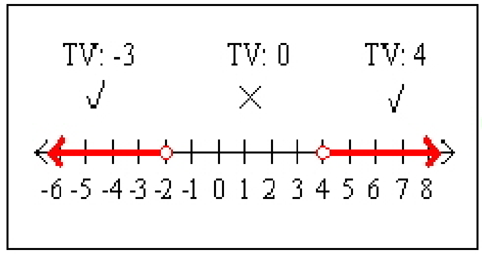
1. Solve each inequality and graph the solution on a number line.

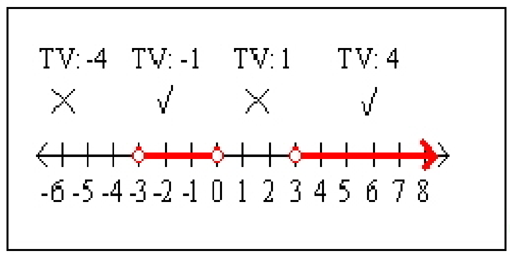
   (a) $x^2 - 2x - 5 > 3$

$$x^2 - 2x - 5 = 3$$
$$x^2 - 2x - 8 = 0$$
$$(x-4)(x+2) = 0$$
$$x = 4, x = -2$$




   (b) $\frac{9}{x} \leq x$

$$\tfrac{9}{x} = x$$
$$9 = x^2$$
$$x = \pm 3$$
$$x = 3, x = -3$$




2. Find the equation of the line described.

   (a) The line through the points $(2, 4)$ and $(3, -1)$

$$m = \frac{-1-4}{3-2} = \frac{-5}{1} = -5$$

$$y - 4 = -5(x-2)$$

   (b) The line perpendicular to $y = 2x - 4$ and with $y-$intercept 5.

$$m = -\frac{1}{2}$$

$$y = -\frac{1}{2}x + 5$$

3. Determine if $x^2 + 1$ is a factor of $2x^3 - 7x + 16$. Make sure to clearly state if it is or is not a factor.

$$\begin{array}{r l} & 2x \\ x^2+1 \big) & \overline{2x^3 - 7x + 16} \\ & \underline{2x^3 + 2x} \\ & \quad - 9x + 16 \end{array}$$

Since the remainder is not 0, $x^2 + 1$ is not a factor of $2x^3 - 7x + 16$.

4. Let $f(x) = x^2 - 3x + 4$

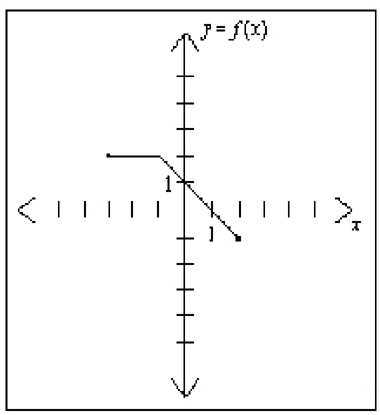
(a) Find $\frac{f(x)-f(2)}{x-2}$ and simplify as much as possible.

$$\begin{aligned} \frac{f(x)-f(2)}{x-2} &= \frac{x^2-3x+4-\left(2^2-3(2)+4\right)}{x-2} \\ &= \frac{x^2-3x+2}{x-2} \\ &= \frac{(x-2)(x-1)}{x-2} \\ &= x-1 \end{aligned}$$

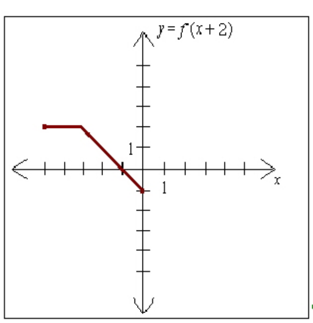
(b) Find $\frac{f(1+h)-f(1)}{h}$ and simplify as much as possible.

$$\begin{aligned} \frac{f(1+h)-f(1)}{h} &= \frac{(1+h)^2-3(1+h)+4-\left(1^2-3(1)+4\right)}{h} \\ &= \frac{h^2-h}{h} \\ &= h-1 \end{aligned}$$

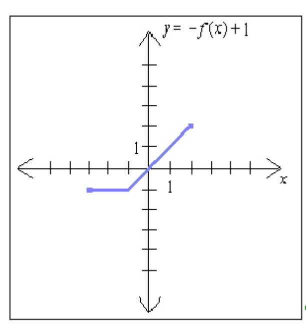
5. The graph of $y = f(x)$ is given below.



