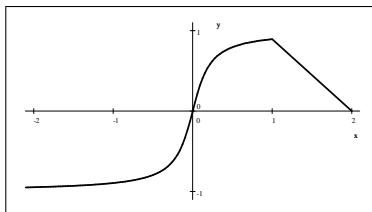


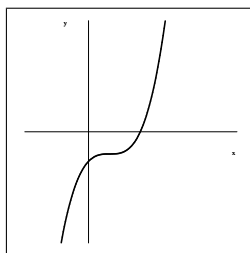
- Simplify: a)  $\frac{x^3 - 9x}{x^2 - 7x + 12}$  b)  $\frac{x^2 - 2x - 8}{x^3 + x^2 - 2x}$  c)  $\frac{\frac{1}{x} - \frac{1}{5}}{\frac{1}{x^2} - \frac{1}{25}}$  d)  $\frac{9 - x^{-2}}{3 + x^{-1}}$
- Rationalize the denominator: a)  $\frac{2}{\sqrt{3} + \sqrt{2}}$  b)  $\frac{4}{1 - \sqrt{5}}$
- Write each of the following expressions in the form  $c a^p b^q$  where  $c, p, q$  are numbers:
  - $\frac{(2a^2)^3}{b}$
  - $\sqrt{9ab^3}$
  - $\frac{a \left(\frac{2}{b}\right)}{\frac{3}{a}}$
  - $\frac{ab - a}{b^2 - b}$
  - $\frac{a^{-1}}{(b^{-1})\sqrt{a}}$
  - $\left(\frac{a^{2/3}}{b^{1/2}}\right)^2 \left(\frac{b^{3/2}}{a^{1/2}}\right)$
- Solve for  $x$ . Do not use a calculator.
  - $5^{x+1} = 25$
  - $\frac{1}{3} = 3^{2x+2}$
  - $\log_2 x = 3$
  - $\log_3 x^2 = 2 \log_3 4 - 4 \log_3 5$
- Simplify
  - $\log_2 5 + \log_2 (x^2 - 1) - \log_2 (x - 1)$
  - $3^{2 \log_3 5}$
  - $2 \log_4 9 - \log_2 3$
- Simplify
  - $\log_{10} (10^{1/2})$
  - $\log_{10} \left(\frac{1}{10^x}\right)$
  - $2 \log_{10} \sqrt{x} + 3 \log_{10} x^{1/3}$
- Solve the following equations for the indicated variables.
  - $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ , for  $a$
  - $S = 2(ab + bc + ac)$ , for  $a$
  - $A = 2\pi r^2 + 2\pi r h$ , for positive  $r$
  - $A = P + nPr$ , for  $P$
  - $2x - 2yd = y + xd$ , for  $d$
  - $\frac{2x}{4\pi} + \frac{1-x}{2} = 0$  for  $x$
- Find the vertex for each of the following parabolas.
  - $y = x^2 + 4x + 3$
  - $3x^2 + 3x + 2y = 0$
  - $9y^2 - 6y - 9 - x = 0$
- Find all real solutions to each of the following equations.
  - $x^6 - 16x^4 = 0$
  - $4x^3 - 8x^2 - 25x + 50 = 0$
  - $8x^3 + 27 = 0$
  - $x^4 = 1$
- Solve the equations:
  - $4x^2 + 12x + 3 = 0$
  - $2x + 1 = \frac{5}{x+2}$
  - $\frac{x+1}{x} - \frac{x}{x+1} = 0$
- Find the remainders on division of
  - $x^5 - 4x^4 + x^3 - 7x + 1$  by  $x + 2$
  - $x^5 - x^4 + x^3 + 2x^2 - x + 4$  by  $x^3 + 1$
- The equation  $12x^3 - 23x^2 - 3x + 2 = 0$  has a solution  $x = 2$ . Find all other solutions.
- Solve the inequalities
  - $x^2 + 2x - 3 \leq 0$
  - $\frac{2x-1}{3x-2} \leq 1$
  - $x^2 + x + 1 > 0$
- Solve for  $x$ :
  - $|5x - 2| = 8$
  - $|2x + 1| = x + 3$
- Determine the equations of the following lines:
  - the line through  $(-1, 3)$  and  $(2, -4)$
  - the line through  $(-1, 2)$  and perpendicular to the line  $2x - 3y + 5 = 0$
  - the line through  $(2, 3)$  and the midpoint of the line segment from  $(-1, 4)$  to  $(3, 2)$ .

16. a) Find the point of intersection of the lines:  $3x - y - 7 = 0$  and  $x + 5y + 3 = 0$   
 b) Shade the region in the  $xy$ -plane that is described by the inequalities  $\begin{cases} 3x - y - 7 < 0 \\ x + 5y + 3 \geq 0 \end{cases}$ .
17. For the circle  $x^2 + y^2 + 6x - 4y + 3 = 0$ , find  
 a) the center and radius    b) the equation of the tangent line at  $(-2, 5)$
18. Find the equations of the following circles:  
 a) the circle with center at  $(1, 2)$  that passes through the point  $(-2, -1)$   
 b) the circle that passes through the origin and has intercepts equal to 1 and 2 on the  $x$ - and  $y$ -axes, respectively.  
 c) A circle is tangent to the  $y$ -axis at  $y = 3$  and has one  $x$ -intercept at  $x = 1$ .
19. a) Find the domain and range of the functions: i)  $f(x) = 7$     ii)  $g(x) = \frac{5x - 3}{2x + 1}$   
 b) Find the domain of the function  $f(x) = \frac{3x + 1}{\sqrt{x^2 + x - 2}}$
20. Simplify  $\frac{f(x+h) - f(x)}{h}$  where    a)  $f(x) = 2x + 3$     b)  $f(x) = x^2$     c)  $f(x) = \frac{1}{x+1}$

