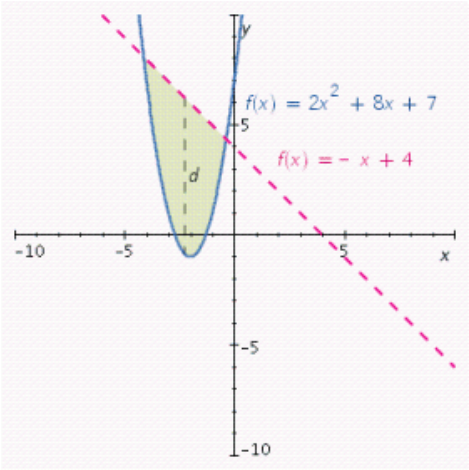
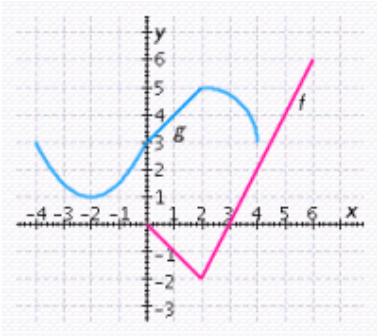
1. Find the maximal vertices distance d between the parabola and the line for the green region.



2. A cable television firm presently serves 6,300 households and charges $14 per month. A marketing survey indicates that each decrease of $1 in the monthly charge will result in 630 new customers. Let $R(x)$ denote the total monthly revenue when the monthly charge is x dollars. Find the value of x that results in maximum monthly revenue.

   $ _____

3. Use the given graphs of f and g to evaluate the expression.



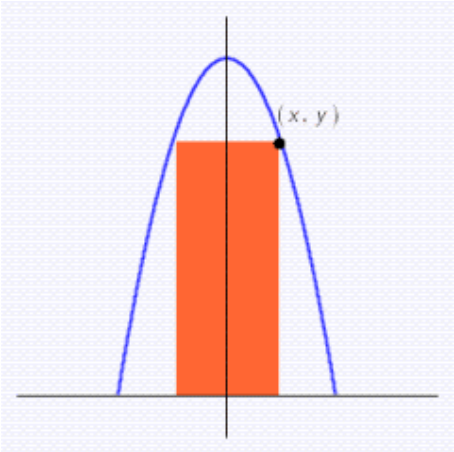
   $(g \circ f)(2) =$ _____

4. A herd of 45 deer is introduced onto a small island. At first the herd increases rapidly, but eventually food resources dwindle and the population declines. Suppose that the number of deer after t years is given by the following formula.

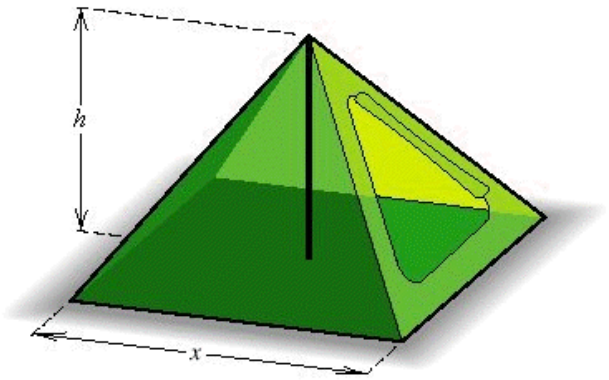
   $N(t) = -t^4 + 4t^2 + 45$, where $t > 0$

   How many years does it take for the population to become extinct?

5. An arch has the shape of the parabola $y = 4 - x^2$. A rectangle is fit under the arch by selecting a point (x,y) on the parabola (see the figure). If $x = 1$, the rectangle has base 2 and height 3. Find the base of a second rectangle that has the same area. Round to two decimal places, if necessary.



6. A canvas camping tent is to be constructed in the shape of a pyramid with a square base. An 6-foot pole will form the center support, as illustrated in the figure. Find the length x of a side of the base so that the total amount of canvas needed for the sides and bottom is 576 ft^2.



