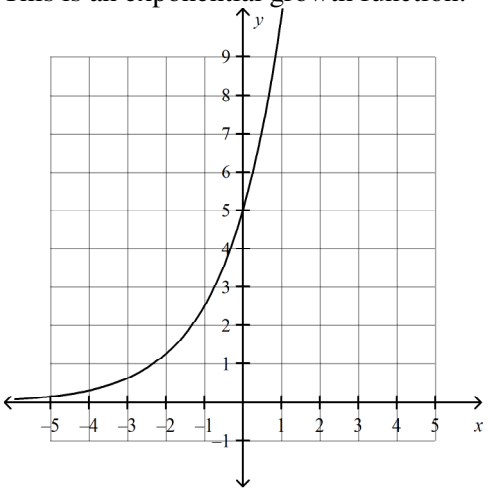
Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Algebra II Practice Test 7

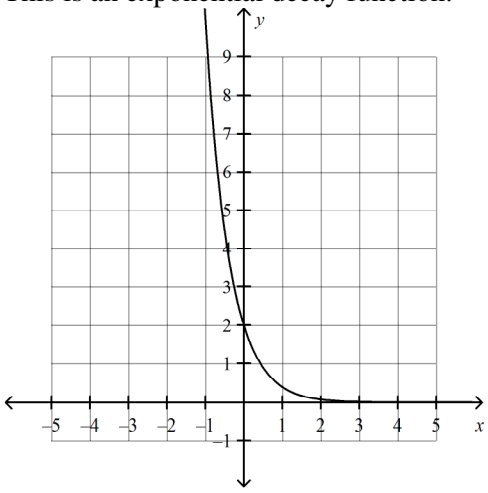
Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Tell whether the function $y = 2(5)^x$ shows growth or decay. Then graph the function.

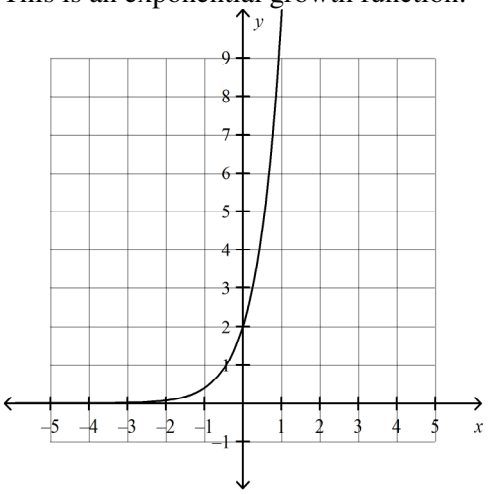
a. This is an exponential growth function.



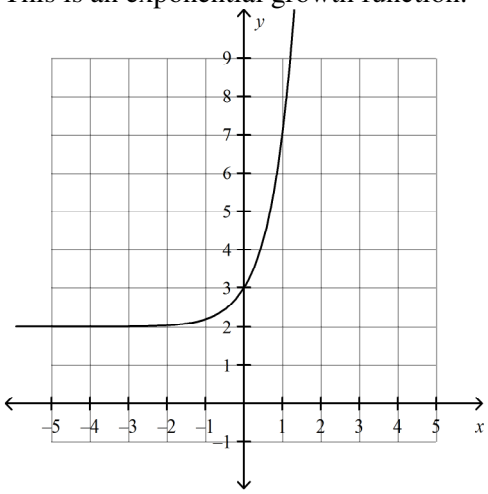
c. This is an exponential decay function.



b. This is an exponential growth function.



d. This is an exponential growth function.

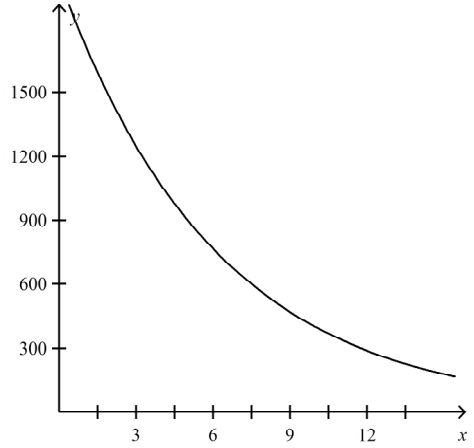


____ 2. Mira bought $300 of Freerange Wireless stock in January of 1998. The value of the stock is expected to increase by 7.5% per year. Use a graph to predict the year the value of Mira's stock will reach $700.

a. 1999
b. 2004
c. 2009
d. 2014

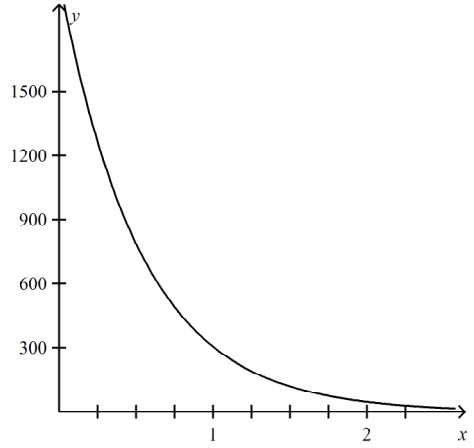
____ 3. A bacteria population starts at 2,032 and decreases at about 15% per day. Write a function representing the number of bacteria present each day. Graph the function. After how many days will there be fewer than 321 bacteria?

a. $f(x) = 2032(0.85)^t$



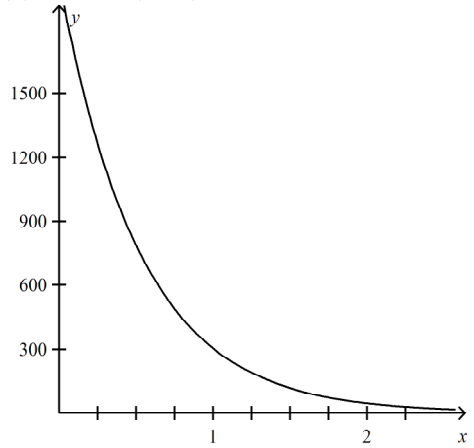
After about 11.3 days, there will be fewer than 321 bacteria.

b. $f(x) = 2,032(0.15)^t$



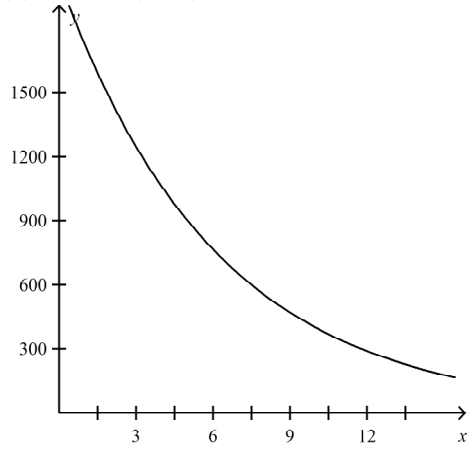
After about 0.97days, there will be fewer than 321 bacteria.

c. $f(x) = 2,032(0.15)t$



After about 1.05 days, there will be fewer than 321 bacteria.

d. $f(x) = 2,032(0.85)t$



After about 0.19 days, there will be fewer than 321 bacteria.

