

Year 9 Term 1

Percentages

What do I need to be able to do?

By the end of this unit you should be able to:

- Use FDP equivalence
- Calculate percentage increase and decrease
- Express percentage change
- Solve reverse percentage problems
- Solve percentage problems (calculator and non calculator problems)

Keywords

Percent: parts per 100 – written using the % symbol

Decimal: a number in our base 10 number system. Numbers to the right of the decimal place are called decimals.

Fraction: a fraction represents how many parts of a whole value you have.

Equivalent: of equal value.

Reduce: to make smaller in value.

Growth: to increase/ to grow.

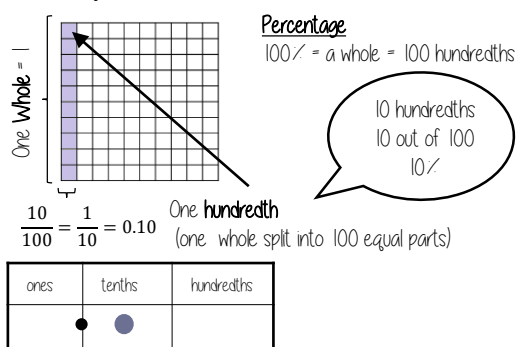
Integer: whole number, can be positive, negative or zero.

Invest: use money with the goal of it increasing in value over time (usually in a bank).

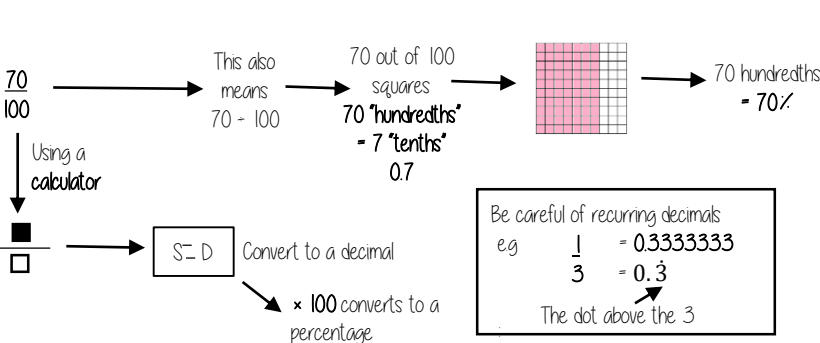
Multiplier: the number you are multiplying by

