interior vs. Exterior Angles



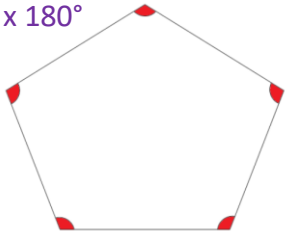
Interior Angles of a Polygon Example

Sum of interior angles = (n-2) x 180°

= (5-2) x 180°

= 3 x 180°

= 540°



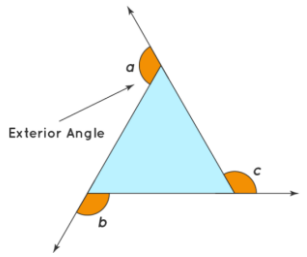
Exterior Angles of a Polygon Example

Exterior angle = 360° / n

= 360° / 3

= 120°

Important: this only works for regular polygons.



hegartymaths

824-826; 560-564; 477-488

Formula- Exterior Angles

Exterior angle

= 360° / n

n is the number of sides the polygon has

Year 8 – Real-life Graphs

Key Concept- Conversion Graphs

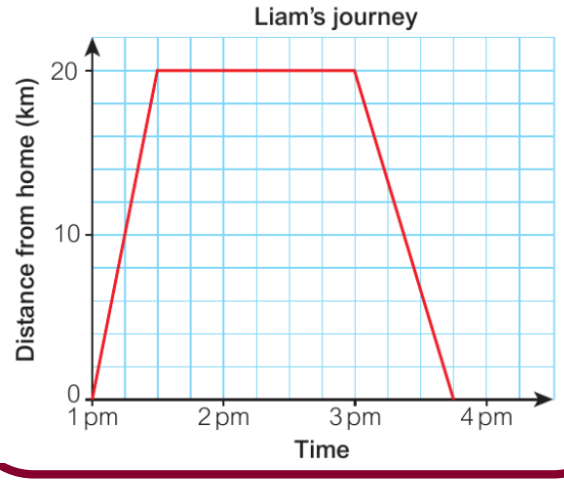
A conversion graph converts values from one unit to another.
For example, pounds to dollars.

Hint- Distance-Time Graphs

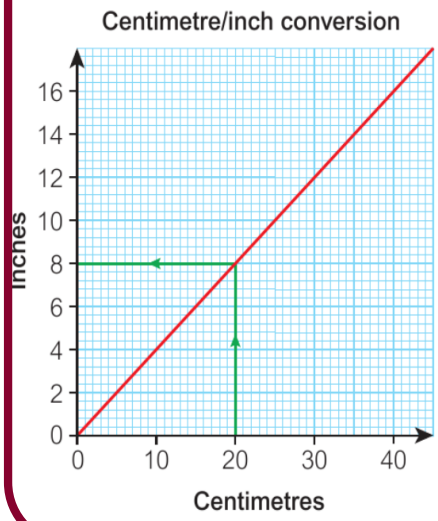
On a distance-time graph, the gradient (steepness) of the line represents the speed of the journey. Steeper = faster.

Example- Distance-Time Graph

Liam drives from his house to the shops.
He stays there for a while, then drives home.
The distance–time graph shows his journey.



Example- Conversion Graph

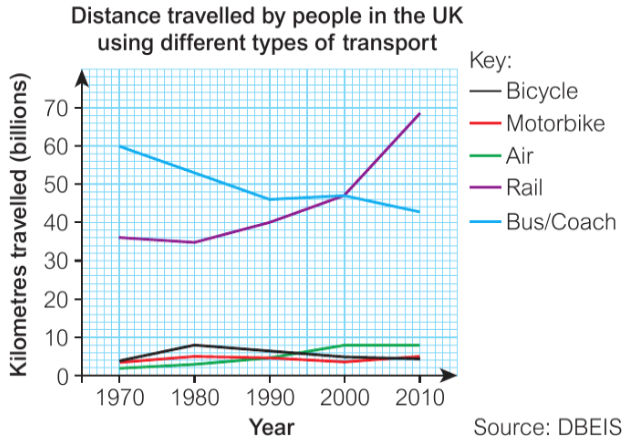


The graph shows us that 20cm is equivalent to 8inches

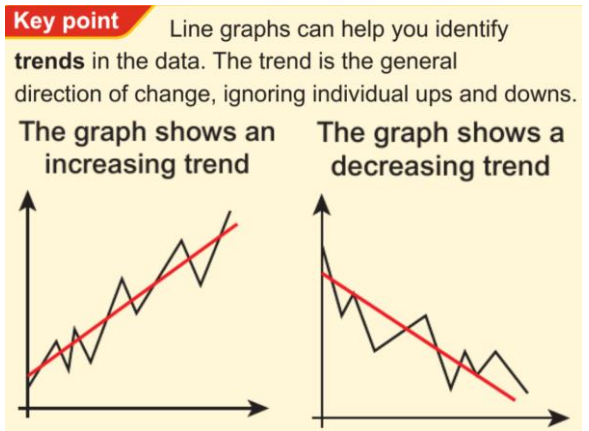
The graph shows us that 12inches is equivalent to 30cm

Example- Real-life line graph

The line graph shows information on the total distance travelled by different modes of transport. Data was collected every decade.