____ 4. A initial investment of $10,000 grows at 11% per year. What function represents the value of the investment after t years?

a. $f(t) = 10000(0.11)^t$

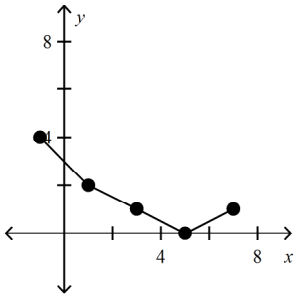
b. $f(t) = 10000(12)^t$

c. $f(t) = 10000(1.11)t$

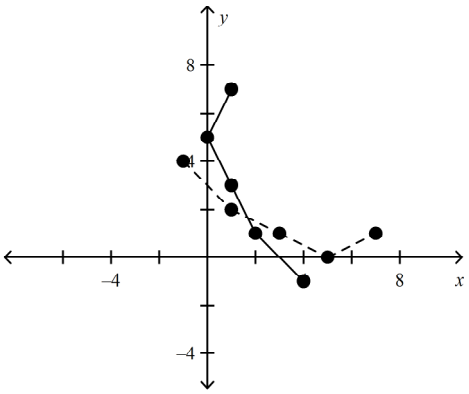
d. $f(t) = 10000(1.11)^t$

____ 5. Graph the inverse of the relation. Identify the domain and range of the inverse.

x	−1	1	3	5	7
y	4	2	1	0	1

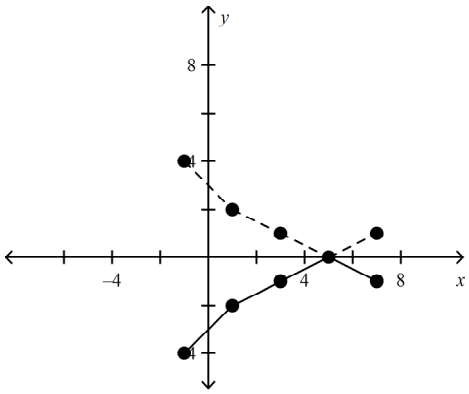


a.



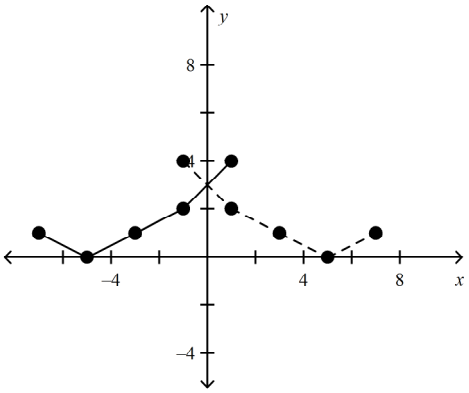
Domain: $\{x \mid 0 \le x \le 4\}$;
Range: $\{y \mid -1 \le y \le 7\}$

c.



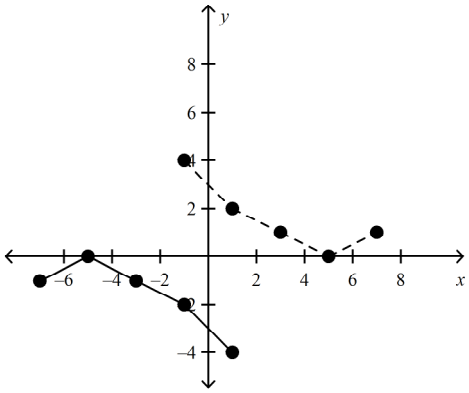
Domain: $\{x \mid -1 \le x \le 7\}$;
Range: $\{y \mid -4 \le y \le 1\}$

b.



Domain: $\{x \mid -7 \le x \le 1\}$;
Range: $\{y \mid 0 \le y \le 4\}$

d.



Domain: $\{x \mid -7 \le x \le 1\}$;
Range: $\{y \mid -4 \le y \le 0\}$

____ 6. Use inverse operations to write the inverse of $f(x) = x - \frac{1}{7}$.

a. $f(x) = x - \frac{1}{7}$

b. $f(x) = x + \frac{6}{7}$

c. $f(x) = x - \frac{6}{7}$

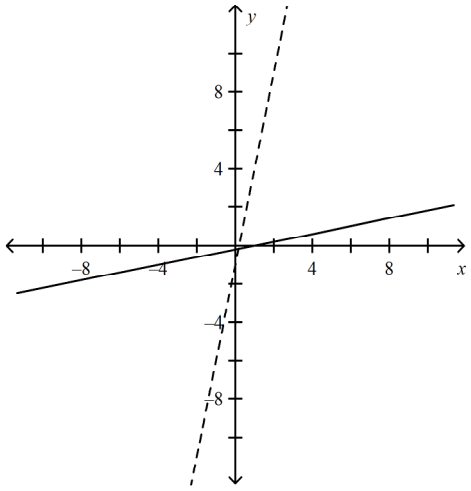
d. $f(x) = x + \frac{1}{7}$

____ 7. Use inverse operations to write the inverse of $f(x) = \frac{x}{4} - 5$.

a. $f^{-1}(x) = 4x + 5$
c. $f^{-1}(x) = 4(x + 5)$
b. $f^{-1}(x) = -5x - 4$
d. $f^{-1}(x) = \frac{x}{4} + 5$

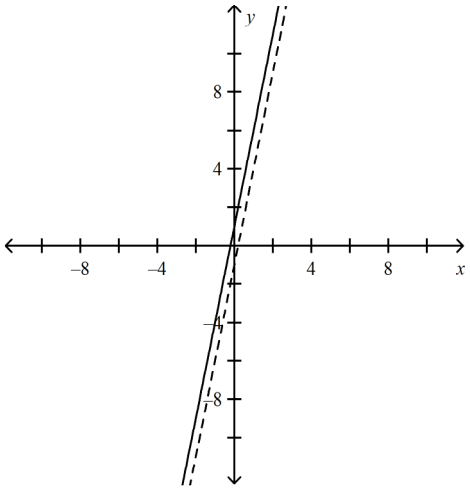
____ 8. Graph $f(x) = 5x - 1$. Then, write and graph the inverse.

a.



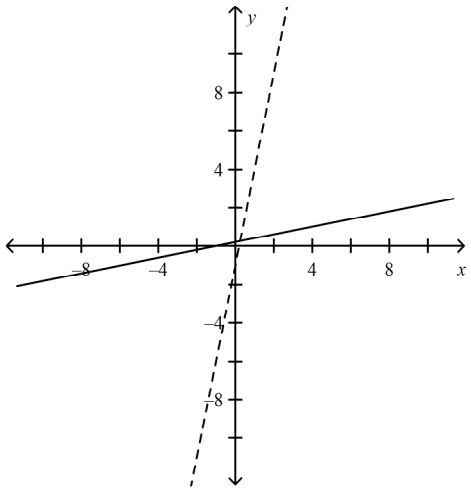
$f^{-1}(x) = \frac{(x-1)}{5}$

c.



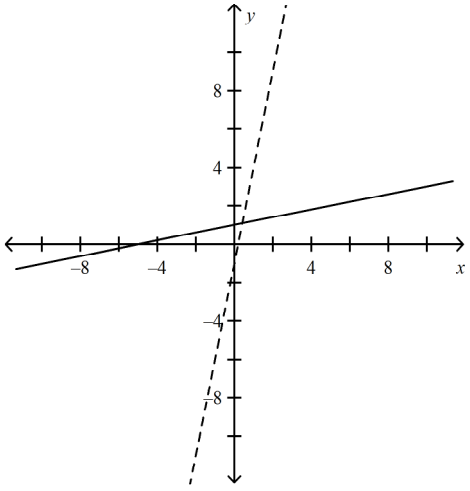
$f^{-1}(x) = 5x + 1$

b.



$f^{-1}(x) = \frac{(x+1)}{5}$

d.



