

Rates and Compound Measures



Use the formula triangle and unit rates to calculate and compare speed, density, and best buys.

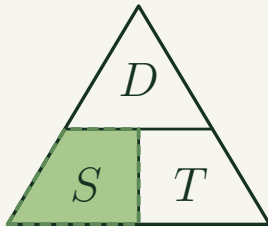
Name _____

Date _____

Show your method

Use the formula triangle: cover the quantity you want, then multiply (top = left $\times$ right) or divide (a bottom cell = top $\div$ the other bottom cell). Show your substitution and answer, with units.

Worked example Find the speed. $D = 140$ km, $T = 2$ h.



Covering S : $S = D \div T$
 $S = 140 \div 2$
 $S = 70$ km/h

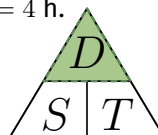
1. Find the speed. $D = 120$ km, $T = 3$ h.



Solution

$S = 120 \div 3$
 $S = 40$ km/h

2. Find the distance. $S = 55$ km/h, $T = 4$ h.



Solution

$D = 55 \times 4$
 $D = 220$ km

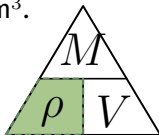
3. Find the time. $D = 175$ km, $S = 25$ km/h.



Solution

$T = 175 \div 25$
 $T = 7$ h

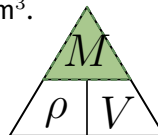
4. Find the density. $M = 84$ g, $V = 12$ cm³.



Solution

$\rho = 84 \div 12$
 $\rho = 7$ g/cm³

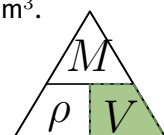
5. Find the mass. $\rho = 6$ g/cm³, $V = 18$ cm³.



Solution

$M = 6 \times 18$
 $M = 108$ g

6. Find the volume. $M = 270$ g, $\rho = 9$ g/cm³.



Solution

$V = 270 \div 9$
 $V = 30$ cm³

7. A 3 kg bag of flour costs \$5.40 and a 5 kg bag costs \$8.50. Find the cost per kg of each and state the better buy.

Solution

$5.40 \div 3 = \$1.80/\text{kg}$
 $8.50 \div 5 = \$1.70/\text{kg}$
5 kg bag is better value

8. A car travels 245 km in 3.5 hours. Calculate its average speed.

Solution

$245 \div 3.5$
 $= 70$ km/h

9. A runner covers 300 m in 40 seconds. Find their speed in m/s.

Solution

$300 \div 40$
 $= 7.5$ m/s

Rates and Compound Measures (continued)

Mixed rate problems and reading a distance-time graph.



Name _____

Date _____

10. A block has a mass of 245 g and a volume of 35 cm^3 . Find its density.

Solution

$$245 \div 35 \\ = 7 \text{ g/cm}^3$$

11. A 6-pack of yoghurt costs \$4.80 and an 8-pack costs \$6.00. Find the cost per yoghurt for each pack and state the better buy.

Solution

$$4.80 \div 6 = \$0.80 \text{ each} \\ 6.00 \div 8 = \$0.75 \text{ each} \\ \text{8-pack is better value}$$

12. A cyclist travels at 18 km/h for 2.5 hours. Find the distance travelled.

Solution

$$18 \times 2.5 \\ = 45 \text{ km}$$

13. A hiker walks 12 km at 4 km/h, then a further 9 km at 3 km/h. Find the total time taken and the average speed for the whole journey.

Solution

$$12 \div 4 = 3 \text{ h}, 9 \div 3 = 3 \text{ h} \\ \text{Total time} = 6 \text{ h}, \text{ distance} = 21 \text{ km} \\ \text{Avg speed} = 21 \div 6 = 3.5 \text{ km/h}$$

14. A train travels for 1.5 hours at 90 km/h, then for 2 hours at 75 km/h. Find the total distance and the average speed, to 2 decimal places.

Solution

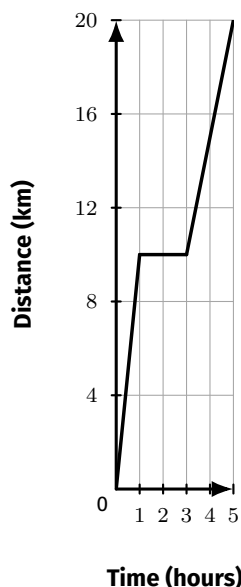
$$90 \times 1.5 = 135 \text{ km}, 75 \times 2 = 150 \text{ km} \\ \text{Total distance} = 285 \text{ km}, \text{ time} = 3.5 \text{ h} \\ \text{Avg speed} = 285 \div 3.5 \approx 81.43 \text{ km/h}$$

15. Two containers hold the same volume of liquid, 500 cm^3 . Container A's liquid has a mass of 450 g and Container B's has a mass of 600 g. Which liquid is denser, and by how much?

Solution

$$\rho_A = 450 \div 500 = 0.9 \text{ g/cm}^3 \\ \rho_B = 600 \div 500 = 1.2 \text{ g/cm}^3 \\ \text{B is denser by } 0.3 \text{ g/cm}^3$$

16. The graph shows a delivery van's journey. Find its speed for the first hour, state what the flat section between 1 and 3 hours represents, then find its speed for the final part of the journey (3 to 5 hours).



Solution

Speed for the first hour: $10 \div 1 = 10 \text{ km/h}$.

The flat section (1 to 3 hours) means the van is stationary (parked, not moving).

Speed for the final part: $(20 - 10) \div (5 - 3) = 10 \div 2 = 5 \text{ km/h}$.