

2.3 - Business and Scientific Problems

↳ This section is just more word problems.

Ex 1 It takes you six hours to dig a hole. Working together, you and your brother can dig a hole in 2 hours. How long does it take ~~you~~ your brother to dig the hole by himself?

X hours

your rate + bro's rate = Combined rate

$$\frac{1}{6} + \frac{1}{x} = \frac{1}{2} \quad \rightarrow \text{don't take reciprocals}$$

$$\frac{1}{x} = \frac{1}{2} - \frac{1}{6} \quad \rightarrow -\frac{1}{6}$$

$$\frac{1}{x} = \frac{3}{6} - \frac{1}{6} \quad \rightarrow CD$$

$$\frac{1}{x} = \frac{2}{6} \quad \rightarrow \text{combine like terms}$$

$$\frac{1}{x} = \frac{1}{3} \quad \rightarrow \text{simplify}$$

$$3 = x \quad \rightarrow \bullet X = 3$$

3 hours

Ex 2) A nursery has 2 types of lawn seed. Type 1 costs \$12 per pound. Type 2 costs \$20 per pound. You buy 100 pounds of a mixture of the 2 types that costs \$14 per pound. How many pounds of each type do you buy?

(2)

→ Amount spent on type 1 + amount spent on type 2 = total spent

Type 1: x pounds
Type 2: $100 - x$ pounds

$$x \cdot 12 + (100 - x) \cdot 20 = 100(14)$$

$$12x + 2000 - 20x = 1400$$

$$-8x + 2000 = 1400$$

$$-8x = -600$$

$$x = \frac{600}{8} = 75$$

→ distribute

→ combine like terms

→ -2000

→ $\div -8$

Type 1: 75 pounds

Type 2: 25 pounds

Ex 3

Two cars leave from the same place.

The first car travels 50 mph. The second car travels 60 mph but leaves 30 minutes later. How long until the second car catches up to the first car?

→ Need consistent units! 30 minutes = $\frac{1}{2}$ hour

Car 1: Speed: 50 miles/hour

time: t hours

distance: $50t$ miles

Car 2: Speed: 60 miles/hour

time: $t - \frac{1}{2}$ hours

distance: $60(t - \frac{1}{2})$ miles

$$50t = 60(t - \frac{1}{2})$$

→ distribute

$$50t = 60t - 30$$

→ $-60t$

$$-10t = -30$$

→ $\div -10$

$$t = 3$$

3 hours after 1st car leaves

2.5 hours after 2nd car leaves

How far away does this happen?

$$50 \cdot 3 = 150 \text{ miles away}$$

$$60(2.5) = 60 \cdot \frac{5}{2} = 30 \cdot 5 = 150 \text{ miles away}$$

Ex 4 How many gallons of 90% vinegar do you add to 1 gallon of 5% vinegar to get 20% vinegar?

→ x gallons

0.05 · 1 = 0.05 → gallons of vinegar in 1 gal 5% vinegar

0.9x → gallons of vinegar in x gallons of 90% vinegar

Total gallons of vinegar → 0.05 + 0.9x

Total gallons of liquid → 1 + x

$$\frac{\text{gallons vinegar}}{\text{gallons liquid}} = \% \text{ (in decimal form)}$$

$$\frac{0.05 + 0.9x}{1+x} = 0.2 \quad \rightarrow \cdot (1+x)$$

$$0.05 + 0.9x = 0.2 + 0.2x \quad \rightarrow -0.2x -0.05$$

$$.7x = 0.15$$

$$x = \frac{0.15}{0.7} = \frac{15}{70} = \frac{3}{14} \text{ gallons}$$

≈ .214 gallons of 90% vinegar