7. A storage tank for propane gas is to be constructed in the shape of a right circular cylinder with a hemisphere attached to the top. If the total height of the structure is 40 feet, determine the radius of the cylinder that results in a total volume of $1{,}368\,\pi\,\text{ft}^3$.

8. For a particular salmon population, the relationship between the number S of spawners and the number R of offspring that survive to maturity is given by the following formula.

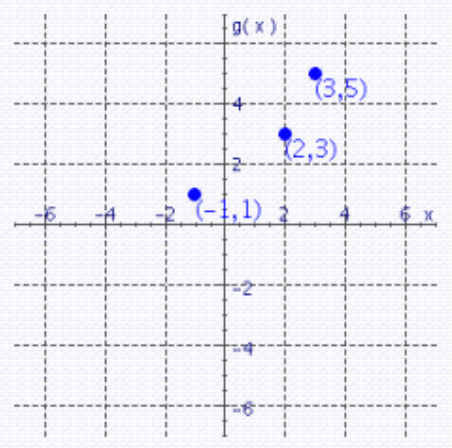
$$R = \frac{4{,}700S}{S + 580}$$

Find the number of spawners that would yield 60% of the greatest possible number of offspring that survive to maturity.

9. The period P of a simple pendulum - that is, the time required for one complete oscillation - is directly proportional to the square root of its length l. Express P in terms of l and a constant of proportionality k. If a pendulum 3.8 feet long has a period of 2.3 seconds, find the value of k.

10. Let $h(x) = 1 - x$.

x	-1	0	1	2	3
$f(x)$	2	3	4	5	6



Use the table and graph to evaluate the expression.

$(h^{-1} \circ f \circ g^{-1})(3) =$ _____

11. If a savings fund pays interest at a rate of 8% per year compounded semi-annually, how much money invested now will amount to $8,000 after 1 year?

12. Solve the equation:

$$81^{2x} \cdot \left(\frac{1}{9}\right)^{x+2} = 729 \cdot (9^x)^{-2}$$

13. The radioactive bismuth isotope ^{210}Bi has a half-life of 5 days. If there is 100 milligrams of ^{210}Bi present at $t = 0$, then the amount $f(t)$ remaining after t days is given by:

$$f(t) = 100(2)^{-\frac{t}{5}}$$

How much ^{210}Bi remains after 10 days?

14. Some lending institutions calculate the monthly payment M on a loan of L dollars at an interest rate r (expressed as a decimal) by using the formula:

$$M = \frac{Lrk}{12(k-1)}$$

where, $k = [1 + (r / 12)]^{12t}$ and t is the number of years that the loan is in effect.

An automobile dealer offers customers no-down-payment 9-year loans at an interest rate of 15%. If a customer can afford to pay \$124 per month, find the price of the most expensive car that can be purchased.

15. If monthly payments p are deposited in a savings account paying an annual interest rate r, then the amount A in the account after n years is given by:

$$A = \frac{p\left(1 + \frac{r}{12}\right)\left[\left(1 + \frac{r}{12}\right)^{12n} - 1\right]}{\frac{r}{12}}$$

Estimate n for $p = 67$, $r = 0.09$ and $A = \$209{,}198$. Give the answer to the nearest tenth, if necessary.

16. In fishery science, a cohort is the collection of fish that results from one annual reproduction. It is usually assumed that the number of fish $N(t)$ still alive after t years is given by an exponential function. For Pacific halibut, $N(t) = N_o e^{-0.2t}$, where N_o is the initial size of the cohort.

Approximate the percentage of the original number still alive after 7 years. Round to one decimal place, if necessary.

17. How much money, invested at an interest rate of 11% per year compounded continuously, will amount to \$91,000 after 17 years?

18. The 1980 population of the United States was approximately 227 million, and the population has been growing continuously at a rate of 0.7% per year. Predict the population in the year 2030 if this growth trend continues.

