

Summer Math Packet for AP Precalculus White Station High School

The Summer Work is due the first day of class. It will be graded for ACCURACY and will count as 40 points of your first test grade. After we go over the Summer Work, you will have a test that will count as the remaining 60 points of your first test. All problems should be worked without a calculator, but you can check your work with a calculator.

Find an equation of the line described.

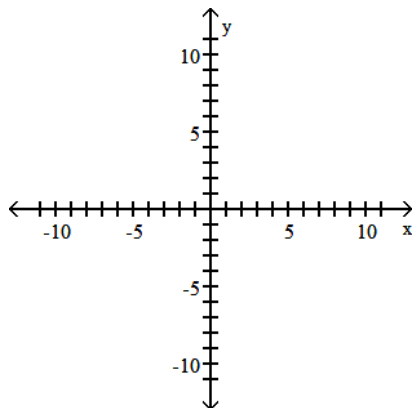
1. Through (4, -9), perpendicular to the y-axis

Solve. A relationship.

2. A vendor has learned that, by pricing pretzels at \$1.50, sales will reach 91 pretzels per day. Raising the price to \$2.25 will cause the sales to fall to 58 pretzels per day. Let y be the number of pretzels the vendor sells at x dollars each. Write a linear equation that models the number of pretzels sold per day when the price is x dollars each.

For the polynomial, list each real zero and its multiplicity. Determine whether the graph crosses or touches the x-axis at each x-intercept.

3. $f(x) = \frac{1}{5}x^2(x^2 - 3)(x - 4)$



Solve the problem.

4. For the polynomial function $f(x) = 2x^4 - 7x^3 + 11x - 4$
 - a) Find the x- and y- intercepts of the graph of f . Round to two decimal places, if necessary.
 - b) Determine whether the graph crosses or touches the x-axis at each x-intercept.
 - c) End behavior: find the power function that the graph of f resembles for large values of $|x|$.
 - d) Use a graphing utility to graph the function. Approximate the local maxima rounded to two decimal places, if necessary. Approximate the local minima rounded to two decimal places, if necessary.
 - e) Determine the number of turning points on the graph.
 - f) Put all the information together, and connect the points with a smooth, continuous curve to obtain the graph of f .

Use the Factor Theorem to determine whether $x - c$ is a factor of $f(x)$.

5. $f(x) = x^4 - 12x^2 - 64$; $x - 4$

6. $f(x) = x^4 - 45x^2 - 196$; $x - 7$

Use the Rational Zeros Theorem to find all the real zeros of the polynomial function. Use the zeros to factor f over the real numbers.

7. $f(x) = 5x^4 - 8x^3 + 13x^2 - 16x + 6$

Find the real solutions of the equation.

8. $x^4 - 3x^3 + 5x^2 - x - 10 = 0$

Solve the problem.

9. Find k such that $f(x) = x^4 + kx^3 + 2$ has the factor $x + 1$.

Use the Intermediate Value Theorem to determine whether the polynomial function has a zero in the given interval.

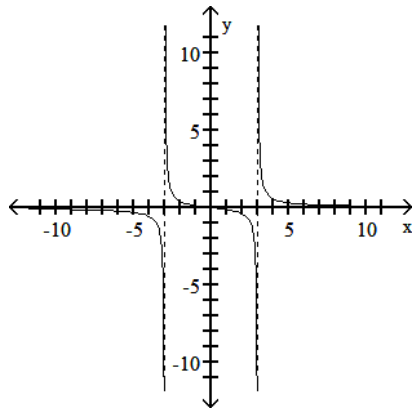
10. $f(x) = 10x^3 - 5x^2 - 10x - 2$; $[1, 2]$

Form a polynomial $f(x)$ with real coefficients having the given degree and zeros.

11. Degree: 4; zeros: -1 , 2 , and $1 - 2i$.

Use the graph to determine the domain and range of the function.

12.



Give the equation of the horizontal asymptote, if any, of the function.

13. $R(x) = \frac{-3x^2}{x^2 + 5x - 36}$

Solve the problem.