$f^{-1}(x) = \frac{x}{5} + 1$

____ 9. A clerk needs to price a cashmere sweater returned by a customer. The customer paid a total of $222.36 that included a gift wrapping charge of $4 and a 9% sales tax. What price should the clerk mark on the tag?

a. $200.33
c. $200.00
b. $24.26
d. $222.00

____ 10. Manny is a plumber and charges $50 when he visits a client and $30 per hour for every hour he works. His bill can be expressed as a function of hours, x, with the function $f(x) = 50 + 30x$. Which statement explains the meaning of the inverse of the function?

a. Total bill as a function of the number of hours
b. Cost per hour as a function of the total bill
c. Number of hours as a function of the total bill
d. Total bill as a function of the cost per hour

____ 11. Write the exponential equation $2^3 = 8$ in logarithmic form.

a. $\log_3 8 = 2$
b. $\log_2 8 = 3$
c. $\log_2 3 = 8$
d. $\log_8 2 = 3$

____ 12. Write the logarithmic equation $\log_4 16 = 2$ in exponential from.

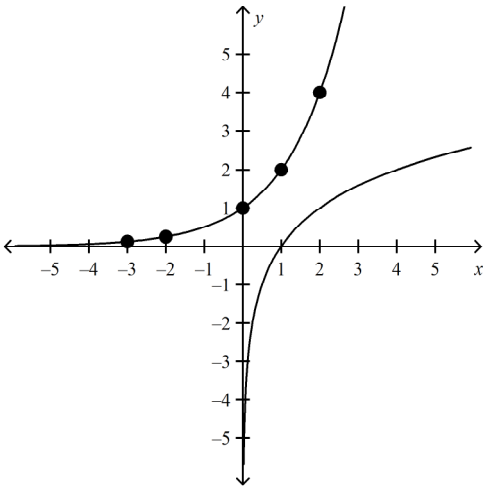
a. $4^{16} = 2$
b. $4^2 = 16$
c. $2^{-4} = 16$
d. $2^4 = 16$

____ 13. Evaluate $\log_4 \frac{1}{16}$ by using mental math.

a. $\frac{1}{4}$
b. 4
c. –2
d. 2

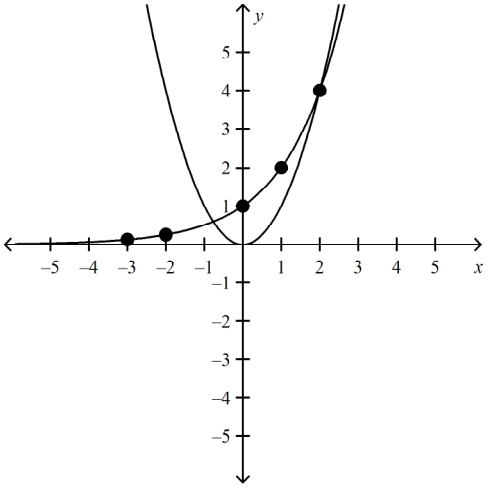
____ 14. Use $x = -3, -2, 0, 1, 2$ to graph the function $f(x) = 2^x$. Then graph its inverse. Describe the domain and range of the inverse function.

a.



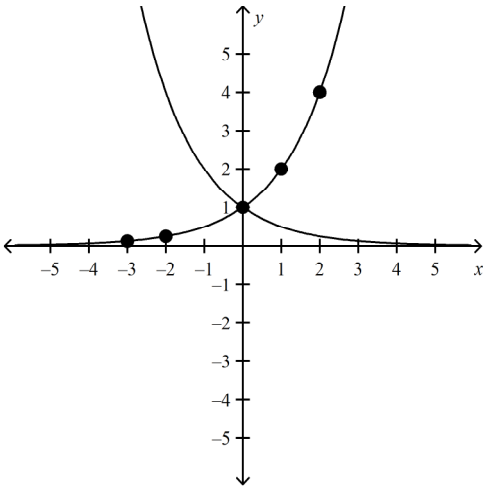
The domain of $f^{-1}(x)$ is $\{x|x > 0\}$, and the range is all real numbers.

b.



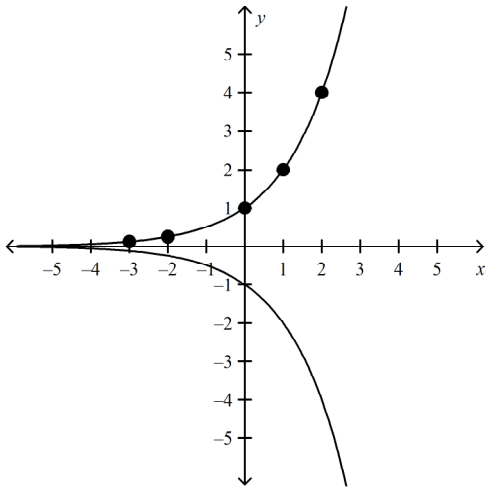
The domain of $f^{-1}(x)$ is all real numbers, and the range is $\{y|y \geq 0\}$.

c.



The domain of $f^{-1}(x)$ is all real numbers, and the range is $\{y|y > 0\}$.

d.



The domain of $f^{-1}(x)$ is all real numbers, and the range is $\{y \mid y < 0\}$.

____ 15. A wildlife biologist in Nova Scotia is testing the pH of stream water. She hopes that the pH of the water is greater than 5.5 so that Atlantic Salmon returning this year to their natal streams will be able to reproduce. The hydrogen ion concentration of the water is 0.0000019 moles per liter. To the nearest tenth, what is the pH of the water? (Recall that $\text{pH} = -\log\left[\text{H}^+\right]$.)

a. 1.9×10^{-6}
c. 6.0
b. 5.7
d. –6.0

____ 16. Express $\log_3 6 + \log_3 4.5$ as a single logarithm. Simplify, if possible.

a. 3
c. $\log_3 10.5$
b. $\log_6 10.5$
d. 27

____ 17. Express $\log_2 64 - \log_2 4$ as a single logarithm. Simplify, if possible.

a. $\log_2 4$
c. 4
b. 8
d. $\log_2 60$

____ 18. Express $\log_3 27^{-3}$ as a product. Simplify, if possible.

a. –9
c. $\frac{1}{27}$
b. 3
d. 9

____ 19. Simplify the expression $\log_4 64$.

a. 16
c. 4
b. 64
d. 3

____ 20. Evaluate $\log_9 243$. If necessary, round your answer to the nearest tenth.

a. 3
c. 27
b. 2.5
d. 1.4

____ 21. The altitude of an aircraft, *h*, in miles, is given by $h = -\left(\frac{100}{9}\right)\log\frac{P}{B}$, where *P* = the outside air pressure, and *B* = the atmospheric pressure at sea level. Let *B* = 31 inches of mercury (in. Hg). What is the outside air pressure at a height of 3.6 miles? Round your answer to the nearest tenth.

a. 14.7 in. Hg
c. 1.2 in. Hg
b. 65.4 in. Hg
d. –0.5 in. Hg

____ 22. Simplify $\log_7 x^3 - \log_7 x$.

a. $\log_7 (x^3 - x)$
b. $2\log_7 x$
c. $\log_7 2x$
d. $2(x^3 - x)$

____ 23. Solve $8^{x+8} = 32^x$.

a. $x = -12$
b. $x = 22$
c. $x = 12$
d. $x = -22$

____ 24. The amount of money in a bank account can be expressed by the exponential equation $A = 300(1.005)^{12t}$ where A is the amount in dollars and t is the time in years. About how many years will it take for the amount in the account to be more than $900?