Key Concept- Line Graphs



Key Words
Graph
Gradient
Trend
Conversion

Key Concept- Linear vs. Non-linear graphs

A linear graph is a single straight line

A non-linear graph is not a single straight line

Hint- Interpreting Graphs

You can interpret graphs from real-life situations by reading values and suggesting what they mean.

hegartymaths
894-896; 874-878

Year 8 Knowledge Organiser
PERCENTAGES, DECIMALS and FRACTIONS

Key Concept
FDP equivalence

F	D	P
$\frac{1}{100}$	0.01	1%
$\frac{1}{10}$	0.1	10%
$\frac{1}{5}$	0.2	20%
$\frac{1}{4}$	0.25	25%
$\frac{1}{2}$	0.5	50%
$\frac{3}{4}$	0.75	75%

Key Concept
Multipliers

Find 15%	× 0.15
Increase by 15%	× 1.15
Decrease by 15%	× 0.85

For **reverse percentage** problems you can divide by the multiplier to find the original amount.

Key Words
Fraction: A fraction is made up of a numerator (top) and a denominator (bottom).
Integer: Whole number.
Ascending Order: Place in order, smallest to largest.
Descending Order: Place in order, largest to smallest.
Terminating decimal: ends after a definite number of digits. Example 0.22.
Recurring decimal: contains a digit which repeats itself forever. Example:0.333..
Percentage: Is a proportion that shows a number as parts per hundred

Examples
Non-Calculator

$\frac{3}{4}$ *of* $32 = 32 \div 4 \times 3 = 24$

16% *of* 240

$10\% = 24$
$5\% = 12$
$1\% = 2.4$
$= 24 + 12 + 2.4$
$= 38.4$

Calculator

Find **32%** of 54.60 = **0.32** × 54.60 = 17.472

Increase 45 by **12%** = 45 × **1.12** = 50.4

Examples
Make the denominators the same.

$\frac{3}{4} \to \frac{6}{8} \to \frac{1}{4}$ (4)
$\frac{3}{8} \to \frac{3}{8} \to \frac{3}{8}$ (2)
$\frac{1}{2} \to \frac{4}{8} \to \frac{1}{2}$ (3)
$\frac{7}{8} \to \frac{7}{8} \to \frac{3}{4}$ (5)
$\frac{1}{4} \to \frac{2}{8} \to \frac{7}{8}$ (1)

Convert them all to decimals.

56%	$\frac{3}{4}$	0.871	23%	$\frac{6}{7}$
0.56	0.75	0.871	0.23	0.857...
2	3	5	1	4
23%	56%	$\frac{3}{4}$	$\frac{6}{7}$	0.871

Tip
-A larger denominator does not mean a larger fraction.
-To find equivalent fractions multiply/divide the numerator and denominator by the same number.
-There is a % function on your calculator.
-To find 25% of 14 on a calculator:
2, 5, SHIFT, (, ×, 1, 4, =

Questions
1) Place these lists in ascending order.

a) $\frac{2}{3}, \frac{3}{4}, \frac{5}{6}, \frac{7}{12}$ b) $\frac{3}{7}, \frac{1}{2}, 0.49, 0.2$ c $\frac{7}{32}, 25\%, 0.05, \frac{29}{100}$

ANSWERS: 1) $\frac{7}{12}, \frac{2}{3}, \frac{3}{4}, \frac{5}{6}$ 2) $0.2, \frac{3}{7}, 0.49, \frac{1}{2}$ 3) $0.05, \frac{7}{32}, 25\%, \frac{29}{100}$

Questions
1) Find these fractions of amounts:

a) $\frac{1}{3}$ *of* 15 a) $\frac{1}{5}$ *of* 65 a) $\frac{2}{7}$ *of* 14 a) $\frac{4}{9}$ *of* 45

2) a) 35% of 140 b) 21% of 360 c) Increase 60 by 15%

ANSWERS: 1) a) 5 b) 13 c) 4 d) 20 2) a) 49 b) 75.6 c) 69