Growing, Growing, Growing Answers

Investigation 1 Additional Practice

1. a. $4^1 = 4$ **b.** $4^2 = 16$ **c.** $4^3 = 64$
d. $4^{10} = 1{,}048{,}576$ **e.** 4^n

2. $2^1 \cdot 5^1 = 10$ **3.** $2^2 \cdot 5^2 = 100$

4. $2^3 \cdot 5^3 = 1{,}000$ **5.** $2^4 \cdot 5^4 = 10{,}000$

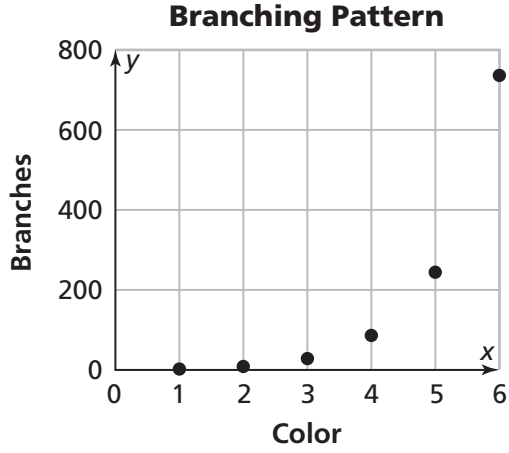
6. a.

Color	Branches
1	3
2	9
3	27
4	81
5	243
6	729

b. $b = 3^c$

c. Color 7 would be used to draw 2,187 branches.

d.



Skill: Using Exponents

1. 3^5 **2.** 2.7^3 **3.** 2^6 **4.** 4^8

5. $0.5 \times 0.5 \times 0.5; 0.125$

6. $2.7 \times 2.7; 7.29$ **7.** $2 \times 2 \times 2; 8$

8. $8.1 \times 8.1 \times 8.1; 531.441$

9. 4.8×10^5 **10.** 9.6×10^5

11. 8.75×10^6 **12.** 4.07×10^5

Investigation 2 Additional Practice

1. a. 20 gal ÷ 2.5 gal/min = 8 minutes

b. The relationship is linear: $w = 2.5t$, where w is the water the bathtub will hold and t is the time in minutes to fill it.

2. a. It will take about 10 hours.

b. The relationship is exponential: $b = 4^n$, where b is the number of bacteria in the colony and n is the time in hours.

3. a. $12 \cdot 3 = 36$ cans

b. The relationship is linear: $c = 3l$, where c is the number of cans in a layer and l is the number of the layer.

4. a. On the sixth day, the plant will be 64 times its original height. On the nth day, it will be 2^n times its original height.

b. $\frac{1}{4}$ centimeter tall

c. The relationship is exponential: $c = \frac{1}{4}(2^n)$, where c is the current height and n is the day of the experiment.

5. linear; $y = 7x + 2$

6. exponential; $y = 2(2^x)$ or $y = 2^{x+1}$

7. exponential; $y = (4^{x-2})$ or $y = \frac{1}{16}(4^x)$

8. inverse; $y = \frac{1}{x + 1}$

9. neither linear nor exponential

Skill: Exponential Functions

1.

Time	Value of Investment
Initial	$800
5 yr	$1200
10 yr	$1800
15 yr	$2700
20 yr	$4050
25 yr	$6075
30 yr	$9112.50
35 yr	$13,668.75

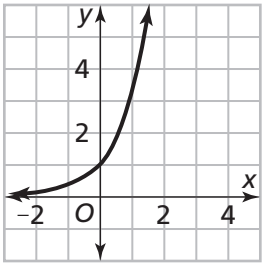
2.

Time	Number of Animals
Initial	18
3 mo	36
6 mo	72
9 mo	144
12 mo	288
15 mo	576
18 mo	1,152
21 mo	2,304

3.

Time	Amount of Matter
Initial	10 g
1 yr	40 g
2 yr	160 g
3 yr	640 g
4 yr	1,280 g
5 yr	2,560 g
6 yr	5,120 g
7 yr	10,240 g

4.



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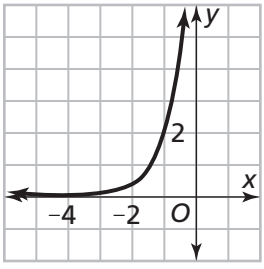

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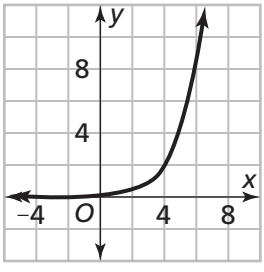


Investigation 3 Additional Practice

1. a. about $1,791

b. The relationship is exponential: $V = 1{,}000(1.06^y)$, where V is the value and y is the number of years.

2. a.

