

1. Solve for x. 79
- $4^x = 16$
- Select the correct choice below and, if necessary, fill in the answer box to complete your choice.
- ☐ A. The solution is $x = \square$.
(Simplify your answer. Type an integer or a fraction. Use a comma to separate answers as needed.)
- ☐ B. The solution is not a real number.
-

2. Solve for x.
- $2^{8x} = 8$
- Select the correct choice below and, if necessary, fill in the answer box to complete your choice.
- ☐ A. The solution is $x = \square$.
(Simplify your answer. Type an integer or a fraction. Use a comma to separate answers as needed.)
- ☐ B. The solution is not a real number.
-

3. Solve for x.
- $4^x = 31$
- Select the correct choice below and, if necessary, fill in the answer box to complete your choice.
- ☐ A. The solution is $x = \square$.
(Type an integer or a decimal. Do not round until the final answer. Then round to four decimal places as needed. Use a comma to separate answers as needed.)
- ☐ B. The solution is not a real number.
-

4.

Solve for x.

$$4^{8x-5} = 256$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

☐ A. The solution is $x = \boxed{}$.

(Type an integer or a simplified fraction. Use a comma to separate answers as needed.)

☐ B. The solution is not a real number.

5.

Solve the following exponential equation.

$$2^x = 6$$

Select the correct choice below and, if necessary, fill in the answer box.

☐ A. The solution is $\boxed{}$.

(Round to four decimal places as needed. Use a comma to separate answers as needed.)

☐ B. The solution is not a real number.

6.

Solve for t.

$$e^{-0.05t} = 0.89$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

☐ A. The solution is $t = \boxed{}$.

(Type an integer or a decimal. Do not round until the final answer. Then round to four decimal places as needed. Use a comma to separate answers as needed.)

☐ B. The solution is not a real number.

7.

Solve for x.

$$9.2^x = 16$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

☐ A. The solution is $x = \boxed{}$.

(Type an integer or a decimal. Do not round until the final answer. Then round to four decimal places as needed. Use a comma to separate answers as needed.)

☐ B. The solution is not a real number.

8. The following equation involves more than one exponential expression. Solve the equation.

$$2^{2x+2} = 6^x$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- ☐ A. The solution is $x = \boxed{}$.
(Type an integer or decimal rounded to four decimal places as needed.)
- ☐ B. The equation has no solution.

9. Solve for x .

$$\log_6 x = 3$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- ☐ A. The solution is $x = \boxed{}$.
(Simplify your answer. Type an integer or a fraction. Use a comma to separate answers as needed.)
- ☐ B. The solution is not a real number.

10. Solve for x .

$$\log x = -2$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- ☐ A. The solution is $x = \boxed{}$.
(Type an exact answer in simplified form. Use a comma to separate answers as needed.)
- ☐ B. There is no solution.

11. Solve for x .

$$\ln x = 3$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- ☐ A. The solution is $x = \boxed{}$.
(Type an exact answer in simplified form. Type exponential notation with positive exponents. Use a comma to separate answers as needed.)
- ☐ B. The solution is not a real number.

12. Solve for x.

$$\log x + \log (x - 9) = 1$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

☐ A. The solution(s) is/are .

☐ B. There is no solution.

13. Solve for x.

$$\log_5(x + 1) - \log_5 x = 2$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

☐ A. The solution is $x = \text{}$.

☐ B. The equation has no solution.

14. Solve for x.

$$\log 5x - \log (2x - 1) = \log 9$$

The solution is $\{\text{}\}$.
(Simplify your answer. Type an integer or a fraction.)

15. Solve the following logarithmic equation.

$$\ln(x + 6) + \ln(x - 3) = 2 \ln x$$

Select the correct choice below and, if necessary, fill in the answer box.

☐ A. The solution(s) is/are .

☐ B. The solution is not a real number.

16. The population of a city was 184 thousand in 1992. The exponential growth rate was 1.5% per year.
- a) Find the exponential growth function in terms of t , where t is the number of years since 1992.
- $P(t) = \square$
- b) Predict the population in 2005, to the nearest thousand.
- $\square$ (Round to the nearest thousand as needed.)
- c) In what year will the population be 198 thousand?
- $\square$ (Round to the nearest year as needed.)

17. Complete the following table.
- | Population | Growth Rate, k | Doubling Time,
T |
|------------|------------------|-----------------------|
| Country A | 2.6% per year | |
| Country B | | 30 years |
-
- | Population | Growth Rate, k | Doubling Time,
T |
|------------|----------------------|-----------------------|
| Country A | 2.6% per year | $\square$ years |
| Country B | $\square$ % per year | 30 years |
- (Round doubling time to the nearest whole number and round growth rate to the nearest tenth.)