a. 19 years
b. 30 years
c. 37 years
d. 221 years

____ 25. Solve $\log_5 x^{10} - \log_5 x^6 = 21$.

a. $x = 21^4$
b. $x = 5^{\frac{4}{21}}$
c. $x = 21^{\frac{1}{4}}$
d. $x = 5^{\frac{21}{4}}$

____ 26. Use a table and graph to solve $3^{2x} = 6561$.

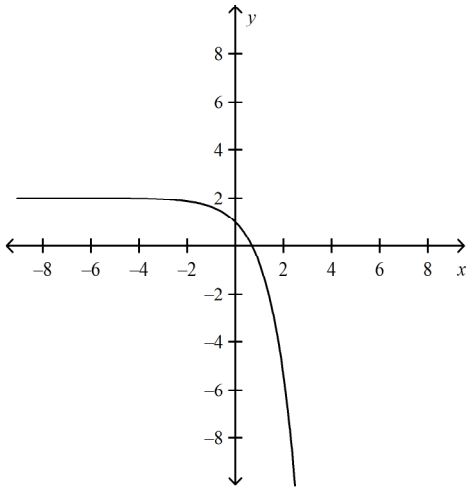
a. $x = 8$
b. $x = 4$
c. $x = 19$
d. $x = 6.5$

____ 27. Solve $b^{x-2} < c$.

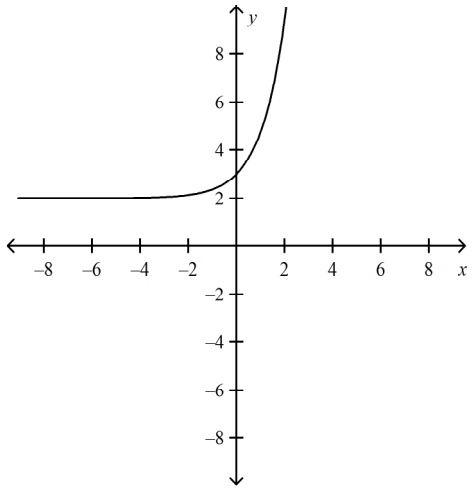
a. $x < \dfrac{\log b}{\log c} + 2$
b. $x < \dfrac{c}{\log b} + 2$
c. $x < \dfrac{\log c}{\log b} + 2$
d. $x < \dfrac{\log c}{b} + 2$

____ 28. Graph $f(x) = e^x + 2$.

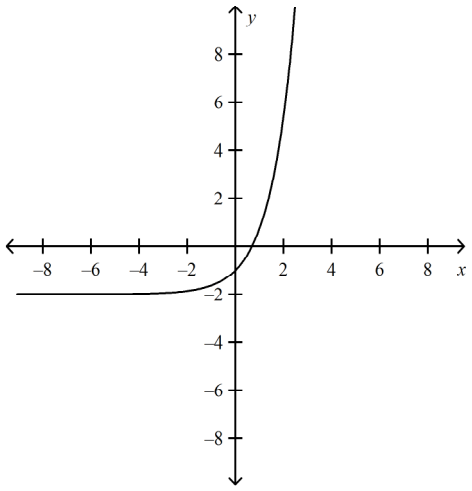
a.



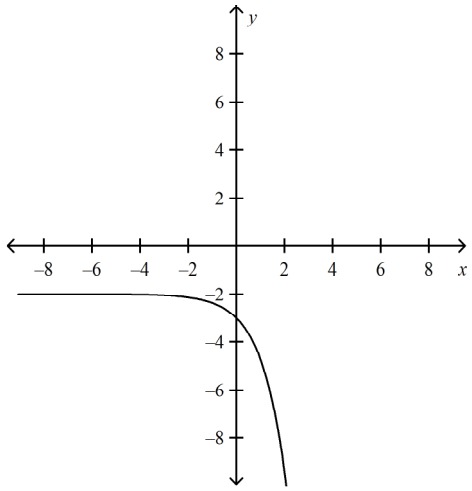
c.



b.



d.



____ 29. Simplify $\ln e^{-5x}$.

a. e^{-5}
c. $-5x$
b. -5
d. e^{-5x}

____ 30. Nadav invests $6,000 in an account that earns 5% interest compounded continuously. What is the total amount of her investment after 8 years? Round your answer to the nearest cent.

a. $8950.95
c. $9850.95
b. $327,588.90
d. $14,950.95

____ 31. Radioactive iodine treatment is so successful at treating hyperthyroidism that it has virtually replaced thyroid surgery. To the nearest full day, determine how long it will take for 400 millicuries of I-131, which has a half-life of 8 days, to decay to 3.125 millicuries.

a. 56 days
c. 128 days
b. 7 days
d. 8 days

____ 32. What expression is equal to $\log 50$?

a. $\ln 50$
c. $\ln 50 \div \ln 10$
b. $\ln 50 - \ln 10$
d. $\ln(50 \div 10)$

____ 33. Determine whether f is an exponential function of x of the form $f(x) = ab^x$. If so, find the constant ratio.

x	–1	0	1	2	3
$f(x)$	$1.1\overline{6}$	3.5	10.5	31.5	94.5

a. The second differences are not constant. The data set is not exponential.
b. The data set is exponential with a constant ratio of $2.\overline{3}$.
c. The ratio of the successive first differences is constant. $f(x)$ is a linear function of x.
d. The data set is exponential with a constant ratio of 3.

____ 34. The table shows US Department of Agriculture estimates of the number of acres defoliated by gypsy moths in Massachusetts during the years 1978 to 1981, the first four years of a major gypsy moth epidemic. Find an exponential model for the data. Use the model to predict the number of thousands of acres defoliated by gypsy moths in 1982, the fifth year of the epidemic.

Epidemic Year	**Thousands of Acres**
1	63
2	226
3	907
4	2,826

a. $A(y) = 50.97y^{2.70}$; 3931
b. $A(y) = 439y^2 - 1298y + 958$; 5443
c. $A(y) = 17.82(3.60)^y$; 10,775
d. $A(y) = 897y - 1237$; 3248

____ 35. The table shows the growth in the population of lemurs on an island over a 5-year period. Find a natural log model for the data, rounding your a- and b-values to the nearest hundredth.
Use the model to predict the year in which the lemur population will reach 500.

Population	222	292	340	366	382
Year	1	2	3	4	5

a. $P(t) = 223.08 + 101.64 \ln t$; year 15
b. $P(t) = 101.64 + 223.08 \ln t$; year 6
c. $P(t) = 202.2 + 39.4t$; year 7
d. $P(t) = 221.46 + 105.15 \ln t$; year 14

Numeric Response

36. Evaluate $\log_4 4096$.

37. Find the missing value if f is an exponential function. Round your answer to the nearest hundredth.

x	0	1	2	3
$f(x)$	6	9	?	20.25

Algebra II Practice Test 7
Answer Section

MULTIPLE CHOICE

1. ANS: B
Step 1 Find the value of the base: 5.
The base is greater than 1. So, this is an exponential growth function.

Step 2 Choose several values of x and generate ordered pairs. Then, graph the ordered pairs and connect with a smooth curve.

	Feedback
A	Check that you have identified the base correctly.
B	Correct!
C	Be sure you are using the sign of the exponent correctly.
D	The coefficient multiplies the power; it is not added to the power.

