Maths questions

Converting units

Convert 1m to mm

Convert 1m to um

Convert 20m^2 to km^2

Convert 5000 000mm^3 to m^3

Significant figures and rounding

Round the number 23.33600 to

4 decimal places

4 significant figures

3 decimal places

2 significant figures

Averages

Arithmetic mean, median and mode

5 mice were weighed and gave masses of 6.2g, 7.7g, 6.7g, 7.1g and 6.3g.

Calculate the mean value.

For the data set 12, 15, 10, 17, 9, 13, 13, 19, 10, 11, 10,

Calculate the median and the mode

Percentage change

A sample weighed 18.50g at the start of an experiment, and at the end it weighed 11.72g.

Calculate the percentage change in mass of the sample.

Equations of lines on a graph.

This task is designed to allow you to practise with the equation of a line on a graph. When there is a straight line on a graph the position of the line can be described using the equation $y = mx + c$. In this equation c is the intercept of the line on the
y-axis and m is the gradient of the line. The equation may be used to find points on a line or to predict the position of a line from given data.

You should already be familiar with the equation of a line from your GCSE studies.

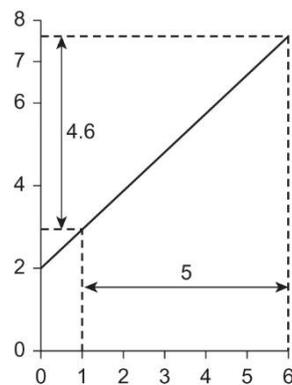---

Worked example

Figure 1 shows an example of a graph.

Figure 1

Question

a   Calculate the gradient, m, of the line.

Answer

Step 1

Mark any two points along the line and use construction lines to find the distance between them along each axis. In this example, change in y is 4.6 units and in x 5 units.

Step 2

Divide the change in y by the change in x to find the gradient.

$m = 4.6 \div 5 = 0.92$

b   Calculate the equation of the line.

Step 1

First find the intercept, c, on the y-axis. Here $c = 2$.

Step 2

Now substitute the values for the gradient and the intercept into the equation.

$y = mx + c$ $\qquad$ $y = 0.92x + 2$

c Calculate the value of y when $x = 3$.

Step 1

Replace x in the equation with the known figure to give

$y = (0.92 \times 3) + 2$ $\qquad$ So $y = 4.76$

d Sketch the graph that corresponds with the equation $y = 4x + 6$

Step 1

Choose any two values for x, say 2 and 5. These will be the x coordinates for two points along the line.

Step 2

Using the equation, find the corresponding y coordinates.

when $x = 2$, y will be $(4 \times 2) + 6 = 14$

when $x = 5$, y will be $(4 \times 5) + 6 = 26$

Remember you also know the intercept, c, which is 6 in this example.

Now try this;

1 An experiment was conducted to find the rate of a reaction while varying the concentration of hydrogen peroxide (measured in mol dm^{-3}) in the presence of excess catalase enzyme. The concentrations of hydrogen peroxide tested were 0.2, 0.4, 0.6, 0.8 and 1.0 mol dm^{-3}. The rate of reaction was oxygen evolved by the reaction in mm^3 s^{-1}

   a The equation of the line was $y = 87.5x + 0$. Sketch the resulting graph.

   (*4 marks*)

b What is the rate of oxygen production when the concentration of catalase is 0.5 mol dm^{-3}?

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(*2 marks*)

± 2 Standard deviations   Worked Example 1. Lions

You have found the following ages of lions in two different zoos. The lions were randomly selected from all the lions in each zoo.

Age of Lions at Bristol Zoo (months)	Age of Lions at London Zoo (months)
36	46
31	50
35	48
24	49
21	51
47	49

You can use the calculators to calculate the mean and standard deviation, using the instructions on the calculator to help!

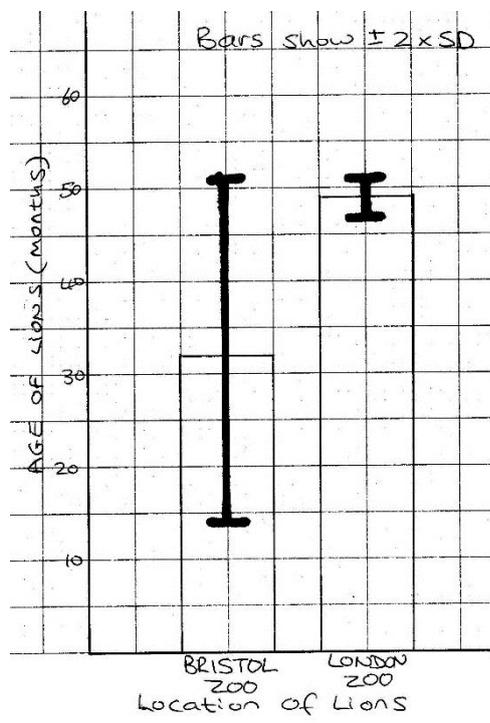The standard deviation is calculated using the formula:

$$SD = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n - 1}}$$

The best way to show these calculations is in do this is in a table.