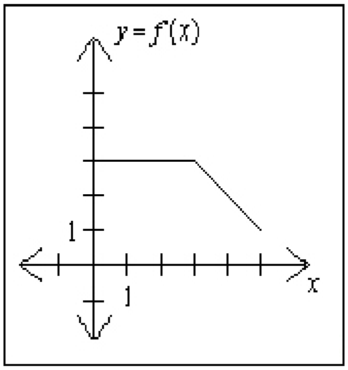

$(a)$ Sketch $y = f(x+2)$

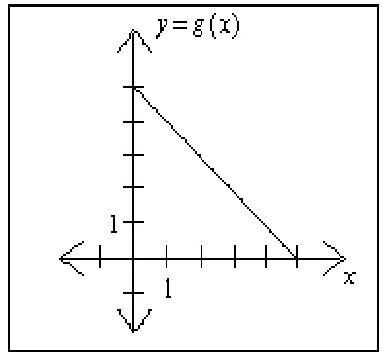



$(b)$ Sketch $y = -f(x)+1$



6. The graphs of $f(x)$ and $g(x)$ are given below.




(a) Find $(f+g)(1)$.

$$(f+g)(1) = f(1) + g(1) = 3 + 4 = 7$$

(b) Find $(f \circ g)(1)$.

$$(f \circ g)(1) = f(g(1)) = f(4) = 2$$

(c) Find $(f \circ f)(1)$.

$$(f \circ f)(1) = f(f(1)) = f(3) = 3$$

7. Solve each system of equations.

(a) $\begin{cases} x + 3y &= 1 \\ 4x - 2y &= 0 \end{cases}$

$$\begin{cases} x + 3y &= 1 \\ 4x - 2y &= 0 \end{cases} \begin{array}{c} \longrightarrow \\ \longrightarrow \end{array} \begin{array}{rcl} 4x + 12y &=& 4 \\ 4x - 2y &=& 0 \\ \hline 14y &=& 4 \\ y &=& \frac{2}{7} \end{array}$$

$$\begin{aligned} x + 3\left(\frac{2}{7}\right) &= 1 \\ x + \frac{6}{7} &= 1 \\ x &= \frac{1}{7} \\ (x, y) &= \left(\frac{1}{7}, \frac{2}{7}\right) \end{aligned}$$

(b) $\begin{cases} x^2 - y^2 &= 1 \\ x + y^2 &= 1 \end{cases}$

$$\begin{array}{rcl} x^2 - y^2 & = & 1 \\ x + y^2 & = & 1 \\ \hline \end{array}$$

$$x^2 + x = 2$$

$$x^2 + x - 2 = 0$$

$$(x+2)(x-1) = 0$$

$$x = -2, x = 1$$

$x = -2:$

$$-2 + y^2 = 1$$

$$y^2 = 3$$

$$y = \pm\sqrt{3}$$

$x = 1:$

$$1 + y^2 = 1$$

$$y^2 = 0$$

$$y = 0$$

$$(x, y) = \left(-2, \sqrt{3}\right), \left(-2, -\sqrt{3}\right) \text{ or } (1, 0)$$

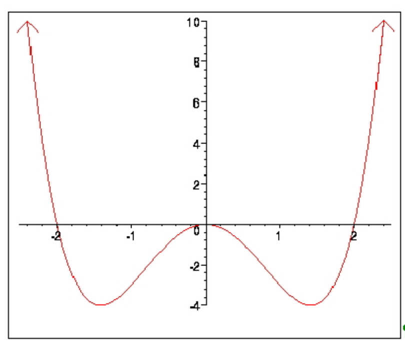
8. Show that $-2$ is a zero of $f(x) = x^3 + 3x^2 - 4x + 6$. Then find all of the zeroes of $f(x)$.

$$\begin{array}{r|rrrr} -2 & 1 & 3 & -4 & -12 \\ & & -2 & -2 & -12 \\ \hline & 1 & 1 & -6 & \underline{|0} \end{array}$$

$$x^2 + x - 6 = 0$$
$$(x+3)(x-2) = 0$$
$$x = -3, 2$$
$$\text{Zeroes are } -2, -3, 2.$$

9. Sketch a graph of the polynomial $f(x) = x^4 - 4x^2$ by $(i)$ finding the left and right-hand behavior of the function, $(ii)$ finding the zeroes of the function, and $(iii)$ figuring out where the graph is for $x-$values between the zeroes. (Make sure you explicitly show the work needed for parts $(i)$, $(ii)$, and $(iii)$.

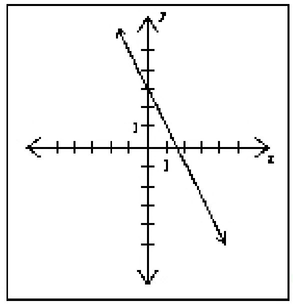
$$\begin{array}{rl} (i) & n = 4 \text{ (even)}, a = 1 \ (>0) \\ (ii) & x^4 - 4x^2 = 0 \\ & x^2\left(x^2 - 4\right) = 0 \\ & x^2 (x-2)(x+2) = 0 \\ & \text{Zeroes are } 0, 2, -2. \\ (iii) & f(-1) = -3 \\ & f(1) = -3 \end{array}$$




10. Short answer.

(a) Write a polynomial in standard form that has zeroes of 1 and $-3$.

(b) Write the equation of the line sketched below.



$$m = -2, b = 3$$
$$y = -2x + 3$$

(c) Find the domain of the function $\frac{\sqrt{x-1}}{x-3}$.

$$x \geq 1, x \neq 3$$