7 Review

7.1 Exponent Rules, pages 356–364

1. Write as a single power, then evaluate.

a) $6^2 \times 6^3$ **b)** $(-2)^2 \times (-2)^4$

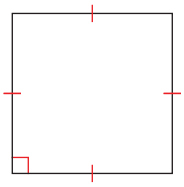
c) $\frac{5^{10}}{5^7}$ **d)** $\left(\frac{1}{3}\right)^3 \times \left(\frac{1}{3}\right)^3$

e) $(10^4)^2$ **f)** $[(-7)^2]^2$

g) $\frac{3^8}{3^5}$ **h)** $\left(-\frac{1}{2}\right)^2 \times \left(-\frac{1}{2}\right)^3$

2. Calculate the area of the square.

$A = s^2$



$\frac{3}{8}$ in.

7.2 Zero and Negative Exponents, pages 365–371

3. Evaluate. Express your answers as whole numbers or fractions.

a) 7^0 **b)** 5^{-1} **c)** 8^{-3}

d) $\left(\frac{1}{50}\right)^0$ **e)** $\left(\frac{2}{3}\right)^{-2}$ **f)** $4^{-2} \times 4^5$

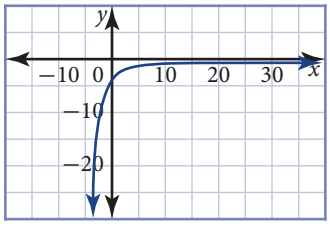
g) $\frac{7^2}{7^3}$ **h)** $[(-3)^2]^{-1}$ **i)** $\frac{1}{2^{-3}}$

j) $\frac{1}{5^{-1}}$

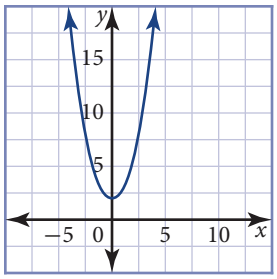
7.3 Investigate Exponential Relationships, pages 372–381

4. Which graph represents an exponential relationship? Explain.

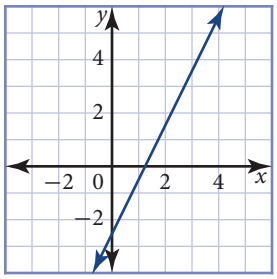
a)



b)



c)



5. A certain type of bacteria doubles every 8 h. A culture begins with 30 000 bacteria. How many bacteria are there after

a) 8 h? **b)** 16 h? **c)** 4 days?

7.4 Exponential Relations, pages 382–394

6. Compare the graphs of $y = 3^x$, $y = 3x^2$, and $y = 3x$, for values of $x = -4, -3, -2, -1, 0, 1, 2, 3, 4$. How are they similar? different?

7. The measure of the acidity of a solution is called its pH. In wells and swimming pools, the pH level of water needs to be checked regularly for the level of hydrogen. The relation $H = \left(\frac{1}{10}\right)^P$ gives an indication of the concentration of hydrogen ions, H, in moles per litre (mol/L), where P represents the pH.

a) Plot a graph of this relation.

b) Water with a pH of less than 7.0 is acidic. What is the hydrogen concentration for a pH of 7.0?

c) Water in a swimming pool needs to be kept at a pH between 7.0 and 7.6. What is the equivalent range of hydrogen concentration?

d) Rain water has a pH of 5.6. Due to sulphur pollution, acid rain has a pH of less than 5.0. Compare the concentrations of hydrogen in rain and acid rain.

7.5 Modelling Exponential Growth and Decay, pages 395–405

8. A town's raccoon population is growing exponentially. The expected population can be estimated using the relation $P = 1250(1.013)^n$, where P is the population and n is the number of years.

a) Use technology to plot a graph of this relation.

b) What is the current raccoon population?

c) What is the expected population in 5 years?

9. The amplitude of a pendulum over a 60-s period is shown in the table.

Time (s)	0	10	20	30	40	50	60
Amplitude (cm)	80.0	40.0	20.0	10.0	5.0	2.5	1.25

a) Use technology to make a scatter plot.

b) Do the results of this experiment demonstrate exponential growth or decay? Explain.

c) What is the rate of growth or decay, in amplitude?

d) How long would it take for the swings to become unnoticeable (less than 0.2 cm)?