	Bristol Zoo	London Zoo
mean	32.3	48.8
SD	9.3	1.7
2 x SD	18.6	2.4
Mean + (2 x SD)	50.9	51.2
Mean - (2 x SD)	13.7	46.4

Describing the results

We can draw a bar chart of the mean and plot the ± 2 Standard deviations from the mean and look at the overlap of the bars.
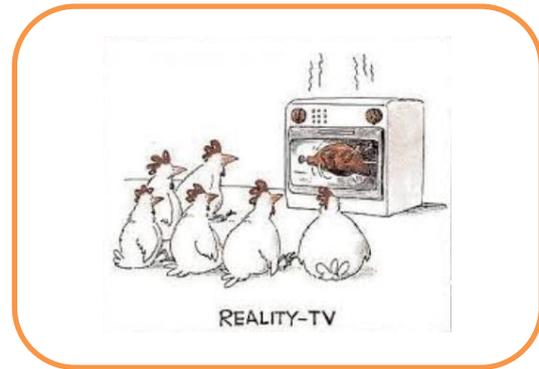

There is an overlap in the (±2 SD) bars.

This indicates that the differences in the means (the age of the Lions at Bristol zoo and London zoo) are **likely** to be due to chance.

Note: You cannot say how 'likely' this is due to chance – just that it is likely!

± 2 Standard deviations Question 1. Heart Rate

REALITY-TV

Compare the data for resting heart rate whilst watching two different TV shows.
Describe the data.

Heart rate (beats per min) whilst watching ..	
Judge Judy	Judge Rinder
117	95
156	155
124	131
128	160
139	145
143	98

Now calculate the mean and standard deviation.

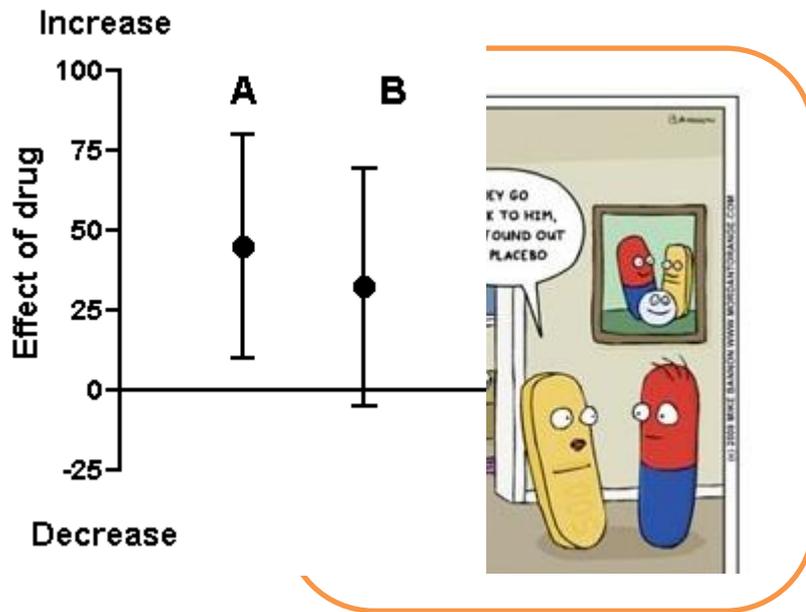|		
mean		
SD		
2 x SD		
Mean + (2 x SD)		
Mean - (2 x SD)		

Describing the results

Plot the bar chart on graph paper and draw on the 2 x SD bars. You may find you
can describe the data without plotting the bar chart though.

There is **an / no** overlap in the (±2 SD) bars.

This indicates that the differences in the means
(………………………………..) is **unlikely/likely** to be due to chance.

± 2 Standard deviations Question 2. Drugs

Describing the results

Compare the data shown in the graph above. This figure depicts two experiments, A and B. In each experiment, control and treatment measurements were obtained. The graph shows the mean difference between control and treatment for each experiment. A positive number denotes an increase; a negative number denotes a decrease. The bars show the 2 x SD for those differences.

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There is ……………………………………………….

This ………

………