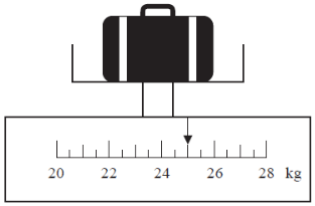
Year 10 Autumn 1: Real life graphs, functions and measures

Themes	Objectives (TG 1-9)	Learning Checks	Interventions - Mathswatch video
Measures	Convert between metric and given imperial units for length and capacity e.g. 1 ml = 1 cm^3 TG2 for area and volume TG3 Know what compound measures are and convert compound measures eg m/s to km/h TG3 Read scales, including those with more challenging increments TG2 Calculations with time including timetablesTG2 Calculate compound measures such as speed and rates of pay TG4 density and pressure TG5 in unfamiliar circumstances where the units vary TG6 Use kinematics formulae to calculate speed and acceleration TG5 Understand that measures are not always accurate Write down maximum/minimum figures for values rounded to a given degree of accuracy TG6 Use inequality notation to specify error intervals due to truncation/rounding TG5 Use upper and lower bounds appropriately in calculations to achieve an overall maximum or minimum value TG8 Evaluate results of calculations related to bounds to give an answer to an appropriate degree of accuracy TG9 Solve a ratio problem in context, using a variety of measures; share a quantity in a given ratio; find one quantity when the other is known; compare a scale model to a real-life object TG3 Recognise that equations of the form *y* = *mx* + *c* correspond to straight-line graphs TG3 Use the conversion rate obtained from a conversion graph TG2 Draw and interpret real-life graphs, distance-time graphs and velocity–time graphs Calculate from these graphs the speed of individual sections, total distance,total time TG4 Use graphs to calculate various measures (of individual sections) including: average speed, distance, time, acceleration; including using enclosed areas by counting squares or using areas of trapezia, rectangles and triangles TG7 Find the gradient from a graph TG4 Draw and interpret straight-line graphs for real-life situations, including ready reckoner graphs, conversion graphs, fuel bill graphs, fixed charge (y-intercept) and cost per unit (gradient); TG4 Use graphical representations of indirect proportion to solve problems in context TG7 Recall and use the formula for the; area of a triangle, trapezium, parallelogram; compound shapes and volume prisms TG5	HMK 1: Compound Measures LC 1: Bounds HMK 2: Real life Graphs	4 Reading Scales 6a Real-Life Tables - Time 6b Real-Life Tables - Timetables and Distance 21 Inverse Operations 22a Money Questions - Non-Calculator 22b Money Questions - Calculator 31 Rounding to the Nearest 10, 100, 1000 32 Rounding to Decimal places 90 Rounding to Significant Figures 91 Estimating Answers 96 Straight Line Graphs 97 The Gradient of a Line 99 Sketching Functions 100 Solving Equations using Flowcharts 101 Subject of a Formula using Flowcharts 102 Generating a Sequence from the nth Term 103 Finding the nth Term 105 Exchanging Money 112 Metric conversions 119 Volume of a Prism 132 Introduction to Bounds 136 Rearranging Simple Formulae 142 Compound Units 143 Distance-Time Graphs 159a Equation of a Straight Line - y = mx+c 159b Equation of a Straight Line - Gradient and 155 Error Intervals 206 Upper and Lower Bounds 214a Inverse Functions - Introduction 214b Inverse Functions - Harder Questions 215 Composite Functions 216 Velocity-Time Graphs
Functions	Complete inputs/outputs from simple function machines TG1 Fill operation in words in function machines TG2 Interpret expressions as functions with an input and output (function machines) TG3 Generate points that satisfy a function and plot these to obtain a graph (including from real-life contexts) TG3 Use linear expressions to describe the *n*th term of an arithmetic sequence TG4 Use function notation, substituting in numerical values TG6 Use function notation, substituting in another function to give composites TG7 Change the subject of a formula involving the use of square roots and squares including cases where; the subject occurs on both sides of the formula, a power of the subject appears or where all variables are in the denominators. Rearrange simple equations TG3 Use function machines, including to find terms of a sequence; coordinates (i.e. given the input *x*, find the output *y*); Find f(*x*) + g(*x*) and f(*x*) – g(*x*), 2f(*x*), f(3*x*) etc. algebraically; TG6 Write the expression for an inverse function TG7; know that $f^{-1}(x)$ refers to the inverse function;	HMK 3: Functions LC2: Inverse functions	

MES 1-6: Faiza buys
one magazine costing £2.30
one paper costing 92p
two identical bars of chocolate
Faiza pays with a £5 note.
She gets 40p change.
Work out the cost of **one** bar of chocolate.