Profit: the income take away any expenses/ costs

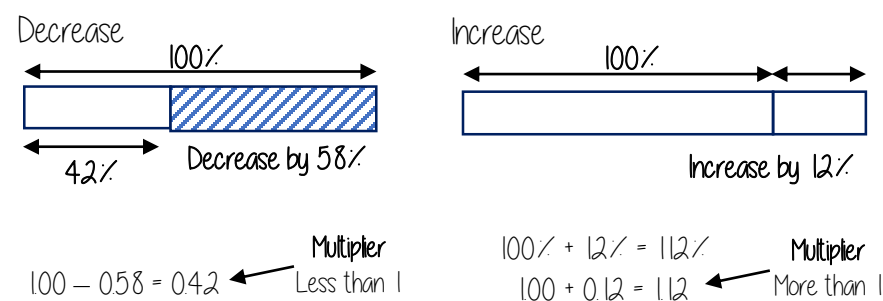
FDP Equivalence



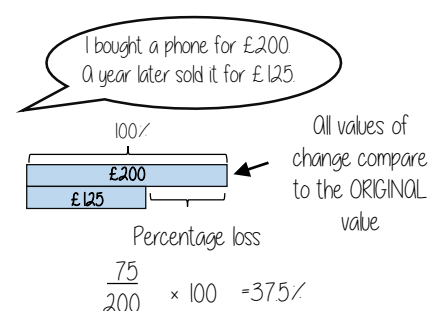
Converting FDP



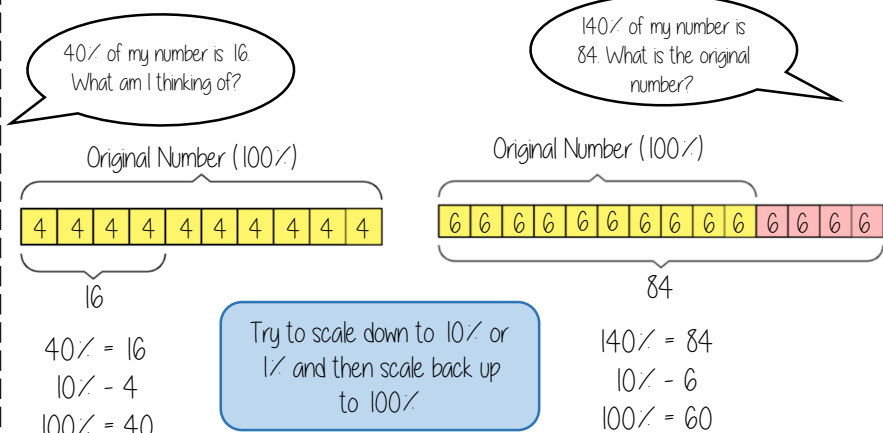
Percentage Increase/ Decrease



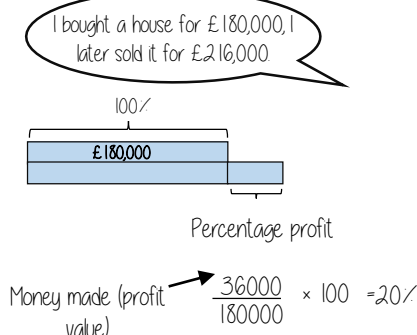
Percentage change



Reverse Percentages



$$\frac{\text{Difference in values}}{\text{Original value}} \times 100$$



Year 9 Term 1

Standard Form

What do I need to be able to do?

By the end of this unit you should be able to:

- Write numbers in standard form and as ordinary numbers
- Order numbers in standard form
- Add/ Subtract with standard form
- Multiply/ Divide with standard form
- Use a calculator with standard form

Keywords

Standard (index) Form: A system of writing very big or very small numbers

Commutative: an operation is commutative if changing the order does not change the result

Base: The number that gets multiplied by a power

Power: The exponent — or the number that tells you how many times to use the number in multiplication

Exponent: The power — or the number that tells you how many times to use the number in multiplication

Indices: The power or the exponent

Negative: A value below zero.

Positive powers of 10

1 billion = 1 000 000 000

$$10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10^9$$

Addition rule for indices $10^a \times 10^b = 10^{a+b}$

Subtraction rule for indices $10^a \div 10^b = 10^{a-b}$

Standard form with numbers > 1

Any number between 1 and less than 10 $\rightarrow A \times 10^n$ $\leftarrow$ Any integer

Example

$$\begin{aligned} 3.2 \times 10^4 \\ = 3.2 \times 10 \times 10 \times 10 \times 10 \\ = 32000 \end{aligned}$$

Non-example

$$\begin{aligned} (0.8) \times 10^4 \\ 5.3 \times 10^{0.7} \end{aligned}$$

Negative powers of 10

0.001	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
$1 \times \frac{1}{1000}$	10^1	10^0	10^{-1}	10^{-2}	10^{-3}
1×10^{-3}	0	0	0	0	1

Any value to the power 0 always = 1

Negative powers do not indicate negative solutions

Numbers between 0 and 1

0.054	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
$= 5.4 \times 10^{-2}$	10^0	10^{-1}	10^{-2}	10^{-3}
	0	0	5	4

A negative power does not mean a negative answer — it means a number closer to 0

Order numbers in standard form

6.4×10^{-2}	2.4×10^2	3.3×10^0	1.3×10^{-1}
0.064	240	1	0.13

Look at the power first will the number be = > or < than 1

Use a place value grid to compare the numbers for ordering

Mental calculations

$$\begin{aligned} 6.4 \times 10^2 \times 1000 & \text{ Not in Standard Form} \\ = 6.4 \times 10^2 \times 10^3 & \text{ Use addition for indices rule} \\ = 6.4 \times 10^5 \end{aligned}$$

$$\begin{aligned} (2 \times 10^3) \div 4 & \text{ Divide the values} \\ = (2 \div 4) \times 10^3 \\ = 0.5 \times 10^3 \end{aligned}$$

$$\begin{aligned} (8 \times 10^5) \times (3) & \text{ Not in Standard Form} \\ = 24 \times 10^5 & \text{ Use addition for indices rule} \\ = 2.4 \times 10^1 \times 10^5 & \text{ Use addition for indices rule} \\ = 2.4 \times 10^6 \end{aligned}$$

Remember the layout for standard form

Any number between 1 and less than 10 $\rightarrow A \times 10^n$ $\leftarrow$ Any integer

Addition and Subtraction

Tip: Convert into ordinary numbers first and back to standard form at the end

$$6 \times 10^5 + 8 \times 10^5$$

Method 1

$$\begin{aligned} &= 600000 + 800000 \\ &= 1400000 \\ &= 1.4 \times 10^6 \end{aligned}$$

Method 2

$$\begin{aligned} &= (6 + 8) \times 10^5 \\ &= 14 \times 10^5 \\ &= 1.4 \times 10^1 \times 10^5 \\ &= 1.4 \times 10^6 \end{aligned}$$

This is not the final answer

Only works if the powers are the same

More robust method
Less room for misconceptions
Easier to do calculations with negative indices
Can use for different powers

