Chapter 6 BLM Answers

BLM 6-1 Prerequisite Skills

1. a) 3, 2, 9 **b)** (–2), 6, 64 **c)** 3, –2, $\frac{1}{9}$

2. a) 2 **b)** 3

3. a) 12 **b)** 20

4. a) 6.63 **b)** 7.57

5. a) 3^5, 243 **b)** 2^8, 256 **c)** $(-5)^4$, 625

6. a) 4^4, 256 **b)** 12^2, 144 **c)** 10^4, 10 000 **d)** $(-2)^6$, 64

7. a) 2^8, 256 **b)** 10^9, 1 000 000 000 **c)** $(-3)^6$, 729 **d)** $(-10)^{15}$, –1 000 000 000 000 000

8. a) m^8 **b)** pq^4 **c)** $125b^{10}$

9. a) 1 **b)** 1 **c)** –1 **d)** –1 **e)** 1 **f)** 1

10. In parts c) and d), the whole power is negative, but in part e), only the base is negative.

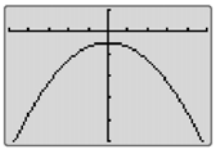
11. a) $\frac{1}{10^3}, \frac{1}{1000}$ **b)** $\frac{1}{6^2}, \frac{1}{36}$ **c)** $\frac{1}{(-2)^6}, \frac{1}{64}$ **d)** $\frac{1}{(-4)^3}, -\frac{1}{64}$ **e)** 3^4, 81 **f)** 6^2, 36

12. a)

x	$y = 2x^2 - 5$	First Differences	Second Differences	Ratios
–2	–13			
		6		
–1	–7		–4	
		2		0.538
0	–5		–4	
		–2		0.714
1	–7		–4	
		–6		1.4
2	–13			1.857

b) Quadratic. Second differences are constant.

c)

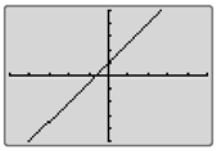


Xmin = –5, Xmax = 5, Xscl = 1, Ymin = –50, Ymax = 10, Yscl = 10
Yes. The graph is a parabola.

13. a)

x	$y = 3x + 2$	First Differences	Second Differences	Ratios
–2	–4			
		3		
–1	–1		0	
		3		0.25
0	2		0	
		3		–2
1	5		0	
		3		2.5
2	8			1.6

Linear. First differences are constant.

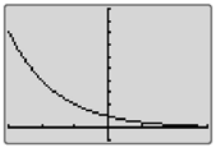


Xmin = –5, Xmax = 5, Xscl = 1, Ymin = –10, Ymax = 10, Yscl = 2
Yes. Graph is a line.

b)

x	$y = \left(\frac{1}{2}\right)^x$	First Differences	Second Differences	Ratios
–2	4			
		–2		0.5
–1	2		1	
		–1		0.5
0	1		0.5	
		–0.5		0.5
1	0.5		0.25	
		–0.25		0.5
2	0.25			

Exponential. Ratios are constant.



Xmin = –3, Xmax = 3, Xscl = 1, Ymin = –1, Ymax = 10, Yscl = 1
Yes. Graph is decreasing at a decreasing rate.

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BLM 6-4 Section 6.1 Exponent Laws

1. a) 4^2, 16 **b)** 3^{-4}, $\frac{1}{81}$

c) 5^{-1}, $\frac{1}{5}$ **d)** 2^{-7}, $\frac{1}{128}$

2. b) $\frac{1}{3^4}, \frac{1}{81}$ **c)** $\frac{1}{5^1}, \frac{1}{5}$ **d)** $\frac{1}{2^7}, \frac{1}{128}$

