London

1l = 108·9p

£1 = $1·46

×1·938

£1·938 = $2·83

New York

1 US gallon = $2·83

1 US gallon = 3·785l

3·785l = $2·83

3·785l = £1·938 ✓

3·785l = 193·8p

(÷3·785) (÷3·785)

1l = 51·2p ✓

New York ✓ because 1l of petrol in London costs 108·9p, whereas 1l in New York costs 51·2p

1. A gold bar has a mass of 12.5 kg.

The density of gold is 19.3 g/cm^3

Work out the volume of the gold bar.
Give your answer correct to 3 significant figures.

volume = mass / density

1kg = 1000g

×12·5 ×12·5

12·5kg = 12500g

Volume = 12500 / 19·3

= 647·67 cm^3

= 648 cm^3 ✓✓

648 ✓ cm^3

(Total for Question is 3 marks)

2. Emily drives 186 miles in 3 hours.

(a) What is her average speed?

to check the units

$$\text{average speed} = \frac{\text{total distance}}{\text{total time taken}} = \frac{186 \text{ miles}}{3 \text{ hours}} = 62 \frac{\text{miles}}{\text{hour}} = \text{mph}$$

$S = \frac{d}{t}$

62 mph

(2)

Sarah drives at an average speed of 58 mph for 4 hours.

(b) How many miles does Sarah drive?

$S = \frac{d}{t}$ (both sides multiplied by t)

$d = S \times t$

UNIT CHECK

$\frac{\text{miles}}{\text{hour}} \times \text{hour} = \text{miles}$

$d = 58 \text{ mph} \times 4 \text{ hours}$

$= 232 \text{ miles}$

232 miles

(2)

(Total for Question is 4 marks)

21 22 23 24 25 26 27 28 29

×3 ×5 ×3 ×2

23, 29

multiple of 2

Yes, all other even numbers have 2 as a factor

• Draw the line $y=-2$ onto the graph (1)

• Find the x values of the 2 points at which the line $y=-2$ and the curve $y=2x^2-x-6$ cross

$y=2x^2-x-6$

-1.6 and 2.6 (1)

3. A force of 70 newtons acts on an area of $20\,cm^2$

The force is increased by 10 newtons.
The area is increased by $10\,cm^2$

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

Helen says,

"The pressure decreases by less than 20%"

Is Helen correct?
You must show how you get your answer.

Initial Pressure:

$P = \frac{F}{A} = \frac{70}{20} = 3.5$ (1)

These values both have the same unit (Ncm^{-1})

New Pressure:

$P = \frac{F}{A} = \frac{70+10}{20+10} = \frac{80}{30} = 2.\dot{6}$

20% less than the initial pressure = 80% of initial pressure

80%

$3.5 \times 0.8 = 2.8$ (1)

80% of initial > new pressure

$2.8 > 2.\dot{6}$ (1)

No, Helen is incorrect. The decrease is greater than 20%

(Total for Question is 3 marks)

120 × 5 = 600 minutes
1 tap takes 600 minutes
600 ÷ 3 = 200 minutes ✓

200 ✓

Each tap fills up pool at the same rate ✓

4. A plane travels at a speed of 213 miles per hour.

(a) Work out an estimate for the number of seconds the plane takes to travel 1 mile.

213 → 200

200 miles per 1 hour
200 miles per 60 minutes
200 miles per 3600 seconds ✓
÷200 ÷200
1 mile per 18 seconds ✓

18 ✓ seconds

(3)

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

Overestimate, because we rounded the speed down ✓

(1)

(Total for Question is 4 marks)

1cm = 10mm

$1cm^3 = 10^3 mm^3$

$37cm^3 = 37000mm^3$

37000

5. Nimer was driving to a hotel.
He looked at his Sat Nav at 13 30

Time	13 30
Distance to destination	65 miles

Nimer arrived at the hotel at 14 48

Work out the average speed of the car from 13 30 to 14 48
You must show all your working.

