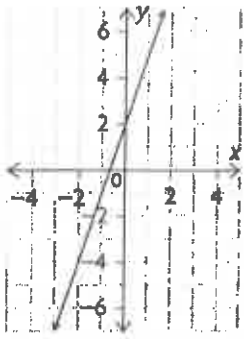
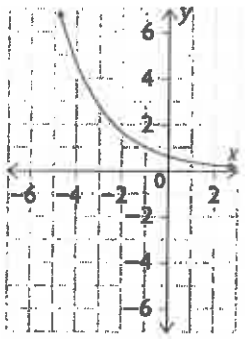
Name: _____ Date: _____

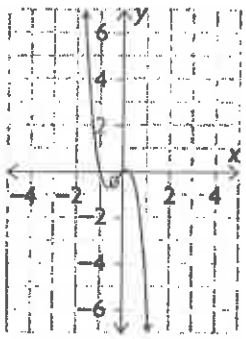
7 Chapter Test

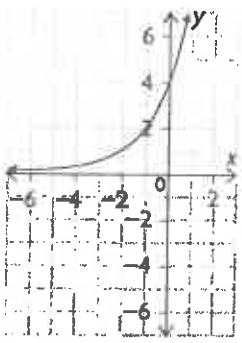
MULTIPLE CHOICE

1. Which graph represents an increasing exponential function?

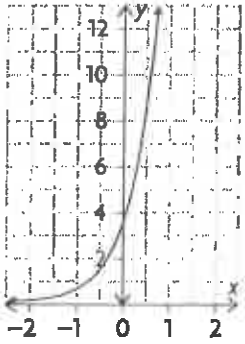
A. 

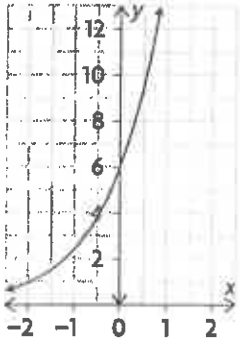
B. 

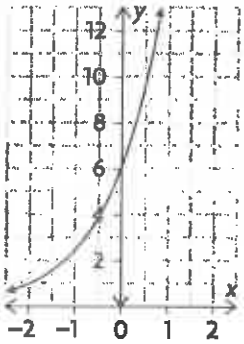
C. 

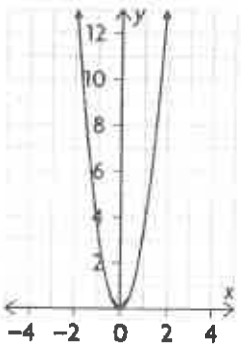
D. 

2. Which graph represents the function $y = 6(3.5)^x$?

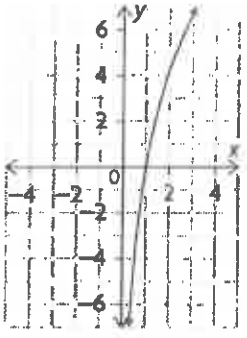
A. 

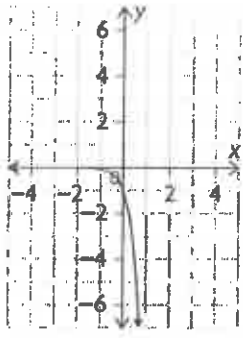
B. 

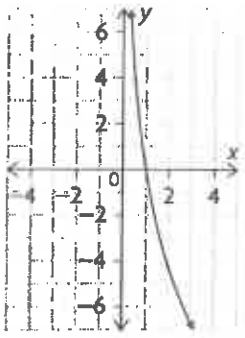
C. 

D. 

3. Which graph represents the function $y = -14 \log x$?

A. 

B. 

C. 

D. 

Name: _____ Date: _____

4. A biologist has been studying the effects of acid rain on the population of fish in a lake. The observations are shown in the table.

Time (years), x	0	1	2	3	4	5
Fish Population (estimated), $f(x)$	2700	2300	1950	1660	1400	1200

a) By what percent is the fish population declining every year?

A. 100% B. 15% C. 400% D. 10%

b) Which exponential regression function models the decline in the fish population?

A. $f(x) = 2700(1.15)^x$ C. $f(x) = 2700(0.15)^x$

B. $f(x) = 2700(0.85)^x$ D. $f(x) = 1200(3.2)^x$

5. Arlene bought a rare stamp for $47 in 2006. She has been tracking the value of the stamp every year since she bought it.

