

# 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**  $327^2 \approx 300^2 = 3^2 \times 100^2 = 90\,000$   
The answer is approximately equal to 90 000.

$\approx$  means 'is approximately equal to'

## Decimal division trick

You might have to divide by a decimal on your non-calculator paper. If you multiply both numbers in a division by the same amount the answer stays the same.

$$\frac{1400}{0.05} = \frac{140\,000}{5} = \frac{280\,000}{10} = 28\,000$$

(Note: The diagram shows arrows indicating multiplication of both numerator and denominator by 100 and then by 2 to simplify the division.)

## 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)  $37.4^3$

$$37.4^3 \approx 40^3 = 4^3 \times 10^3 = 64 \times 1000 = 64\,000$$

Target grade 4

(2 marks)

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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  $40^3 = (4 \times 10)^3 = 4^3 \times 10^3$



Problem solved!

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!**

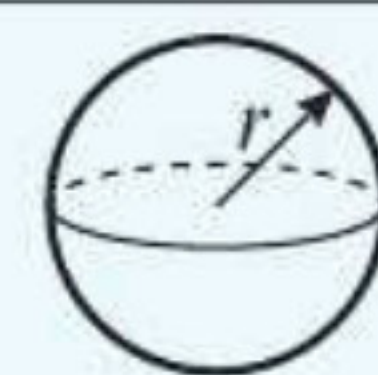


## Worked example

Target grade 5

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

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)

$3 < 3.142$  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

$$\frac{82 \times 285}{64 \times 35}$$

(2 marks)

Target grade 5

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

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)

Worked solution video

