

Unit 3: Number 2

- Red indicates higher tier only -



Knowledge Organiser - Mathematics

Estimation

Estimate the value of 28×48

If we round both to 1 sf, this gives,
 $30 \times 50 = 1500$

Therefore $28 \times 48 \approx 1500$

Rounding to Significant Figures

Rounding to 1 significant figure (1 sf)

- Round 1394 to 1 sf = 1000
- Round 265 to 1 sf = 300
- Round 32 to 1 sf = 30
- Round 187 to 1 sf = 200
- Round 0.439 to 1 sf = 0.4
- Round 0.008722 to 1 sf = 0.009
- Round 0.0005043 to 1 sf = 0.0005

Rounding to 2 significant figures (2 sf)

- Round 1394 to 2 sf = 1400
- Round 265 to 2 sf = 270
- Round 32 to 2 sf = 32
- Round 187 to 2 sf = 190
- Round 0.439 to 2 sf = 0.44
- Round 0.008722 to 2 sf = 0.0087
- Round 0.0005043 to 2 sf = 0.00050

Converting to and from Standard Form

Converting ordinary numbers into standard form

Any integer $A \times 10^n$
Any number between 1 and 10

Examples:

- 700 = $7 \times 100 = 7 \times 10^2$
- 12500 = $125 \times 100 = 125 \times 10^2 = 1.25 \times 10^4$
- 0.00034 = 3.4×10^{-4}

Converting standard form into ordinary numbers

Example 1: $2 \times 10^3 = 2 \times 10 \times 10 \times 10 = 2000$

Example 2: $4.12 \times 10^2 = 4.12 \times 10 \times 10 = 412$

Don't Examples:

- $10 \times 10^2 = 1200$ (must be between 1 and 10)
- $154 \times 10 = 1542$ (must be a power of 10)
- $64 \times 10^3 = 32768$ (must be between 1 and 10)

Simple Interest

I put £1000 in a bank account. It earns simple interest of 10% per year. How much will be in the account after 5 years?



INTEREST:

Simple interest means we calculate the interest the initial amount will earn and add that amount on each year

10% of £1000 = £100

So each year, the account will gain £100 interest.

5 years
 $\text{£}1000 + (\text{£}100 \times 5) = \text{£}1500$

Percentage of an Amount

100% of 300 = 300
10% of 300 = 30

Find 30% of 240

100% of 240 = 240
 10% of 240 = 24
 30% of 240 = 72

A bar model to help visualise it:



Finding 10% is always a good place to start!

Find 81% of 480

100% of 480 = 480
 10% of 480 = 48
 1% of 480 = 4.8

100% of 480 = 480
 10% of 480 = 48
 80% of 480 = 384

$80\% \div 10\% = 8$ so we need to add 4.8 and 384

81% of 480 = 388.8

Multipliers

What multiplier would represent an increase of 15%?

We are finding 100% + 15%, so 115%.

As a decimal this is 1.15

What multiplier would represent a decrease of 15%?

We are finding 100% - 15%, so 85%.

As a decimal this is 0.85

Percentage Increase/Decrease

12% increase means we have 112% of the original price. So we are now finding 112% of £400

100% of £400 = £400
 10% of £400 = £40
 2% of £400 = £8

112% of £400 = £448

Standard Form Arithmetic

$(2.1 \times 10^6) + (3.3 \times 10^3)$

Footproof method convert both numbers to ordinary numbers and then add

$(2.1 \times 10^6) + (3.3 \times 10^3)$
 $2,100,000 + 3300$
 $= 2,103,300$
 $= 2.1033 \times 10^6$

You should leave your answer in the form given in the question

$(2.1 \times 10^6) \times (3.3 \times 10^3)$

In multiplication and division problems, you can multiply the A values and the look at the powers of 10

$2.1 \times 3.3 \times 10^6 \times 10^3$
 $= 6.93 \times 10^6 \times 10^3$
 $= 6.93 \times 10^9$

$(2.8 \times 10^8) \div (7 \times 10^5)$

$\frac{2.8 \times 10^8}{7 \times 10^5} = \frac{0.4 \times 10^8}{10^5} = 0.4 \times 10^3$

BUT 0.4×10^3 is not in standard form, as A is not a number between 1 and 10! So, $0.4 \times 10^3 = 400 = 4 \times 10^2$

4×10^2

Recurring Decimal to Fraction

Convert $0.\dot{1}2$ to a fraction

Let $x = 0.\dot{1}2$,
 $100x = 12.\dot{1}2$

$99x = 12$
 $x = \frac{12}{99} = \frac{4}{33}$

$\frac{12.\dot{1}2}{- 0.\dot{1}2}$
 $\hline 12.00$

Error Intervals (and Calculating with Them)