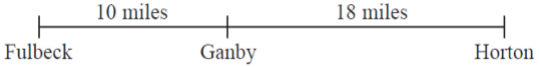
$f = 5x + 2y$
$x = 3$ and $y = -2$
Find the value of f.

Keith is going to catch a plane.
He weighs his bag on some scales.



(a) Write down the weight shown on the scales.
..... kg
There is an extra charge to pay when the weight of a bag is more than 23 kg.
The weight of Grant's bag is 19.5 kg.
He does **not** want to pay the extra charge.
(b) How much more weight can he put in the bag?
..... kg
Nina has two bags. The weight of each bag is 20 kg.
1 kg = 2.2 pounds.
(c) What is the total weight of Nina's bags in pounds? ..... pounds

The distance from Fulbeck to Ganby is 10 miles.
The distance from Ganby to Horton is 18 miles.



Raksha is going to drive from Fulbeck to Ganby.
Then she will drive from Ganby to Horton.
Raksha leaves Fulbeck at 10 00.
She drives from Fulbeck to Ganby at an average speed of 40mph.
Raksha wants to get to Horton at 10 35.
Work out the average speed Raksha must drive at from Ganby to Horton.

$$q = \frac{p}{r} + s$$

Make p the subject of this formula.

Change 72 km/h into m/s.

One day Sally earned £60.
She worked for 8 hours.
Work out Sally's hourly rate of pay

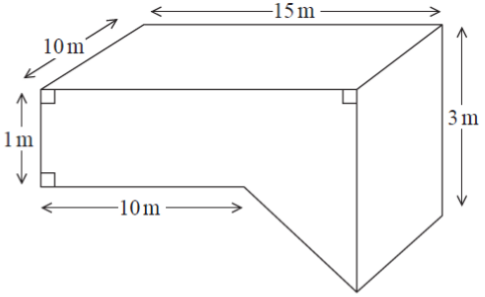
$$\text{Pressure} = \frac{\text{force}}{\text{area}}$$

Find the pressure exerted by a force of 900 newtons on an area of 60 cm2.
Give your answer in newtons/m2.

Sophia pays £222 for a plane ticket.
She also pays 100 euros airport tax.
The exchange rate is £1 = 1.38 euros.
What percentage of the total cost of the ticket and the airport tax does Sophia pay for the
airport tax?
Give your answer correct to 1 decimal place.

Write a number on the dotted line to make the statement correct.
2.75 litres = ... millilitres

A number, y, is rounded to 2 significant figures.
The result is 0.46
Write down the error interval for y.

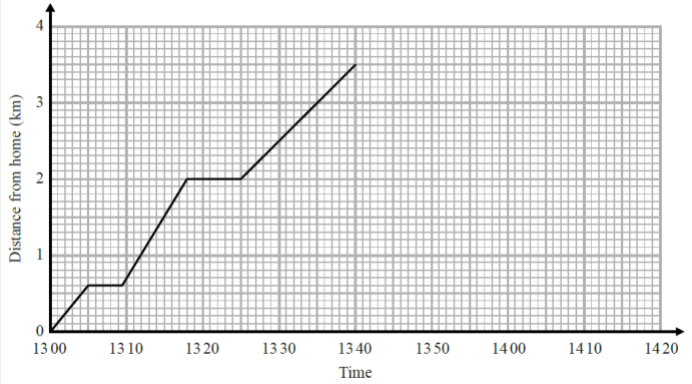


The diagram shows a swimming pool.
The swimming pool is in the shape of a prism.
The swimming pool is filled with water at a rate of 5 litres per second.