3. a) $\left(\frac{5}{4}\right)^3$ **b)** $\left(\frac{8}{3}\right)^2$

4. a) g, 5 **b)** $\frac{1}{w^2}, \frac{1}{9}$

c) $\frac{p^2}{q^2}$, 16 **d)** $\frac{b^3}{a^3}, \frac{27}{8}$

5. a) 7^{-3}, $\frac{1}{343}$ **b)** 5^{-2}, $\frac{1}{25}$

c) 2^9, 512 **d)** 10^{-2}, $\frac{1}{100}$

6. a) x^3, –27 **b)** $\frac{1}{z^2}, \frac{1}{16}$

c) $\frac{c^7}{b^4}$, 128 **d)** s^2t^3, 200

7. a) 4^{-3}, $\frac{1}{64}$ **b)** 5^3, 125

c) $(-2)^8$, 256 **d)** $(-10)^{-6}$, $\frac{1}{1\,000\,000}$

8. a) w^2, 49 **b)** $\frac{1}{25x^6}, \frac{1}{1600}$

c) $\frac{1}{p^4q^6}$, 81 **d)** $\frac{b^2}{c^3}, \frac{16}{125}$

9. a) y^8 **b)** $\frac{1}{v^3}$ **c)** n

d) $\frac{a}{b^2}$ **e)** s^3 **f)** $\frac{x^6}{y^2}$

10. a) 1.07^{-3}, 0.816 **b)** 1.04^{-4}, 0.855
c) 8.1^3, 531.441 **d)** $(-1.01)^{-6}$, 0.942

11. a), b) $\frac{129}{256}$

BLM 6-6 Section 6.2 Rational Exponents

1. a) 13 **b)** 5 **c)** 4 **d)** 2

2. a) –6 **b)** –5 **c)** –6
d) Not possible. There is no number that when multiplied four times gives a negative value.

3. a) 2.872 **b)** –4.129
c) 4.547 **d)** 3.175

4. a) $\sqrt[4]{256}$, 4 **b)** $\sqrt[4]{10\,000}$, 10

c) $\sqrt[7]{128}$, 2 **d)** $\sqrt[3]{\frac{1}{27}}, \frac{1}{3}$

5. a) –1 **b)** –5
c) Not possible. There is no number that when multiplied four times gives a negative value.
d) 8

6. a) 512 **b)** 100 000
c) 8 **d)** 243

7. a) 4 **b)** 125
c) Not possible. There is no number that when multiplied four times gives a negative value.
d) $\frac{8}{343}$

8. a) 4.481 **b)** 2.463 **c)** 2.776
d) 12.083 **e)** 0.727 **f)** 2.053

9. a) Not possible. There is no number that when multiplied twice gives a negative value.
b) –21.544
c) Not possible. There is no number that when multiplied four times gives a negative value.
d) –6.310

10. A power with a negative base and a fractional exponent can only be evaluated if the denominator is odd.

11. a) \$32.85 **b)** \$34.16 **c)** $r = \left(\frac{C}{c}\right)^{\frac{12}{n}} - 1$

12. $45a^6b^4$

BLM 6-8 Section 6.3 Represent Exponential Expressions

1. a) 4^5 **b)** 4^6 **c)** 4^0
d) 4^{12} **e)** 4^6 **f)** 4^8

2. a) 10^4 **b)** 10^{15} **c)** 10^{15}
d) 10^{-2} **e)** 10^{-4} **f)** 10^{-3}

3. a) 2^7 **b)** 2^6 **c)** 2^{15}
d) 2^{24} **e)** 2^0 **f)** 2^{16}

4. a), b) $x = -10$

5. a) $x = 3$ **b)** $a = \frac{1}{2}$ **c)** $p = \frac{1}{2}$

d) $k = \frac{4}{15}$ **e)** $x = \frac{1}{7}$ **f)** $x = \frac{11}{6}$

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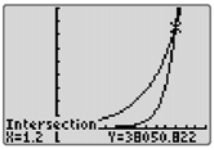
6. a) $x = \frac{6}{5}$ **b)** $x = 6$

7. a, b)

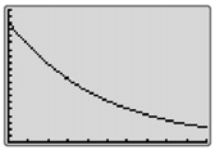


Xmin = –0.5, Xmax = 1.5, Xscl = 1,
Ymin = –5000, Ymax = 45 000, Yscl = 5000
The point of intersection occurs at
$x = 1.2$, or $\frac{6}{5}$. This is where the graphs cross.