Years since Purchase, t	0	1	2	3	4	5
Stamp Value ($), $A(t)$	47.00	61.57	79.43	106.43	138.36	179.87

a) Which regression equation best models the value of the stamp over time?

A. $A(t) = 47t + 2$ C. $A(t) = 47(1.3)^t$

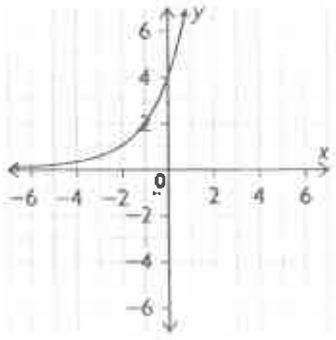
B. $A(t) = 2.1t + 47$ D. $A(t) = 1.3(47)^t$

b) Assume the same growth rate as in part a). What will the stamp be worth 10 years after it was purchased?

A. $120 B. $210 C. $470 D. $695

NUMERICAL RESPONSE

6. Examine the graph of the exponential function.



a) There are ___ x-intercepts.

b) The y-intercept is ___.

c) The graph extends from Quadrant ___ to Quadrant ___.

d) The domain is _____.

e) The range is _____.

Name: _____ Date: _____

7. Complete the table to predict the characteristics of each exponential function.

	Function	*y*-intercept	Base	Increasing or Decreasing
a)	$y = 7(3)^x$			
b)	$y = 4\left(\frac{1}{3}\right)^x$			
c)	$y = 6(2)^x$			

8. Complete the table to predict the characteristics of each function. Verify your predictions using graphing technology.

	Function	*x*-intercept	Number of *y*-intercepts	End Behaviour	Domain	Range	Increasing or Decreasing
a)	$y = -6 \log x$			from Quadrant ___ to Quadrant ___			
b)	$y = 12 \ln x$			from Quadrant ___ to Quadrant ___			

9. The element strontium-90 is radioactive. The percent of strontium-90, $A(t)$, left in a sample can be modelled by the half-life function

$$A(t) = A_0\left(\frac{1}{2}\right)^{\frac{t}{29}}$$

where t represents the time, in years, after the initial time, and A_0 represents the initial amount, 100% of the strontium.

a) A sample of strontium-90 will decay to half its initial amount in ___ years.

b) After 20 years, _____% of a sample of strontium-90 will remain. Round your answer to one decimal place.

c) A sample of strontium-90 will decay to 20% of its original amount in _____ years, rounded to one decimal place.

10. Canada's exports, in billions of dollars, are shown from 2002 to 2008.

Year, *t*	2002	2003	2004	2005	2007	2008
Exports (billions of dollars), *E*(*t*)	261	261	279	316	405	459

a) An exponential regression equation for Canada's exports over this period is _____.

b) An estimated value for Canada's exports in 2006 is $___ billion. This value is $___ billion less than the actual value of $365 billion.

c) An estimated value for Canada's exports in 2009 is $___ billion. This value is $___ billion more than the actual value of $323 billion.

Name: _____ Date: _____

WRITTEN RESPONSE

11. Predict whether each function is increasing or decreasing, without graphing it. Explain how you know. Verify your predictions by graphing the functions.

a) $y = 6(2)^x$

b) $y = 5(0.9)^x$

12. A telephone dial tone has a sound level of 80 dB. A motorcycle engine has a sound level of 100 dB. How many times louder is the motorcycle engine than the telephone dial? Explain.

TIP

The loudness of sound is measured in decibels (dB). The decibel scale is logarithmic, like the pH scale. A measure of 11 dB is 10 times louder than a measure of 1 dB.

13. The population of British Columbia is given from 2007 to 2011.

Year	2007	2008	2009	2010	2011
Population (1000s)	4309.6	4384.0	4459.9	4529.7	4573.3

a) Construct a scatter plot to display the data.

b) Use exponential regression to define a function that models the data.

c) Assuming the same growth rate as in part b), estimate the population of British Columbia in 2020. Describe your process.

d) Assuming the same growth rate as in part b), when would you expect the population to reach 4 700 000? Describe your process.

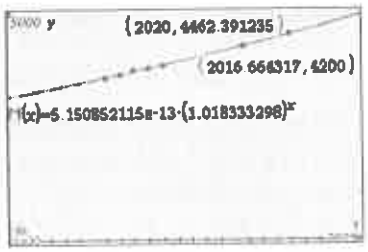
Name: _____ Date: _____

14. Carla invested $12 000 in a guaranteed investment certificate that pays 4% interest, compounded annually, over the next 5 years.

