

Using Units to Solve Multi-Step Problems

Grade 9 – Algebra 1 math · Worksheet Answer Key · Standards: N-Q.A.1, N-Q.A.2, N-Q.A.3

Every answer key below shows the conversion factors, the arithmetic and a quick check. Compare the way the units cancel with your own setup, not only the final number, so that the same method works on new problems.

Standards: N-Q.A.1, N-Q.A.2, N-Q.A.3 · **Level:** Grade 9 Algebra 1

Problem 1 Hours to minutes

Multiply by $\frac{(60 \text{ min})}{(1 \text{ h})}$: $4.5 \times 60 = 270$.

The hours cancel, leaving minutes: **270 minutes**.

Problem 2 Feet to miles

$7,920 \text{ ft} \times \frac{(1 \text{ mi})}{(5,280 \text{ ft})} = 1.5 \text{ mi}$ (check: $5,280 \times 1.5 = 7,920$).

1.5 miles

Problem 3 Gallons to quarts

$3.2 \text{ gal} \times \frac{(4 \text{ qt})}{(1 \text{ gal})} = 12.8 \text{ qt}$ (check: $12.8 \div 4 = 3.2$).

12.8 quarts

Problem 4 Units of a product

$\$2.75 \frac{1}{(1 \text{ lb})} \times 6.4 \text{ lb} = \$17.60$. The pounds cancel, so the unit is dollars.

\$17.60

Problem 5 Cyclist speed

$90 \text{ min} = 1.5 \text{ h}$. Speed = $22.5 \text{ mi} \div 1.5 \text{ h} = 15 \text{ mi/h}$.

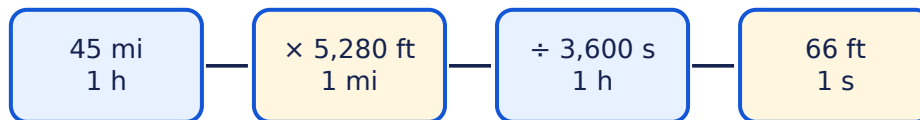
Check: $15 \times 1.5 = 22.5$.

15 mi/h

Problem 6 Miles per hour to feet per second

$45 \times 5,280 = 237,600$ ft per hour. Divide by 3,600 s per hour: $237,600 \div 3,600 = 66$.

Check: $66 \times 3,600 = 237,600$.



$$45 \times 5,280 \div 3,600 = 66.$$

66 ft/s

Problem 7 Leaking faucet

Per day: $5 \times 24 = 120$ fl oz. Convert: $120 \div 128 = 0.9375$ gal.

Check: $0.9375 \times 128 = 120$. Rounded: **0.94 gallon**

Problem 8 Hose flow rate

Rate per minute: $14 \div 8 = 1.75$ gal/min. Multiply by 60 min/h: $1.75 \times 60 = 105$.

Check: $105 \text{ gal/h} \times \frac{8}{60} \text{ h} = 14 \text{ gal}$.

105 gallons per hour

Problem 9 Square yards to square feet

One square yard contains $3 \times 3 = 9$ square feet, as the grid shows. So $2 \text{ yd}^2 \times 9 = 18 \text{ ft}^2$.

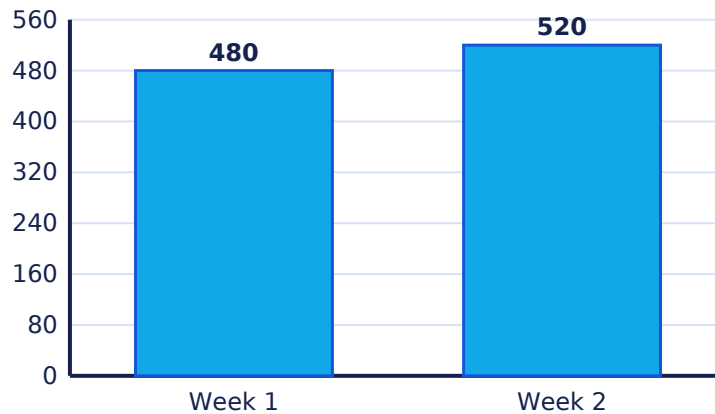
Check: converting with the length factor only ($2 \times 3 = 6$) would be wrong because both dimensions change.

