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BLM 4–3

Chapter 4 Review

4.1 The Exponent Laws

1. Use the exponent laws to simplify. Leave your answers in exponential form.

a) $\frac{8^{12}}{8^4}$ **b)** $(4^5)^3$

c) $\frac{0.4^9}{\left(0.4^2\right)\left(0.4^3\right)}$ **d)** $(5a^2b^4)^3$

2. Simplify. Express your answers using only positive exponents.

a) $(x^7)^{-5}$ **b)** $(z^{-6})(z^2)$

c) $\left(\frac{3u}{7v^3}\right)^2$ **d)** $(-3x^{-4})(-4x^{-2})$

e) $(-5p^{-7}q)^{-3}$ **f)** $\left(\frac{2a}{3b^6}\right)^{-2}$

3. Evaluate using a calculator. Round your answers to four decimal places where necessary.

a) 3.4^{-2} **b)** 6×8.5^{-1}

c) $\sqrt[3]{5.8^4}$ **d)** -2.9^{-5}

e) $\sqrt[5]{79.4^3}$ **f)** $\sqrt[3]{(-7.1)^5}$

4. Simplify. Express your answers using only positive exponents.

a) $u^{\frac{1}{5}} \times u^{\frac{2}{5}}$ **b)** $n^{\frac{3}{4}} \times n^{-\frac{1}{2}}$

c) $h^{\frac{1}{3}} \div h^{\frac{5}{6}}$ **d)** $\left(x^{\frac{5}{2}}\right)^{-4}$

e) $\left(d^{-\frac{4}{9}}\right)^{\frac{3}{7}}$ **f)** $\frac{a^{\frac{1}{2}}b^{-\frac{2}{3}}}{ab^{\frac{1}{4}}}$

4.2 Solving Exponential Equations Graphically

5. How is the graph of $y = \left(\frac{1}{3}\right)^x$ related to the graph of $y = 3^{-x}$? Explain why.

6. a) Graph $y = \left(\frac{1}{4}\right)^x$, $y = \left(\frac{1}{2}\right)^x$, and $y = 0.7^x$ without technology.

b) Compare the three graphs. Discuss domain and range, asymptote, y-intercept, y-value when $x = 1$, and steepness or rate of decrease.

7. a) Sketch the graph of an exponential function that has the following properties:
- domain $\{x \in \mathbb{R}\}$
- range $\{y \in \mathbb{R},\ y > 0\}$
- y-intercept 2
- horizontal asymptote $y = 0$
- increasing function

b) Is it possible to sketch the graph of another exponential function with the same properties as the exponential function in part a)? Explain.

8. Use the graph of $y = 2^x$ to solve the equation $2^x = \frac{1}{4}$.

9. a) Without a calculator, estimate the value of $4^x = 50$. Justify your answer.

b) Use Technology Use a graphing calculator to graph $y = 4^x$ and $y = 50$ to solve the equation $4^x = 50$. Round your answer to one decimal place.

10. Use Technology $2000 is invested at a rate of 4% per year. The amount of money in the account is represented by the equation $A = 2000 \times 1.04^n$, where n is the number of years and A is the amount, in dollars.

a) Graph the relation using technology.

b) What does 2000 represent on the graph?

c) How much will be in the account after 5 years?

d) How long would it take to double the initial investment?

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4.3 Solving Exponential Equations Numerically

11. Solve each of the following equations by finding a common base.

a) $2^x = 16$ **b)** $(-3)^x = -27$

c) $6^{x+3} = 36^x$ **d)** $4^{x-2} = 1$

e) $25^{2-x} = 125^{2x-4}$ **f)** $8^{x+3} = 16^{2x+1}$

12. Use Technology Use systematic trial to find a solution to the following equations. Round your answers to one decimal place.

a) $5^x = 8$

b) $3^x = 40$

c) $-6^x = -100$

d) $4^{2x} = 73$

13. Solve each of the exponential equations by finding a common base. Express your answers as integers or fractions reduced to lowest terms.

a) $\left(\frac{4}{9}\right)^x = \frac{27}{8}$

b) $\left(1\frac{3}{8}\right)^{2x} = \frac{64}{121}$

c) $5^{2x+1} = \frac{1}{625}$

d) $16^{\frac{1}{3}(x+2)} = 8^{\frac{1}{4}(x-3)}$

e) $\left(\sqrt[3]{16\ 807}\right)^{x+5} = \left(\sqrt{49}\right)^{x-1}$

14. A radioactive sample with a mass of 80 mg has a half-life of 3 days.

a) Write an equation that models this exponential decay, where t is the time, in days, and A is the amount remaining, in milligrams.

b) Determine the amount of the sample remaining after 10 days. Round your answer to the nearest tenth of a milligram.

c) How long will it take for the sample to decay to 5 mg?

4.4 Points of Intersection

15. Determine the point of intersection, if it exists, for each pair of functions.

a) $y = 2^{x+3}$ and $y = 8^{x-3}$

b) $y = 27^x$ and $y = 3^{x+2}$

c) $y = 25^{x+2}$ and $y = 125^{2(x+2)}$

d) $y = 2^{x+3}$ and $y = -4^{x+1}$

16. a) Graph the exponential function $y = 3^x$ and the linear function $y = 9$ on the same set of axes.

b) Determine the point of intersection of the graphs of the two functions.

c) State the x-coordinate of the point of intersection you found in part b).

d) How could the solution be determined without graphing? Explain why.

17. The table gives Wanda's yearly earnings, in dollars, rounded to the nearest dollar, since the beginning of 2005.

Year	Earnings ($)
2005	35 000
2006	35 700
2007	36 414
2008	37 142
2009	37 885

a) Use the table to construct a model for Wanda's yearly earnings.

b) Predict Wanda's earnings in 2012.

c) Predict when she might expect to earn more than $45 000.

4.5 Logarithms

18. Write each logarithm statement in exponential form.

a) $\log_2 32 = 5$

b) $\log 0.001 = -3$

c) $\log_9 3 = \frac{1}{2}$

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19. Evaluate each of the following logarithms.
a) $\log_4 64$
b) $\log_3 243$
c) $\log_2 \frac{1}{256}$
d) $\log 1$

20. a) Explain how $y = 3^x$ can be used to evaluate $\log_3 18$.
b) Use Technology Use a graphing calculator to evaluate $\log_3 18$, rounded to one decimal place.

4.6 Solving Problems Using Logarithms

21. Evaluate each of the following to three decimal places.
a) $\log_6 37$ **b)** $\log_{12} 25$

22. Solve each of the following for t to two decimal places.
a) $7^t = 65$ **b)** $1000 = 250(1.03)^t$

23. An investment of $2500 earns 3.75% per year, compounded semi-annually.
a) Write an equation to model the amount, A, in dollars, after t years.
b) How long will it take for the investment to double in value? Express your answer to the nearest tenth of a year.

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