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Indicate the answer choice that best completes the statement or answers the question.

Evaluate each expression.

1. log 75

a. 7.5 b. 1.88
c. 0.53 d. 3.76

2. Solve $\log_6 x = 2$

a. 36 b. 12
c. 6 d. 64

3. When rabbits were introduced to the continent of Australia they quickly multiplied and spread across the continent since there were only primitive marsupial competitors and predators to interfere with the exponential growth of their population. The data in the following table can be used to create a model of rabbit population growth.

Time (months)	0	3	6	9	12
No. of Rabbits	6	32	107	309	770

1. Find the regression equation for the rabbit population as a function of time *x*.
2. Write the regression equation in terms of base *e*.
3. Use the equation from part b to estimate the time for the rabbits to exceed 10,000.

a. 1. $y = 7.898 \times (1.491)^x$
2. $y = 7.898e^{0.3992x}$
3. x = 17.9 months

b. 1. $y = 7.982 \times (1.497)^x$
2. $y = 7.982e^{0.4035x}$
3. x = 17.7 months

c. 1. $y = 7.982 \times (1.907)^x$
2. $y = 7.982e^{0.6455x}$
3. x = 20.6 months

d. 1. $y = 7.898 \times (1.049)^x$
2. $y = 7.898e^{0.0478x}$
3. x = 149 months

4. Find ln 375. Round your answer to four decimal places.

a. –5.9269 b. 6.9269
c. 5.9269 d. –6.9269

5. Find the amount of time required to double an amount at 5.84% if the interest is compounded continuously.

a. 5.15 years b. 5.94 years
c. 11.87 years d. 23.74 years

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6. A housing developer uses the number of new residents in a community to decide when to plan a new construction project. The following table shows the county registrar's records of new residents over a period of five years.

Year	2006	2007	2008	2009	2010
New Residents	127	147	173	196	232

1. Find an exponential function to model the data as a function of *x* years since 2006.
2. Write the equation from part a in terms of base *e*.
3. Estimate when the number of new residents will exceed 400 per year.

a. 1. $y = 127 \times (1.116)^x$
2. $y = 127e^{0.1098x}$
3. 2016

b. 1. $y = 127 \times (1.016)^x$
2. $y = 127e^{0.0159x}$
3. 2013

c. 1. $y = 127 \times (1.161)^x$
2. $y = 127e^{0.1493x}$
3. 2014

d. 1. $y = 127 \times (1.111)^x$
2. $y = 127e^{0.1053x}$
3. 2017

Express each logarithm in terms of ln 3 and ln 5.

7. $\ln \frac{81}{125}$

a. 4 ln 5 – 3 ln 3
b. 5 ln 3 – 3 ln 4
c. 4 ln 3 – 3 ln 5
d. 3 ln 4 – 5 ln 3

Evaluate each expression.

8. $6^{\log_6 1.5}$

a. 6
b. $6^{1.5}$
c. 1.5^6
d. 1.5

9. Evaluate the expression $\log_5 \frac{1}{25}$.

a. $-\frac{1}{2}$
b. –2
c. $\frac{1}{2}$
d. 2

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10. Find an exponential function to model the data.

x	*y*
1	7
2	16
3	30
4	61
5	124
6	271
7	522

a. $f(x) = 116.4 - 42.8 \ln x$
b. $f(x) = 2.04(3.56)^x$
c. $f(x) = 3.56(2.04)^x$
d. $f(x) = -42.8 + 116.4 \ln x$

Evaluate each expression.

11. $\log_3 243$

a. 5
b. 7
c. 4
d. 6

Use the graph of *f* to describe the transformation that results in the graph of *g*. Then sketch the graphs of *g* and *f*.

12. $f(x) = e^x$; $g(x) = -5e^{x+4} + 2$

a. $g(x)$ is the graph of $f(x)$ translated 4 unit(s) to the left, 2 unit(s) down, and expanded vertically by a factor of 5.
b. $g(x)$ is the graph of $f(x)$ translated 4 unit(s) to the left, 2 unit(s) up, and expanded vertically by a factor of 5.
c. $g(x)$ is the graph of $f(x)$ translated 4 unit(s) to the right, 2 unit(s) up, and expanded vertically by a factor of 5.
d. $g(x)$ is the graph of $f(x)$ translated 4 unit(s) to the right, 2 unit(s) down, and expanded vertically by a factor of 5.

