



Estimation

You can estimate the answer to a calculation by rounding each number to **1 significant figure**, and then doing the calculation. You can use this method to check your answers, or to estimate calculations on your **non-calculator paper**. Here are two examples:

1 $4.32 \times 18.09 \approx 4 \times 20 = 80$

The answer is approximately equal to 80.

2 $327^2 \approx 300^2 = 3^2 \times 100^2 = 90000$

The answer is approximately equal to 90000.

\approx means 'is approximately equal to'

Worked example

Work out an estimate for

(a) $\frac{4.31 \times 278}{0.487}$

$$\frac{4.31 \times 278}{0.487} \approx \frac{4 \times 300}{0.5} = \frac{1200}{0.5} = 2400$$

(b) 37.4^3

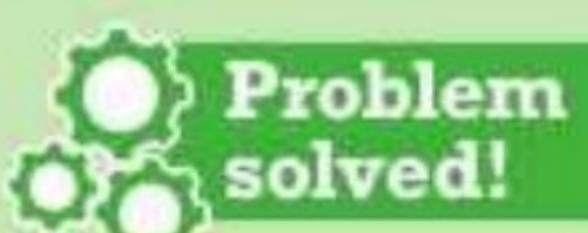
$$37.4^3 \approx 40^3 = 4^3 \times 10^3 = 64 \times 1000 = 64000$$

Target grade **4**

(2 marks)

Round all the numbers to **1 significant figure**. Then **write out** the calculation with the rounded values before calculating your estimate.

You can use the laws of indices to work out 40^3 without a calculator.
 $(ab)^n = a^n \times b^n$
 $so 40^3 = (4 \times 10)^3 = 4^3 \times 10^3$



On your non-calculator paper you can use $\pi = 3.142$ then round to 1 s.f. to make your estimate.

Examiners' report

You have rounded **both values down** so your answer will be an underestimate. The question says 'give a reason' so show working and write a conclusion in **words**.

Real students have struggled with questions like this in recent exams – **be prepared!**

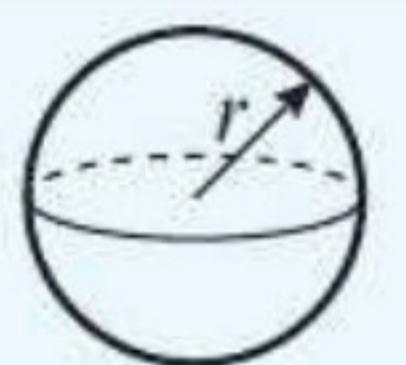


Worked example

Target grade **5**

A spherical ball-bearing has a radius of 2.35cm.

$$\text{Surface area of sphere} = 4\pi r^2$$



(a) Work out an estimate for its surface area in square centimetres. (2 marks)

$$4\pi r^2 = 4 \times 3.142 \times 2.35^2 \approx 4 \times 3 \times 2^2 = 48 \text{ cm}^2$$

(b) Is your answer to part (a) an overestimate or an underestimate? Give a reason for your answer. (1 mark)

$$3 < 3.142 \text{ and } 2 < 2.35$$

so the answer is an underestimate.

Now try this

Target grade **4**

1 Showing your rounding, work out an estimate for

$$\frac{82 \times 285}{64 \times 35} \quad (2 \text{ marks})$$

Worked solution video



Target grade **5**

2 A scientist models a raindrop as a sphere with radius 3.2mm.

$$\text{Volume of a sphere} = \frac{4}{3}\pi r^3$$

(a) Work out an estimate for the volume of the raindrop. (2 marks)

(b) Is your answer to part (a) an overestimate or an underestimate?

Give a reason for your answer. (1 mark)