Years since Investment	0	1	2	3	4	5
Value of Investment ($)	12 000	12 480	12 979	13 498	14 038	14 600

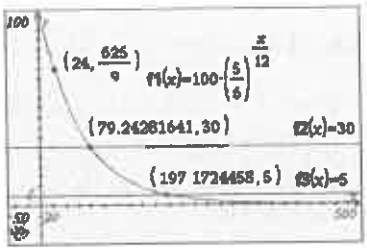
a) Use exponential regression to determine the equation of a function that models the growth of Carla's investment over x years.

b) Determine the value of Carla's investment after 8 years, assuming that the interest rate remains the same over the entire time.

2. a) 

b) $f(x) = 5.150\ldots(1.018\ldots)^x$ c) 4 070 000 d) 2017

3. e.g., a) $f(x) = 1.569\ldots(1.020\ldots)^x$ b) 92.4
c) My value was 1.1 higher than the actual value.
4. a) $5.475\ldots(1.135\ldots)^x$ b) 4 817 000 c) 2012
5. a) 69 barrels per week b) Week 79 c) Week 197



Lesson 7.4, page 188

1.

	x-intercept	Number of y-intercepts	End Behaviour	Domain	Range
a)	1	0	from Quadrant I to Quadrant IV	$\{x \mid x > 0, x \in R\}$	$\{y \mid y \in R\}$
b)	1	0	from quadrant IV to Quadrant I	$\{x \mid x > 0, x \in R\}$	$\{y \mid y \in R\}$

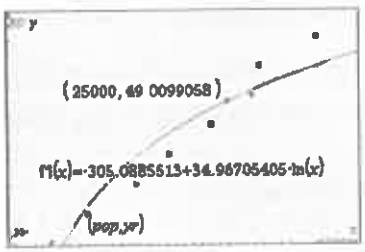
2.

	Function	x-intercept	Number of y-intercepts	End Behaviour	Domain	Range	Increasing or Decreasing
a)	$y = -4 \log x$	1	0	from Quadrant I to Quadrant IV	$\{x \mid x > 0, x \in R\}$	$\{y \mid y \in R\}$	decreasing
b)	$y = 13 \ln x$	1	0	from Quadrant IV to Quadrant I	$\{x \mid x > 0, x \in R\}$	$\{y \mid y \in R\}$	increasing
c)	$y = 20 \log x$	1	0	from Quadrant IV to Quadrant I	$\{x \mid x > 0, x \in R\}$	$\{y \mid y \in R\}$	increasing
d)	$y = -50 \ln x$	1	0	from Quadrant I to Quadrant IV	$\{x \mid x > 0, x \in R\}$	$\{y \mid y \in R\}$	decreasing

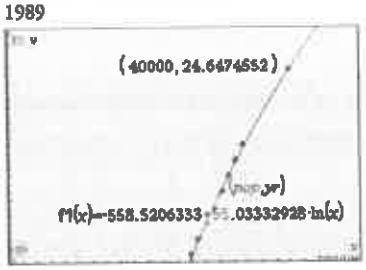
3. e.g., i) goes with c) because it is in logarithmic form and goes from quadrant IV to quadrant I; ii) goes with a) because it is in logarithmic form and goes from quadrant I to quadrant IV; iii) goes with b) because it is in exponential form and its y-intercept is 1.
4. a) Yes, it represents a logarithmic function; e.g., It extends from quadrant I to quadrant IV; it has no y-intercept; the x-intercept is 1; the domain is $\{x \mid x > 0, x \in R\}$; the range is $\{y \mid y \in R\}$.
b) No, does not represent a logarithmic function; e.g., It extends from quadrant II to quadrant I; it has a y-intercept; it has no x-intercept; the domain is $\{x \mid x \in R\}$; the range is $\{y \mid y > 0, y \in R\}$.
5. C. 6. A.
7. a) P-intercept: 100, no x-intercepts; $\{P \mid P > 0, P \in R\}$, $\{t \mid t \in R\}$; increasing; at $P = 100$, $t = 0$; e.g., The full amount of the sample present at time $t = 0$
b) About 30 years; e.g., I graphed the equations $y = -96.336 \log \frac{x}{100}$ and $y = 50$, then I determined their point of intersection.