PTS: 1 DIF: Basic REF: Page 491
OBJ: 7-1.1 Graphing Exponential Functions NAT: 12.5.1.h
TOP: 7-1 Exponential Functions Growth and Decay KEY: exponential function | graph

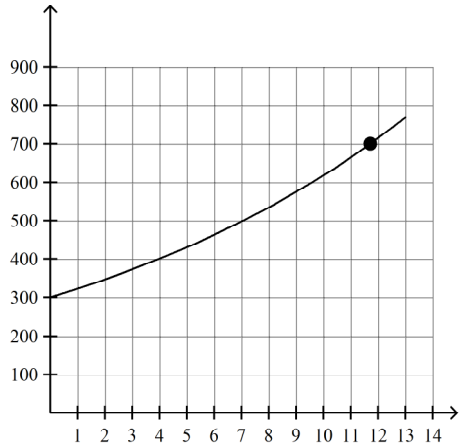
2. ANS: C

Step 1 Write a function to model the expected growth in value of the stock.

$f(t) = a(1+r)^t$ Exponential growth function

$f(t) = 300(1+0.075)^t$ Substitute 300 for a and 0.075 for r.

Step 2 Graph the function.



Step 3 Use the graph to predict when the value of the stock will reach \$700. Use the [TRACE] feature to find the t-value when $f(t) \approx 700$.

The value of the function is approximately \$700 when $t \approx 11.72$. Thus, the stock will be worth \$700 about 11.72 years after it was bought, or sometime in 2009.

	Feedback
A	Substitute 300 for a, and 0.075 for r in the exponential growth function. Graph and then use the [TRACE] function on your calculator.
B	Substitute 300 for a, and 0.075 for r in the exponential growth function. Graph and then use the [TRACE] function on your calculator.
C	Correct!
D	Substitute 300 for a, and 0.075 for r in the exponential growth function. Graph and then use the [TRACE] function on your calculator.

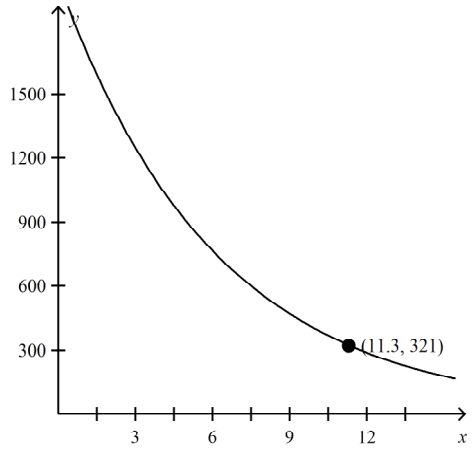
PTS: 1 DIF: Basic REF: Page 492 OBJ: 7-1.2 Application
NAT: 12.5.1.e TOP: 7-1 Exponential Functions Growth and Decay

3. ANS: A

$f(x) = a(1-r)^t$ Write exponential decay function.

$f(x) = 2{,}032(1-0.15)^t$ Substitute 2032 for a and 015 for r.

$f(x) = 2{,}032(0.85)^t$ Simplify.



After about 11.3 days, there will be fewer than 321 bacteria.

	Feedback
A	Correct!
B	For exponential decrease, subtract the rate from 1.
C	Use an exponential function for a function that changes at a constant rate.
D	Use an exponential function for a function that changes at a constant rate.

PTS: 1 DIF: Average REF: Page 492 OBJ: 7-1.3 Application
NAT: 12.5.1.e TOP: 7-1 Exponential Functions Growth and Decay

4. ANS: D

The investment follows an exponential growth of 11% per year with an initial value of $10,000. Using the formula $f(t) = P(1+r)^t$, substitute the given values.

$f(t) = 10000(1+11\%)^t$

$f(t) = 10000(1+0.11)^t$

$f(t) = 10000(1.11)^t$

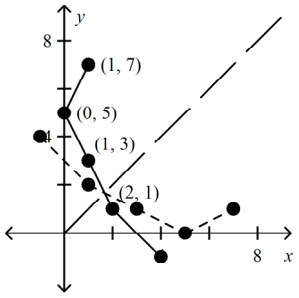
	Feedback
A	Use the formula for exponential growth.
B	Change the rate to a decimal before adding.
C	Use the formula for exponential growth.
D	Correct!

PTS: 1 DIF: Advanced NAT: 12.5.1.e
TOP: 7-1 Exponential Functions Growth and Decay

5. ANS: A
For the inverse relation, switch the x and y-values in each ordered pair.

x	4	2	1	0	1
y	−1	1	3	5	7

Graph each point and connect the points.
The inverse is the reflection of the original relation across the line $y = x$.



Domain: $\{x \mid 0 \le x \le 4\}$; Range: $\{y \mid -1 \le y \le 7\}$

	Feedback
A	Correct!
B	To find the inverse, switch the x and y values of the original relation.
C	To find the inverse, switch the x and y values of the original relation.
D	To find the inverse, switch the x and y values of the original relation.

PTS: 1 DIF: Basic REF: Page 498 OBJ: 7-2.1 Graphing Inverse Relations
TOP: 7-2 Inverses of Relations and Functions

6. ANS: D
$f(x) = x - \frac{1}{7}$ The number $\frac{1}{7}$ is subtracted from x.
$f^{-1}(x) = x + \frac{1}{7}$ Add $\frac{1}{7}$ to x to write the inverse.

	Feedback
A	The opposite of addition is subtraction, and vice versa.
B	Add or subtract the same number.
C	The opposite of addition is subtraction, and vice versa.
D	Correct!

PTS: 1 DIF: Basic REF: Page 499
OBJ: 7-2.2 Writing Inverse Functions by Using Inverse Operations
TOP: 7-2 Inverses of Relations and Functions

7. ANS: C

$f(x) = \frac{x}{4} + (-5)$ The variable, x, is divided by 4, then –5 is added.

$f^{-1}(x) = 4(x - (-5))$ Undo the addition by subtracting –5. Undo the division by multiplying by 4.

$f^{-1}(x) = 4(x + 5)$

	Feedback
A	Be sure to undo operations in the correct order.
B	To find the inverse, replace $f(x)$ with y, then solve the resulting equation for x.
C	Correct!
D	To find the inverse, replace $f(x)$ with y, then solve the resulting equation for x.

PTS: 1 DIF: Average REF: Page 499
OBJ: 7-2.3 Writing Inverses of Multi-Step Functions
TOP: 7-2 Inverses of Relations and Functions

8. ANS: B

Set $y = f(x)$. $y = 5x - 1$

Switch x and y. $x = 5y - 1$

Solve for y. $x + 1 = 5y$ So, $\frac{(x+1)}{5} = y$.

Write in $y =$ form. $y = \frac{(x+1)}{5}$

Write the inverse. $f^{-1}(x) = \frac{(x+1)}{5}$

	Feedback
A	This equation has the correct slope, but the wrong intercept.
B	Correct!
C	To find the inverse, switch the x and y variables and solve for y.
D	This equation has the correct slope, but the wrong intercept.

PTS: 1 DIF: Average REF: Page 500
OBJ: 7-2.4 Writing and Graphing Inverse Functions
TOP: 7-2 Inverses of Relations and Functions

9. ANS: C

$c = 1.09(p + 4)$ Cost c is a function of price p.

$c = 1.09p + 4.36$ Distribute.

$c - 4.36 = 1.09p$ Subtract 4.36 from both sides.

$\frac{c - 4.36}{1.09} = p$ Divide to isolate p.

$\frac{222.36 - 4.36}{1.09} = p$ Substitute 222.36 for c.

$200 = p$ Simplify.

The clerk should mark the price on the tag as $200.00.