Multiplication and division

$$\frac{1.5 \times 10^5}{0.3 \times 10^3}$$

Division questions can look like this

For multiplication and division you can look at the values for A and the powers of 10 as two separate calculations

$$(1.5 \times 10^5) \div (0.3 \times 10^3)$$

$$15 \div 0.3 \times 10^5 \div 10^3$$

$$= 5 \times 10^2$$

Addition law for indices

$$a^m \times a^n = a^{m+n}$$

Subtraction law for indices

$$a^m \div a^n = a^{m-n}$$

Revisit addition and subtraction laws for indices — they are needed for the calculations

Using a calculator

$$14 \times 10^5 \times 3.9 \times 10^3$$

Use a calculator to work out this question to a suitable degree of accuracy

Input 14 and press $\times 10^1$ Then press 5 (for the power)
Press $\times$
Input 3.9 and press $\times 10^3$ Then press 3 (for the power)
Press $=$

This gives you the solution



Click calculator for video tutorial

To put into standard form and a suitable degree of accuracy

Press **SHIFT** **SETUP** and then press 7 for sci mode

Choose a degree of accuracy so in most cases press 2

$$\text{Answer: } 5.5 \times 10^6$$

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Equations and Formulae

What do I need to be able to do?

By the end of this unit you should be able to:

- Solve inequalities with negative numbers
- Solve equations with unknowns on both sides
- Solve inequalities with unknowns on both sides
- Substitute into formulae and equations
- Rearrange formulae

Keywords

Inequality: an inequality compares two values showing if one is greater than, less than or equal to another

Variable: a quantity that may change within the context of the problem

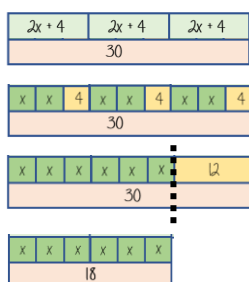
Rearrange: Change the order

Inverse operation: the operation that reverses the action

Substitute: replace a variable with a numerical value

Solve: find a numerical value that satisfies an equation

Solve equations with brackets



$$3(2x + 4) = 30$$

Expand the brackets

$$6x + 12 = 30$$

$$-12 \quad -12$$

$$6x = 18$$

$$-6 \quad -6$$

$$x = 3$$

Form and solve inequalities



Two more than treble my number is greater than 11

Find the possible range of values

$$3x + 2 > 11$$

Solve

$$x \leftarrow -3 \leftarrow -2 \leftarrow 11$$

$$x > 3$$

Inequalities with negatives

Method 1 Make x positive first

$$2 - 3x > 17$$

$$+3x \quad +3x$$

$$2 > 17 + 3x$$

$$-17 \quad -17$$

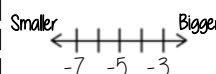
$$-15 > 3x$$

$$\div 3 \quad \div 3$$

$$-5 > x$$

x is true for any value smaller than -5

✓ **CHECK IT!**
 $2 - 3(-6) = 20$
TRUE/ CORRECT



Equations with unknown on both sides

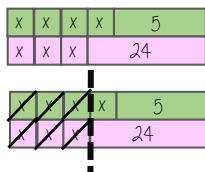
$$4x + 5 = 3x + 24$$

$$-3x \quad -3x$$

$$x + 5 = 24$$

$$-5 \quad -5$$

$$x = 19$$



Inequalities with unknown on both sides

Solving inequalities has the same method as equations

$$5(x + 4) < 3(x + 2)$$

$$5x + 20 < 3x + 6$$

$$2x + 20 < 6$$

$$2x < -14$$

$$x < -7$$

Check it!

$$5(-8 + 4) < 3(-8 + 2)$$

$$5(-4) < 3(-6)$$

$$-20 < -18$$

✓ -20 IS smaller than -18

Method 2 Keep the negative x

$$2 - 3x > 17$$

$$-2 \quad -2$$

$$-3x > 15$$

$$\div -3 \quad \div -3$$

$$x > -5$$

x is true for any value bigger than -5

This cannot be true...

$$x < -5$$

When you multiply or divide x by a negative you need to reverse the inequality

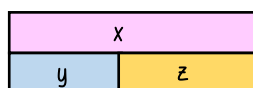
Formulae and Equations

Formulae — all expressed in symbols

Substitute in values

Equations — include numbers and can be solved

Rearranging Formulae (one step)



$$x = y + z$$

Rearrange to make y the subject

$$y = x - z$$

$$y \rightarrow +z \rightarrow x$$

$$y \leftarrow -z \leftarrow x$$

Using inverse operations or fact families will guide you through rearranging formulae

Rearranging can also be checked by substitution

Language of rearranging...