Lesson 7.5, page 192

1. $y = 0.036\ldots + 23.871\ldots \ln x$; x-intercept: 1, no y-intercepts; graph extends from quadrant IV to quadrant I; domain $\{x \mid x > 0, x \in R\}$, range $\{y \mid y \in R\}$; increasing

2. a) 

b) $t = -305.286\ldots + 34.986\ldots \ln P$; P-intercept = 1, no t-intercept; graph extends through quadrant I; domain $\{P \mid P > 0, P \in N\}$, range $\{t \mid t \in R\}$; increasing
c) 1989

3. a) 

b) $t = -558.520\ldots + 55.033\ldots \ln x$; P-intercept = 1; no t-intercept; graph extends through quadrant I; domain $\{P \mid P > 0, P \in N\}$, range $\{t \mid t \in R\}$; increasing
c) 2021
4. 15 years; 21 years
5. 10 years

Chapter 7 Test Prep, page 196

Q1: An exponential function of the form $f(x) = a(b)^x$, where $a > 0$, $b > 0$, and $b \neq 1$,
- has 0 x-intercept(s) and 1 y-intercept(s)
- extends from Quadrant II to Quadrant I
- has domain $\{x \mid x \in R\}$ and range $\{y \mid y > 0, y \in R\}$

Q2:
- The value of a is the y-intercept of the graph of the function.
- The value of b in the exponential function determines whether the function increases or decreases. The function increases when $b \geq 1$. The function decreases when $0 \leq b \leq 1$.

Q3: A logarithmic function of the form $f(x) = a \log x$ or $f(x) = a \ln x$, where $a \neq 0$,
- has 1 x-intercept(s) and 0 y-intercept(s)
- extends from Quadrant IV to Quadrant I if $a \geq 0$, or from Quadrant I to Quadrant IV if $a \leq 0$
- has domain $\{x \mid x \geq 0, x \in R\}$ and range $\{y \mid y \in R\}$

Q4:
- If a scatter plot of the data appears to follow an exponential or logarithmic curve, you can use regression to determine the function that models the data.
- You can make predictions by reading values from the curve of best fit or by using the equation of the regression function.

Chapter 7 Test, page 197

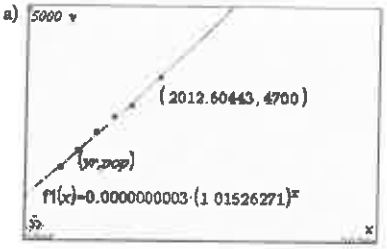
1. D. 2. B. 3. C. 4. a) B. b) B
5. a) C. b) D.
6. a) 0 b) 4 c) II, I d) $\{x \mid x \in R\}$ e) $\{y \mid y > 0, y \in R\}$
7.

	Function	y-intercept	Base	Increasing or Decreasing
a)	$y = 7(3)^x$	7	3	increasing
b)	$y = 4\left(\frac{1}{3}\right)^x$	4	$\frac{1}{3}$	decreasing
c)	$y = 6(2)^x$	6	2	increasing

8.

	Function	x-intercept	Number of y-intercepts	End Behaviour	Domain	Range	Increasing or Decreasing
a)	$y = -6 \log x$	1	0	from Quadrant I to Quadrant IV	$x \in \mathbb{R}$		decreasing
b)	$y = 12 \ln x$	1					increasing

9. a) 29 years b) 62.0% c) 67.3 years
10. a) 2.406...(1.106...)^x b) \$362 billion; \$3 billion less
    c) \$491 billion; \$168 billion more
11. a) increasing, because $a > 0$ and $b > 1$
    b) decreasing, because $a > 0$ and $0 < b < 1$
12. 100 times as loud
13. a)



    b) $f(x) = 0.000\,000\,000\,271(1.015...)^x$
    c) 5 265 120; e.g., I substituted $x = 2020$ into my function from part b).
    d) e.g., in the second half of 2012; I identified the point of intersection of the regression function and $y = 4700$.
14. a) $f(x) = 11\,999.911...(1.039...)^x$ b) \$16 422.63

Chapter 8

Getting Started, page 202

1. a) iii) b) iv) c) vi) d) i) e) v) f) ii)
2. a) 0.978 c) 0.208
   b) 0.438 d) −0.899
3. a) $y = 1.259...(1.079...)^x$ b) e.g., 1.52 million
4. a) $\{y \mid y \in R\}$ b) $\{y \mid y \geq -3, y \in R\}$ c) $\{y \mid 1 \leq y \leq 2, y \in R\}$
5. a)

x	0°	10°	25°	40°	55°	70°	85°	90°
$\sin x$	0	0.17	0.42	0.64	0.82	0.94	0.99	1
$\cos x$	1	0.98	0.91	0.77	0.57	0.34	0.09	0

   b) e.g., The value of sin x increases from 0 to 1, increasing more slowly as the value of x increases.
   c) e.g., The value of cos x decreases from 1 to 0, decreasing more quickly as the value of x increases.
6. a) 9.4 b) 14.0 c) 5.3

