

6.4 Practice A

In Exercises 1–3, identify the initial amount a and the rate of growth r (as a percent) of the exponential function. Evaluate the function when $t = 5$. Round your answer to the nearest tenth.

1. $y = 50(1 + 0.25)^t$

$a = 50$

$r = 25\%$

$y = 152.59$

2. $y = 172(1 + 0.3)^t$

$a = 172$

$r = 30\%$

$y = 638.62$

3. $y = 1000(1.75)^t$

$a = 1000$

$r = 75\%$

$y = 16,413.09$

In Exercises 4 and 5, write a function that represents the situation.

4. Profits of \$100,000 increase by 15% each year.

$$y = 100,000(1.15)^t$$

5. College enrollment of 41,000 increases by 7% every year.

$$y = 41,000(1.07)^t$$

6. The number of food trucks in a city has been increasing by 50% annually. There were two food trucks in the year 2010.

- a. Write an exponential growth function that represents the number of food trucks
- t
- years after 2010.

$$y = 2(1.5)^t$$

- b. How many food trucks will there be in the year 2030? Does this sound reasonable? Explain.

$$y = 2(1.5)^{20} = 6,650.51$$

In Exercises 7–9, identify the initial amount a and the rate of decay r (as a percent) of the exponential function. Evaluate the function when $t = 3$. Round your answer to the nearest tenth.

7. $y = 12(1 - 0.35)^t$

$a = 12$

$r = 35\%$

$y = 3.30$

8. $y = 360(1 - 0.9)^t$

$a = 360$

$r = 90\%$

$y = .36$

9. $h(t) = 550(0.4)^t$

$a = 550$

$r = 1 - 0.4 = .4 = 60\%$

$y = 35.2$

In Exercises 10 and 11, write a function that represents the situation.

10. A school population of 1200 decreases by 6% each year.

$$y = 1200(1 - .06)^t$$

11. A stock valued at \$49.50 decreases in value by 7% each year.

$$y = 49.50(1 - .07)^t$$

In Exercises 12 and 13, determine whether the table represents an exponential growth function, an exponential decay function, or neither. Explain.

12.

x	0	1	2	3
y	4	12	36	108

x3 x3 x3

exp. Growth

13.

x	0	1	2	3
y	200	100	50	25

y2 y2 y2

exp decay

In Exercises 14–16, determine whether the function represents exponential growth or exponential decay. Identify the percent rate of change.

14. $y = 3(0.4)^t$

Decay
60%

15. $y = 18(1.3)^t$

Growth
30%

16. $y = 41(1.07)^t$

Growth
7%

6.5

Practice A

In Exercises 1–9, solve the equation. Check your solution.

1. $3^{4x} = 3^{12}$

$$4x = 12$$

$$x = 3$$

2. $2^{x+3} = 2^5$

$$x+3 = 5$$

$$x = 2$$

3. $5^{3x} = 5^{2x-7}$

$$3x = 2x - 7$$

$$x = -7$$

4. $3^x = 27$

$$x = 3$$

5. $5^x = 625$

$$x = 4$$

6. $11^{x-4} = 121^x$

$$x-4 = 2x$$

$$x = -4$$

7. $\left(\frac{1}{3}\right)^x = 81$

$$3^{-x} = 3^4$$

$$x = -4$$

8. $\frac{1}{125} = 5^{2x+7}$

$$5^{-3} = 5^{2x+7}$$

$$-3 = 2x+7$$

$$x = -5$$

9. $7^{5-4x} = \frac{1}{343}$

$$5-4x = -3$$

$$-4x = -8$$

$$x = 2$$

10. Describe and correct the error in solving the exponential equation.

X

$$\left(\frac{1}{6}\right)^{3x-1} = 36^{x-7}$$

$$(6^{-1})^{3x-1} = (6^{-2})^{x-7}$$

$$-3x+1 = -2x+14$$

$$x = -13$$

$$(6^{-1})^{3x-1} = 6^{2(x-7)}$$

$$-3x+1 = 2x-14$$

$$15 = 5x$$

$$x = 3$$

In Exercises 17–19, solve the equation using the Property of Equality for Exponential Equations.

17. $40 \cdot 5^{x-2} = 200$

$$5^{x-2} = 5^1$$

$$x-2 = 1$$

$$x = 3$$

18. $8 \cdot 2^{x+6} = 32$

$$2^{x+6} = 4$$

$$2^{x+6} = 2^2$$

$$x+6 = 2$$

$$x = -4$$

19. $3(4^{-3x-1}) = 48$

$$4^{-3x-1} = 16$$

$$4^{-3x-1} = 4^2$$

$$-3x-1 = 2$$

$$-3x = 3 \quad x = -1$$

20. A bacterial culture triples in size every hour. You begin observing the number of bacteria 2 hours after the culture is prepared. The amount y of bacteria x hours after the culture is prepared is represented by $y = 162(3^{x-2})$. When will there be 8100 bacteria?

$$8100 = 162(3^{x-2})$$

$$50 = 3^{x-2} \quad x = 5.55$$

In Exercises 21–23, solve the equation.