7.6 Solve Problems Involving Exponential Growth and Decay, pages 406–413

10. The remaining mass of a drug in a person's bloodstream is modelled by $M = 500\left(\frac{1}{2}\right)^{\frac{t}{2}}$, where M is the remaining mass in milligrams, and t is the time, in hours, that the drug is in the bloodstream.

a) What is the half-life of the drug?

b) What was the dosage of the drug?

c) What will be the concentration of the drug in the bloodstream

i) after 2 h?

ii) after 6 h?

11. From 1994 to 2004, average personal incomes grew in Canada according to the relation $I = I_0(1.041)^n$, where I is the resulting income, I_0 is the initial income, and n is the number of years of growth.

a) If a person's income was \$34 000 in 1994, what would it be in 2004?

b) If a person's income was \$50 000 in 1996, what would it be in 2003?

c) What was the average yearly rate of growth from 1994 to 2004?

7 Practice Test

1. True or false?

a) Linear growth shows increases by a constant amount each time period.

b) Exponential growth shows increases by a constant factor each time period.

c) Exponential decay shows decreases by a fixed amount each time period.

d) Quadratic growth is confirmed by unequal first differences and equal second differences.

2. Evaluate. Write your answers as integers or fractions.

a) $3^3 \times 3^2$

b) $\frac{9^7}{9^5}$

c) $(2^3)^2$

d) 6^0

e) 7^{-2}

f) $\left(\frac{1}{5}\right)^{-3}$

g) $4^{12} \times 4^{-3} \times 4^{-9}$

h) $\left(\frac{1}{3}\right)^2\left(\frac{1}{3}\right)^{-1}$

3. **i)** Sketch a graph of each relation.

ii) Classify each as exponential growth, exponential decay, or neither. Justify your response.

a) $y = \left(\frac{1}{4}\right)^x$

b) $y = 6x^2$

c) $y = 5^x$

d) $y = 3(0.5)^{\frac{x}{4}}$

4. Topsoil is commonly measured in cubic yards (yd^3) and cubic feet (ft^3). A medium-sized dump truck can hold about 9 yd^3 of topsoil. A wheelbarrow can hold about 3 ft^3 of topsoil.

a) How many cubic feet are in a cubic yard? (1 yd = 3 ft) Express your answer as a power.

b) Express 9 yd^3 in cubic feet as a power with base 3.

c) A family ordered 9 yd^3 of topsoil to landscape their yard. How many trips with a wheelbarrow will they need to make in order to move all the topsoil that was delivered?

5. You have investigated graphs of exponential relations of the form $y = b^x$ for $b > 0$. Explain why graphs of this form remain above the x-axis.

6. In 1878, moose were first introduced in Newfoundland with a single bull and a single cow. Today, there are approximately 150 000 moose in Newfoundland.

a) On the same set of axes, draw a linear, a quadratic, and an exponential graph to represent growth of the moose population.

b) Which type of growth is most likely? Explain.

Chapter Problem Wrap-Up

The table shows the recommended maximum continuous exposure times to loud sounds.

Sound Intensity	Recommended Maximum Continuous Exposure Time
85 dB	8.0 h
88 dB	4.0 h
91 dB	2 h
94 dB	1.0 h
97 dB	30.0 min
100 dB	15.0 min
103 dB	7.5 min
106 dB	3.75 min
109 dB	1.875 min
112 dB	0.9375 min
115 dB	0.46875 min

a) Consider your answers to the chapter problems in the previous sections. Explain why the relationship between sound intensity and exposure time is exponential.

b) Write a paragraph describing how continued exposure to loud sounds could affect hearing loss. Use the words "exponential relation" and "continuous exposure" in your answer.

7. Atmospheric pressure depends on the altitude above sea level. Altitude is measured in kilopascals (kPa).

Altitude (km)	Atmospheric Pressure (kPa)
0	101.3
1	89.4
2	78.9
3	69.7
4	61.5
5	54.3
6	47.9
7	42.3
8	37.3
9	32.9
10	29.1

a) Use graphing technology to create a scatter plot of the data.

b) Find an equation that models the data using exponential regression.

c) What is the atmospheric pressure at sea level?

d) At how many metres above sea level will a mountain climber experience atmospheric pressure of 89 kPa?

e) What is the atmospheric pressure 4250 m above sea level?