Warm Up

For Exercises 8 and 9, use the table of values to determine the exponential decay equation. Then, find the decay factor and the decay rate.

8.

x	y	
0	24	·0.25
1	6	·0.25
2	1.5	·0.25
3	0.375	·0.25
4	0.09375	

$y = 24 \cdot 0.25^x$

$df = 0.25$

$dr = 75\%$

9.

x	y	
0	128	0.75
1	96	0.75
2	72	0.75
3	54	

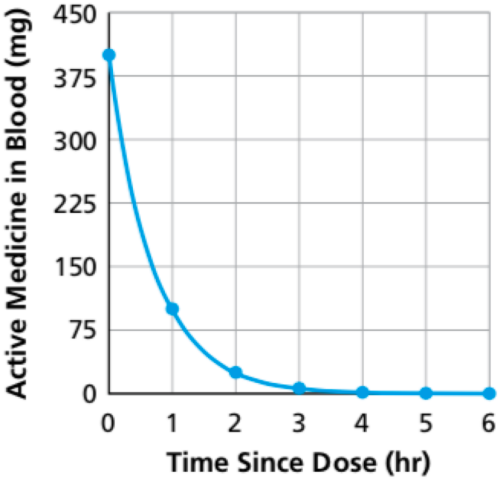
$y = 128(0.75)^x$

$df = 0.75$

$dr = 25\%$

Problem 4.2 Recap

Part A

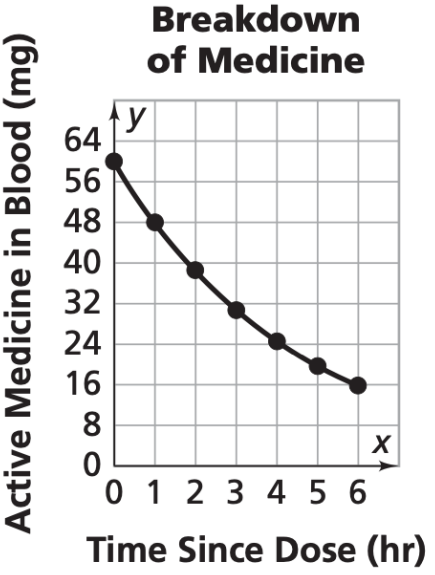


$$m = 400\left(\frac{1}{4}\right)^h$$

Factor = 0.25

Rate = 75% ↓

Part B



$$m = 60(0.8)^h$$

Factor = 0.8

Rate = 20% ↓

Problem 4.3

Done for you!

A **1.** Complete the table with data from your experiment.

Hot Water Cooling

Time (min)	Water Temperature	Room Temperature
0	■	■
5	■	■
10	■	■
■	■	■

# of minutes

Time (min)	Water Temp. (°C)	Room Temp. (°C
0	89	27
5	71	27
10	59	27
15	52	27
20	47	27
25	43	27
30	40	27
35	37	27
40	35	27
45	33	27
50	32	27
55	31	27
60	30	27

0 1 2 3 4 5 6 7 8 9 10 11 12

Start here

Make a graph of your (*time, water temperature*) data.

2. Describe the pattern of change in the data. When did the water temperature change most rapidly? When did it change most slowly?

3. Is the relationship between time and water temperature an exponential decay relationship? Explain.

B 1. Add a column to your table. In this column, record the difference between the water temperature and the air temperature for each time value.

Start here

2. Make a graph of the (*time, temperature difference*) data. Compare this graph with the graph you made in Question A.

3. Describe the pattern of change in the data. When did the temperature difference change most rapidly? Most slowly?

4. Estimate the decay factor for the relationship between temperature difference and time in this experiment.

5. Write an equation for the (*time, temperature difference*) data. Your equation should allow you to predict the temperature difference at the end of any 5-minute interval.

Time (min)	Water Temp. (°C)	Room Temp. (°C)
0	89	27
5	71	27
10	59	27
15	52	27
20	47	27
25	43	27
30	40	27
35	37	27
40	35	27
45	33	27
50	32	27
55	31	27
60	30	27