19. Solve the equation.

$$e^{x \ln 2} = 0.125$$

20. An urban density model is a formula that relates the population density D (in thousands/ mi^2) to the distance x (in miles) from the center of the city. The formula $D = ae^{-bx}$ for the central density a and coefficient of decay b has been found to be appropriate for many large U.S. cities.

For the city of Atlanta in 1970, $a = 5.5$ and $b = 0.10$. At approximately what distance was the population density 2,800 per square mile? Round the answer to the nearest tenth, if necessary.

21. When the volume control on a stereo system is increased, the voltage across a loudspeaker changes from V_1 to V_2, and the decibel increase is given by

$$db = 17\log\frac{V_2}{V_1}$$

Find the decibel increase if the voltage changes from 1.5 volts to 2.8 volts. Round to the nearest tenth, if necessary.

22. Solve the equation.

$\log_3(x+78)+\log_3 x = 5$

23. Find the solution of the exponential equation using common logarithms, correct to four decimal places, if necessary.

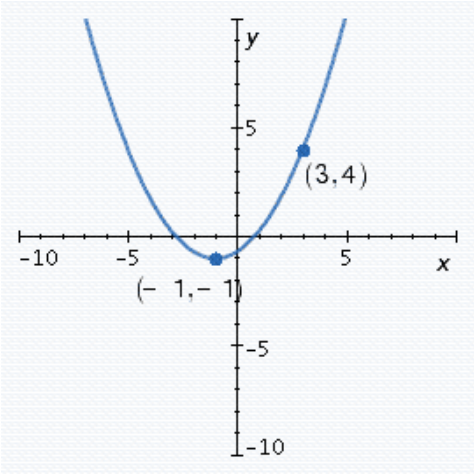
$3^{2x+1} = 5^{x-2}$

24. Explain how the graph of the function compares to the graph of $y = f(x)$.

$y = 2f(x-1)$

Shifted _____ unit(s) to _____ (*left* or *right*) , stretched _____ (*vertically* or *horizontally*) by a factor of _____.

25. Find the standard equation of the parabola shown in the figure.



26. Find the domain of $(f \circ g)(x)$.

$f(x) = \sqrt{x-4}$,and $g(x) = \sqrt{x+7}$

Please enter your answer in interval notation.

27. A fire has started in a dry open field and is spreading in the form of a circle. If the radius of this circle increases at the rate of 4 ft/min, express the total fire area A as a function of time t (in minutes).

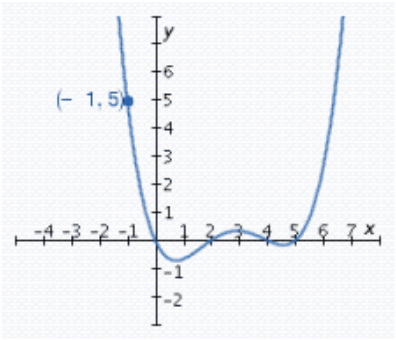
28. If one zero of the following function is 4, find the other two zeros.

$f(x)=x^3-4x^2-25x+100k$

29. Use synthetic division to find the quotient and remainder if the first polynomial is divided by the second.

$f(x)=4x^3-4x^2+7x-5;\quad x-2$

30. Find the fourth-degree polynomial function whose graph is shown in the figure.



31. Determine the range of f^{-1} for the function without actually finding f^{-1}. *Hint:* First find the domain and range of f.

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

32. Find the inverse function of f.

$f(x)=\sqrt{6-x}$

33. Simplify the expression.

$$\frac{(e^{v}+e^{-v})(e^{v}+e^{-v})-(e^{v}-e^{-v})(e^{v}-e^{-v})}{(e^{v}+e^{-v})^2}$$

34. Express in terms of logarithms of x, y, z, or w.

$\log_a \dfrac{y^7w^4}{x^8z^5}$

35. Solve the equation.

$\log_2(x+7)=\log_2(x-7)+\log_3 9+2^{\log_2 3}$