8. a), b) $x = 5$ **c)** They are the same.
9. a), b) $x = -4$ **c)** They are the same.
d) Answers may vary.
10. a) i, ii) $5^{4-x} = 5^{-1}$ **iii)** $x = 5$
b) i, ii) $3^{3x-1} = 3^{-4}$ **iii)** $x = -1$
c) i) $27^{x+1} = 9^{5-2x}$ **ii)** $3^{3x+3} = 3^{10-4x}$ **iii)** $x = 1$

BLM 6-11 Section 6.4 Tools and Strategies to Solve Equations Involving Exponents

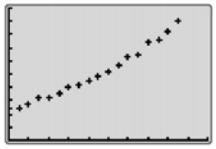
1. a) 4.1 **b)** 3 **c)** 2 **d)** 2
2. a) 4.41 **b)** 7.58 **c)** 12.90 **d)** 7.28
3. Estimates may vary. For example:
a) 3.2 **b)** 7.1 **c)** 3.9 **d)** 2.5
4. a) 3.16 **b)** 7.13 **c)** 3.93 **d)** 2.49
5. a) 63.70 **b)** 56.56
6. 3.11
7. 9
8. 22 years
9. a)



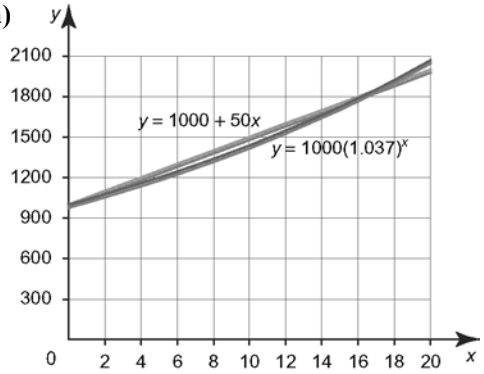
Xmin = 0, Xmax = 10, Xscl = 1, Ymin = 0,
Ymax = 2, Yscl = 0.1
The graph is decreasing at a decreasing rate.
b) i) 1.458 m **ii)** 0.957 m **iii)** 0.508 m
10. a) 1.8 m **b)** 7 bounces
11. $r = 14.51$ cm

BLM 6-14 Section 6.5 Construct and Apply Exponential Models

1. a) Exponential. The graph is decreasing at a decreasing rate.
b) i) 41.35 g **ii)** 18.70 g **c)** 3.5 h
2. a) Neither. The graph is a curve that appears to increase at a constant rate.
b) \$800.51 **c)** 10.41%
3. a)



Xmin = 0, Xmax = 20, Xscl = 2, Ymin = 0, Ymax = 100, Yscl = 10
b) $m = 3.772t + 18.521$; slope: rate of growth is 3.772 g/h; vertical intercept has no meaning in this context.
c) 131.68 g **d)** 32.2 h
4. a) $m = 0.138t^2 + 1.431t + 24.766$
b) 191.90 g **c)** 24.2 h
5. a) $m = 24.268(1.080)^x$ **b)** 244.20 g **c)** 22.8 h
6. a)



The savings account is a linear relation.
The savings bond is an exponential relation.
b) Answer depends on the length of time the money is invested. For less than 16 years, the savings account earns more interest. For greater than 16 years, the savings bond earns more interest.
7. Option 1; after the initial investment, Option 2 will yield more interest than Option 1.