Lesson 8.1, page 204

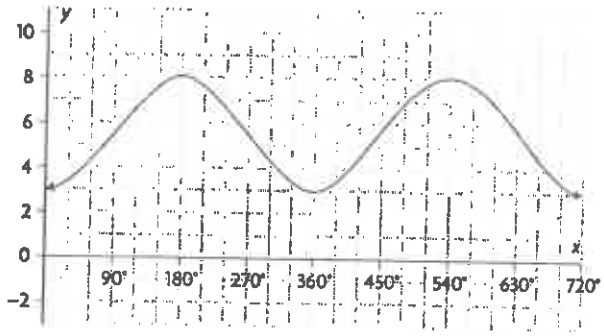
1. e.g., a) 0.4 b) 4
2. e.g., a) 20° b) 160° c) 211° d) 348°
3. e.g., a) 45° b) 200° c) 420°
4. e.g., a) 6.7 b) 12.5
5. e.g., a) 1.7 b) 4.7 c) 6.4
6. B. 7. A.
8. e.g., 410°; 7.1
9. Patty travelled about 10 m farther.

Lesson 8.2, page 208

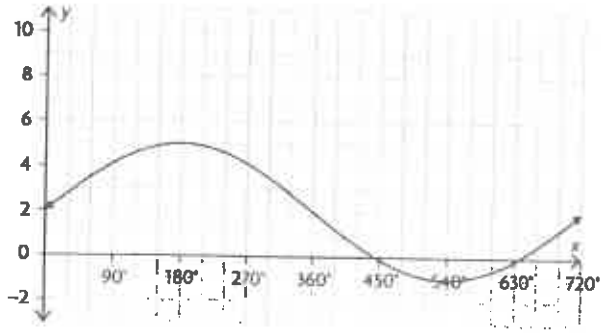
1. a) $y = \cos x$ b) neither; amplitude is greater than 1
   c) neither; has no x-intercepts d) neither; period is 720°

Lesson 8.3, page 210

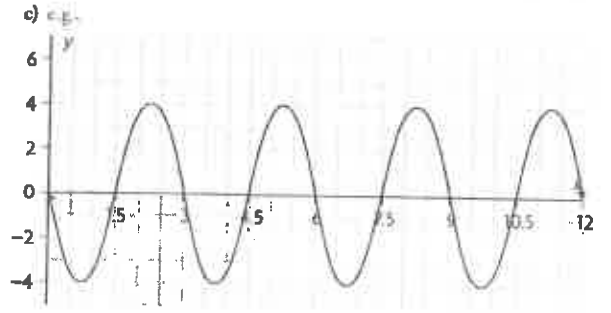
1. a) $\{y \mid -4.5 \leq y \leq 3.5, y \in R\}$; 4 b) $\{y \mid -4 \leq y \leq 2, y \in R\}$; 3
2. a) $y = 1$; 2 b) $y = -2$; 4
3. a) 120° b) 3
4. a) $\{y \mid -9 \leq y \leq 1, y \in R\}$; $y = -4$; 5; 180°
   b) $\{y \mid -2 \leq y \leq 8, y \in R\}$; $y = 3$; 3; 5
5. $\{x \mid 0 \leq x \leq 2.2, x \in R\}$; $\{y \mid -9 \leq x \leq 4, x \in R\}$; $y = -2.5$; 6.5; 0.5
6. a) e.g.,



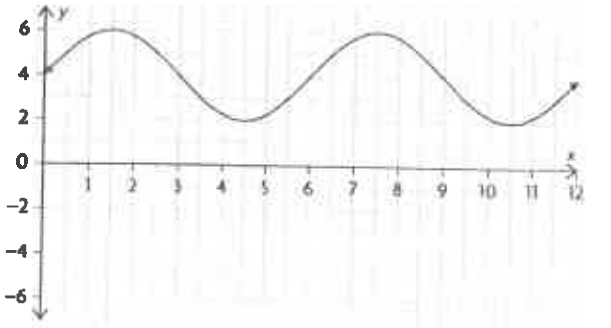
   b) e.g.,



   c) e.g.,



   d) e.g.,



7. B.
8. e.g., A and B have the same midline equation: True: A graph with a maximum of 3 and a minimum of −3 and a graph with a maximum of 2 and a minimum of −2 have the same midline equation, $y = 0$.