13. Jimmy invests $500 in an account with a 3% interest rate, making no other deposits or withdrawals. What will Jimmy's account balance be after 10 years if the interest is compounded 2 times each year?

a. $173.43
b. $580.27
c. $903.06
d. $673.43

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14. Uranium ore is composed of two main isotopes, mostly U_{238} with just a trace amount of U_{235}. The two isotopes cannot be separated using chemical reactions because they are chemically identical. In a sample of Uranium ore 99.85% of the atoms are U_{238} atoms and 0.15% are U_{235} atoms. However, before the Uranium can be used in a nuclear power plant, the proportion of U_{235} must be increased to 15% (thus reducing the proportion of U_{238} to 85%).

This is done by a process called gas diffusion. The ratio of the masses of these two isotopes is $\frac{238}{235} = 1.013$, which means gaseous U_{238} atoms will travel more slowly than the U_{235} atoms after the uranium ore is vaporized. Each cycle of the gas diffusion process will decrease the U_{238} proportion by 1.3%.

What will the U_{238} percent be after 6 cycles of the gas diffusion process? How many cycles will be needed to reduce the U_{238} percent to 85%?

a. 86.85%; 7 gas diffusion cycles
b. 92.31%; 13 gas diffusion cycles
c. 92.55%; 12 gas diffusion cycles
d. 92.05%; 11 gas diffusion cycles

Solve each equation.

15. $4^{x+7} = 5x^{-3}$

a. –65.13
b. 65.13
c. 14.53
d. 192.7

16. If the Laffite family deposits $8500 in a savings account at 6.75% interest, compounded continuously, how much will be in the account after 25 years?

a. $227,338.93
b. $45,950.57
c. $38,094.36
d. $38,720.02

17. As automobiles age, the average miles traveled per gallon decreases. Determine the regression equation that best models the data.

Age (years)	MPG
1	35
3	34
5	33
7	31
9	28
11	26
13	23
15	18

a. power
b. logarithmic
c. quadratic
d. exponential

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Use the graph of *f* to describe the transformation that results in the graph of *g*. Then sketch the graphs of *g* and *f*.

18. $f(x) = \left(\frac{1}{2}\right)^x$; $g(x) = \left(\frac{1}{2}\right)^{x+1} - 3$

a. $g(x)$ is the graph of $f(x)$ translated 3 unit(s) to the left and 1 unit(s) down.
b. $g(x)$ is the graph of $f(x)$ translated 1 unit(s) to the right and 3 unit(s) down.
c. $g(x)$ is the graph of $f(x)$ translated 3 unit(s) to the right and 1 unit(s) down.
d. $g(x)$ is the graph of $f(x)$ translated 1 unit(s) to the left and 3 unit(s) down.

19. Among various populations of plants or animals, diseases spread exponentially. Use the function $y = 8000(1 - e^{-0.03t})$ to model the spread of Common Corn Rust through a field of 8000 corn plants, with *t* equal to the number of days since the first case of the disease. How many plants will be infected with Common Corn Rust after 10 days?

a. 761 b. 236
c. 5927 d. 2073

20. Use Newton's Law of Cooling, $y = ae^{-kt} + c$, to find the temperature of a substance as a function the time *t* in minutes that it has spent cooling off. Two samples of the substance were heated in a container of boiling water until their initial temperatures were both 100° C. The first sample will be cooled by being left out at a room temperature of 24° C, and the second sample of the substance will instead be cooled off in a refrigerator with an inside temperature of c = 4° C. The value of *a* will equal the *difference* between each sample's initial temperature and that sample's surrounding temperature, and the cooling constant of the substance is k = 0.12.

Find the first sample's temperature after it has cooled for 20 minutes. Then find the second sample's temperature after it has cooled for 10 minutes.

a. 11.1° C; 30.1° C b. 33.1° C; 34.1° C
c. 30.9° C; 32.9° C d. 26.2° C; 5.2° C

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21. Janice has a savings account from her elementary school days that she has not made any deposits to or withdrawals from since December 31, 2007. In September of 2014 she plans to withdraw the amount in the account to buy college textbooks and help with her tuition. Her mother saved the year-end bank statements showing the balance in the account, as given in the following table.