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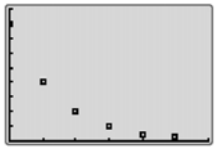
8. a), b) non-linear

Time (s)	Units Remaining	First Differences	Second Differences
0	4000		
		–2000	
14	2000		1000
		–1000	
28	1000		500
		–500	
42	500		250
		–250	
56	250		125
		–125	
70	125		

c) Yes. Ratios are all 0.5.

d)



Xmin = 0, Xmax = 84, Xscl = 14, Ymin = 0, Ymax = 4500, Yscl = 500

e) $y = 4000(0.5)^{x \div 14}$ **f)** 167.5 s

9. a)

Time (days)	Units Remaining
0	1000
74	**500**
148	**250**
222	**125**
296	**62.5**
370	**31.25**

b) Non-linear; first and second differences are not constant.

c) Exponential; the common ratio is a constant, $\frac{1}{2}$.

d) $y = 10\ 00(0.5)^{x \div 74}$

e) approximately 490 days

BLM 6-17 Chapter 6 Review

1. a) 6^{-2}, $\frac{1}{36}$ **b)** 5^3, 125

c) 3^{-4}, $\frac{1}{81}$ **d)** 10^4, 10 000

2. a) $\frac{1}{k}$ **b)** $\frac{1}{x^5}$ **c)** $\frac{m^{10}}{n^4}$ **d)** a^2b^4

3. $\frac{4y^2z^6}{x^8}, \frac{9}{64}$

4. a) 175.62 **b)** 0.02

5. a) 10

b) Not possible. There is no number that when multiplied four times gives a negative value.

c) –5 **d)** 2

6. a) $\sqrt{256}$, 16 **b)** $-\sqrt[4]{256}$, –4

c) $\sqrt[8]{-256}$ **.** Not possible. There is no number that when multiplied eight times gives a negative value.

d) $\left(\sqrt{36}\right)^3$, 216

e) $\sqrt{-49}$ **.** Not possible. There is no number that when multiplied twice gives a negative value.

f) $\left(\sqrt[3]{-8}\right)^5$, – 32

7. 5400 cm^2

8. a) 4^6 **b)** 4^3 **c)** 4^{10} **d)** 4^0

9. a) $x = 6$ **b)** $x = 2$ **c)** $x = -16$ **d)** $x = -2$

10. 10 h 50 min

11. 2 h

12. 19.1 cm^2

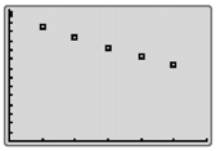
13. 546.1 cm^2

14. a), b)

Year	Value ($)	First Differences	Second Differences	Ratios
0	35 000.00			
		–3500.00		0.9
1	31 500.00		–350.00	
		–3150.00		0.9
2	28 350.00		–315.00	
		–2835.00		0.9
3	25 515.00		–283.50	
		–2551.50		0.9
4	22 963.50		–255.15	
		–2296.35		0.9
5	20 667.15			

c) Exponential. Ratios are constant.

d)



Xmin = 0, Xmax = 6, Xscl = 1, Ymin = 0, Ymax = 36 000, Yscl = 2400

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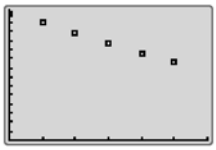
15. a)

Year	Value ($)	First Differences	Second Differences	Ratio
0	35 000			
		–2750		0.921
1	32 250		0	
		–2750		0.915
2	29 500		0	
		–2750		0.907
3	26 750		0	
		–2750		0.897
4	24 000		0	
		–2750		0.885
5	21 250			

Linear. First differences are constant.