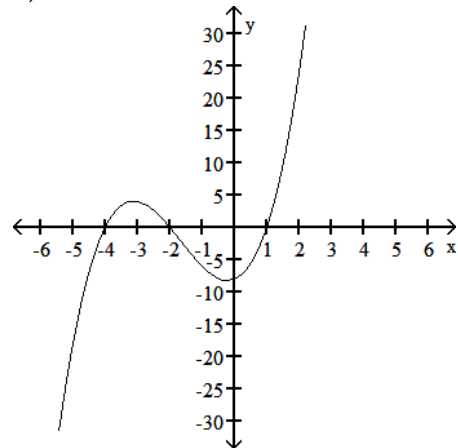
14. A lens can be used to create an image of an object on the opposite side of the lens, such as the image created on a movie screen. Every lens has a measurement called its focal length, f . The distance s_1 of the object to the lens is related to the distance s_2 of the lens to the image by the function

$$s_1 = \frac{fs_2}{s_2 - f}.$$

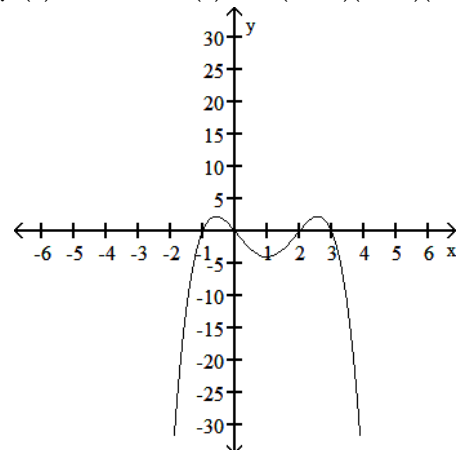
For a lens with $f = 0.3$ m, what are the asymptotes of this function?

Solve the inequality by using the graph of the function.

15. $f(x) < 0$, where $f(x) = (x + 4)(x + 2)(x - 1)$.



16. $f(x) > 0$, where $f(x) = -x(x + 1)(x - 2)(x - 3)$.



Solve the inequality algebraically. Express the solution in interval notation.

17. $x^3 - 4x^2 - 45x > 0$

Solve the problem.

18. What is the domain of the function

$$f(x) = \sqrt{x^3 - 4x^2} ?$$

Solve the inequality algebraically. Express the solution in interval notation.

19. $\frac{x+8}{x+5} < 8$

20. $\frac{14}{x-6} > \frac{12}{x-1}$

Solve the problem.

21. The temperature T , in degrees Fahrenheit, of a person during a certain illness is given by the function

$$T = \frac{5t}{t^2 + 1} + 98.6, \text{ where } t \text{ is the time,}$$

in hours. Determine the time interval for which the temperature is greater than 100° .

Evaluate the expression using the values given in the table.

22. $(f \circ g)(3)$

x	1	4	9	12
f(x)	-4	9	2	13

x	-5	-4	1	3
g(x)	1	-6	4	9

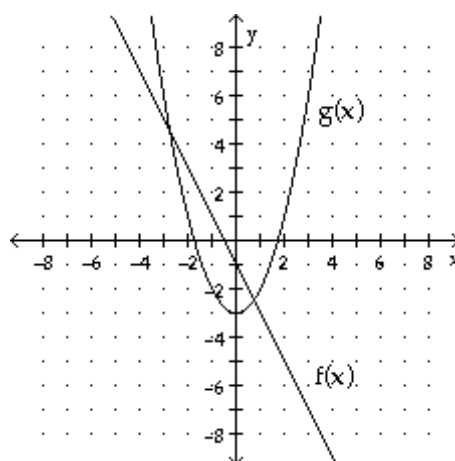
23. $(g \circ f)(1)$

x	1	7	9	12
f(x)	-4	9	2	14

x	-5	-4	1	3
g(x)	1	-7	7	9

Evaluate the expression using the graphs of $y = f(x)$ and $y = g(x)$.

24. Evaluate $(fg)(-1)$.



For the given functions f and g , find the requested composite function value.

25. $f(x) = \frac{x-6}{x}$, $g(x) = x^2 + 9$; Find $(g \circ f)(-2)$.