Date	12/31/07	12/31/08	12/31/09	12/31/10	12/31/11	12/31/12
Balance	$385.64	$409.49	$434.81	$461.69	$490.24	$520.56

1. Find the function for the amount as a function of *x* years since Dec. 31, 2007.
2. Write the equation from part a in terms of base *e*.
3. Find the interest rate on the account if it was compounded continuously.
4. Use the equation from part b to predict the value on September 30, 2014.

a. 1. $y = 385.64 \times (1.0618)^x$
   2. $y = 385.64e^{0.060x}$
   3. $i = 6.18\%$
   4. $585.26

b. 1. $y = 385.64 \times (1.0684)^x$
   2. $y = 385.64e^{0.0662x}$
   3. $i = 6.62\%$
   4. $602.90

c. 1. $y = 385.64 \times (1.0684)^x$
   2. $y = 385.64e^{0.0662x}$
   3. $i = 6.84\%$
   4. $611.92

d. 1. $y = 385.64 \times (1.0618)^x$
   2. $y = 385.64e^{0.060x}$
   3. $i = 6.0\%$
   4. $578.19

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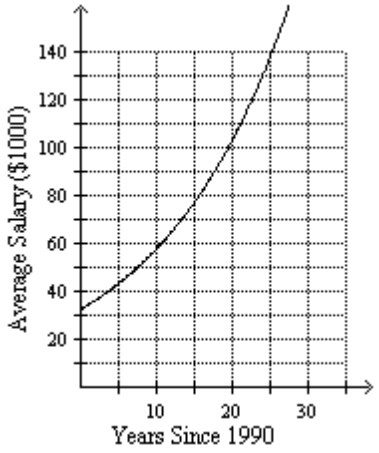
22. The nationwide average salary of a computer programmer can be modeled by the equation $y = 31.8 \times (1.06)^n$, where y is the salary in thousands of dollars and n is the number of years since 1990.

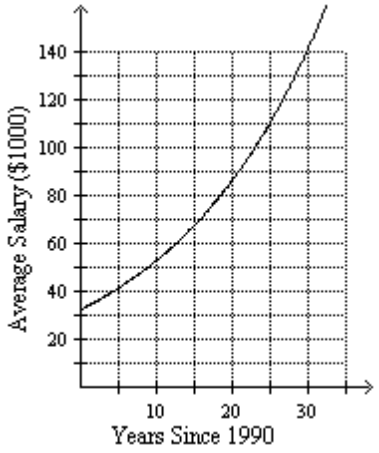
Graph the function. Then, using this model, predict the average programmer's salary in 2010.

a.



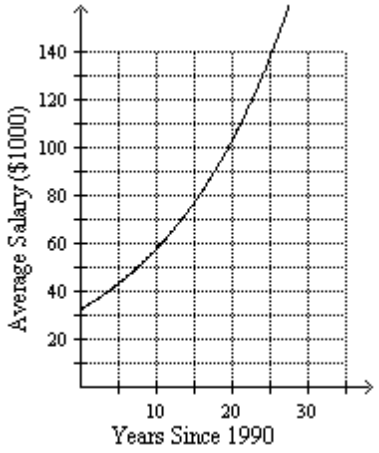
$102,000

b.



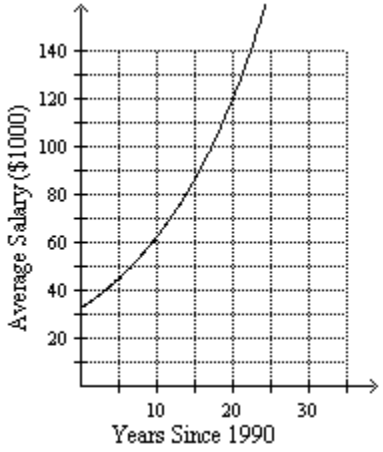
$83,000

c.



$86,000

d.



$121,000

Use the graph of *f* to describe the transformation that results in the graph of *g*.