Xmin = 0, Xmax = 6, Xscl = 1, Ymin = 0, Ymax = 36 000, Yscl = 2400

b) boat **c)** car

16. a)

Time (years)	Units Remaining
0	2500
12.5	**1250**
25.0	**625**
37.5	**312.5**
40.0	**156.25**
52.5	**78.125**

b) Non-linear; first and second differences are not constant.

c) Exponential; the common ratio is a constant, $\frac{1}{2}$.

d) $y = 2500(0.5)^{x \div 12.5}$

e) approximately 100 years

17. Option 1; the interest rate is such that it will yield the higher interest at the end of each year.

18. Option 2; after approximately 2 years, the interest paid will be greater than for Option 1.

BLM 6-18 Chapter 6 Practice Test

1. C
2. D
3. D
4. A
5. a) 4^4 **b)** 4^9
c) 4^5 **d)** 4^0

6. a) 4^3, 64 **b)** 5^5, 3125 **c)** $\frac{b^2}{a^6}, \frac{9}{64}$
d) $\frac{m}{n^3}, \frac{-3}{8}$ **e)** $\frac{v^2}{w^3}, \frac{25}{8}$

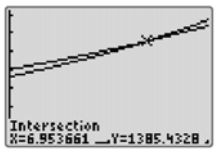
7. a) $x = 2$ **b)** $x = 6$ **c)** $x = 18$

8. a) 2 **b)** 100
c) 16 **d)** $-\frac{1}{32}$

9. a) Not possible. There is no number that when multiplied twice gives a negative value.
b) 9 **c)** –5

10. a) 3.825 **b)** 82.819

11. a)



Xmin = 0, Xmax = 10, Xscl = 1, Ymin = 0, Ymax = 1800, Yscl = 250

Exponential. Graphs are increasing at an increasing rate.

b) Answer depends on the length of time the money is invested. For less than seven years, Option A earns more interest. For greater than seven years, Option B earns more interest.

12. 284 cm^2

13. a) Exponential. The value of the vehicle decreases by a percent.
b) Exponential. The amount of the substance decreases by a percent.
c) Linear. The number of books increases by a constant amount.

14. a)

Time (years)	Units Remaining
0	370
2	**185**
4	**92.5**
6	**46.25**
8	**23.125**
10	**11.5625**

b) Non-linear; first and second differences are not constant.

c) Exponential; the common ratio is a constant, $\frac{1}{2}$.

d) $y = 370(0.5)^{x \div 2}$

e) approximately 17.1 years

15. 8 h 8 min

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BLM 6-19 Chapter 6 Test

1. B

2. B

3. C

4. D

5. a) 8^6 **b)** 8^4
c) 8^{10} **d)** 8^4

6. a) 5^3, 125 **b)** $(-2)^{-6}$, $\frac{1}{64}$ **c)** $\frac{9b^2}{a^8}$, 144
d) x^3y^3, 8 **e)** $\frac{p}{q^4}$, $\frac{2}{625}$

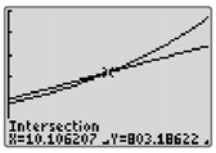
7. a) $x = 5$ **b)** $x = 2$ **c)** $x = -7$ **d)** $x = 10$

8. a) 8 **b)** 4 **c)** –243 **d)** $\frac{1}{8}$

9. a) –4
b) Not possible. There is no number that when multiplied twice gives a negative value.
c) Not possible. There is no number that when multiplied four times gives a negative value.
d) 4

10. a) 19.784 **b)** 106.921

11. a)



Xmin = 0, Xmax = 20, Xscl = 2, Ymin = 0, Ymax = 1500, Yscl = 250
Option A: Linear. The graph is a line.
Option B: Exponential. The graph is increasing at an increasing rate.

b) Answer depends on the length of time the money is invested. For less than ten years, Option A earns more interest. For greater than ten years, Option B earns more interest.

12. $r = 9.4$ cm

13. a) Linear. The value of the vehicle decreases by a constant amount each year.
b) Exponential. The number of sections increases by a percent.
c) Exponential. The amount of money remaining decreases by a percent.

14. a) $m = 2.301t + 18.649$
b) 76.17 g
c) 35.4 h
d) $m = 0.099t^2 + 1.113t + 20.827$
e) 110.53 g
f) 23.3 h
g) $m = 20.283(1.07)^t$
h) 110.08 g
i) 23.6 h

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