Jeremy has 10 hours to fill the swimming pool.
1 m³ = 1000 litres.

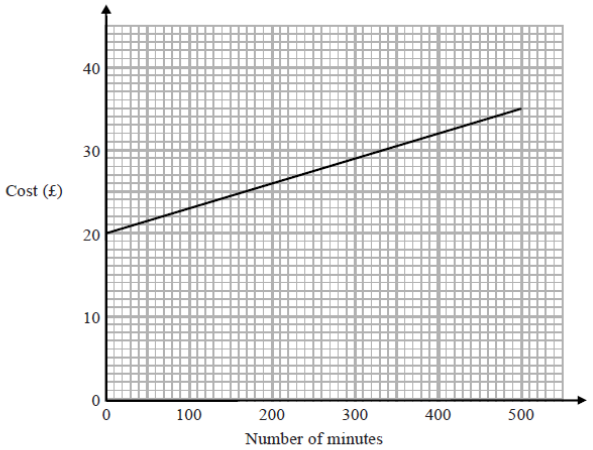
Will he completely fill the swimming pool in 10 hours?
You must show all your working.

Arshad delivers parcels on his bike.
He starts from his home.
Here is the travel graph for the first 40 minutes of Arshad's journey



(a) What time did Arshad start his journey?
Arshad had to stop to deliver each parcel.
(b) How long, in minutes, did his first stop take? ..... minutes
(c) What is the distance between the two stops shown on the travel graph? ..... km
At 13 40, Arshad stopped for 10 minutes to deliver his last parcel.
He then cycled home at a steady speed.
Arshad got home at 14 15
(d) Complete the travel graph to show this information.

The graph shows the cost of using a mobile phone for one month for different numbers of minutes of calls made.



The cost includes a fixed rental charge of £20 and a charge for each minute of calls made.

Work out the charge for each minute of calls made.

ork out the output for this number machine.

.....

(*b*) Work out the input for this number machine.

.....

(*c*) The input for this number machine is *m*.

Find an expression, in terms of *m*, for the output. .....

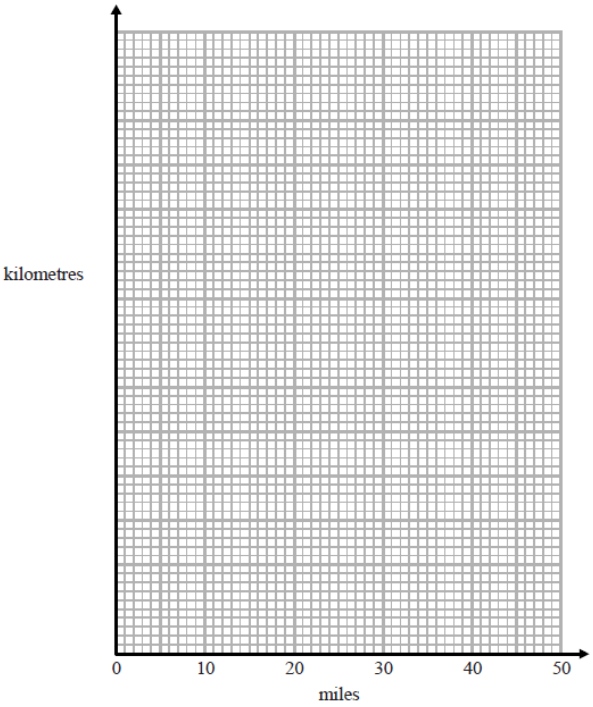
(*d*) The output for this number machine is *n*.

Find an expression, in terms of *m*, for the output. .....

You can use the information in the table to convert between kilometres and miles.

miles	0	5	20	40
kilometres	0	8	32	64

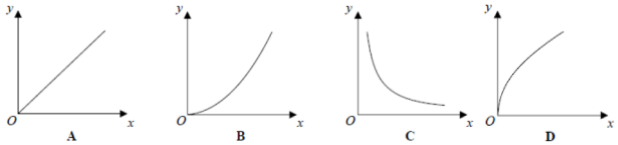
(*a*) Use this information to draw a conversion graph.