	Feedback
A	Tax is applied to the gift wrapping fee.
B	Tax is a percent. Convert it to a decimal.
C	Correct!
D	Cost is (1 + tax) times the price.

PTS: 1 DIF: Average REF: Page 500 OBJ: 7-2.5 Application
TOP: 7-2 Inverses of Relations and Functions

10. ANS: C

The function $f(x)$ represents the total bill as a function of the number of hours Manny works. The inverse uses the output of the function as its input and uses the input of the function as its output. The output of the function is the total bill. This becomes the input of the inverse function. The input of the function is the number of hours Manny works. This becomes the output of the inverse function. The inverse of the function therefore represents the number of hours Manny works as a function of the total bill.

	Feedback
A	This represents the function, not its inverse.
B	The inverse uses the output of the function as its input and uses the input of the function as its output.
C	Correct!
D	The inverse uses the output of the function as its input and uses the input of the function as its output.

PTS: 1 DIF: Advanced TOP: 7-2 Inverses of Relations and Functions

11. ANS: B
The base of the exponent becomes the base of the logarithm.
The exponent is the logarithm.
$2^3 = 8$ becomes $\log_2 8 = 3$.

	Feedback
A	A logarithm is the exponent to which a base is raised to obtain a given value.
B	Correct!
C	The exponent is the logarithm.
D	The base of the exponent becomes the base of the logarithm.

PTS: 1 DIF: Basic REF: Page 505
OBJ: 7-3.1 Converting from Exponential to Logarithmic Form TOP: 7-3 Logarithmic Functions

12. ANS: B
Logarithmic form: $\log_4 16 = 2$

Exponential form: $4^2 = 16$
The base of the logarithm becomes the base of the power, and the logarithm is the exponent.

	Feedback
A	The logarithm is the exponent.
B	Correct!
C	The base of the logarithm becomes the base of the power, and the logarithm is the exponent.
D	The base of the logarithm becomes the base of the power.

PTS: 1 DIF: Basic REF: Page 506
OBJ: 7-3.2 Converting from Logarithmic to Exponential Form TOP: 7-3 Logarithmic Functions

13. ANS: C
$4^{?} = \frac{1}{16}$ The log is the exponent.

$4^{-2} = \frac{1}{16}$ Think: What power of the base is the number?

$\log_4 \frac{1}{16} = -2$

	Feedback
A	Since the logarithm is the exponent, think: What power of the base is the number?
B	Since the logarithm is the exponent, think: What power of the base is the number?
C	Correct!
D	Since the logarithm is the exponent, think: What power of the base is the number?

PTS: 1 DIF: Average REF: Page 506
OBJ: 7-3.3 Evaluating Logarithms by Using Mental Math TOP: 7-3 Logarithmic Functions

14. ANS: A

Graph $f(x) = 2^x$ using a table of values.

x	–3	–2	0	1	2
$f(x) = 2^x$	$\frac{1}{8}$	$\frac{1}{4}$	1	2	4

To graph the inverse $f^{-1}(x) = \log_2 x$, reverse each ordered pair.

x	$\frac{1}{8}$	$\frac{1}{4}$	1	2	4
$f^{-1}(x) = \log_2 x$	–3	–2	0	1	2

The domain of $f^{-1}(x)$ is $\{x | x > 0\}$ and the range is all real numbers.

	Feedback
A	Correct!
B	The inverse of an exponential function is a logarithmic function.
C	The inverse of an exponential function is a logarithmic function.
D	The inverse of an exponential function is a logarithmic function.

PTS: 1 DIF: Average REF: Page 507
OBJ: 7-3.4 Graphing Logarithmic Functions TOP: 7-3 Logarithmic Functions

15. ANS: B

$\text{pH} = -\log\left[\text{H}^+\right]$

$\text{pH} = -\log(0.0000019)$ Substitute the known values in the function.

Use a calculator to find the value of the logarithm in base 10. Press the [LOG] key.

The stream water has a pH of about 5.7. Atlantic Salmon returning to their natal streams will be able to reproduce this year!

	Feedback
A	Substitute 0.0000019 in the equation for the pH. Use your calculator to solve.
B	Correct!
C	Substitute 0.0000019 in the equation for the pH. Use your calculator to solve.
D	Substitute 0.0000019 in the equation for the pH. Use your calculator to solve.

PTS: 1 DIF: Average REF: Page 508 OBJ: 7-3.5 Application
TOP: 7-3 Logarithmic Functions

16. ANS: A

$\log_3 6 + \log_3 4.5 = \log_3 27$ To add the numbers, multiply the logarithms

3 Think. What exponent on base 3 gives 27? $3^3 = 27$

	Feedback
A	Correct!
B	To add logarithms of two numbers with the same base, multiply the numbers. Then simplify if possible.
C	To add logarithms of two numbers with the same base, multiply the numbers. Then simplify if possible.
D	This is the product. Take the logarithm of this number to the given base.

PTS: 1 DIF: Basic REF: Page 514 OBJ: 7-4.1 Adding Logarithms
TOP: 7-4 Properties of Logarithms

17. ANS: C

To subtract the logarithms divide the numbers.

$\log_2 64 - \log_2 4 = \log_2 (\frac{64}{4}) = \log_2 16 = 4$

	Feedback
A	Divide the values, then take the logarithm of that value.
B	This is what we'd get if we were adding the logarithms. To subtract logarithms, divide the values and then take the logarithm.
C	Correct!
D	To subtract logarithms, divide the values and then take the logarithm.

PTS: 1 DIF: Average REF: Page 513 OBJ: 7-4.2 Subtracting Logarithms
TOP: 7-4 Properties of Logarithms

18. ANS: A

$\log_3 27^{-3}$

$= -3 \log_3 27$ The Power Property of Logarithms says $\log_b a^p = p \log_b a$.

$= -3(3)$ Because $3^3 = 27$, $\log_3 27 = 3$.

$= -9$

	Feedback
A	Correct!
B	Use the Power Property of Logarithms when simplifying.
C	Use the Power Property of Logarithms when simplifying.
D	Use the Power Property of Logarithms when simplifying.

PTS: 1 DIF: Average REF: Page 513
OBJ: 7-4.3 Simplifying Logarithms with Exponents TOP: 7-4 Properties of Logarithms

19. ANS: D

Factor 64. Then write it in the form of 4^3, and apply the Inverse Properties of Logarithms and Exponents.

	Feedback
A	Factor, then apply the Inverse Properties of Logarithms and Exponents.
B	Factor, then apply the Inverse Properties of Logarithms and Exponents.
C	Apply the Inverse Properties of Logarithms and Exponents; this is the base, not the answer.
D	Correct!

PTS: 1 DIF: Basic REF: Page 514 OBJ: 7-4.4 Recognizing Inverses
TOP: 7-4 Properties of Logarithms

20. ANS: B

Method 1 Change to base 10.

$\log_9 243 = \dfrac{\log 243}{\log 9} = \dfrac{2.3856}{0.9542}$ Use a calculator.

$\log_9 243 = 2.5$

Method 2 Change to base 3, because both 9 and 243 are powers of 3.

$\log_9 243 = \dfrac{\log_3 243}{\log_3 9} = \dfrac{5}{2} = 2.5$

	Feedback
A	To find the base *b* logarithm of a number *n*, divide the base 10 logarithm of *n* by the base 10 logarithm of *b*.
B	Correct!
C	To find the base *b* logarithm of a number *n*, divide the base 10 logarithm of *n* by the base 10 logarithm of *b*.
D	To find the base *b* logarithm of a number *n*, divide the base 10 logarithm of *n* by the base 10 logarithm of *b*.

