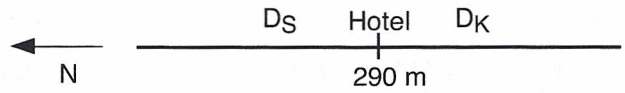
Lesson 19 More Motion Problems

Once again the key is how you draw the problem. After the sketch is made, isolating the variable by substituting other information is critical to solving the equation. Here are four examples with an accompanying discussion.

Example 1 Two saleswomen left the hotel at the same time traveling in opposite directions. Sue headed north at 60 mph, while Kelly headed south at 56 mph. If they left at 7:22 AM, what time will it be when they are 290 miles apart?

Step 1: Identify Unknowns. $D_S = R_S T_S$ $D_K = R_K T_K$ S for Sue & K for Kelly

Step 2: Draw a picture.



The distance adds up to 290 m. $D_S + D_K = 290$

Substitute RT for D in both equations. $R_S T_S + R_K T_K = 290$

Step 3: Figure out what we know, then substitute.

$T_S = T_K$ so we can use T since the time is the same.

Sue's rate is 60 mph. Kelly's rate is 56 mph. $(60)(T) + (56)(T) = 290$

$116\ T = 290$

Step 4: Solve for the missing info. $T = 2.5$ h

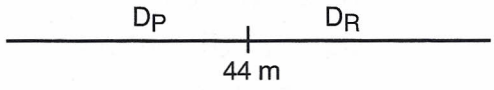
The time is 7:22 + 2:30 = 9:52

Step 5: Check the solution. $(60)(2.5) + (56)(2.5) = 290$ It works!

Example 2 On the fundraising bike hike Heidi rode until she was tired, then pushed the bike the rest of the way. She pushed her bike at 4 mph and rode it at 9 mph. She finished the 44 mile trek in 6 hours. How long did she push, and how long did she ride?

Step 1: Identify Unknowns. $D_P = R_P T_P$ $D_R = R_R T_R$ P for push & R for ride

Step 2: Draw a picture.



The distance adds up to 44 m. $D_P + D_R = 44$

Substitute RT for D in both equations. $R_P T_P + R_R T_R = 44$

Step 3: Figure out what we know, then substitute.

Pushing rate is 4 mph. Riding rate is 9 mph. $(4)(T_P) + (9)(6 - T_P) = 44$

$4T + 54 - 9T = 44$

$T_P + T_R = 6,\ T_R = 6 - T_P$

$T_P = 2$ h

Step 4: Solve for the missing info. Time pushing is 2, so time riding is 4.

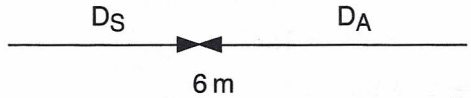
Step 5: Check the solution. $(4)(2) + (9)(4) = 44$

Example 3 Samuel was at the park 6 miles away. Ada knew he would be leaving at 1:30PM ,so she harnessed the horse and left in the buggy at the same time. He walks 5 mph and the buggy travels at 10 mph. How soon till they meet?

S for Samuel & A for Ada

Step 1: Identify Unknowns. $D_S = R_S T_S$ $D_A = R_A T_A$

Step 2: Draw a picture.



The distance adds up to 6 m. $D_S + D_A = 6$

Substitute RT for D in both equations. $R_S T_S + R_A T_A = 6$

Step 3: Figure out what we know, then substitute.

Samuel's rate is 5 mph.
Ada's rate is 10 mph.
The Time is the same. So $T_S = T_A$

$(5)(T) + (10)(T) = 6$
$15T = 6$
$T = 2/5 h$

Step 4: Solve for the missing info.

2/5 of an hour is 2/5 of 60 = 24 minutes, plus 1:30 PM = 1:54 PM

Step 5: Check the solution. $(5)(2/5) + (10)(2/5) = 6$

Practice Problems

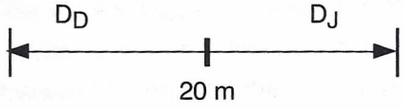
1) The CB radio had a range of 20 miles. David walked west at a rate of 4 mph and Jonathan left at the same time, jogging at a rate of 8 mph towards the east. How long did it take them to reach the maximum range of their radios?

2) The lake was 3,000 yards wide. Glenda and Jessica were on opposite shores and decided to swim toward each other. Glenda swims at a rate of 120 yards per minute, while Jessica strokes along at 80 yards per minute, so Jessica was given a 5 minute head start. When did they meet?

3) While rafting down a 19.5 mile stretch of the Youghigheny River, we went through the rapids at 5 mph, then paddled in the slower current at 3 mph. We spent twice as much time in the rapids as in the slower current. How long were we in each?

Solutions

1) $D_D = R_D T_D$ $D_J = R_J T_J$

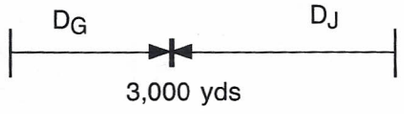


D for David & J for Jonathan

David's rate is 4 mph.
Jonathan's rate is 8 mph.
The Time is the same. So $T_D = T_J$

$D_D + D_J = 20$
$R_D T_D + R_J T_J = 20$
$(4)(T) + (8)(T) = 20$
$12T = 20$
$T = 1\ 2/3$ hr.

2) $D_G = R_G T_G$ $D_J = R_J T_J$

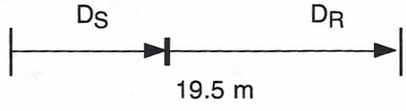


G for Glenda & J for Jessica

Glenda's rate is 120 ypm.
Jessica's rate is 80 ypm.
$T_J = T_G + 5$ since Jessica is 5 minutes more than Glenda.

$D_G + D_J = 20$
$R_G T_G + R_J T_J = 20$
$(120)(T_G) + (80)(T_G + 5) = 3{,}000$
$200T + 400 = 3{,}000$
T = 13 minutes for Glenda and 18 minutes for Jessica.

3) $D_S = R_S T_S$ $D_R = R_R T_R$



R for Rapids & S for Slower

Rapids'rate is 5 mph.
Slower current's rate is 10 mph.
Time in rapids = 2 x time in slow, So $T_R = 2T_S$

$D_S + D_R = 19.5$
$R_S T_S + R_R T_R = 19.5$
$(3)(T_S) + (5)(2T_S) = 19.5$
$13T = 19.5$
T = 1 1/2 hr. in slower and 3 hr. in rapids.