YEAR 8

Working in the Cartesian plane

What do I need to be able to do?

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

- Label and identify lines parallel to the axes
- Recognise and use basic straight lines
- Identify positive and negative gradients
- Link linear graphs to sequences
- Plot y = mx + c graphs

Keywords

Quadrant: four quarters of the coordinate plane.

Coordinate: a set of values that show an exact position.

Horizontal: a straight line from left to right (parallel to the x axis)

Vertical: a straight line from top to bottom (parallel to the y axis)

Origin: (0,0) on a graph. The point the two axes cross

Parallel: Lines that never meet

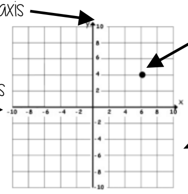
Gradient: The steepness of a line

Intercept: Where lines cross

Coordinates in four quadrants

y-axis

x-axis



Coordinate (x, y) (6, 4)

From the origin this coordinate is 6 places along the positive x axis and 4 places up the positive y axis.

(x, y)

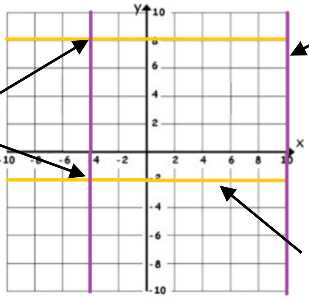
Always the position on the x axis first

Always the position on the y axis second

(0, a) Will be always be a point on the y axis (a can be any number)

(a, 0) Will be always be a point on the x axis (a can be any number)

Lines parallel to the axes



Intersection points

All the points on this line have a x coordinate of 10

'a' can be ANY positive or negative value including 0

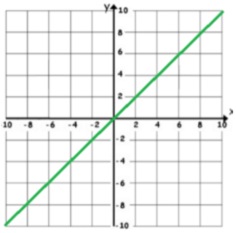
Lines parallel to the **y axis** take the form **x = a** and are **vertical**

Lines parallel to the **x axis** take the form **y = a** and are **horizontal**

All the points on this line have a y coordinate of -2

e.g (3, -2) (7, -2) (-2, -2) all lay on this line because the y coordinate is -2

Recognise and use the line y=x



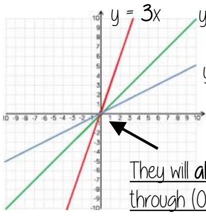
This means the x and the y coordinate have the same value

Examples of coordinates on this line: (0, 0) (-3, -3) (8, 8)

The axes **scale is important** – if the scale is the same y = x will be a straight line at 45⁰

Recognise and use the lines y=kx

The value of **k** changes the steepness of the line



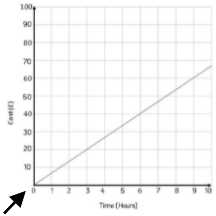
Note: y =x is the same as y= 1x

They will **always** go through (0,0)

The bigger the value of k the **steeper** the line will be.

The closer to 0 the value of k the closer the line will be to the x axis.

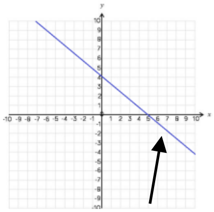
Direct Proportion using y=kx



The line must be straight to be directly proportional – variables increase at the same rate **k**

Direct proportion graphs always start at (0,0) as they are describing relationships between two variables

Lines with negative gradients



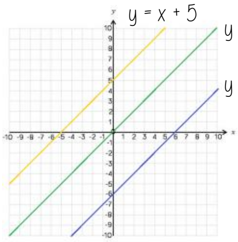
Any straight-line graph with a negative x value has a negative gradient.

Eg y = -2x

y = -x y + x = 12

Direction of all negative gradients

Lines in the form y = x + a



All the lines are **parallel** because the gradients are the same

y = x + a

This is the line y=x when the y and x coordinate are the same

This shows the translation of that line.

e.g y = x + 5

Is the line y=x moved 5 places up the graph

5 has been added to each of the x coordinates

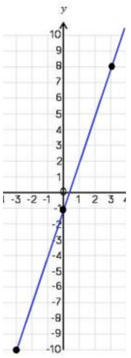
Plotting y = mx + c graphs

$y = 3x - 1$ → 3 x the x coordinate then – 1

x	−3	0	3
y	- 10	- 1	8

Draw a table to display this information

This represents a coordinate pair (-3, - 10)



You only need two points to form a straight line

Plotting more points helps you decide if your calculations are correct (if they do make a straight line)

Remember to join the points to make a line

YEAR 8

Fractions & Percentages

@whisto_maths

What do I need to be able to do?