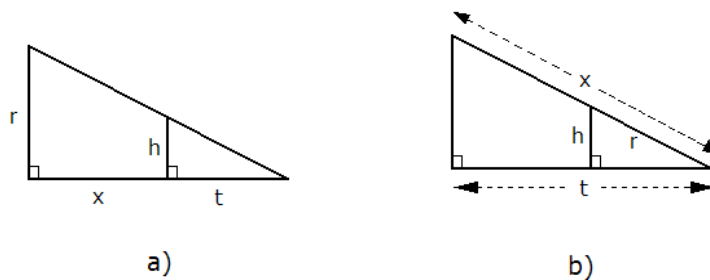
21. The graph of a function  $y = f(x)$  is given as follows:



- Plot the graph of each of the following functions:    a)  $f(x+1)$     b)  $f(-x)$     c)  $|f(x)|$     d)  $f(|x|)$
22. Sketch the graph of the functions:    a)  $g(x) = |3x + 2|$     b)  $h(x) = |x(x - 1)|$
23. a) Sketch the graph of the quadratic function  $y = 2x^2 - 4x + 3$   
 b) The graph of a quadratic function (a parabola) has  $x$ -intercepts  $-1$  and  $3$  and a range consisting of all numbers less than or equal to 4. Determine an expression for the function.
24. Find the inverse of the following functions.  
 a)  $f(x) = 2x + 3$     b)  $f(x) = \frac{x + 2}{5x - 1}$     c)  $f(x) = x^2 + 2x - 1, \quad x > 0$
25. A function  $f(x)$  has the following graph. Sketch the graph of the inverse function  $f^{-1}(x)$ .



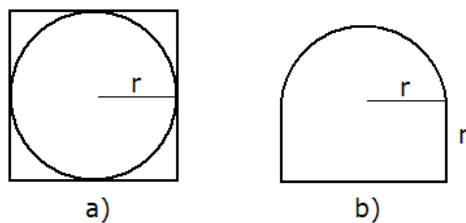
26. Express  $x$  in terms of the other variables in the picture.



27. A curve is traced by a point  $P(x, y)$  which moves such that its distance from the point  $A(-1, 1)$  is three times its distance from the point  $B(2, -1)$ . Determine the equation of the curve.

28. Let  $f(x) = \frac{|x|}{x}$ . Show that  $f(x) = \begin{cases} 1 & \text{if } x > 0 \\ -1 & \text{if } x < 0 \end{cases}$ . Find the domain and range of  $f(x)$ .

29. a) Find the ratio of the area inside the square but outside the circle to the area of the square in picture (a) below.



b) Find a formula for the perimeter of a window of the shape on picture (b) above.

c) A water tank has the shape of a cone (like an ice cream cone without ice cream). The tank is 10 m high and has a radius of 3 m at the top. If the water is 5 m deep (in the middle) what is the surface area of the top of the water?

d) Two cars start moving from the same point. One travels south at  $100 \frac{\text{km}}{\text{h}}$  (kilometer per hour), the other west at  $50 \frac{\text{km}}{\text{h}}$ . How far apart are they two hours later?

e) A kite is 100 m above the ground. If there is 200 m of string out, what is the angle between the string and the horizontal? (Assume that the string is perfectly straight.)

30. Without using a calculator, evaluate each of the following:

- a)  $\cos 210^\circ$       b)  $\sin \frac{5\pi}{3}$       c)  $\tan^{-1}(-1)$       d)  $\sin^{-1}(-1)$   
 e)  $\cos \frac{9\pi}{4}$       f)  $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$       g)  $\tan\left(\frac{7\pi}{6}\right)$       h)  $\cos^{-1}(-1)$

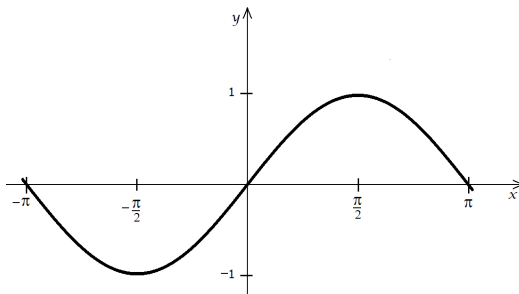
31. Solve for  $x$  : a)  $3 \sin^2 x = \cos^2 x$ ;  $0 \leq x \leq 2\pi$       b)  $\cos^2 x - \sin^2 x = \sin x$ ;  $-\pi \leq x \leq \pi$   
c)  $\tan x + \sec x = 2 \cos x$ ;  $-\infty < x < \infty$

32. Prove each of the following identities.

a)  $\sin 2x = 2 \sin x \cos x$       b)  $\cos 2x = \cos^2 x - \sin^2 x$       c)  $\cos 2x = 2 \cos^2 x - 1$

d)  $\cos 2x = 1 - 2 \sin^2 x$       e)  $\left| \cos \frac{x}{2} \right| = \sqrt{\frac{1 + \cos x}{2}}$       f)  $\left| \sin \frac{x}{2} \right| = \sqrt{\frac{1 - \cos x}{2}}$

33. Given the graph of  $y = \sin x$ , sketch the graphs of



a)  $y = \sin\left(x - \frac{\pi}{4}\right)$       b)  $y = \sin\left(\frac{x}{2}\right)$       c)  $y = 2 \sin x$       d)  $y = \cos x$       e)  $y = \frac{1}{\sin x}$