Year 9 Minimum Expected Standard Autumn 2 FDPR:

Including Bounds, Estimation and Approximation

Themes	Objectives (TG 1-9)	Learning Checks	Interventions - Mathswatch video and worksheet
Bounds, Estimation and Approximation	Understanding of base 10 and where it originates (links to powers of 10) (TG1) Understanding how to write and say all numbers (TG1) Multiply or divide any number by powers of 10 (TG2) Add, subtract, multiply and divide decimals and whole numbers (TG1/2) Understanding that multiplying by a number less than 1 makes a number smaller and dividing by a number lesson than 1 makes a number bigger (TG3) Performing arithmetic with decimals where knowledge of BIDMAS is needed (TG4) Put digits in the correct place in a decimal calculation (TG3/4) Use one calculation to find the answer to another; check answers by rounding and using inverse operations (TG3) Convert FDP including a recurring decimals to fraction (TG1-6) Round numbers; to the nearest 10, 100, 1000, the nearest integer, decimal places and number of significant figures (TG1) Round numbers, measures and answers to appropriate degree of accuracy, which is stated, or make a sensible decision on rounding in context of question (TG4/5). Know that some answers are inappropriate unless they are rounded (TG3) Evaluate results from rounding and the impact on their answers (TG5) Make sensible estimates for items in metric units (TG3) Use, estimate and name standard units of mass, length, time, money and other measures using decimal quantities where appropriate (TG1-3) Estimate answers to calculations by rounding numbers to 1 significant figure; check calculations using approximation and estimation, including answers obtained using technology (TG3/4) Estimate powers and roots of any given positive number by considering the values it must lie between (TG6) Estimate area, perimeter, surface area and volume by rounding measurements to 1 significant figure to check reasonableness of answers (TG3) Worded problems involving estimation, commenting on whether an estimate was sensible (TG4) Use scale to estimate a length (TG3/4) Use inequality notation to specify an error bound (TG4) Calculate the upper and lowers bounds of numbers given to varying degrees of accuracy (TG6) Calculate the upper and lower bounds of calculations addition and multiplication (TG8/9) Calculate the upper and lower bounds of calculations subtraction and division Evaluate results of calculations related to bounds to give an answer to an appropriate degree of accuracy (TG8/9)	Homework 1: Calculations with decimals LC 1: Show that estimation overestimate or underestimate Homework 2: Estimation and approximation LC 2: Estimation and error intervals Homework 3: Bounds calculations	30 — Multiplying and Dividing by Powers of 10 17 — Adding Integers and Decimals 18 — Subtracting Integers and Decimals 32 — Rounding to Decimal places 66 — Multiplying Decimals 67 — Dividing Decimals 84 — Decimals and Fractions 85 — Fractions, Percentages, Decimals 177 — Recurring Decimals to Fractions 189 — Recurring Decimals - Proof 75 — BODMAS/BIDMAS 31 — Rounding to the Nearest 10, 100, 1000 90 — Rounding to Significant Figures 112 — Metric conversions 91 — Estimating Answers 155 — Error Intervals 132 — Introduction to Bounds 206 — Upper and Lower Bounds

Write these numbers in order of size.
 Start with the smallest number.

  0.74   0.744   0.704   0.7

Write down the value of the 9 in 213.95

Write 17 653 correct to the nearest 1000

(*a*)   Write the number 4117 in words.
(*b*)   Write the number 4117 to the nearest hundred.

Write down the value of the 3 in the number 4376

Work out 6.34×5.2

Work out 5.4×0.24
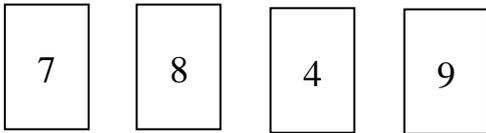
Write the following numbers in order of size.
Start with the smallest number.

  3.25   3.2   3.05   3.205

Here are four cards.
There is a number on each card.

| 7 | 8 | 4 | 9 |

(a) Write down the largest 4-digit number that can be made using each card only once

(b) Write down the smallest 4-digit even number that can be made using each card only once

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

Paul organised an event for a charity.
Each ticket for the event cost £19.95
Paul sold 395 tickets.
Paul paid costs of £6000
He gave all money left to the charity.
(*a*) Work out an estimate for the amount of money Paul gave to the charity.
(*b*) Is your answer to (*a*) an underestimate or an overestimate?
Give a reason for your answer.

The formulae below can be used to work out the cost, £*C*, of a taxi journey of *x* miles with three different taxi companies.