Year	Balance
0	$2,000.00
1	$2,100.00
2	$2,205.00
3	$2,315.25
4	$2,431.01
5	$2,552.56

b. $b = 2{,}000(1.05^t)$

c. It will take between 14 years ($3,960) and 15 years ($4,158) for the original deposit to double.

d. It will take between 7 years ($3,897) and 8 years ($4,287) for the original deposit to double at an interest rate of 10%. A 10% interest rate cuts the doubling time approximately in half.

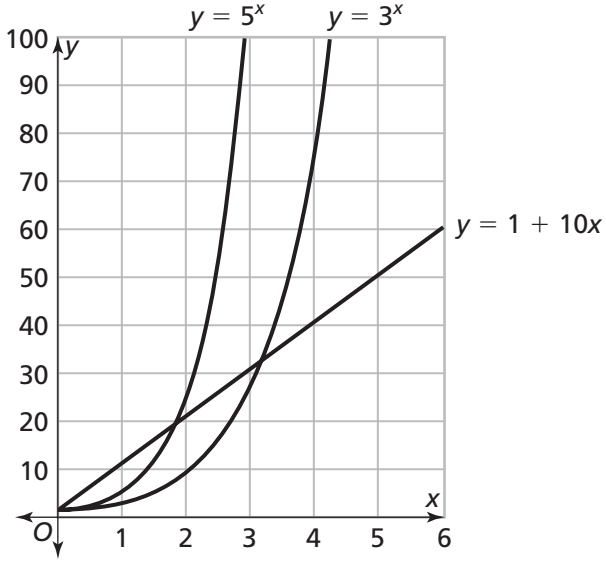
3. exponential; $y = 2(1.3^x)$

4. exponential; $y = 500(1.1x)$

5. linear; $y = 1.5x + 2.3$

6. inverse; $y = \frac{1}{2x}$

7. a.



b. All three graphs intersect at the point $(0, 1)$. If students consider intersections of just two graphs, the graphs of $y = 5^x$ and $y = 1 + 10x$ intersect at about $(1.85, 19.5)$. The graphs of $y = 3^x$ and $y = 1 + 10x$ intersect at about $(3.18, 32.8)$.

c. The graph of $y = 1 + 10x$ increases at the greatest rate for x between 1 and 2 (about $x = 1.4$); then the graph of $y = 5^x$ increases at the greatest rate.

d. Because the graph of $y = 1 + 10x$ is a straight line, it is not an example of exponential growth.

e. The equation $y = 1 + 10x$ does not include a variable exponent, so it is not an example of exponential growth.

Skill: Compound Interest

1. $300, $5,300;
$5,300, $318, $5,618;
$5,618, $337.08, $5,955.08;
$5,955.08, $357.30, $6,312.38

2. $216, $7,416;
$7,416, $222.48, $7,638.48;
$7,638.48, $229.15, $7,867.63;
$7,867.63, $236.03, $8,103.66

3. a. $y = 500 \cdot 1.04^x$; $3553.34

b. $25,252.47

c. $1,275,374.90

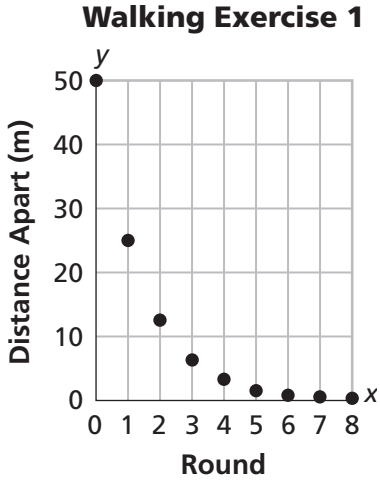
d. $64,412,743.02

Investigation 4 Additional Practice

1. a.

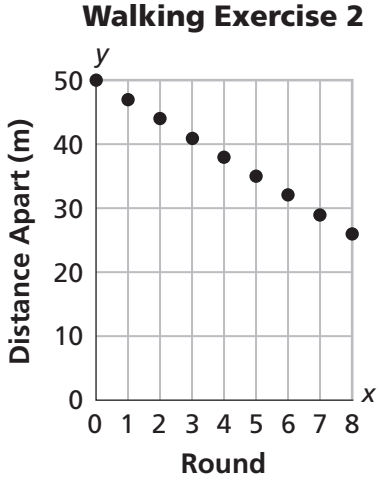
Round	Distance Apart (m)
0	50
1	25
2	12.5
3	6.25
4	3.125
5	1.5625
6	0.78125
7	0.390625
8	0.1953125

b.



c.

Round	Distance Apart (m)
0	50
1	47
2	44
3	41
4	38
5	35
6	32
7	29
8	26



d. The first walking exercise is an example of exponential decay. The walkers get very close very fast. The second walking exercise is a linear relationship. The decrease is more gradual and consistent, and it will take longer for them to get close. However, they will meet (or walk past each other); in the exponential situation, theoretically, they will never meet.