distance
time

13:30
↓ + 1hr
14:30
↓ + 18mins
14:48

time 1hr 18mins = 1.3hrs

60 mins in 1hr
↓ ×0.3 ↓
18mins = 0.3hrs

$\text{speed} = \frac{\text{distance}}{\text{time}}$

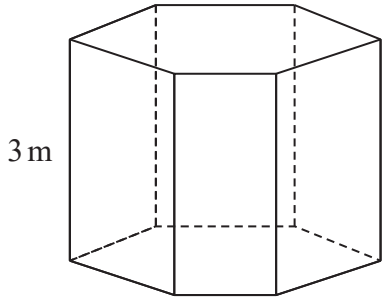
$\text{speed} = \frac{65}{1.3}$

speed = 50 mph

50 mph

(Total for Question is 4 marks)

6. The diagram shows a prism placed on a horizontal floor.

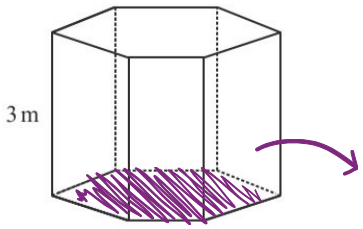


$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

The prism has height 3 m
The volume of the prism is 18 m^3

The pressure on the floor due to the prism is 75 newtons/m^2

Work out the force exerted by the prism on the floor.



$$\text{pressure} = \frac{\text{force}}{\text{cross-sectional area}}$$

cross-sectional area

Work out cross-sectional area:

$$\text{cross-sectional area} = \frac{\text{volume}}{\text{height}} = \frac{18}{3} = 6\ m^2$$ (1)

Work out force:

$$\text{pressure} = \frac{\text{force}}{\text{cross-sectional area}}$$

$$75 = \frac{\text{force}}{6}$$ (1)

$$\therefore \text{Force} = 75 \times 6 = 450\ \text{N}$$

(1)

450 ..... newtons

(Total for Question is 3 marks)

7. Andy cycles a distance of 30 km at an average speed of 24 km/h.
He then runs a distance of 12 km at an average speed of 8 km/h.

Work out the total time Andy takes.
Give your answer in hours and minutes.

$\text{speed} = \frac{\text{distance}}{\text{time}} \quad \therefore \quad \text{time} = \frac{\text{distance}}{\text{speed}}$

$\text{time}_1 = \frac{30}{24} = 1.25 \text{ hours}$ (1)

$\text{time}_2 = \frac{12}{8} = 1.5 \text{ hours}$

Total time $= 1.25 + 1.5 = 2.75$ hours (1)

2.75 hours = 2 hours and 0.75 hours.

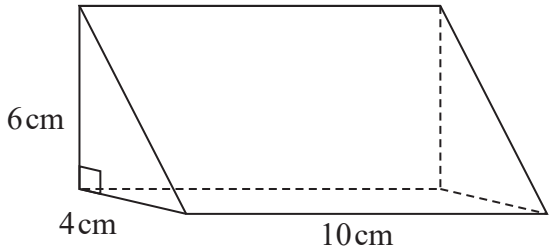
1 hour = 60 minutes (x 0.75)
0.75 hours = 45 minutes (x 0.75)

$\therefore$ 2.75 hours = 2 hours and 45 minutes. (1)

2 hours 45 minutes

(Total for Question is 3 marks)

8. The diagram shows a solid triangular prism.



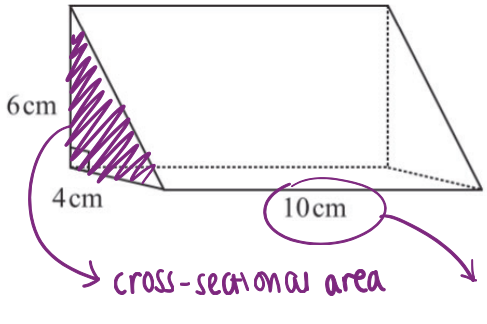
The prism is made from wood with a density of 0.8 g/cm³

Work out the mass of this prism.

Density = $\frac{\text{mass}}{\text{volume}}$

Find the volume of the prism:

volume = (cross-sectional area) x length.



cross-sectional area = $\frac{\text{base x height}}{2}$

$= \frac{4 \times 6}{2} = 12\ \text{cm}^2$

(1)

$\therefore$ volume = $12\ \text{cm}^2 \times 10\ \text{cm} = 120\ \text{cm}^3$

Find the mass of the prism:

Density = $\frac{\text{mass}}{\text{volume}}$ $\therefore$ $0.8 = \frac{\text{mass}}{120}$ (1)

Mass = $0.8 \times 120 = 96$ g. (1)

96 g

(Total for Question is 3 marks)