23. $f(x) = \log x$; $g(x) = 2\log x + 6$

a. The graph of $g(x)$ is the graph of $f(x)$ expanded vertically by a factor of 2, and translated 6 unit(s) up.
b. The graph of $g(x)$ is the graph of $f(x)$ reflected in the x-axis, expanded vertically by a factor of 2, and translated 6 unit(s) up.
c. The graph of $g(x)$ is the graph of $f(x)$ expanded vertically by a factor of 2, and translated 6 unit(s) down.
d. The graph of $g(x)$ is the graph of $f(x)$ reflected in the x-axis, expanded vertically by a factor of 2, and translated 6 unit(s) down.

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24. Solve $e^{-5x} = 7.4$ for x correct to four decimal places.

a. –0.4003 b. 0.4003
c. 0.8692 d. –0.8692

25. The following table contains the account balance at year's end for an account which has had zero deposits and zero withdrawals over a period of seven years.

Year	2005	2006	2007	2008
Balance	$3489.44	$3749.95	$4029.90	$4330.75

Year	2009	2010	2011	2012
Balance	$4654.07	$5001.52	$5374.91	$5776.17

1. Find a function that models the amount as a function of x years since 2005.
2. Write the equation from part a in terms of base e.
3. Find the interest on the account, assuming it was compounded continuously.

a. 1. $y = 3021.47 \times (1.0766)^x$
2. $y = 3021.47e^{0.0738x}$
3. 7.4%

b. 1. $y = 3489.44 \times (1.0466)^x$
2. $y = 3489.44e^{0.0455x}$
3. 4.55%

c. 1. $y = 3489.44 \times (1.0747)^x$
2. $y = 3489.44e^{0.0720x}$
3. 7.2%

d. 1. $y = 3489.44 \times (1.0766)^x$
2. $y = 3489.44e^{0.0738x}$
3. 7.4%

Use the graph of *f* to describe the transformation that results in the graph of *g*. Then sketch the graphs of *g* and *f*.

26. $f(x) = e^x$; $g(x) = -\frac{3}{4}e^{x-5} - 1$

a. $g(x)$ is the graph of $f(x)$ translated 5 unit(s) to the right, 1 unit(s) up, and compressed vertically by a factor of $\frac{3}{4}$.

b. $g(x)$ is the graph of $f(x)$ translated 5 unit(s) to the left, 1 unit(s) up, and compressed vertically by a factor of $\frac{3}{4}$.

c. $g(x)$ is the graph of $f(x)$ translated 5 unit(s) to the left, 1 unit(s) down, and compressed vertically by a factor of $\frac{3}{4}$.

d. $g(x)$ is the graph of $f(x)$ translated 5 unit(s) to the right, 1 unit(s) down, and compressed vertically by a factor of $\frac{3}{4}$.

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27. Find a logarithmic function to model the data.

x	*y*
1	60
2	54
3	51
4	50
5	46
6	45
7	44

a. $f(x) = 60.73(0.95)^x$ b. $f(x) = 0.93(60.73)^x$

c. $f(x) = 60.04 - 8.25 \ln x$ d. $f(x) = 8.25 - 60.04 \ln x$

Use the graph of *f* to describe the transformation that results in the graph of *g*. Then sketch the graphs of *g* and *f*.

28. $f(x) = \left(\frac{1}{3}\right)^x$; $g(x) = \left(\frac{1}{3}\right)^{x-2} - 4$

a. $g(x)$ is the graph of $f(x)$ translated 4 unit(s) to the right and 2 unit(s) down.

b. $g(x)$ is the graph of $f(x)$ translated 2 unit(s) to the right and 4 unit(s) down.

c. $g(x)$ is the graph of $f(x)$ translated 2 unit(s) to the left and 4 unit(s) down.

d. $g(x)$ is the graph of $f(x)$ translated 4 unit(s) to the left and 2 unit(s) down.

Solve each equation.

29. $\log_7 (x^2 + 11) = \log_7 15$

a. ±4 b. ±2

c. ±3.87 d. ±12

Evaluate each expression.

30. $6^{\log_6 9.3}$

a. $6^{9.3}$ b. 9.3

c. 6 d. 9.3^6

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