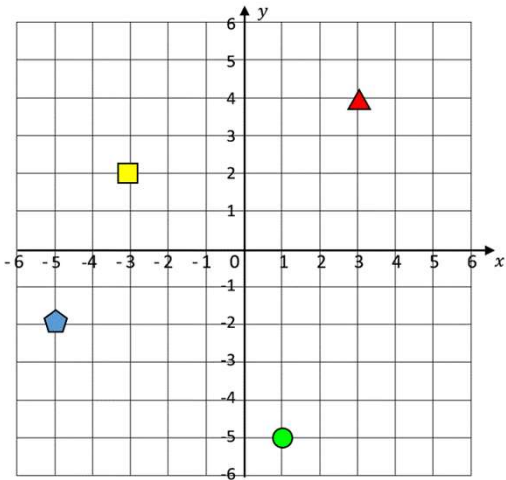
- A = 30 (to the nearest whole number) Error Interval for A: $29.5 < A < 30.5$
- B = 115 (to the nearest 1 decimal place) Error Interval for B: $114.5 < B < 115.5$
- C = 300 (to the nearest 1 significant figure) Error Interval for C: $250 < C < 350$

Calculate the maximum value of A + B
UB of A + UB of B: $30.5 + 115.5 = 420.5$

Calculate the maximum value of C - B

UB of C - LB of B: $350 - 114.5 = 307.5$ (2dp)
Calculate the minimum value of A x C
LB of A x LB of C: $29.5 \times 250 = 7375$

Coordinates in Four Quadrants



"Along the corridor, and up the stairs", meaning along the horizontal x-axis & up the vertical y-axis

- Red Triangle = (3,4)
- Yellow Square = (-3,2)
- Green Circle = (1,-5)
- Blue Pentagon = (-5,-2)

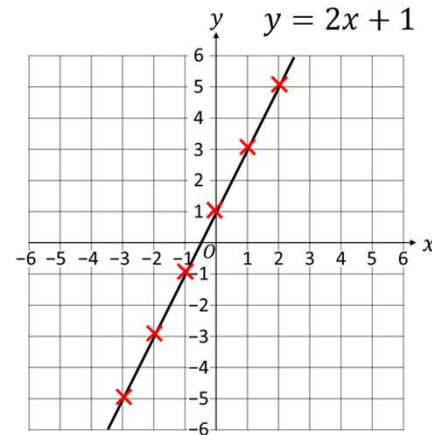
Drawing Linear (Straight-Line) Graphs

1) Complete a Table of Values.

x	-3	-2	-1	0	1	2	3
y	-5	-3	-1	1	3	5	7

2) Plot each pair of values as coordinates.

3) Join the points to make a line.



Parallel Lines

Example: Find the equation of a line parallel to $2x + y = 4$, that crosses the y-axis at 3.

1. Rearrange the equation in the form $y = mx + c$
 $y = 2x + 4$
2. Identify the gradient, in this case 2

Any line with the same gradient is parallel

3. Write c as the y-intercept. The line that has the same gradient and has a y-intercept of 3 is $y = 2x - 3$

Equation of a Straight Line

The general equation of any straight line is:

$$y = mx + c$$

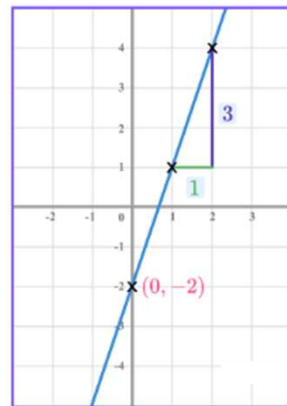
c is the **y-intercept** (where the line crosses the y-axis)

m is the **gradient** (steepness) of the line

Example The graph of the line $y = 3x - 2$

The gradient is 3

The y-intercept is -2, the coordinate (0, -2)



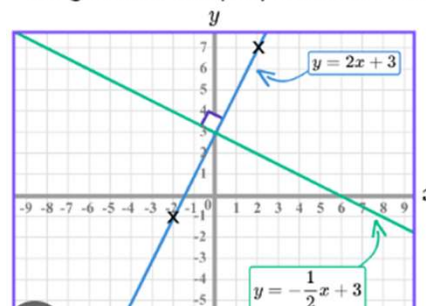
Gradient

The steepness of a line. Calculated as difference along the y-axis divided by difference along the x-axis, or dy/dx .

Perpendicular Lines

Perpendicular lines have gradients that multiply to give -1.

The gradients of perpendicular lines are the **negative reciprocals** of each other.



Example

The line $y = 2x + 3$ has a gradient of 2

The line $y = -\frac{1}{2}x + 3$ has a gradient of $-\frac{1}{2}$

$$2 \times -\frac{1}{2} = \frac{-2}{2} = -1$$

The gradients multiply to give -1