

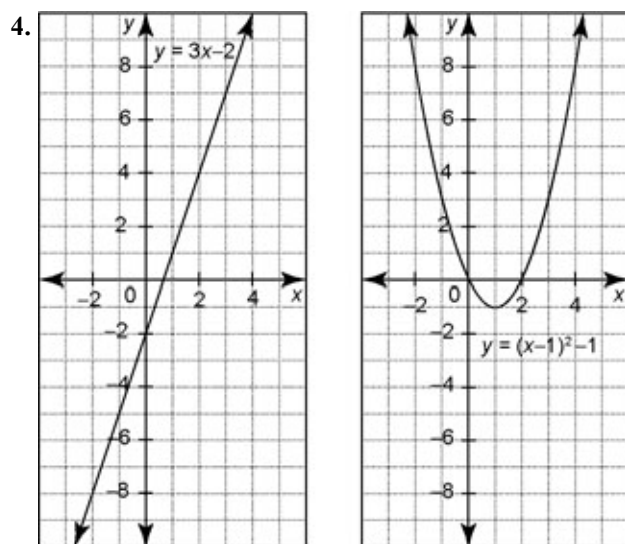
Chapter 6 BLM Answers

Prerequisite Skills

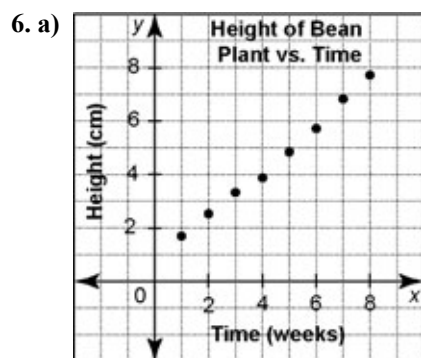
1. a) base: 2, exponent: 3 b) base: -1, exponent: 7
c) base: $\frac{1}{4}$, exponent: 4 d) base: 6, exponent: 6

2. a) 4^5 b) $(-8)^3$ c) 3.6^6 d) $\left(\frac{1}{3}\right)^3$

3. a) $5 \times 5 \times 5 \times 5 \times 5$ b) $(-1)(-1)$
c) $\frac{9}{10} \times \frac{9}{10} \times \frac{9}{10} \times \frac{9}{10}$ d) $\left(-\frac{7}{3}\right)\left(-\frac{7}{3}\right)\left(-\frac{7}{3}\right)$



5. a) $y = 2x + 6$ b) $y = (x + 1)^2 + 4$ c) $y = x^2 + 2x + 5$
d) E.g., The parabola $y = x^2$ underwent a translation of 1 unit to the left and 4 units up.



- b) linear c) Sketches may vary; E.g., 9.2 cm
7. a) 36 cm b) 120.76 m² c) 56 cm² d) 55.0 m²

8. a)

x	y	First Differences	Second Differences
-3	37	-11	
-2	26	-9	2
-1	17	-7	2
0	10	-5	2
1	5	-3	2
2	2	-1	2
3	1		

- b) Quadratic; E.g., The second differences are constant and the expanded form of $y = (x - 3)^2 + 1$ contains an x^2 term.

Section 6.1 The Exponent Rules

1. a) 11^{13} b) 3^9 c) $\left(\frac{1}{4}\right)^8$ d) $(-2)^{10}$
2. a) 9^2 b) 5^5 c) 6^3 d) $(-10)^7$
3. a) 5^{15} b) 8^{24} c) 12^{45} d) $(-2)^6$
4. a) 6^3 b) $(-4)^2$ c) $(0.1)^3$ d) $\left(\frac{1}{2}\right)^4$
5. a) p^6 b) $4x^5y^6$ c) $6xy^6$
6. a) 3^{16} b) e.g., $(3^8)^2$ and $(3^4)^4$ c) $3^3 \times 3^{13}$
7. a) 0.0016 b) 0.064
8. a) It is 1000 times greater in magnitude. b) 5.0
9. a) $\frac{1}{4}$ b) $\frac{1}{1024}$
10. a) 6^{ab} b) $10^{(ab-bc)}$ c) $(-8)^{ab}$

Section 6.2 Evaluate Powers with Integer Exponents

1. a) $\frac{1}{81}$ b) $\frac{1}{144}$ c) $\frac{1}{125}$ d) $\frac{1}{20}$
2. a) $\frac{1}{1331}$ b) $\frac{1}{7776}$ c) $\frac{1}{4096}$ d) $\frac{1}{4096}$
3. a) 2^{-5} b) 15^{-2} c) 10^{-3} d) 10^{-6}
4. a) $\frac{10}{27}$ b) 0 c) $\frac{5}{216}$ d) $\frac{3}{4}$
5. a) 8 b) $\frac{16}{25}$ c) 16 d) 1 000 000