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

- Convert between FDP less than and more than 100.
- Increase or decrease using multipliers.
- Express an amount as a percentage.
- Find percentage change.

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.

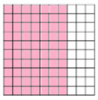
Integer: whole number, can be positive, negative or zero.

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

Convert FDP

R

$\frac{70}{100}$ → This also means 70 ÷ 100 → 70 out of 100 squares, 70 "hundredths" = 7 "tenths", 0.7 →



→ 70 hundredths = 70%

Using a calculator

$\frac{■}{□}$ → S⇌D Convert to a decimal

This will give you the answer in the simplest form

× 100 converts to a percentage

Be careful of recurring decimals

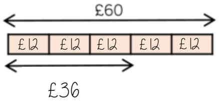
e.g $\frac{1}{3}$ = 0.3333333 = $0.\dot{3}$

The dot above the 3

Fraction/ Percentage of amount

R

Find $\frac{3}{5}$ of £60



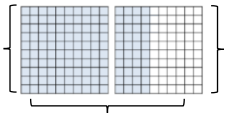
Remember $\frac{3}{5}$ = 60%

10% of £60 = £6
50% of £60 = £30
60% of £60 = £36

Remember
$\frac{3}{5}$ = 60% = 0.6

60% of £60
= 0.6 x 60
= £36

Convert FDP < and > 100%



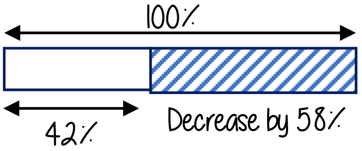
100 hundredths
10 tenths
100%

40 hundredths
4 tenths
40%

140 hundredths
14 tenths
140%

100%+40%
1 + 0.40
= 1.40

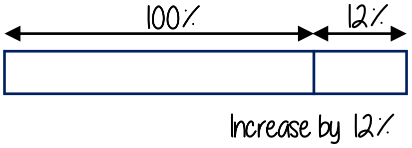
Percentage decrease: Multipliers



100% - 58% = 42%

1.00 – 0.58 = 0.42 ← Multiplier Less than 1

Percentage increase: Multipliers

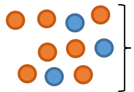


100% + 12% = 112%

1.00 + 0.12 = 1.12 ← Multiplier More than 1

Express as a % - Non-calculator

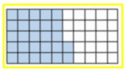
Percent – per hundred



7 per every 10 are orange $\frac{7}{10}$

This means that 70 per every 100 are orange $\frac{70}{100}$

70%



27 per every 50 shaded $\frac{27}{50}$

54 per every 100 shaded $\frac{54}{100}$

54%

Denominator 100

Equivalent fractions

Express as a % - Calculator

$\frac{13}{30}$ → $\frac{■}{□}$ → $\frac{13}{30}$ → × 100 → 43.3333….%
43%

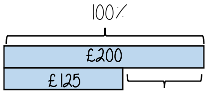
Can't use equivalence easily to find 'per hundred'

This the same as 13 ÷ 30

Decimal percentages are still a percentage.

Percentage change

I bought a phone for £200.
A year later sold it for £125.



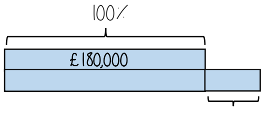
All values of change compare to the ORIGINAL value

Percentage loss

$\frac{75}{200}$ × 100 =37.5%

$\frac{\text{Difference in value}}{\text{Original value}}$ × 100

I bought a house for £180,000, I later sold it for £216,000.



Percentage profit

Money made (profit value) → $\frac{36000}{180000}$ × 100 =20%

Choose appropriate method

The language and wording of the question is the key.

Have you represented the question in a bar model?
Can you use a calculator?

YEAR 8

Brackets, Equations & Inequalities

What do I need to be able to do?

By the end of this unit you should be able to:
- Form Expressions
- Expand and factorise single brackets
- Form and solve equations
- Solve equations with brackets
- Represent inequalities
- Form and solve inequalities

Keywords

Simplify: grouping and combining similar terms

Substitute: replace a variable with a numerical value

Equivalent: something of equal value

Coefficient: a number used to multiply a variable

Product: multiply terms

Highest Common Factor (HCF): the biggest factor (or number that multiplies to give a term)