21. $2^{3x-6} = 8^{x-2}$
 $2^{3x-6} = 2^{3x-6}$
 all real x

22. $9^{3x-2} = 27^{2x-2}$
 $3^{2(3x-2)} = 3^{3(2x-2)}$
 $6x-4 = 6x-6$
 No solution

23. $2^{4(x-3)} = 16^{x+1}$
 no solution

In Exercises 24 and 25, solve the equation.

24. $7^{x+3} = \sqrt{7}$
 $x+3 = 1/2$
 $x = -5/2$

25. $(\sqrt[4]{10})^x = 10^{3x-1}$
 $x^{1/4} = 3x-1$
 $\frac{1}{4}x = 3x-1$
 $-\frac{11}{4}x = -1$
 $x = 4/11$

6.5 Practice B

In Exercises 1–9, solve the equation. Check your solution.

1. $3^{8x} = 3^{5x-6}$

$8x = 5x - 6$

$3x = -6$

$x = -2$

4. $25^{x-2} = 125^{3x+1}$

$2x - 4 = 9x + 3$

$-7 = 7x$

$x = -1$

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

$-3(2x+4) = 4(4-x)$

$-6x - 12 = 16 - 4x$

$-28 = 2x$

$x = -14$

2. $4^x = 2^{5x+3}$

$2x = 5x + 3$

$x = -1$

5. $9^{x-6} = 729^{3(x+2)}$

$x - 6 = 3 \cdot 3(x + 2)$

$x - 6 = 9x + 18$

$-24 = 8x$

$x = -3$

8. $(\frac{2}{3})^{x+8} = (\frac{3}{2})^{2x-5}$

$x + 8 = -2x + 5$

$3x = -3$

$x = -1$

3. $8^{5x} = 4^{4x+7}$

$15x = 8x + 14$

$7x = 14$

$x = 2$

6. $4^{6(-x+2)} = 8^{-3x-4}$

$2^{2 \cdot 6(-x+2)} = 2^{3(-3x-4)}$

$12(-x+2) = -9x - 12$

$-12x + 24 = -9x - 12$

9. $(\frac{5}{4})^{3x+5} = (\frac{16}{25})^{-4x}$

$(\frac{5}{4})^{3x+5} = (\frac{4^2}{5^2})^{-4x}$

$3x + 5 = -4x$

$36 = 3x$

$x = 12$

10. Describe and correct the error in solving the exponential equation.

\times $(\frac{1}{16})^{3x} = 64^{x-4}$

$(4^{-2})^{3x} = (8^2)^{x-4}$

$-6x = 2x - 8$

$x = 1$

$(4^{-2})^{3x} = 4^{2(x-4)}$

$-6x = 2x - 8$

$-9x = -12$

$x = 4/3$

17. A bread dough doubles in size every hour. You begin measuring the volume of the dough 1 hour after the dough is prepared. The volume y (in cubic inches) of the dough x hours after the dough is prepared is represented by $y = 35(2^{x-1})$.

When will the volume of the dough be 4200 cubic inches?

$4200 = 35(2^{x-1})$

$120 = 2^{x-1}$

$x = 5.9$

In Exercises 18–20, solve the equation.

18. $125^{x-1} = 5^{3x-2}$

$$3x-3 = 3x-2$$

no solution

19. $8^{2x+1} = 2^{3(2x+1)}$

$$6x+3 = 6x+3$$

Infinite

20. $3^{8(2x-1)} = 81^{4x-2}$

$$16x-8 = 16x-8$$

Infinite

21. You deposit \$750 in a savings account that earns 4% annual interest compounded yearly. Write and solve an exponential equation to determine when the balance of the account will be \$1000.

$$1000 = 750 \left(1 + \frac{.04}{1} \right)^t$$

$$1.33 = 1.04^t$$

$$t = 7.2$$

In Exercises 22 and 23, solve the equation.

22. $(\sqrt{3})^x = 3^{3x-5}$

$$3^{1/2 x} = 3^{3x-5}$$

$$\frac{1}{2} x = 3x - 5$$

$$-\frac{14}{5} x = -5$$

$$x = \frac{25}{14}$$

23. $(\sqrt[6]{2})^{2x} = (\sqrt[4]{2})^{x-3}$

$$2^{1/6 \cdot 2x} = 2^{1/4(x-3)}$$

$$\frac{1}{3} x = \frac{1}{4} x - \frac{3}{4}$$

$$\frac{1}{12} x = -\frac{3}{4}$$

$$x = -9$$