PTS: 1 DIF: Average REF: Page 514
OBJ: 7-4.5 Changing the Base of a Logarithm TOP: 7-4 Properties of Logarithms

21. ANS: A

$3.6 = -\left(\frac{100}{9}\right)\log\frac{P}{31}$	Substitute 3.6 for h.
$-\frac{9}{100}(3.6) = \log\frac{P}{31}$	Multiply both sides by $-\frac{9}{100}$.
$-0.324 = \log\frac{P}{31}$	Simplify.
$-0.324 = \log P - \log 31$	Apply the Quotient Property of Logarithms.
$-0.324 = \log P - 1.491$	Calculate.
$1.167 = \log P$	Add 1.491 to both sides.
$P = 10^{1.167}$	Apply the Inverse Property of Exponents and Logarithms.
$P \approx 14.7$	Calculate.

	Feedback
A	Correct!
B	You are given B, the pressure at sea level, and need to find P.
C	Use the Inverse Property of Exponents and Logarithms.
D	Use the fact that $\log(a/b) = \log a - \log b$.

PTS: 1 DIF: Average REF: Page 515 OBJ: 7-4.6 Application
TOP: 7-4 Properties of Logarithms

22. ANS: B

$\log_7 x^3 - \log_7 x$	
$= 3\log_7 x - \log_7 x$	Use the Power Property of Logarithms.
$= 2\log_7 x$	Simplify.

	Feedback
A	To subtract the logarithms, divide x cubed by x.
B	Correct!
C	The logarithm of a power is the product of the exponent and the logarithm of the base.
D	Use the Power Property of Logarithms, and simplify.

PTS: 1 DIF: Advanced TOP: 7-4 Properties of Logarithms

23. ANS: C

$\left(2^3\right)^{x+8} = \left(2^5\right)^x$ Rewrite each side as powers of the same base.

$2^{3(x+8)} = 2^{5x}$ To raise a power to a power, multiply the exponents.

$3(x+8) = 5x$ The bases are the same, so the exponents must be equal.

$x = 12$

The solution is $x = 12$.

	Feedback
A	Rewrite each side as powers of the same base and then set the exponents equal.
B	Rewrite each side as powers of the same base and then set the exponents equal.
C	Correct!
D	Rewrite each side as powers of the same base and then set the exponents equal.

PTS: 1 DIF: Average REF: Page 522
OBJ: 7-5.1 Solving Exponential Equations
TOP: 7-5 Exponential and Logarithmic Equations and Inequalities

24. ANS: A

$900 = 300(1.005)^{12t}$ Write 900 for the amount.

$3 = 1.005^{12t}$ Divide both sides by 300.

$\log 3 = \log 1.005^{12t}$ Take the log of both sides.

$\log 3 = (12t)\log 1.005$ Use the Power Property.

$\frac{\log 3}{12\log(1.005)} = t$ Divide by $12\log(1.005)$.

$t = 18.36$ Evaluate with a calculator.

$t \approx 19$ years Round to the next year.

	Feedback
A	Correct!
B	First divide by 300, then take the log of both sides. Use the Power Property to solve for t.
C	First divide by 300, then take the log of both sides. Use the Power Property to solve for t.
D	First divide by 300, then take the log of both sides. Use the Power Property to solve for t.

PTS: 1 DIF: Average REF: Page 523 OBJ: 7-5.2 Application
TOP: 7-5 Exponential and Logarithmic Equations and Inequalities

25. ANS: D

$\log_5 \frac{x^{10}}{x^6} = 21$	Apply the Quotient Property.
$\log_5 x^4 = 21$	Simplify.
$4 \log_5 x = 21$	Use the Power Property.
$\log_5 x = \frac{21}{4}$	Divide.
$5^{\log_5 x} = 5^{\frac{21}{4}}$	Use 5 as the base for both sides.
$x = 5^{\frac{21}{4}}$	Use inverse properties.

	Feedback
A	Use the base of the logarithm when solving.
B	Isolate the logarithm before using the inverse property.
C	Use the base of the logarithm when solving.
D	Correct!

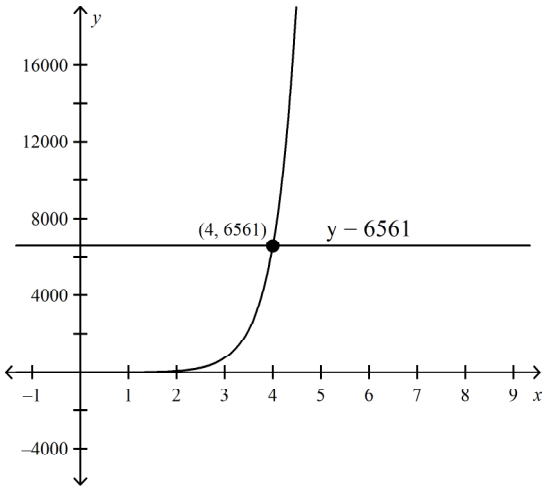
PTS: 1 DIF: Advanced REF: Page 523
OBJ: 7-5.3 Solving Logarithmic Equations
TOP: 7-5 Exponential and Logarithmic Equations and Inequalities

26. ANS: B

Use a graphing calculator. Enter 3^{2x} as Y1 and 6561 as Y2. Use the table to locate the value of x where Y1 = Y2.

X	Y1	Y2	
1	9	6561	
2	81	6561	
3	729	6561	
4	**6561**	**6561**	←
5	59049	6561	

The graph shows $x = 4$ as the point of intersection of Y1 and Y2.



	Feedback
A	Solve for x, not the exponent.
B	Correct!
C	Graph the intersection of $y = 6561$ and $y = 3\text{^}(2x)$.
D	The base is 3 and the exponent is $2x$.

PTS: 1 DIF: Basic REF: Page 524
OBJ: 7-5.4 Using Tables and Graphs to Solve Exponential and Logarithmic Equations and Inequalities
TOP: 7-5 Exponential and Logarithmic Equations and Inequalities

27. ANS: C

$b^{x-2} < c$

$\log b^{x-2} < \log c$ Take the log of both sides.

$(x-2)\log b < \log c$ Apply the Power Property of Logarithms.

$x - 2 < \dfrac{\log c}{\log b}$ Divide both sides by $\log b$.

$x < \dfrac{\log c}{\log b} + 2$

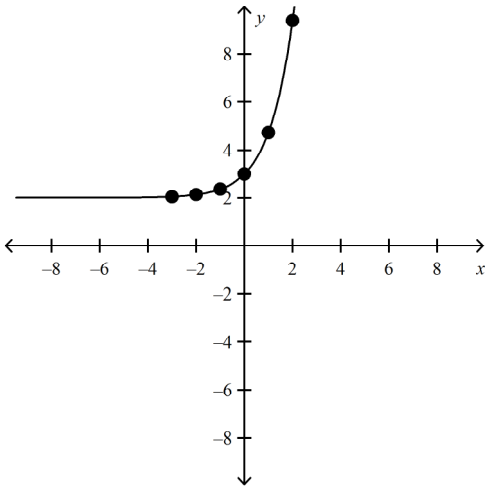
	Feedback
A	You switched log(b) and log(c).
B	To find the solution, take the log of both sides.
C	Correct!
D	To find the solution, take the log of both sides.

PTS: 1 DIF: Advanced
TOP: 7-5 Exponential and Logarithmic Equations and Inequalities

28. ANS: C

Make a table. Because e is irrational, round the values.

x	−3	−2	−1	0	1	2	3
$f(x) = e^x + 2$	2.05	2.14	2.37	3	4.72	9.39	22.09



	Feedback
A	Make a table to check your values.
B	Make a table to check your values.
C	Correct!
D	Make a table to check your values.