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

Form expressions

For unknown variables, a letter is normally used in its place

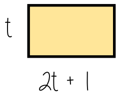
More than – ADD

Less than/ difference – SUBTRACT

eg 4 more than t ⟶ t + 4

8 less than k ⟶ k - 8

Only similar terms can be grouped together



eg Find the perimeter of this shape

(Perimeter = length around outside of shape)

t + 2t + 1 + t + 2t + 1 ⟶ 6t + 2

Directed numbers

\+ + ⟶ +

\- - ⟶ +

\+ - ⟶ -

\- + ⟶ -

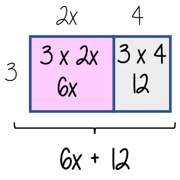
eg a = -5 and b = 2

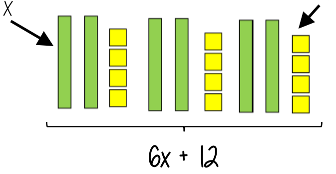
a^2 = a x a = -5 x – 5 = 25

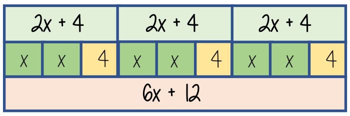
b + a = 2 + - 5 = -3

Multiply single brackets

3 (2x + 4)



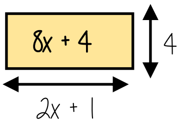




Different representations of 3(2x+4) = 6x + 12

Factorise into a single bracket

8x + 4



⟵ Try and make this the **highest** common factor

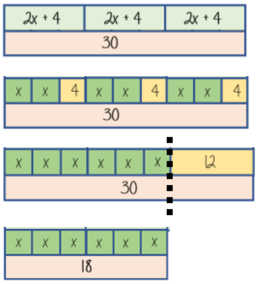
The two values **multiply** together (also the area) of the rectangle

8x + 4 ≡ 4 (2x + 1)

Note:
8x + 4 ≡ 2(4x + 2)
This is factorised but the HCF has not been used

Solve equations with brackets

3 (2x + 4) = 30



3 (2x + 4) = 30

Expand the brackets

6x + 12 = 30

-12 -12

6x = 18

÷ 6 ÷ 6

Substitute to check your answer. This could be negative or a fraction or decimal

x = 3

Simple Inequalities

< less than

≤ Less than or equal to

\> More than

≥ More than or equal to

x < 10
Say this out loud
"x is a value less than 10"

10 > x
Say this out loud
"10 is more than the value"

Note:
x<10 and 10>x represent the same values

x + 2 ≤ 20
"my value + 2 is less than or equal to 20"
x ≤ 18
The biggest the value can be is 18

Form and solve inequalities

Two more than treble my number is greater than 11

Find the possible range of values

Form

x ⟶ x3 ⟶ +2 ⟶ 11

3x + 2 > 11

Solve

x ⟵ ÷3 ⟵ -2 ⟵ 11

x > 3

Check

This would suggest any value bigger than 3 satisfies the statement

3 x 3 + 2 = 11 ✓ 10 x 3 + 2 = 32 ✓

Algebraic constructs

Expression
A sentence with a minimum of two numbers and one maths operation

Equation
A statement that two things are equal

Term
A single number or variable

Identity
An equation where both sides have variables that cause the same answer includes ≡

Formula
A rule written with all mathematical symbols
eg area of a rectangle A = b x h

YEAR 8

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 from
- 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

$A \times 10^n$

Any number between 1 and less than 10

Any integer

Example

3.2×10^4

$= 3.2 \times 10 \times 10 \times 10 \times 10$

$= 32000$

Non-example

0.8×10^4

$5.3 \times 10^{0.7}$

Negative powers of 10

0.001

$1 \times \frac{1}{1000}$

1×10^{-3}

10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
10^1	10^0	10^{-1}	10^{-2}	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

$= 5.4 \times 10^{-2}$

1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
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

10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}	10^{-4}

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

$6.4 \times 10^2 \times 1000$ Not in Standard Form

$= 6.4 \times 10^2 \times 10^3$ Use addition for indices rule

$= \underline{6.4 \times 10^5}$

$8 \times 10^5 \times 3$

$= 24 \times 10^5$ Not in Standard Form

$= 2.4 \times 10^1 \times 10^5$ Use addition for indices rule

$= \underline{2.4 \times 10^6}$

$(2 \times 10^3) \div 4$ Divide the values

$= (2 \div 4) \times 10^3$

$= \underline{0.5 \times 10^3}$

Remember the layout for standard form

$A \times 10^n$

Any number between 1 and less than 10

Any integer

Addition and Subtraction

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

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

Method 1

$= 600000 + 800000$

$= 1400000$

$= \underline{1.4 \times 10^5}$

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

Method 2

$= (6 + 8) \times 10^5$

$= 14 \times 10^5$

This is not the final answer

$= 1.4 \times 10^1 \times 10^5$

$= \underline{1.4 \times 10^5}$

Only works if the powers are the same

Multiplication and division

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

Division questions can look like this

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

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

$= \underline{5 \times 10^2}$

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

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

Addition law for indices

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

Subtraction law for indices

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

Using a calculator

$1.4 \times 10^5 \times 3.9 \times 10^3$

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

Input 1.4 and press [x10^x] Then press 5 (for the power)

Press [×]

Input 3.9 and press [x10^x] 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

Answer: 5.5×10^8

YEAR 8

Applying number

What do I need to be able to do?

