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Section 7.5 Modelling Exponential Growth and Decay

1. Truong studied a pond where frogs lay eggs. He found the number of tadpoles increased by a factor of 2.43 per day. The number of tadpoles, T, can be modelled by the relation $T = 265(2.43)^t$, where t is the time in days.

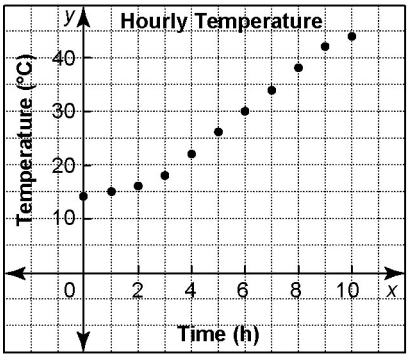
a) Use a graphing calculator. Graph the relation.

b) How many tadpoles were present at the start of Truong's study?

c) How many tadpoles were present after two days?

d) How many tadpoles were present after one week?

2. The graph shows the temperature in a small South African village each hour for 10 h.



a) After how long did the temperature increase to 20°C?

b) After how long did the temperature increase to 30°C?

c) Is it reasonable to expect that the temperature will continue to increase? Explain.

3. Late in the summer, the population of black flies starts to decrease by 4% per day. The population, P, can be modelled by the relation $P = 6720(0.96)^t$, where t is the time in days.

a) Use a graphing calculator. Graph the relation.

b) What is the initial population of black flies?

c) What would be the population at the end of each of the first and second weeks?

d) Approximately how long will it take for the population to be reduced by 50%?

4. For every 5°C increase in temperature, the length of a metal bar increases by 6%. The length of the bar is 2.50 m at 10°C.

a) Make a table of values for this relation. Use increments of 5°C.

b) Use a graphing calculator to make a scatter plot of the data.

c) Find the equation of the exponential curve of best fit.

d) Use the equation to find the temperature at which the bar would be 4.00 m long.

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5. The table shows the amount remaining from a 500 mg sample of radioactive material over time.

Time (days)	Mass (mg)
0	500
1	243
2	108
3	63
4	28
5	19

a) Use a graphing calculator. Plot the data and find the equation of the exponential curve of best fit.
b) Use the equation to find the mass remaining after 14 days.
c) When will there be 0.001 mg remaining?

6. The table shows the world population in billions. The year 1750 is set as $t = 0$.

Year	t	Population (billions)
1750	0	0.79
1800	50	0.98
1850	100	1.26
1900	150	1.65
1950	200	2.52
2000	250	6.06

a) Make a scatter plot of the data. Find the equation of the exponential curve of best.
b) Use the equation to estimate the population in 2050.
c) When will the world population reach 7 billion?

7. The initial population of a bacterial culture is 2000 and the population grows at a fixed rate. The table shows the population every hour for 6 h.

Time (h)	Population
0	2000
1	2270
2	2614
3	2980
4	3392
5	3914
6	4456

a) Use a graphing calculator. Find the equation of the exponential curve of best fit.
b) Use the equation to find the population of bacteria after 12 h and after 24 h.
c) How long will it take for the population to reach 20 000?

8. The populations, P, of the twin cities New Oldtown (NO) and Old Newtown (ON) can be modelled by the relations $P_{NO} = 225\ 150(1.032)^t$ and $P_{ON} = 274\ 500(1.026)^t$, where t is time in years since 2007.
a) Use technology to determine the year in which the populations of the two cities will be equal.
b) What is this population?