18. Country A has a growth rate of 3.8% per year. The population is currently 4,214,000, and the land area of Country A is 15,000,000,000 square yards. Assuming this growth rate continues and is exponential, after how long will there be one person for every square yard of land?
- This will happen in $\square$ years.
- (Round to the nearest integer.)

Suppose that P is invested in a savings account in which interest, k , is compounded continuously at 5% per year. The balance $P(t)$ after time t , in years, is $P(t) = Pe^{kt}$.

a) What is the exponential growth function in terms of P and 0.05?

$$P(t) = \square$$

b) If \$7000 is invested what is the balance after 2 years?

$$\square$$

(Round to the nearest cent.)

c) When will an investment of \$7000 double itself?

$$\square \text{ years}$$

(Round to the nearest tenth of a year.)

20. *Carbon dating.* The amount of carbon-14 present in animal bones after t years is given by $P(t) = P_0 e^{-0.00012t}$. A bone has lost 38% of its carbon-14. How old is the bone?

To the nearest year, what is the age of the bone?

$$\square$$

(Round to the nearest integer as needed.)

21. The decay rate of a certain chemical is 9.4% per year. What is its half-life? Use the exponential decay model $P(t) = P_0 e^{-kt}$ where k is the decay rate, and P_0 is the original amount of chemical.

The half-life of the chemical is $\square$ years.

(Round to the nearest integer.)

22. The sales, S , of a product have declined in recent years. There were 204 million sold in 1984 and 1.5 million sold in 1994. Assume the sales are decreasing according to the exponential decay model, $S(t) = S_0 e^{-kt}$.

a) Find the value k and write an exponential function that describes the number sold after time, t , in years since 1984.

b) Estimate the sales of the product in the year 2002.

c) In what year (theoretically) will only 1 of the product be sold?

a) Rounded to six decimal places, $k = \square$.

b) To the nearest unit, the total is $\square$.

c) Only one unit will be sold in the year $\square$.
(Round to the nearest year as needed.)

23. A coin sold for \$229 in 1977 and was sold again in 1989 for \$458. Assume that the growth in the value V of the collector's item was exponential.

a) Find the value k of the exponential growth rate. Assume $V_0 = 229$.

$$k = \square$$

(Round to the nearest thousandth.)

b) Find the exponential growth function in terms of t , where t is the number of years since 1977.

$$V(t) = \square$$

c) Estimate the value of the coin in 2011.

$$\$ \square$$

(Round to the nearest dollar.)

d) What is the doubling time for the value of the coin to the nearest tenth of a year?

$$\square \text{ years}$$

(Round to the nearest tenth.)

e) Find the amount of time after which the value of the coin will be \$2204.

$$\square \text{ years}$$

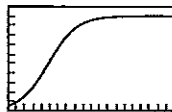
(Round to the nearest tenth.)

24. In a town whose population is 4000, a disease creates an epidemic. The number of people N infected t days after the disease has begun is given by the function $N(t) = \frac{4000}{1 + 18.3 e^{-0.4t}}$. Graph the function.

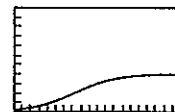
Find the number of people initially infected and the number infected after 7 days.

Choose the correct graph.

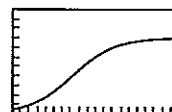
☐ A.



☐ B.



☐ C.



All graphs are $[0, 20, 0, 5500]$ $X_{\text{scl}} = 1$, $Y_{\text{scl}} = 500$.

How many are initially infected with the disease ($t = 0$)? $\square$ people
(Round to nearest integer or whole person.)

How many are infected after 7 days? $\square$ people
(Round to nearest integer or whole person.)

25. According to Newton's Law of Cooling, if a body with temperature T_1 is placed in surroundings with temperature T_0 different from that of T_1 , the body will either cool or warm to temperature T after t minutes, where $T(t) = T_0 + (T_1 - T_0)e^{-kt}$.

A chilled jello salad with temperature 46°F is taken from a refrigerator and placed in a 68°F room. After 10 minutes, the temperature of the salad is 51°F . Use Newton's Law of Cooling to find the salad's temperature after 20 minutes.

After 20 minutes the jello salad will have a temperature of $^\circ\text{F}$.
(Round to the nearest integer.)