18 square feet

Problem 10 Truncated axis

(a) The bars start at 450, so the heights are $480 - 450 = 30$ and $520 - 450 = 70$. Ratio $70 \div 30 = 7/3 \approx 2.33$.

(b) True ratio: $520 \div 480 = 13/12 \approx 1.08$.



The same sales with the axis starting at 0.

The cut-off axis makes Week 2 look about **2.33 times** as large, but the true ratio is **about 1.08**.

Problem 11 Accuracy of an area

Exact product: $8.3 \times 5.6 = 46.48 \text{ ft}^2$. Both measurements have two significant figures, so keep two: 46.

Check: $8 \times 6 = 48$, close to 46.48.

46 ft²

Problem 12 Crowded parks

Define visitors per acre. Park A: $1,260 \div 18 = 70$. Park B: $930 \div 15 = 62$.

Check: $70 \times 18 = 1,260$ and $62 \times 15 = 930$.

Park A is more crowded (70 per acre versus 62 per acre).

Problem 13 Days to seconds

$$3 \text{ d} \times \frac{(24 \text{ h})}{(1 \text{ d})} \times \frac{(60 \text{ min})}{(1 \text{ h})} \times \frac{(60 \text{ s})}{(1 \text{ min})} = 3 \times 24 \times 60 \times 60 = 259,200.$$

Check: $259,200 \div 86,400 = 3$.

259,200 seconds

Problem 14 Conveyor speed

$3.5 \times 3,600 = 12,600 \text{ ft per hour}$. Divide by 5,280: $12,600 \div 5,280 \approx 2.3864$.

Check: $2.39 \times 5,280 \approx 12,619$, close to 12,600.

about 2.39 mi/h

Problem 15 Road trip fuel cost

Gallons: $364 \text{ mi} \div 28 \text{ mi/gal} = 13 \text{ gal}$. Cost: $13 \text{ gal} \times \$3.85/\text{gal} = \$50.05$.

Units: $\text{mi} \div (\text{mi/gal}) = \text{gal}$, then $\text{gal} \times (\text{dollars per gal}) = \text{dollars}$.

\$50.05

Problem 16 Filling the pool

Volume: $30 \times 15 \times 4 = 1,800 \text{ ft}^3$. Water: $1,800 \times 7.5 = 13,500 \text{ gal}$. Time: $13,500 \div 450 = 30 \text{ h}$.

Check: $450 \times 30 = 13,500$.

30 hours

Problem 17 Hiking average speed

Distance: $2.4 + 1.8 = 4.2 \text{ mi}$. Time: $50 + 45 = 95 \text{ min} = 95/60 \text{ h}$.

Speed: $4.2 \div (95/60) = 252/95 \approx 2.65$.

Check: $2.65 \times 1.583 \approx 4.2$.

about 2.65 mi/h

Problem 18 Better juice buy

Juice A: $\$3.84 \div 64 = \$0.06 = 6 \text{ cents per fl oz}$.

Juice B: $1.5 \text{ gal} \times 128 = 192 \text{ fl oz}$. $\$10.56 \div 192 = \$0.055 = 5.5 \text{ cents per fl oz}$.

Check: $5.5 \times 192 = 1,056 \text{ cents}$.

Juice B is cheaper (5.5 cents versus 6 cents per fl oz).

Problem 19 Muffin sugar

Sugar needed: $40 \times 1.5 = 60 \text{ cups}$. Bags: $60 \div 11.25 \approx 5.33$.

Only whole bags are sold, so round up: 6 bags (5 bags give 56.25 cups, not enough).

6 bags

Problem 20 Garden soil bags

Area: $12.5 \times 8.25 = 103.125 \text{ ft}^2$. Bags: $103.125 \div 6 \approx 17.19$.

The garden needs full coverage, so round up to 18 bags (17 bags cover only 102 ft^2).

18 bags