

Problem A

Note: Picture not drawn to scale

Given: • A and B start at same time
finish at same time

• 8 hours = Total time

• D = Total distance

• A travels:

- first 3 hours at 60 mph

- rest of time at 40 mph

↳ 8 hours - 3 hours = 5 hours at 40 mph

• B travels:

- first 2 hours at twice the speed it travels the rest of the time.

So if B travels at a speed, x, for the last 6 hours,

Then it travels TWICE that, or 2x, the first 2 hours.

Find: B's speed during the first 2 hours.

$$\boxed{\text{Distance} = \text{Rate} \times \text{Time}}$$

$$D = (60)(3) + (40)(5) = 180 + 200 = \underline{380 \text{ miles}}$$

distance A
travels for
first 3 hrs

distance A
travels for
next 5 hrs

Since A and B travel the same route, the distance they traveled are equal, so distance B travels is 380 miles.

$$D = 380 = \underbrace{(2x)(2)}_{\text{distance B travels for first 2 hrs}} + \underbrace{(x)(6)}_{\text{distance B travels for rest of time}} = 4x + 6x = 10x$$

Solve for x:

$$380 = 10x$$

$$x = 38$$

We want B's speed the first 2 hrs, 2x,

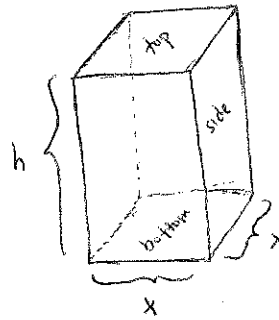
x is B's speed during the last 6 hrs, so we need to double it:

$$2x = 2(38) = \boxed{76 \text{ mph}}$$

Problem B

We have a box.

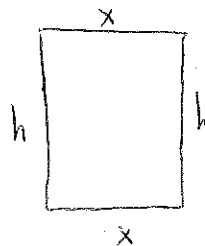
- top and bottom are squares
- sides are rectangles.
- Volume of box is 20 m^3 .



Q : Express total surface area of box in terms of length of one side of base.

The base is square so the sides are equal. Call the sides x : $x \times x$

The rectangle:



shares 2 sides with the top and bottom of the box, so those 2 sides are x length. Call the other 2 sides length h .

$$\begin{aligned} \text{The } \underline{\text{SURFACE AREA}} &= \text{sum of Area of each side of box} \\ \text{SA} &= \text{top area} + \text{bottom area} + \text{area of 4 sides} \\ &= x^2 + x^2 + 4 \times h \times x. \end{aligned}$$

$$\underline{\text{SA}} = 2x^2 + 4hx$$

Volume is the product of each dimension of the box:

$$V = h \times x \times x = hx^2$$

But we know $V = 20 \text{ m}^3$, so we have

$$\underline{20 = hx^2}$$

We want SA in terms of x , so we get rid of h .

$$20 = hx^2 \Rightarrow h = \frac{20}{x^2}$$

$$\text{SA} = 2x^2 + 4hx = 2x^2 + 4\left(\frac{20}{x^2}\right)x = 2x^2 + \frac{80}{x}$$

$$\boxed{\text{SA} = 2x^2 + \frac{80}{x}}$$