1.9 Problem Solving Day 3: Distance, Rate, Time

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Distance} = \text{Speed} \times \text{Time}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$
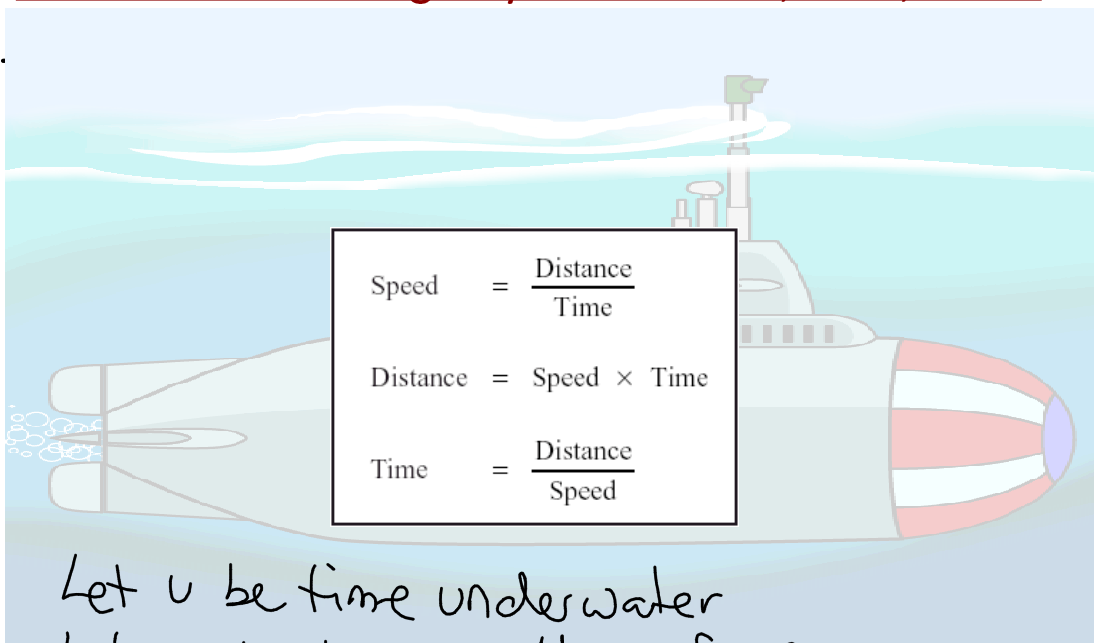
Let u be time underwater
Let s be time on the surface

① $u + s = 12.5$

② $10u + 16s = 160$

10×① $\quad 10u + 10s = 125$

② $\qquad 10u + 16s = 160$

①-② $\qquad\quad -6s = -35$

$$s = \frac{-35}{-6}$$

$$s = 5\frac{5}{6}$$

$\frac{5}{6} \times 60$

5 hrs 50 min

→ Sub $s = \frac{35}{6}$ into ①

$$u + \frac{35}{6} = 12.5$$

$$6u + 35 = 75$$

$$6u = 40$$

$$u = \frac{40}{6}$$

$$u = \frac{20}{3}$$

$$u = 6\frac{2}{3}$$

$\frac{2}{3} \times 60$

6 hrs 40 min

∴ The sub spent
5 hrs 50 min. underwater
6 hrs 40 min on the surface

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2. A helicopter pilot finds that with a tail wind a 120 km distance takes 45 minutes. The return trip, into the wind, takes one hour. Determine the rate of the helicopter in still air and the rate of the wind.

let x = rate of helicopter and y = rate of wind

① $120 = (x+y)(\frac{3}{4})$ $\frac{3}{4} hr = 45$ minutes

② $120 = (x-y)(1)$

① $120 = \frac{3}{4}x + \frac{3}{4}y$

② $120 + y = x$

Sub $x = 120+y$ into ①

$120 = \frac{3}{4}(120+y) + \frac{3}{4}y$

$480 = 3(120+y) + 3y$

$480 = 360 + 3y + 3y$

$120 = 6y$

$20 = y$

Sub $y = 20$ into ②

$120 + 20 = x$

$140 = x$

∴ The helicopter's speed was 140 km/h

& The wind was 20 km/hr

3. A plane left Montreal for Calgary, a distance of 3000 km, travelling at 550 km/h. At the same time, a plane left Calgary for Montreal travelling at 450 km/h. How long after take-off did the planes pass each other?

Let x be time for m ⟹ C
Let y be time for c ⟶ M

① $x = y$

② $3000 = 550x + 450y$

Sub ① into ②

$3000 = 550y + 450y$

$3000 = 1000y$

$3 = y$

$\hookrightarrow x = 3$

∴ They met after 3 hours

4. A freight train and a passenger train are in stations 540 km apart. The freight train leaves the station at noon travelling at 60 km/h in the direction of the passenger train. One hour later, the passenger train leaves and heads towards the freight train at 90 km/h. At what time will the two trains meet?

Let x be time for freight
Let y be time for passenger

① $\quad x = y + 1$
② $\quad 540 = 60x + 90y$

Sub ① into ②

$540 = 60(y+1) + 90y$
$540 = 60y + 60 + 90y$
$480 = 150y$
$\dfrac{480}{150} = y$
$\dfrac{16}{5} = y$

↓ 3hr 12min

Sub into ①

$x = \dfrac{16}{5} + 1$
$x = \dfrac{16}{5} + \dfrac{5}{5}$
$x = \dfrac{21}{5}$
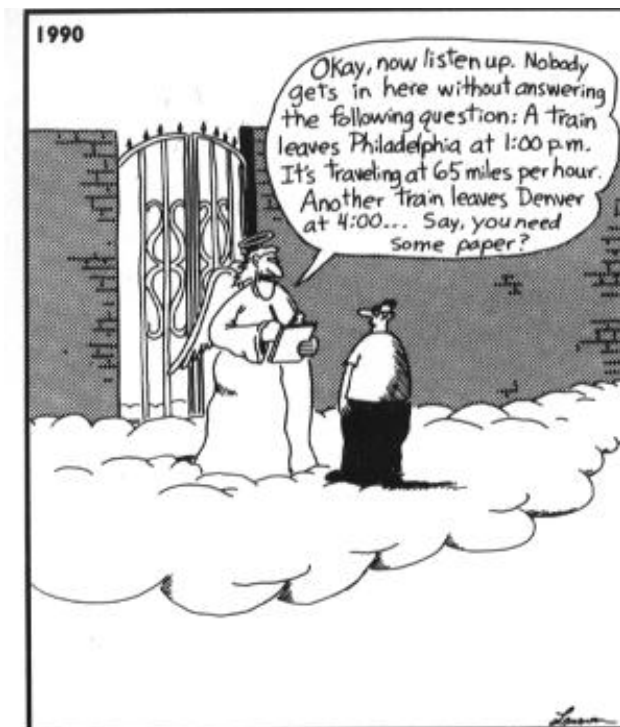
↓ 4hr 12min

∴ They met at 4:12pm

Homework

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Math phobic's nightmare