Reliable Taxis	Speedy Taxis	City Taxis
$C = 1.5x$	$C = 1.1x + 11.5$	$C = 1.25x + 8$

Which is
the cheapest company to use for a taxi journey of 30 miles?
You must show how you get your answer.

Henry is thinking of having a water meter.
These are the two ways he can pay for the water he uses.

Water Meter
A charge of £28.20 per year
plus
91.22p for every cubic metre of water used
1 cubic metre = 1000 litres

No Water Meter
A charge of £107 per year

Henry uses an average of 180 litres of water each day.
Use this information to determine whether or not Henry should have a water meter

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This shape is used from two rectangles

2.05 cm
2.15 cm
5.02 cm
7.37 cm
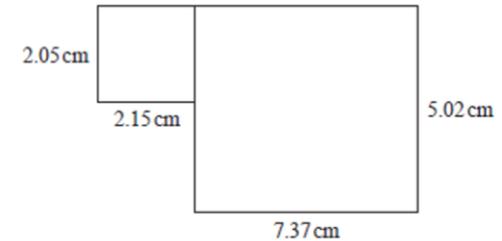
(a) Work out an estimate for the total area of the shape.
(b) Is your answer to (a) an underestimate or an overestimate?

Give a reason for your answer.
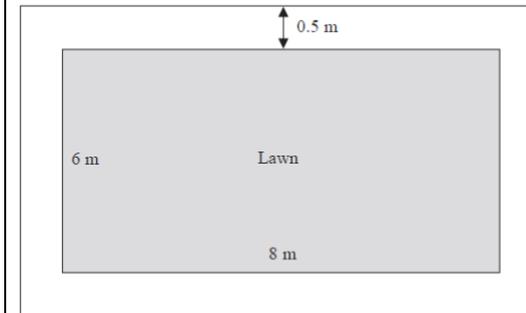
Here is a diagram of Gareth's lawn.

Diagram NOT accurately drawn
0.5 m
6 m   Lawn
8 m

The lawn is in the shape of a rectangle. The length of the lawn is 8 m.
The width of the lawn is 6 m.

There is a path all the way around the lawn. The path is made from paving slabs.
Each paving slab is a square 0.5 m by 0.5 m. The width of the path is 0.5 m.
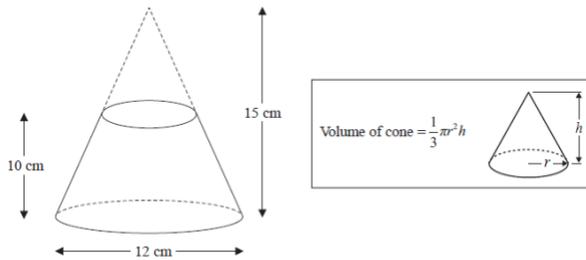
Work out the number of paving slabs in the path.

One uranium atom has a mass of 3.95×10^{-22} grams.
(a) Work out an estimate for the number of uranium atoms in 1 kg of uranium.
(b) Is your answer to (a) an underestimate or an overestimate?
Give a reason for your answer.

A frustum is made by removing a small cone from a large cone as shown in the diagram.

The frustum is made from glass.
The glass has a density of 2.5 g/cm^3
Work out the mass of the frustum.
Give your answer to an appropriate degree of accuracy.

$$m = \frac{\sqrt{s}}{t}$$
$s = 3.47$ 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.

Work out an estimate for the value of $\dfrac{43.2 \times \sqrt{99.05}}{0.193}$

Work out an estimate for $\sqrt{4.98 + 2.16 \times 7.35}$

$$v = \sqrt{\frac{a}{b}}$$

$a = 6.43$ correct to 2 decimal places.
$b = 5.514$ correct to 3 decimal places.
By considering bounds, work out the value of v to a suitable degree of accuracy.
Give a reason for your answer.

The average fuel consumption (c) of a car, in kilometres per litre, is given by the formula

$$c = \frac{d}{f}$$

where d is the distance travelled in kilometres and f is the fuel used in litres.

$d = 190$ correct to 3 significant figures.
$f = 25.7$ correct to 1 decimal place.

By considering bounds, work out the value of c to a suitable degree of accuracy.
You must show **all** of your working **and** give a reason for your final answer.

The population of a city increased by 5.2% for the year 2014
At the beginning of 2015 the population of the city was 1560000
Lin assumes that the population will continue to increase at a constant rate of 5.2% each year.
(a) Use Lin's assumption to estimate the population of the city at the beginning of 2017
Give your answer correct to 3 significant figures.

(b) (i) Use Lin's assumption to work out the year in which the population of the city will reach 2000000

(ii) If Lin's assumption about the rate of increase of the population is too low, how might this affect your answer to (b)(i)?