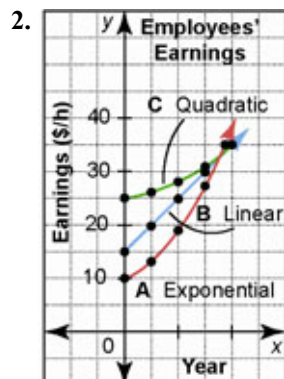
6. a) 6^1 b) 2^4 c) $\left(\frac{1}{3}\right)^{-3}$ d) $\left(\frac{2}{5}\right)^{-4}$
 7. 10^{-3} cm
 8. 3^{-6}
 9. 110 Hz
 10. E.g., -2 and 2, -2 and 4
 11. $p = -4, q = 4, r = 2, s = -2$, or $p = -2, q = 2, r = 4, s = -4$. Yes, E.g., since the exponents are even, both p^q and r^s will be positive. There are two ways to arrange the values so that the result is 1024.

Section 6.3 Investigate Rational Exponents

1. a) 7 b) -4 c) 0.4 d) -2
 2. a) $\frac{4}{5}$ b) $-\frac{2}{5}$ c) 0.6 d) 0.2
 3. a) 27 b) 729 c) 100 d) 0.16
 4. a) $\frac{64}{125}$ b) 9 c) $\frac{81}{10000}$ d) 0.064
 5. a) 3.780 b) -0.582
 6. a) $5^{\frac{3}{2}}$ b) $5^{\frac{1}{3}}$
 7. a) 10 000 visitors b) July
 c) December; 5 120 000 visitors
 8. a) 1.4, 2.0, 2.8, 4.0, 5.7
 b) 57.1 mm, 40.0 mm, 28.6 mm, 20 mm, 14.0 mm
 9. a) 4.9 cm b) $V = \frac{4}{3}\pi r^3$ c) E.g., yes, $r = \left(\frac{3V}{4\pi}\right)^{\frac{1}{3}}$

Section 6.4 Model Data with Exponential Functions

1. a) Linear. The distance Andre ran increased by 40 m each day.
 b) Exponential. The distance Kady ran increased by a factor of 2 each day.
 c) Quadratic. The second differences between the distances Mei ran are all 2 m.



3. Sketches may vary. The curve for the cup placed in the refrigerator should show a steeper curve and reach a lower final temperature.

4. a) Sketches may vary.
 b) Descriptions may vary, e.g., The graph curves up more and more steeply as you move to the right.
 c) Yes, it is exponential. The ratio of any cost to the previous cost is always 2:1.

5. a)

Day	Number of Friends
1	3
2	9
3	27
4	81
5	243
6	729
7	2187

- b) Yes. E.g., the ratios between successive values are all 3:1.
 c) 16th day
 6. Yes. The ratios between successive values are constant.

Section 6.5 Exponential Functions and Their Properties

1. a) domain = $\{x \in \mathbf{R}\}$, range = $\{y > 0, y \in \mathbf{R}\}$
 b) asymptote
 c) increasing when $c > 1$, decreasing when $0 < c < 1$
 2. a) Answers may vary. E.g., $f(x) = 2^x$ and $g(x) = 0.5^x$
 b) Graphs may vary.
 3. $f(x) = 0.2^x$
 4. $y = 5^x$
 5. a) $a > 1$ b) $0 < a < 1$
 6. a) $\frac{3}{5}, \frac{9}{25}$
 b) E.g., $I = 0.6^d$, where I is the intensity, in units, and d is the depth, in 10-m intervals below the surface.
 c) 50 m
 7. a) The Moon appears approximately 1446 times brighter than Venus.
 b) Jupiter appears approximately 15 856 times brighter than Neptune.
 8. a) average ratio: 0.80

Time, t (min)	Temperature of Soup, T ($^{\circ}\text{C}$)	Ratio
0	48.75	0.80
5	39.00	
10	31.20	0.80
15	24.34	0.78
20	19.96	0.82

- b) E.g., $T = 48.75(0.8^s)$, where T is the temperature of the soup, in degrees Celsius, and s is the time, in 5-min intervals.
c) E.g., 15.97°C
9. The sound pressure of a 140 dB sound is 100 times greater than the sound pressure of a 100 dB sound.