2. a. 0.95

b. $r = 10{,}000(0.95t)$, where r is trees remaining and t is time in years

c. (Figure 1)

d. This will be when about 1,500 of the trees remain, which will occur around year 37 (when about 1,499 trees remain). (Note: Students can solve this by trial-and-error or by graphing.)

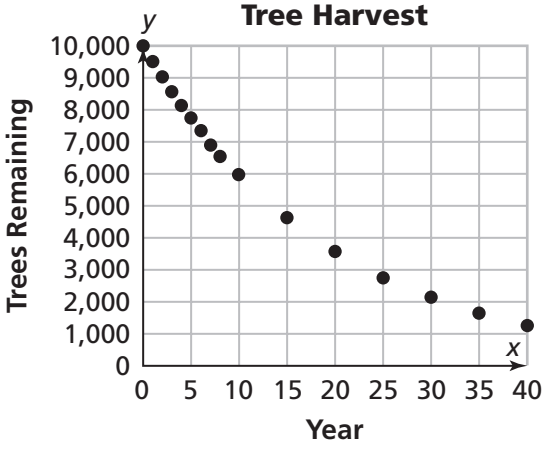


Figure 1

Supply of Trees

Year	10	15	20	25	30	35	40
Trees Remaining	5,987	4,633	3,585	2,774	2,146	1,661	1,285

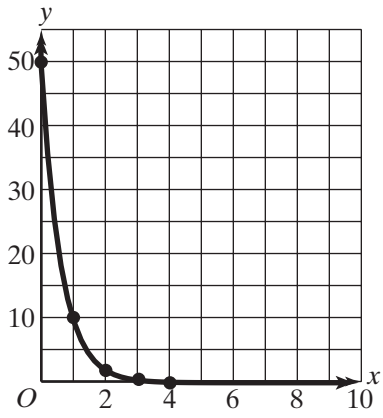
3. a. Tribett Population

Year	Tribetts
0	10,000
1	7,000
2	4,900
3	3,430
4	2,401
5	1,681

b. $T = 10{,}000(0.7)^x$ **c.** Year 7

Skill: Exponential Growth and Decay

1. 50; (0, 50); 10; (1, 10); 2; (2, 2); 0.4; (3, 0.4); 0.08; (4, 0.08)



2. a. $y = 4{,}500{,}000 \cdot 0.98x$; 4,235,364

b. 4,067,644

c. 3,676,828

d. 3,004,236

3. a. $y = 10{,}500 \cdot 0.85x$; $8,925

b. $7,586.25

c. $5,481.07

d. $2,067.18

4. a. $y = 2{,}950{,}000 \cdot 0.975x$; 2,876,250

b. 2,599,232

c. 2,017,861

d. 1,566,525

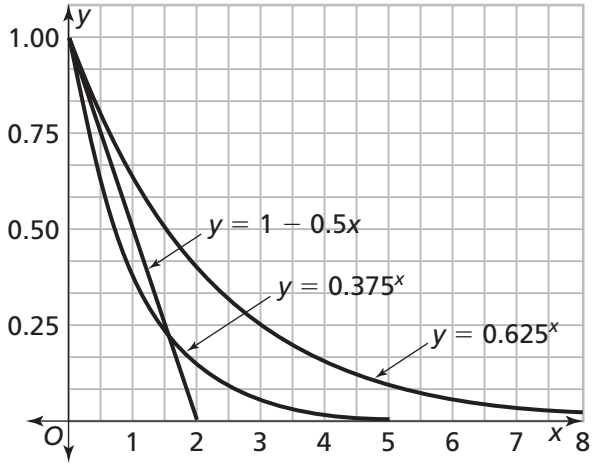
5. a. $y = 25{,}000 \cdot 0.88x$; \$22,000
b. \$17,036.80
c. \$13,193.30
d. \$10,216.89

Investigation 5 Additional Practice

1. a. 2^{10} **b.** 2^{11} **c.** 5^8
d. 3^3 **e.** 10^3 **f.** 6^3

2. a. 4 **b.** 1
c. 7 **d.** 7

3. a.



b. All three graphs intersect at the point $(0, 1)$. If students consider the intersections of just two graphs, the graphs of $y = 0.375x$ and $y = 1 - 0.5x$ intersect at about the point $(1.57, 0.214)$.

c. None; as the x-value increases, the y-value starts to "level off" in the exponential relationships; in the linear relationship, the decrease remains constant.

4. a. False, since $3^5 + 3^5 = 243 + 243 = 486$ and $3^{10} = 59{,}049$. $3^5 \times 3^5 = 3^{10}$

b. False, since $5^4 + 2^4 = 625 + 16 = 641 \neq 7^4$ or 2,401.

Skill: Simplifying Exponential Expressions

1. 3^7 **2.** 1^7 **3.** 5^7
4. 4.5^{10} **5.** 3^8 **6.** $=$
7. $<$ **8.** $>$ **9.** $\frac{1}{9}$
10. 4,096 **11.** 256 **12.** 49
13. $-\frac{1}{27}$