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

- Round numbers to powers of 10 and 1 sf
- Round numbers to any dp
- Estimate solutions
- Calculate using order of operations
- Calculate with money, units of measurement and time

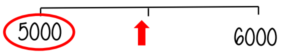
Keywords

Significant: Place value of importance
Round: Making a number simpler but keeping its value close to what it was.
Decimal: Place holders after the decimal point.
Overestimate: Rounding up – gives a solution higher than the actual value
Underestimate: Rounding down – gives a solution lower than the actual value.
Metric: A system of measurement.
Balance: The amount of money in a bank account
Deposit: Putting money into a bank account.

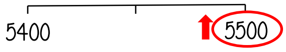
Round to powers of 10 and 1 sig figure

If the number is halfway between we "**round up**"

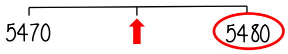
5495 to the nearest 1000



5475 to the nearest 100



5475 to the nearest 10



370 to 1 significant figure is 400
37 to 1 significant figure is 40
3.7 to 1 significant figure is 4
0.37 to 1 significant figure is 0.4
0.00037 to 1 significant figure is 0.0004

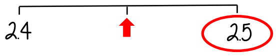
Round to the first non-zero number

Round to decimal places

2.46192 ← Focus on the numbers **after** the decimal point

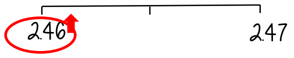
"To 1dp" – to one number after the decimal
"To 2dp" – to two numbers after the decimal

2.46192 (to 1dp) - Is this closer to 2.4 or 2.5



2.4 | 6192 This shows the number is closer to 2.5

2.46192 (to 12dp) - Is this closer to 2.46 or 2.47



2.46 | 192 This shows the number is closer to 2.46

Estimate the calculation

Round to 1 significant figure to estimate

$4.2 + 6.7 \approx 4 + 7 \approx 11$ This is an **overestimate** because the 6.7 was rounded up more

The equal sign changes to show it is an estimation

$21.4 \times 3.1 \approx 20 \times 3 \approx 60$ This is an **underestimate** because both values were rounded down

It is good to check all calculations with an estimate in all aspects of maths – it helps you identify calculation errors.

Order of operations

Brackets Operations in brackets are calculated first

Other operations e.g. powers, roots,

Multiplication/ Division

They are carried out in the order from left to right in the question

Addition/ Subtraction

They are carried out in the order from left to right in the question

Calculations with money

Debit - You have £0 or more in an account

Credit - You have less than £0 in an account

Money calculations are to 2dp

Using a calculator – ensure you are working in the correct units.
£1.30 + 50p = 130 + 50 (in pence)
= 1.30 + 0.50 (in pounds)

£1 = 100p

Units are important: Useful Conversions

$\text{mm} \underset{\div 10}{\overset{\times 10}{\rightleftarrows}} \text{cm} \underset{\div 100}{\overset{\times 100}{\rightleftarrows}} \text{m} \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \text{km}$

$\text{g} \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \text{kg} \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \text{T}$

$\text{ml} \underset{\div 1000}{\overset{\times 1000}{\rightleftarrows}} \text{L}$

Metric measures of length

Kilo = 1000 x meter
Centi - $\frac{1}{100}$ x meter
Milli - $\frac{1}{1000}$ x meter

Units of weight/ capacity

Weight = g, kg, t
Capacity (volume of liquid) = ml, L

Time and the calendar

1 Year – the amount of time it takes Earth to go around the sun **365** (and a quarter) **days**

Leap Year – **366 days** (every 4 years)

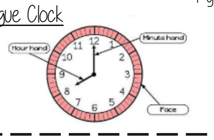
12 Months = one year = 52 weeks
31 days – **Jan, March, May, July Aug, Oct, Dec**
30 days – **April, June, Sept, Nov**
28 days – **Feb** (29 leap year)

1 week – 7 days
Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday

1 day – 24 hours
1 hour - 60 minutes
1 minute – 60 seconds

Use a number line for time calculations!

Analogue Clock



12-hour clock

- Use am (morning) and pm (afternoon)
- Only use hour times up to 12

Digital Clock (24-hour times)

24-hour clock

- 0-11 (morning hours)
- 12-23 (afternoon hours)