CH 30 – MOTION PROBLEMS, PART II

❑ Introduction

This chapter is simply a collection of more motion problems. They should be worked just like the ones in the previous chapter.

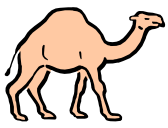
Homework

1. A jet ski leaves the beach. Nine hours later a motorboat begins to pursue the jet ski and finally catches up with it. If d_1 is the distance the jet ski travels, and if d_2 is the distance the motorboat travels, write an appropriate equation.

2. Mutt and Jeff leave the mall at the same time and head in the same direction. Jeff's speed is 9 mph more than 6 times Mutt's speed. Four hours later Jeff is 1036 miles ahead of Mutt. If d_1 is the distance Mutt traveled, and if d_2 is the distance Jeff traveled, write an appropriate equation.

❑ Pursuit

EXAMPLE 1: **A camel leaves the oasis traveling 5 mph. Eight hours later a horse begins to pursue the camel at a speed of 45 mph. How many hours after the horse leaves the oasis will it catch up with the camel?**



Solution: This problem gives us the rates of both animals, so those aren't an issue. In fact, the question is asking for the travel time of the horse. In addition, we don't know the travel time of the camel, either. So how about we let

c = the travel *time* of the camel, and

h = the travel *time* of the horse

These variables will go into the Time column of our table. And since the rates (speeds) of the animals are given, we'll simply place them in the Rate column. As in the previous example, the Distance is found by multiplying the Rate by the Time. Here's the table will all the known and unknown information in it:

	Rate	× **Time**	= **Distance**
camel	5	c	$5c$
horse	45	h	$45h$

Again, two variables will require two equations. We'll start with the Time column. Notice that the horse left after the camel (by 8 hours). This implies that the horse's travel time was 8 hours less than the camel's. This observation (which is not very obvious) leads to the first equation:

$h = c - 8$ [Equation 1]

To determine the second equation, we have to visualize where the animals are going. They start in the same place, leave one after the other, and then go in the same direction and end up in the same place. Thus, each of them went the same distance even though the camel left before the horse. This fact means that we can set the two distances in the table equal to each other:

$5c = 45h$ [Equation 2]

Substituting Equation 1 into Equation 2:

$5c = 45(\boldsymbol{c - 8})$ (since $h = c - 8$)

$\Rightarrow \quad 5c = 45c - 360$ (distribute)

$\Rightarrow \quad -40c = -360$ (subtract $45c$ from each side)

$\Rightarrow \quad c = 9$ (divide each side by -40)

This tells us that the camel traveled for 9 hours. But the question asked for the horse's travel time, so we use Equation 1 to find h:

$$h = c - 8 = 9 - 8 = 1$$

We conclude that

> It takes the horse 1 hour to catch up with the camel.

Homework

3. A camel leaves the oasis traveling 10 mph. Five hours later a dune buggy begins to pursue the camel at a speed of 15 mph. How many hours after the dune buggy leaves the oasis will it catch up with the camel?

4. A sailboat leaves the island traveling 14 mph. Five hours later a hydrofoil begins to pursue the sailboat at a speed of 24 mph. How many hours after the hydrofoil leaves the island will it catch up with the sailboat?

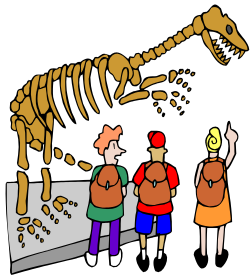
5. A robber leaves the bank traveling 15 mph. Four hours later a sheriff begins to pursue the robber at a speed of 35 mph. How many hours after the sheriff leaves the bank will he catch up with the robber?

6. A rowboat leaves the harbor traveling 26 mph. Seven hours later a speedboat begins to pursue the rowboat at a speed of 39 mph. How many hours after the speedboat leaves the harbor will it catch up with the rowboat?

7. A robber leaves the bank traveling 26 mph. Three hours later a sheriff begins to pursue the robber at a speed of 39 mph. How many hours after the sheriff leaves the bank will she catch up with the robber?

❑ Same Direction

EXAMPLE 2: **Six hours after Mary and Moe leave the museum at the same time and head in the same direction, Moe is 252 miles ahead of Mary. If Moe's speed is 8 mph less than 3 times Mary's speed, find the speeds of Mary and Moe.**



Solution: Mary and Moe left the museum at the same time and each traveled for 6 hours, so both times in the table must be 6. Since the rates are unknown, we let x represent Mary's speed and let y represent Moe's speed.

	Rate ×	Time =	Distance
Mary	x	6	$6x$
Moe	y	6	$6y$

First we need an equation relating x and y. The phrase "Moe's speed is 8 mph less than 3 times Mary's speed" translates to

$$y = 3x - 8 \qquad \text{[First equation]}$$

Now, according to the table, Mary traveled $6x$ miles, while Moe traveled $6y$ miles. The problem says that at the end of the 6 hours, Moe is 252 miles ahead of Mary. This means that Moe's distance ($6y$) is 252 miles more than Mary's distance ($6x$), which translates to our second equation:

$$6y = 6x + 252 \qquad \text{[Second equation]}$$

Substituting the first equation into the second equation gives us

$$6(3x - 8) = 6x + 252$$

$$\Rightarrow \quad 18x - 48 = 6x + 252 \qquad \text{(distribute)}$$

$\Rightarrow \quad 12x = 300$ (subtract $6x$ and add 48)

$\Rightarrow \quad \underline{x = 25}$ (divide by 12)

which implies that Moe's rate is $y = 3x - 8 = 3(\mathbf{25}) - 8 = 67$.

Mary's speed was 25 mph and Moe's speed was 67 mph.

Homework

8. Moe and Curly leave the airport at the same time and head in the same direction. Curly's speed is 8 mph less than 3 times Moe's speed. Five hours later Curly is 430 miles ahead of Moe. Find the speeds of Moe and Curly.

9. Sally and Maria leave the mall at the same time and head in the same direction. Maria's speed is 6 mph less than 2 times Sally's speed. Ten hours later Maria is 410 miles ahead of Sally. Find the speeds of Sally and Maria.

10. Lucy and Ethyl leave the mall at the same time and head in the same direction. Ethyl's speed is 4 mph more than 4 times Lucy's speed. Four hours later Ethyl is 604 miles ahead of Lucy. Find the speeds of Lucy and Ethyl.

11. George and Gracie leave the stadium at the same time and head in the same direction. Gracie's speed is 3 mph less than 4 times George's speed. Eight hours later Gracie is 1080 miles ahead of George. Find the speeds of George and Gracie.

12. Mutt and Jeff leave the stadium at the same time and head in the same direction. Jeff's speed is 8 mph less than 3 times Mutt's speed. Ten hours later Jeff is 660 miles ahead of Mutt. Find the speeds of Mutt and Jeff.

Solutions

1. $d_1 = d_2$

2. $d_1 + 1036 = d_2$ OR $d_2 - d_1 = 1036$ OR $d_2 - 1036 = d_1$

3. 10 hours **4**. 7 hours **5**. 3 hours **6**. 14 hours

7. 6 hours **8**. 47 mph & 133 mph

9. 47 mph & 88 mph **10**. 49 mph & 200 mph

11. 46 mph & 181 mph **12**. 37 mph & 103 mph

"Nothing in this world can take the place of persistence.

Talent can not; nothing is more common than unsuccessful men with talent.

Genius can not; unrewarded genius is almost a proverb.

Education can not: the world is full of educated derelicts.

Persistence and determination alone are omnipotent."

Calvin Coolidge