Section 6.6 Compare Linear, Quadratic, and Exponential Functions

1. a) linear b) quadratic c) linear d) exponential
2. a) A: quadratic, B: exponential, C: linear
b) A: exponential, B: linear, C: quadratic
3. a) linear b) exponential c) quadratic d) exponential
4. a) linear b) exponential c) none
5. quadratic; The second differences of the areas are all near 6 and the ratios between successive values are not similar.
6. exponential; The ratios between successive values are all approximately 0.91.
7. a) exponential; The ratio between her savings in successive years will be constant.
b) Yes, Jordan's savings are growing slowly, but at an exponential rate.
8. $a = 1$, $b = 0.5$, $c = 2$

Section 6.7 Exponential Growth and Decay

1. about 29.8%
2. Estimates may vary, e.g., 23 000 years old.
3. a) 500 years b) 12.5%
c) Estimates may vary, e.g., 41.5 years.
4. a) Sketches may vary, but should show a decreasing curve, a value of 500 μg at time 0 and a value of approximately 35 μg at 48 months.
b) e.g., 12 months c) e.g., correct
d) e.g., after approximately 17 hours
5. a) Sketches may vary, but should be a decreasing curve through or near these values (0, 87.9) and (10 000, 28.5).
b) e.g., approximately 5500 m above sea level
c) e.g., approximately 32.3 kPa
d) approximately 74.5 kPa
6. a) E.g., $M = 80(0.5)^{\frac{d}{3.8}}$ where M is the mass of Rn-222 remaining, in micrograms, and d is the time, in days
b) approximately 12.9 μg c) e.g., approximately 12 days
7. a) approximately 14.6 million b) e.g., 2.2 %
8. a) 48 cm^2 b) e.g., $A = 64(0.75)^s$
c) approximately 20.3 cm^2 d) after 7 steps

Chapter 6 Review

1. a) 3^4 b) z^2 c) $(-3)^{12}$ d) p^3
2. a) k^{10} b) $2x^3y^5$
3. a) $\frac{1}{32}$ b) 125 c) $\frac{5}{16}$ d) $\frac{4}{9}$
4. a) 3 b) 9 c) 0.1

5. a) 6.350 b) 0.008 c) 0.108
6. a) i) quadratic; the second differences between the distances Stefan ran are equal
ii) linear; the distance Leah ran increased by 15 m each day
iii) exponential; the ratio between successive distances Kiyoe ran are all 1.4
b) Stefan ran the farthest on the fifth day.

7. a)

x	y
-3	1000.000
-2	100.000
-1	10.000
0	1.000
1	0.100
2	0.010
3	0.001

Sketches may vary, but should pass through the points in the table of values.

- b) domain = $\{x \in \mathbf{R}\}$, range = $\{y > 0, y \in \mathbf{R}\}$,
 x -intercept: none, y -intercept: 1, function is always decreasing, asymptote is the x -axis, or $y = 0$
8. a) none b) none c) quadratic
 9. a) 3 cm^2
b) Sketches may vary, but should pass through or near (0, 3) and (21, 184).
c) approx. 4.44 cm^2 ; 9.72 cm^2 ; approx 21.28 cm^2
d) after 24 days

Chapter 6 Practice Test

1. B 2. D 3. A 4. C
5. $\frac{216}{343}$ years
6. The growth pattern does not appear to be exponential, since the ratios between successive numbers of houses are not constant.
7. a) $\frac{4}{5}$; $\frac{16}{25}$
b) $I = 0.8^d$ where I is the intensity, in units, and d is the depth, in 10-m intervals below the surface.
c) just after 70 m
8. $y = 1.6^x$
9. an exponential function; the share value increases by 2% each week
10. a) Sketches may vary but the decreasing curve should pass through or near (0, 150) and (24, 9.4).
b) estimates may vary, e.g., 6 h c) e.g., correct
d) approximately 12 h

Chapter 6 Test

1. D 2. B 3. A 4. B
5. a) approximately 3.3 s b) approximately 9.0 m/s^2

6. a)

Day	Planned Exercise Time (s)
1	2
2	6
3	18
4	54
5	162

- b) Yes, the ratios between successive values are all 3.
c) One the 11th day, Samuel's planned exercise time is greater than the time in a day.

7. a) $h(x)$ b) $f(x)$ c) $x = 0$

8. The diameter of cobblestone is 256 times greater than that of coarse sand.

9. Neither; the ratios between successive values are not constant.

10. a) 2.5 m

b) the third bounce

c) No; according to the relation given, the ball does not stop bouncing.