

COT 3100 Recitation #2: D = RT Quiz and Solutions
9/4-8/2020

1) Kerry drives from Orlando to Jacksonville averaging 20 miles per hour. She will return from Jacksonville to Orlando and wants her average speed on the return trip to be such that the whole trip (Orlando to Jacksonville and back) average is 30 miles per hour. What must her average speed be on the return leg of the trip to achieve her desired overall average speed?

Solution

Let D be the distance between Orlando and Jacksonville and let r be the average speed on the return trip in miles per hour. Equate two expressions of the time it takes to complete the round trip to solve for r :

$$\frac{D}{20} + \frac{D}{r} = \frac{2D}{30}$$

$$\frac{D}{r} = \frac{D}{15} - \frac{D}{20}$$

$$\frac{1}{r} = \frac{1}{15} - \frac{1}{20}$$

$$\frac{1}{r} = \frac{4}{60} - \frac{3}{60} = \frac{1}{60}$$

It follows that the desired rate of speed is **60 miles per hour**.

2) Mario is a race car driver. When driving full speed, he averages 200 miles per hour. Unfortunately, he has to take pit stops to refuel and make other adjustments. His goal is to finish a 500 mile race in three or fewer hours. If it takes him four minutes per pit stop, what is the maximum number of pit stops he can take and still accomplish his goal. Assume that his average speed when not on a pit stop is 200 miles per hour.

Solution

Mario has to spend $\frac{500}{200} = 2\frac{1}{2}$ hours driving at full speed (total distance divided by average driving speed) to finish the race. This leaves 30 minutes for pit stops. If a single pit stop takes 4 minutes, he can take up to 7 pit stops and still finish the race on time, since $4 \times 7 = 28 < 30$ and $4 \times 8 > 30$.

3) Josh and Karen live 20 miles apart and at exactly 2 pm, both decide to ride their bikes towards each other's houses so that they can meet on the path somewhere in between. Josh rides at an average speed of 15 miles per hour and Karen rides at an average speed of 10 miles per hour. If Josh takes a 10 minute break after he starts to look at some birds while Karen rides the whole time, how many miles from Karen's house will they meet? (Note: Question 4 uses the same premise as this question but asks a different question about the scenario, so save your work from question 3 to answer question 4.)

Solution

Let t be the time in hours that Karen rides till they meet. It follows that Josh will ride for $t - \frac{1}{6}$ hours since he stops for a sixth of an hour (10 minutes). Since we know how fast both bike, we can set up an equation for the total distance biked, adding up the distance Josh bikes to the distance Karen bikes to get a total of 20 miles:

$$\begin{aligned}15\left(t - \frac{1}{6}\right) + 10t &= 20 \\15t - \frac{5}{2} + 10t &= 20 \\25t &= \frac{45}{2} \\t &= \frac{9}{10}\end{aligned}$$

It follows that Karen bikes for $\frac{9}{10}$ of an hour. In that time, she will travel $10 * (\frac{9}{10}) = \underline{\mathbf{9 \text{ miles.}}}$

4) Josh and Karen live 20 miles apart and at exactly 2 pm, both decide to ride their bikes towards each other's houses so that they can meet on the path somewhere in between. Josh rides at an average speed of 15 miles per hour and Karen rides at an average speed of 10 miles per hour. If Josh takes a 10 minute break after he starts to look at some birds while Karen rides the whole time, at what time will they meet?

Solution

Since they started at 2 pm and biked for $\frac{9}{10}$ th of an hour, they biked for $\frac{9}{10} \times 60 = 54$ minutes. It follows that they'll meet at **2:54 pm.**

5) One day Cheyenne kayaked on a river downstream from her house to a picnic point and back to her house (upstream) when the river was flowing at 1 mile per hour. On a different day, the river was flowing at 5 miles per hour and her round trip took twice as much time as the previous trip. On both trips Cheyenne rowed at the same constant rate of speed. What fast, in miles per hour, does she row in still water?

Solution

Let r be Cheyenne's rate of rowing in still water and let D be the distance from her house to the picnic point. The amount of time she takes the first time she takes the round trip is:

$$\frac{D}{r+1} + \frac{D}{r-1}$$

The second time she took the following amount of time:

$$\frac{D}{r+5} + \frac{D}{r-5}$$

But we know that the second expression is twice the first, so we can set up the following equation:

$$2D \left(\frac{1}{r+1} - \frac{1}{r-1} \right) = D \left(\frac{1}{r+5} + \frac{1}{r-5} \right)$$

$$\frac{2(r+1+r-1)}{(r+1)(r-1)} = \frac{(r+5+r-5)}{(r+5)(r-5)}$$

$$\frac{2(2r)}{(r+1)(r-1)} = \frac{(2r)}{(r+5)(r-5)}$$

$$2(r+5)(r-5) = (r+1)(r-1)$$

$$2r^2 - 50 = r^2 - 1$$

$$r^2 = 49$$

Since $r > 0$, it follows that $r = 7$. Thus, Cheyenne's rate of rowing in still water is **7 miles per hour**.