

## Sue and Oscar and the Ducks

Imagine that your two friends Sue and Oscar are in separate stationary boats on a still pond. They are a distance of 108 meters apart. Sue has a lot of toy ducks in her boat and releases them into the water at a rate of one duck every 27<sup>th</sup> of a minute, that is, 27 ducks/minute. Once they are released, the ducks swim toward Oscar's boat at a rate of 54 m/minute. He picks them out of the water.

### A. Draw a sketch of each situation below and then answer the question.

1. How long before the first duck reaches Oscar's boat? \_\_\_\_\_
2. After the ducks begin to reach him, how many ducks does Oscar pick out of the water in one minute? \_\_\_\_\_
3. If Oscar's boat moves toward Sue's boat at a speed of 18 m/minute, then how many ducks does he pick up in one minute? \_\_\_\_\_
4. If Oscar's boat moves away from Sue's boat at 18 m/minute, then how then how many ducks does he pick up in one minute? \_\_\_\_\_
5. Suppose that Oscar's boat is stationary again. Now Sue's boat moves toward Oscar's boat at a speed of 27 m/minute. How many ducks does Oscar pick out of the water in a minute? \_\_\_\_\_
6. If Sue's boat moved away from Oscar's boat at 27 m/minute, then how many ducks does he pick up in one minute? \_\_\_\_\_
7. Now let's get very complicated! Suppose that both boats are moving.  
Oscar's boat is moving toward Sue's at a speed of 18 m/minute, AND Sue's boat is moving toward his at a speed of 27 m/minute, how many ducks does he pick up in one minute? \_\_\_\_\_
8. Oscar's boat is moving away from Sue's at a speed of 18 m/minute, AND Sue's boat is moving toward his at a speed of 27 m/minute, how many ducks does he pick up in one minute? \_\_\_\_\_
9. Oscar's boat is moving toward Sue's at a speed of 18 m/minute, AND Sue's boat is moving away from his at a speed of 27 m/minute, how many ducks does he pick up in one minute? \_\_\_\_\_
10. Oscar's boat is moving away from Sue's at a speed of 18 m/minute, AND Sue's boat is moving away from his at a speed of 27 m/minute, how many ducks does he pick up in one minute? \_\_\_\_\_

**B. Mathematical model making:**

1. Suppose that in questions 3 and 4 above, Oscar's boat was moving toward or away from Sue's boat at a speed of only 6 m/minute. Then how many ducks would he pull out of the water? \_\_\_\_\_, \_\_\_\_\_. How about if he was going 9 m/minute? \_\_\_\_\_, \_\_\_\_\_.

Now we can take these data and make a table. The frequency of the ducks is 27/minute, and the velocity of the ducks is 54 m/minute.

Vel Oscar	Freq ducks, Oscar
0	
18	
-18	
6	
-6	
9	
-9	

Now we can make a mathematical model

$$\text{Freq ducks Oscar} = \text{freq ducks} * \text{function}(\text{vel ducks}, \text{vel Oscar})$$

What is this function?

2. This mathematical model is called the \_\_\_\_\_
3. Let's check it with your values from the questions above.

Vel Oscar	Vel Sue	Freq ducks, Oscar	Freq model equation
0	0		
18	0		
-18	0		
6	0		
-6	0		
9	0		
-9	0		
0	27		
0	-27		
18	27		
-18	27		
18	-27		
-18	-27		