Problems 1 - 3: Solve each inequality. When appropriate, express your answer in interval notation.

1. \(x(x + 7) > -12\)  
2. \(3r^3 + 10r^2 - 8r \leq 0\)  
3. \(\frac{4}{k-1} \leq 5\)

4. Use the table below to evaluate each expression.

<table>
<thead>
<tr>
<th>(x)</th>
<th>(f(x))</th>
<th>(g(x))</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>0</td>
<td>-1</td>
</tr>
<tr>
<td>-1</td>
<td>2</td>
<td>-3</td>
</tr>
<tr>
<td>0</td>
<td>-5</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>-4</td>
<td>5</td>
</tr>
</tbody>
</table>

(a) \((f + g)(0)\)  
(b) \((fg)(-3)\)  
(c) \((f \circ g)(-1)\)  
(d) \((f \circ f)(2)\)

5. Let \(f(x) = -x^2 + 2x\) and \(g(x) = x - 1\). Find each of the following.

(a) \(\left(\frac{f}{g}\right)(-4)\)  
(b) \((f - g)(k)\)  
(c) \((g \circ f)(3)\)  
(d) \((f \circ g)(x)\) and state its domain

6. Let \(f(x) = \sqrt{x + 2}\) and \(g(x) = 3x^2 + 1\). Find each of the following.

(a) \((g \circ f)(x)\)  
(b) \((g \circ g)(-1)\)

7. Find the vertex of each of the following parabolas.

(a) \(y = \frac{2}{3}x^2\)  
(b) \(y = x^2 - 5\)  
(c) \(f(x) = (x + 6)^2\)

8. Determine the type(s) of symmetry (x-axis, y-axis, origin) that is possessed by the graph of \(2x^2 + y^2 = 4x\).

9. Determine which function(s) is/are one to one. There may be more than one answer.

(a) \(f(x) = x^2 + x + 1\)  
(b) \(f(x) = |x| + 5\)  
(c) \(f(x) = (x - 2)^3 + 2\)  
(d) \(f(x) = -(x + 3)^4\)

10. Determine if \(f(x) = \frac{x+5}{3}\) and \(g(x) = 3x - 5\) are inverses of each other. Show all work!!!

11. Let \(f(x) = \frac{3}{5}x - \frac{4}{3}\).

(a) Find \(f^{-1}(x)\).  
(b) Graph \(f\) and \(f^{-1}\) on the same set of axes.  
(c) Verify that \((f^{-1} \circ f)(x) = x\).
12. Let \( f(x) = \sqrt{x - 4} \).
   
   (a) Find \( f^{-1}(x) \).  
   (b) Graph \( f \) and \( f^{-1} \) on the same set of axes.  
   (c) Find the domain and range of \( f \) and \( f^{-1} \).

13. Solve the system \[
\begin{align*}
  x + 2y &= 1 \\
  2x + 4y &= 2
\end{align*}
\]  
   If the system is inconsistent or has infinitely many solutions, say so.

14. Solve the system \[
\begin{align*}
  3x - 4y &= 13 \\
  2x + 3y &= 3
\end{align*}
\] using each of the methods below.  If the system is inconsistent or has infinitely many solutions, say so.
   
   (a) substitution method  
   (b) elimination method

Problems 15-16: Solve each system using the elimination method.  If the system is inconsistent or has infinitely many solutions, say so.

15. \[
\begin{align*}
  4x + 2y + 5z &= 30 \\
  5x - 3y - z &= 3 \\
  3x - y + 2z &= 13
\end{align*}
\]

16. \[
\begin{align*}
  x + y + z &= 7 \\
  x - y + 2z &= 7 \\
  2x + 3z &= 15
\end{align*}
\]

Problems 17-18: Use a system of equations to answer the following problems.

17. At a local grocery store, 6 cans of cola and 2 bags of potato chips cost $5.12.  Eight cans of cola and 4 bags of potato chips cost $8.56.  Find the price per bag of potato chips.

18. A piece of string 18 inches long is cut into 3 pieces.  The shortest piece is 6 inches less than the largest piece.  The largest piece is 3 inches more than the middle-sized piece.  What is the length of the smallest piece?

Problems 19-21: Graph each function.  Give the vertex, axis, domain, and range.

19. \( y = 2(x + 3)^2 - 1 \) (Also find the intercepts)

20. \( f(x) = 2x^2 - 4x + 2 \)

21. \( f(x) = -3x^2 + 6x - 1 \) (Graph by completing the square)

22. Graph the inequality \( x - y \leq 0 \).

23. Graph the compound inequality \( y > -2x + 1 \) and \( y \leq 1 \).
1. \((-\infty, -4) \cup (-3, \infty)\)
2. \((-\infty, -4] \cup [0, \frac{2}{3}]\)
3. \((-\infty, 1] \cup [\frac{3}{5}, \infty)\)

4. (a) 1 (b) 0 (c) 0 (d) 4
5. (a) \(\frac{3x}{2}\) (b) \(-k^2 + k + 1\) (c) -4 (d) \(-x^2 + 4x - 3\), \(D = (-\infty, \infty)\)

6. (a) \(3x + 7\) (b) 49
7. (a) (0,0) (b) (0,-5) (c) (-6,0)

8. x-axis
9. c
10. yes

11. (a) \(f^{-1}(x) = \frac{5}{3}x + \frac{20}{9}\)
   (b) \(f^{-1}(x) = x^2 + 4, x \geq 0\)
   (c) \(\{(1 - 2y, y)\}, \text{infinitely many solutions}\)

12. \(D_f = \mathbb{R}, D_{f^{-1}} = [4, \infty), D_{f^{-1}} = \mathbb{R} = [0, \infty)\)

13. \(V = (-3,-1)\)
   A: \(x = -3\)
   D: \((-\infty, \infty)\)
   R: \([-1, \infty)\)
   x-int = \(-3 \pm \frac{\sqrt{2}}{2}\)
   y-int = 17

14. \(V = (0,4)\)
   A: \(x = 1\)
   D: \((-\infty, \infty)\)
   R: \([0, \infty)\)

15. \(V = (2,8)\)
   A: \(x = 2\)
   D: \((-\infty, \infty)\)
   R: \([0, \infty)\)

16. 3 in
17. $1.30

18. 3 in
19. (0,17)
   \((-3,-1)\)
20. (1,0)
   \((0,2)\)
21. (1,2)
   \((0,-1)\)
22. (1,1)
23. (0,1)