Make XXX the subject

Change the subject

Rearrange

Rearranging Formulae (two step)

In an equation (find x)

$$4x - 3 = 9$$

$$+3 \quad +3$$

$$4x = 12$$

$$\div 4 \quad \div 4$$

$$x = 3$$

In a formula (make x the subject)

$$xy - s = a$$

$$+s \quad +s$$

$$xy = a + s$$

$$\div y \quad \div y$$

$$x = \frac{a + s}{y}$$

The steps are the same for solving and rearranging

Rearranging is often needed when using $y = mx + c$

e.g Find the gradient of the line $2y - 4x = 9$

Make y the subject first $y = \frac{4x + 9}{2}$

Gradient = $\frac{4}{2} = 2$

Year 9 Term 1

Constructions

What do I need to be able to do?

By the end of this unit you should be able to:

- Draw and measure angles
- Construct scale drawings
- Find locus of distance from points, lines, two lines
- Construct perpendiculars from points, lines, angles
- Identify congruence
- Identify congruent triangles

Keywords

Protractor: piece of equipment used to measure and draw angles

Locus: set of points with a common property

Equidistant: the same distance

Discorectangle: (a stadium) — a rectangle with semi circles at either end

Perpendicular: lines that meet at 90°

Arc: part of a curve

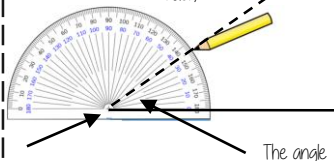
Bisector: a line that divides something into two equal parts

Congruent: the same shape and size

Draw and measure angles

Draw a 35° angle

Make a mark at 35° with a pencil
And join to the angle point (use a ruler)



Make sure the cross is at the end of the line (where you want the angle)

The angle

Scale drawings

A picture of a car is drawn with a scale of 1:30

For every 1cm on my image is 30cm in real life

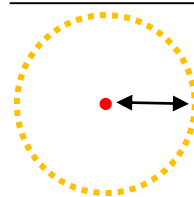
The car image is 10cm

Image : Real life
1cm : 30cm
 $\times 10$ $\times 10$
10cm : 300cm



Locus of a distance from a point

All points are equidistant (the same distance) from the fixed point in the middle

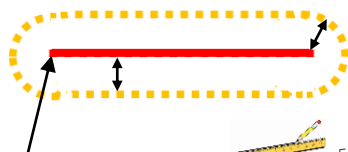


If the point is in the corner it can only make a quarter circle



Equipment needed
The radius is the distance from the fixed point

Locus of a distance from a straight line



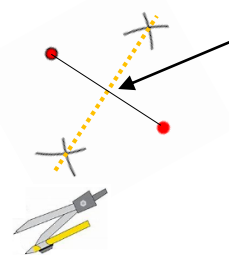
All points are equidistant (the same distance) from line



Equipment needed
The line is straight so a ruler is used for the straight lines parallel to your original line

The ends of the line are fixed points

Locus equidistant from two points



Also a perpendicular bisector

Because if the points are joined, this new line intersects it at a 90°



Join the intersections with a ruler.
All points on this line are equidistant from both points

Keep the compass the same size and draw two arcs from each point

Locus of a distance from two lines

Also an angle bisector

This cuts the angle in half

From the angle vertex draw two arcs that cut the lines forming the angle

Keep the compass the same size and use the new arcs as centres to draw intersecting arcs in the middle

Join the vertex to the intersection

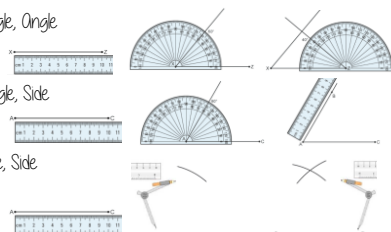


Constructing Triangles

Side, Angle, Angle

Side, Angle, Side

Side, Side, Side



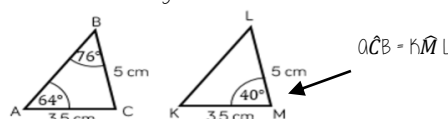
Link to steps →

Congruent figures



Congruent figures are identical in size and shape — they can be reflections or rotations of each other

Congruent shapes are identical — all corresponding sides and angles are the same size



Because all the angles are the same and $AC = KM$, $BC = LM$ triangles ABC and KLM are **congruent**

Construct a perpendicular from a point



Use a compass and draw an arc that cuts the line. Use the point to place the compass

Keep the compass the same distance and now use your new points to make new intersecting arcs



Connecting the arcs makes the bisector

If P is a point on the line the steps are the same

Congruent triangles

Side-side-side

All three sides on the triangle are the same size

Angle-side-angle

Two angles and the side connecting them are equal in two triangles

Side-angle-side

Two sides and the angle in-between them are equal in two triangles (it will also mean the third side is the same size on both shapes)

Right angle-hypotenuse-side

The triangles both have a right angle, the hypotenuse and one side are the same