(*b*) Which is further, 20 kilometres or 15 miles?
You must show how you got your answer.

6-9

Here are four graphs.



(*a*) Write down the letter of the graph that could represent y is proportional to x^2.

(*b*) The force of attraction, *F* newtons, between two magnets varies inversely as the square of the distance, *d* cm, between the two magnets.

(i) What happens to the force of attraction between the magnets when the distance between the magnets is doubled?

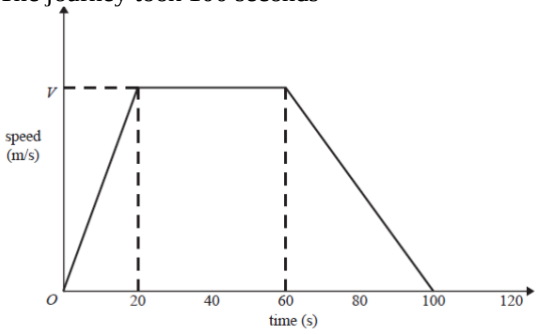
When the magnets are 3 cm apart the force of attraction between them is 40 newtons.

(ii) What is the force of attraction between the magnets when they are 10 cm apart?

Make *a* the subject of $a+3=\frac{2a+7}{r}$

The function f is such that
f(x) = 4x – 1
(a) Find $f^{-1}(x)$
The function g is such that
g(x) = kx^2 where k is a constant.
Given that fg(2) = 12
(b) work out the value of k

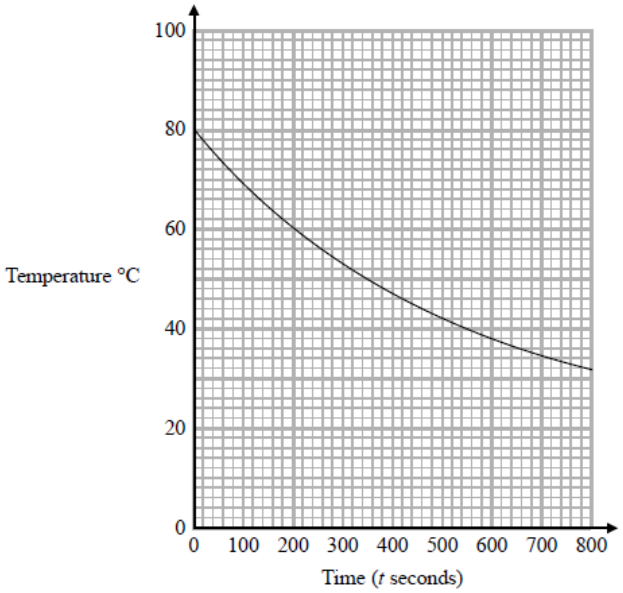
Here is a speed-time graph for a car journey.
The journey took 100 seconds



The car travelled 1.75 km in the 100 seconds.
(*a*) Work out the value of *V*.
(*b*) Describe the acceleration of the car for each part of this journey.

The quantity of heat, *H* calories, delivered by an electric current, *I* amps, acting for *t* seconds to heat an amount of water is given by the formula
$H = atI\,2 - b$
where *a* and *b* are constants.
(*a*) Rearrange the formula to make *I* the subject.

The graph gives information about the variation in the temperature, in °C, of an amount of water that is allowed to cool from 80 °C.



(*b*) (i) Work out the average rate of decrease of the temperature of the water between $t = 0$ and $t = 800$.
The instantaneous rate of decrease of the temperature of the water at time *T* seconds is equal to the average rate of decrease of the temperature of the water between $t = 0$ and $t = 800$.
(ii) Find an estimate for the value of *T*.
You must show how you got your answer.

$\boldsymbol{m = \frac{\sqrt{s}}{t}}$
$s = 3.47$ correct to 3 significant figures
$t = 8.132$ correct to 4 significant figures
By considering bounds, work out the value of *m* to a suitable degree of accuracy.
Give a reason for your answer.