PTS: 1 DIF: Basic REF: Page 531
OBJ: 7-6.1 Graphing Exponential Functions NAT: 12.5.1.e
TOP: 7-6 The Natural Base e

29. ANS: C

$\ln e^{-5x} = -5x \ln e = -5x(1) = -5x$

	Feedback
A	Use the inverse property of l*n*.
B	Remember the variable.
C	Correct!
D	Use the inverse property of l*n*.

PTS: 1 DIF: Basic REF: Page 532
OBJ: 7-6.2 Simplifying Expressions with e or ln TOP: 7-6 The Natural Base e

30. ANS: A

$A = Pe^{rt}$ Substitute 6,000 for P, 0.05 for r, and 8 for t.

$A = 6000e^{0.05(8)}$ Use the [e^x] key on a calculator.

$A \approx 8950.95$

The total amount after 8 years is $8950.95.

	Feedback
A	Correct!
B	5% = 0.05
C	Check the answer on your calculator.
D	Use the formula for continuously compounded interest. Don't add 6000.

PTS: 1 DIF: Average REF: Page 532 OBJ: 7-6.3 Application
NAT: 12.5.1.e TOP: 7-6 The Natural Base e

31. ANS: A

Step 1 Find the decay constant for ^{131}I.

$N_t = N_0 e^{-kt}$	Use the natural decay function.
$\frac{1}{2} = 1e^{-k8}$	Substitute 1 for N_0, 8 for t, and $\frac{1}{2}$ for N_t because half the initial quantity will remain.
$\ln\left(\frac{1}{2}\right) = \ln\left(e^{-8k}\right)$	Simplify and take the ln of both sides.
$\ln\left(2^{-1}\right) = -8k$	Write $\frac{1}{2}$ as 2^{-1}, and simplify the right side.
$-\ln 2 = -8k$	Properties of logarithms
$k = \frac{\ln 2}{8} \approx 0.08664$	

Step 2 Write the decay function and solve for t.

$N_t = N_0 e^{-0.08664t}$	Substitute 0.08664 for k.
$3.125 = 400e^{-0.08664t}$	Substitute 3.125 for N_t and 400 for N_0.
$0.007813 = e^{-0.08664t}$	Divide both sides by 400.
$\ln(0.007813) = \ln\left(e^{-0.08664t}\right)$	Take the ln of both sides.
$\ln(0.007813) = -0.08664t$	Simplify.
$t = \frac{\ln(0.007813)}{-0.08664} \approx 56$	

It will take approximately 56 days for 400 millicuries of I-131 to decay to 3.125 millicuries.

	Feedback
A	Correct!
B	You found the number of half-lives? How many days comprise 7 half-lives?
C	Use what you know about the half-life to find k for the decay of I-131. Then find the time t it takes for 400 millicuries to decay to 3.125 millicuries.
D	Use what you know about the half-life to find k for the decay of I-131. Then find the time t it takes for 400 millicuries to decay to 3.125 millicuries.

PTS: 1 DIF: Average REF: Page 533 OBJ: 7-6.4 Application
TOP: 7-6 The Natural Base e

32. ANS: C
Use the change of base formula.
$\log 50 = \log_{10} 50 = \dfrac{\ln 50}{\ln 10} = \ln 50 \div \ln 10$

	Feedback
A	Use the change of base formula.
B	Use the change of base formula.
C	Correct!
D	Use the change of base formula.

PTS: 1 DIF: Advanced TOP: 7-6 The Natural Base e

33. ANS: D
Compute the first differences.

x	–1	0	1	2	3
$f(x)$	$1.1\overline{6}$	3.5	10.5	31.5	94.5

First differences: $2.\overline{3}$ 7 21 63

The ratios of the first differences are $\frac{63}{21} = \frac{21}{7} = \frac{7}{2.\overline{3}} = 3$. Thus the data set is exponential with a constant ratio of 3.

	Feedback
A	Compute the ratios, not the differences, of the first differences.
B	This is the first difference for the values of $f(x)$ at $x = -1$ and $x = 0$. To find the constant ratio, compute the ratio of the successive first differences.
C	$f(x)$ is linear if the first differences are constant. $f(x)$ is exponential if $f(x)$ is not linear and the ratios of the first differences are constant.
D	Correct!

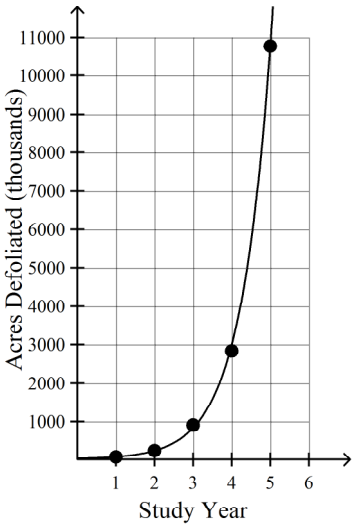
PTS: 1 DIF: Average REF: Page 545 OBJ: 7-8.1 Identifying Exponential Data
NAT: 12.5.2.g TOP: 7-8 Curve Fitting with Exponential and Logarithmic Models

34. ANS: C

Step 1 Enter the data into two lists in a graphing calculator. Use the exponential regression feature: [STAT] > CALC > 0: ExpReg.

An exponential model is $A(y) = 17.82(3.60)^{y}$, where A is the number of thousands of acres defoliated by gypsy moths and y is number of years since the beginning of the epidemic.

Step 2 Graph the data and the model function to verify that it fits the data.



Step 3 Enter 5 for *X1* and use the intersection feature to find y when *X1* is 5. You might need to expand the window to find the intersection. The model predicts 10,775 thousands of acres were defoliated by gypsy moths in 1982.

The actual value was 1,383. That year a viral infection in the gypsy moth population reduced their numbers dramatically.

	Feedback
A	Use the exponential regression feature to find a function of the form $A(y) = a(b^{\wedge}y)$.
B	Use the exponential regression feature to find a function of the form $A(y) = a(b^{\wedge}y)$.
C	Correct!
D	Use the exponential regression feature to find a function of the form $A(y) = a(b^{\wedge}y)$.

PTS: 1 DIF: Average REF: Page 546 OBJ: 7-8.2 Application
NAT: 12.5.2.g TOP: 7-8 Curve Fitting with Exponential and Logarithmic Models

35. ANS: A
Put the population values in a *y*-list and the years in the *x*-list of a graphing calculator. Perform a natural log regression.

The regression equation is $P(t) = 223.08 + 101.64 \ln t$.

Find the *t*-value where the graphs of $P(t)$ and $y = 500$ intersect. They intersect when $t \approx 15$.

So the lemur population will reach 500 in approximately 15 years.

	Feedback
A	Correct!
B	Check the positions of the *a*- and *b*-values in your regression equation.
C	This is a linear model. Use a natural log model.
D	Be sure to use all of the data in the table.

PTS: 1 DIF: Average REF: Page 547 OBJ: 7-8.3 Application
NAT: 12.5.2.g TOP: 7-8 Curve Fitting with Exponential and Logarithmic Models

NUMERIC RESPONSE

36. ANS: 6

PTS: 1 DIF: Average TOP: 7-3 Logarithmic Functions

37. ANS: 13.5

PTS: 1 DIF: Advanced NAT: 12.5.1.e
TOP: 7-8 Curve Fitting with Exponential and Logarithmic Models