MOTION PROBLEMS – PURSUIT

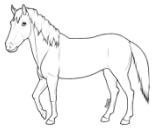
❑ *INTRODUCTION*

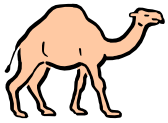
Homework

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.

❑ *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:

$$h = c - 8 \qquad \text{[Equation 1]}$$

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:

$$5c = 45h \qquad \text{[Equation 2]}$$

Substituting Equation 1 into Equation 2:

$$5c = 45(\mathbf{c - 8}) \qquad \text{(since } h = c - 8\text{)}$$

$$\Rightarrow \quad 5c = 45c - 360 \qquad \text{(distribute)}$$

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

$$\Rightarrow \quad c = 9 \qquad \text{(divide each side by } -40\text{)}$$

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

2. 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?

3. 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?

4. 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?

5. 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?

6. 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?

Solutions

1. $d_1 = d_2$

2. 10 hours

3. 7 hours

4. 3 hours

5. 14 hours

6. 6 hours

"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, 30th President of the U.S.