26. $f(x) = 17x^2 - 5x$, $g(x) = 7x - 5$; Find $(f \circ g)(3)$.

For the given functions f and g , find the requested composite function.

$$27. f(x) = \frac{x-4}{8}, \quad g(x) = 8x + 4;$$

Find $(g \circ f)(x)$.

Find functions f and g so that $f \circ g = H$.

$$28. H(x) = \frac{1}{x^2 - 5}$$

Find the domain of the composite function $f \circ g$.

$$29. f(x) = \frac{-1}{x-8}; \quad g(x) = \frac{-80}{x}$$

$$30. f(x) = \sqrt{2-x}; \quad g(x) = |2x-1|$$

The function f is one-to-one. Find its inverse.

$$31. f(x) = (x+2)^3 - 8.$$

Determine i) the domain of the function, ii) the range of the function, iii) the domain of the inverse, and iv) the range of the inverse.

$$32. f(x) = \frac{1}{x-5}$$

Solve the problem.

$$33. \text{ If } 5^x = 4, \text{ what does } 5^{-3x} \text{ equal?}$$

$$34. \text{ If } 9^x = 6, \text{ what does } 9^{-3x} \text{ equal?}$$

Solve the equation.

$$35. 3(3x-6) = 27$$

$$36. 9^{2x} \cdot 27(3-x) = \frac{1}{9}$$

$$37. (e^x)^x \cdot e^{18} = e^{9x}$$

Solve the problem.

38. Two bacteria are placed in a petri dish. The population will triple every day. The formula for the number of bacteria in the dish on day t is

$$N(t) = 2(3)^t$$

where t is the number of days after the two bacteria are placed in the dish. How many bacteria are in the dish eight days after the two bacteria are placed in the dish?

39. Find the amount in a savings account at the end of 8 years if the amount originally deposited is \$3000 and the interest rate is 5% compounded quarterly.

$$\text{Use: } A = P \left(1 + \frac{r}{n} \right)^{nt} \text{ where:}$$

A = final amount

P = \$3000 (the initial deposit)

r = 5% = 0.05 (the annual rate of interest)

n = 4 (the number of times interest is compounded each year)

t = 8 (the duration of the deposit in years)

Change the exponential expression to an equivalent expression involving a logarithm.

40. $8^{5/3} = 32$

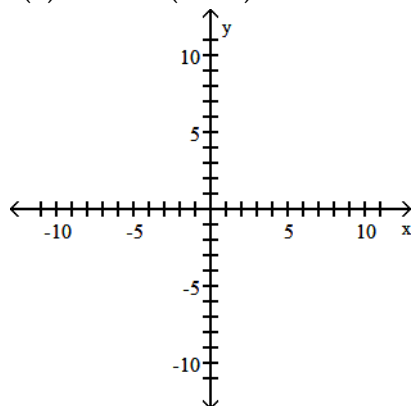
Find the domain of the function.

41. $f(x) = \log(x - 4)$

42. $f(x) = \log_5(9 - x^2)$

Graph the function.

43. $f(x) = 2 - \ln(x + 4)$



Solve the equation.

44. $\log_6(x^2 - 5x) = 1$

45. $\log_{42}(x^2 - x) = 1$

46. $\ln \sqrt{x + 7} = 2$

The Richter scale converts seismographic readings into numbers for measuring the magnitude of an earthquake according to this

function $M(x) = \log \left\{ \frac{x}{x_0} \right\}$ where $x_0 = 10^{-3}$.

47. What is the magnitude of an earthquake whose seismographic reading is 7.6 millimeters at a distance of 100 kilometers from its epicenter? Round the answer to four decimal places.

Solve the problem.

48. $\text{pH} = -\log_{10}[\text{H}^+]$ Find the $[\text{H}^+]$ if the $\text{pH} = 2.4$.

Write as the sum and/or difference of logarithms. Express powers as factors.

49. $\log_5 \left(\frac{x^4}{y^8} \right)$

50. $\log_2 \left(\frac{x + 4}{x^6} \right)$

51. $\log_{19} \frac{\sqrt[10]{7}}{\frac{2}{y}x}$

Express as a single logarithm.