Δ

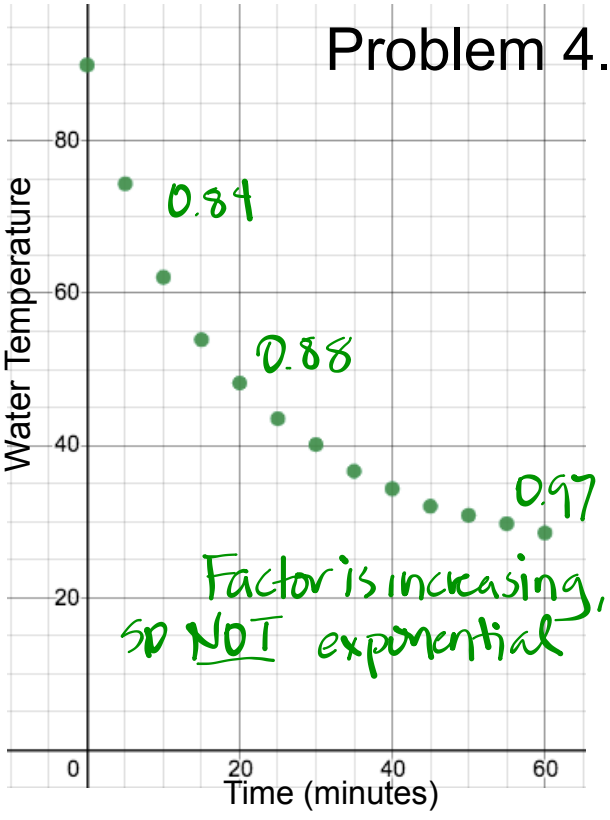
62

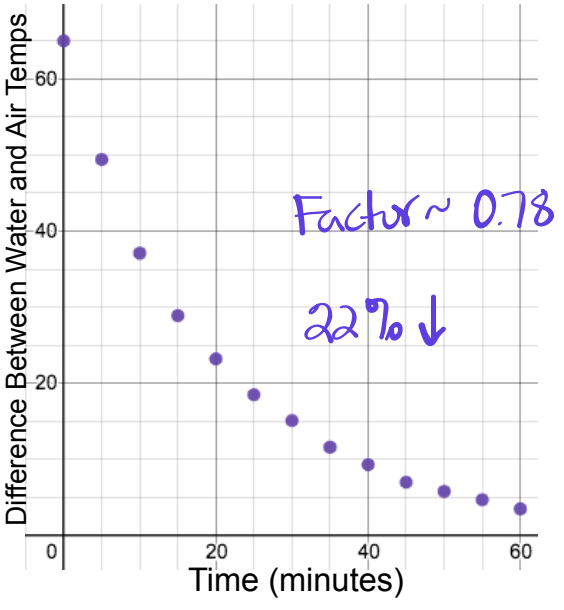
C

1. What do you think the graph of the (*time, temperature difference*) data would look like if you had continued the experiment for several more hours?
2. What factors might affect the rate at which a cup of hot liquid cools?
3. What factors might introduce errors in the data you collect?

D Compare the graphs in Questions A and B with the graphs in Problems 4.1 and 4.2. What similarities and differences do you observe?

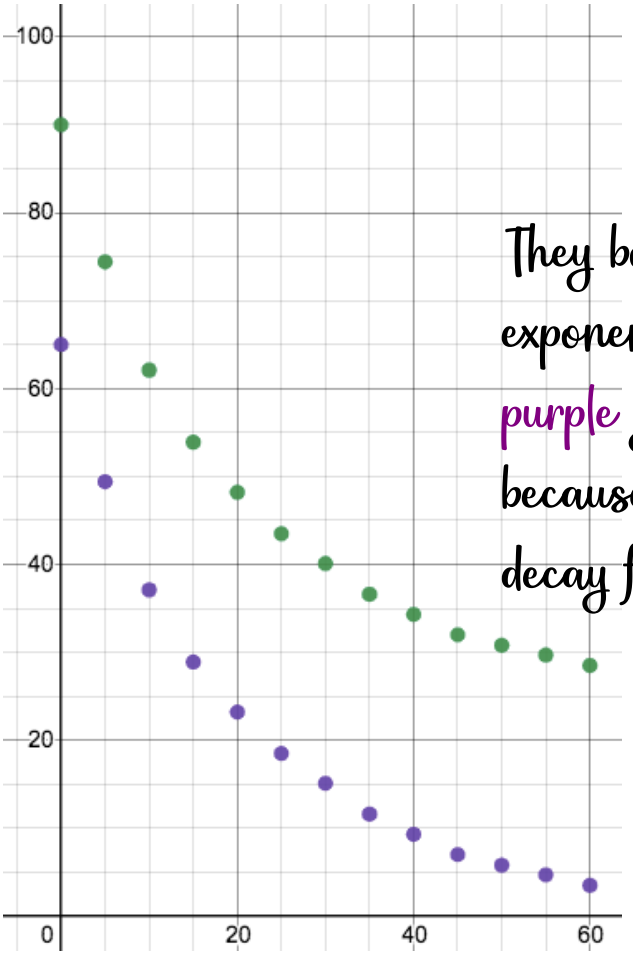
Problem 4.3 Recap





Big Take Away:

Curved doesn't always mean exponential!



They both look like they are exponential, but only the purple graph is exponential because it has a constant decay factor.