52. $6\log_b q - \log_b r$

Solve the problem.

53. Which of the two rates would yield the larger amount in 1 year: 4.8% compounded quarterly or 4.7% compounded monthly?

54. The half-life of plutonium-234 is 9 hours. If 10 milligrams is present now, how much will be present in 2 days? (Round your answer to three decimal places.)

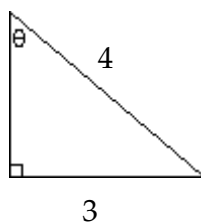
55. A thermometer is taken from a room at 71°F to the outdoors where the temperature is 14°F . Determine what the reading on the thermometer will be after 5 minutes, if the reading drops to 45°F after 1 minute. Assume the cooling follows Newton's Law of Cooling:

$$U = T + (U_0 - T)e^{kt}.$$

(Round your answer to two decimal places.)

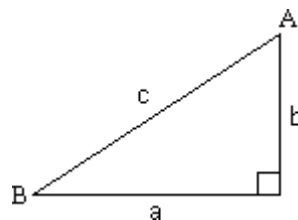
Find the value of the indicated trigonometric function of the angle θ in the figure. Give an exact answer with a rational denominator.

56.



Find $\tan \theta$.

Solve the right triangle using the information given. Round answers to two decimal places, if necessary.



57. $b = 2$, $A = 25^{\circ}$; Find a , c , and B .

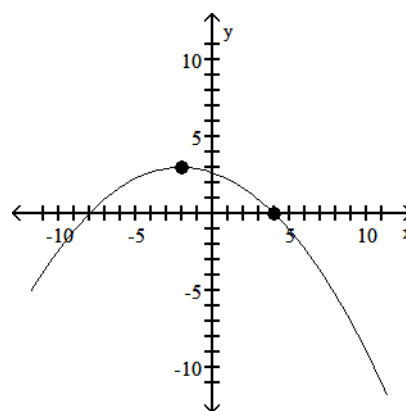
58. $a = 4$, $A = 40^{\circ}$; Find b , c , and B .

Find the equation of the parabola described.

59. Vertex at $(1, 7)$; focus at $(1, 5)$

Write an equation for the parabola.

60.



points: $(-2, 3)$, $(4, 0)$

Find the center, foci, and vertices of the ellipse.

61. $16(x - 1)^2 + 9(y + 2)^2 = 144$

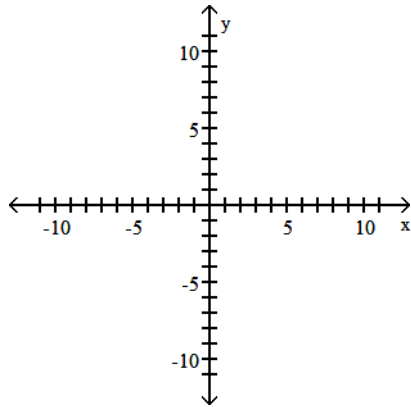
Solve for x.

65.
$$\begin{vmatrix} 5 & 9 \\ -2 & x \end{vmatrix} = 8$$

Find an equation for the ellipse described.

Graph the equation.

62. Vertices at (5, -4) and (5, 8); length of minor axis is 6



Solve the system of equations using substitution.

66.
$$\begin{cases} xy = 42 \\ x + y = 13 \end{cases}$$

67.
$$\begin{cases} \ln x = 3 \ln y \\ 3^x = 27^y \end{cases}$$

Write out the first five terms of the sequence.

68. $\{c_n\} = \left\{ \frac{5^n}{n} \right\}$

Find the center, transverse axis, vertices, foci, and asymptotes of the hyperbola.

63. $x^2 - 4y^2 + 8x + 16y - 4 = 0$

Solve the system of equations. [Hint: Let $u = \frac{1}{x}$

and $v = \frac{1}{y}$, and solve for u and v. Then let $x =$

$\frac{1}{u}$, and $y = \frac{1}{v}$.]

64.
$$\begin{cases} \frac{2}{x} + \frac{4}{y} = 7 \\ \frac{1}{x} - \frac{2}{y} = 4 \end{cases}$$