1. Test for symmetry with respect to the x-axis, y-axis, and origin.
   (a) \( y = x^4 + x^2 \)   (b) \( y = x^3 + 10x \)   (c) \( y^2 = x \)
   Solution:
   \[
   \begin{array}{ccc}
   \text{(a)} & \text{x-axis} & \text{(b)} & \text{x-axis} & \text{(c)} & \text{x-axis} \\
   (-y) &=& x^4 + x^2 & (-y) &=& x^3 + 10x & (-y)^2 &=& x \\
   y &=& -(x^4 + x^2) & y &=& -(x^3 + 10x) & y^2 &=& x \\
   \text{No} & \text{No} & \text{Yes} \\
   \text{y-axis} & \text{y-axis} & \text{y-axis} \\
   y &=& (-x)^4 + (-x)^2 & y &=& (-x)^3 + 10(-x) & y^2 &=& (-x) \\
   y &=& x^4 + x^2 & y &=& -(x^3 + 10x) & y^2 &=& x \\
   \text{Yes} & \text{No} & \text{No} \\
   \text{origin} & \text{origin} & \text{origin} \\
   (-y) &=& (-x)^4 + (-x)^2 & (-y) &=& (-x)^3 + 10(-x) & (-y)^2 &=& (-x) \\
   y &=& -(x^4 + x^2) & y &=& x^3 + 10x & y^2 &=& -x \\
   \text{No} & \text{Yes} & \text{No} \\
   \end{array}
   \]

2. For the following points.
   (a) Plot the points in the xy-plane.
   (b) Find the distance between them.
   (c) Find the midpoint of the segment that joins them.
   \((-2, 1), (2, 3)\)
   Solution:

   ![Figure 1](image_url)

   Figure 1: \( d = \sqrt{(-2-2)^2 + (1-3)^2} = 2\sqrt{5}, M = \left(\frac{-2+2}{2}, \frac{1+3}{2}\right) = (0,2) \)
3. Which of the points $P(3, 1)$ and $Q(-1, 3)$ is closer to the point $R(-1, -1)$.
Solution:
\[ d(P, R) = \sqrt{(3 + 1)^2 + (1 + 1)^2} = \sqrt{20} = 2\sqrt{5} \]
\[ d(Q, R) = \sqrt{(-1 + 1)^2 + (3 + 1)^2} = \sqrt{16} = 4, \quad Q \text{ is closer.} \]

4. Find the center and radius of the circle, and sketch its graph.
(a) $(x - 3)^2 + y^2 = 4$ (b) $x^2 + (y + 1)^2 = 4$
Solution:

Figure 2: (a) $(h, k) = (3, 0)$ $r = 2$

Figure 3: (b) $(h, k) = (0, -1)$ $r = 2$
5. Show that the equation represents a circle, and find the center and radius.
\[ x^2 + y^2 - 2x + 4y + 1 = 0 \]
Solution:
\[
\begin{align*}
(x^2 - 2x) + (y^2 + 4y) &= -1 \\
(x^2 - 2x + 1) + (y^2 + 4y + 4) &= -1 + 4 \\
(x - 1)^2 + (y + 2)^2 &= 4 \\
(h, k) &= (1, -2), \ r = 2
\end{align*}
\]

6. Find an equation of the line that satisfies the given conditions.
(a) Through (2, 3); slope 5
(b) Through (2, 1) and (1, 6)
(c) Slope 3, \ y-intercept -2
Solution:
\[
\begin{align*}
\text{(a)} \quad y - 3 &= 5(x - 2) \\
y &= 5x - 7 \quad \text{(b)} \quad m &= \frac{6 - 1}{1 - 2} = -5 \\
y - 1 &= -5(x - 2) \\
y &= -5x + 11 \\
\text{(c)} \quad y &= 3x - 2
\end{align*}
\]

7. Find an equation of the line that satisfies the given conditions.
(a) Through (1, -6); parallel to the line \( x + 2y = 6 \)
(b) Through (-1, -2); perpendicular to the line \( 2x + 5y + 8 = 0 \)
Solution:
\[
\begin{align*}
\text{(a)} \quad y &= 3 - \frac{1}{2}x \\
m &= -\frac{1}{2} \\
y + 6 &= -\frac{1}{2}(x - 1) \\
y &= -\frac{1}{2}x - \frac{11}{2} \\
\text{(b)} \quad y &= -\frac{2}{5}x - \frac{8}{5} \\
m &= \frac{5}{2} \\
y + 2 &= \frac{5}{2}(x + 1) \\
y &= \frac{5}{2}x + \frac{1}{2}
\end{align*}
\]
8. Find the slope and \( y \)-intercept of the line, and draw its graph.
\[3x - 4y = 12\]
Solution:
\[\begin{align*}
3x - 4y &= 12 \\
3x &= 4y + 12 \\
\frac{3x}{4} &= y + 3 \\
y &= \frac{3}{4}x - 3, \quad m = \frac{3}{4}, \quad y - \text{int} = -3
\end{align*}\]

![Figure 4: \( y = \frac{3}{4}x - 3 \), \( m = \frac{3}{4} \), \( y - \text{int} = -3 \)](image-url)

9. Determine which, if any, of the following relations is a function.
If it is a function give the domain and range using set notation.
(a) \( S = \{(9, -8), (0, 9), (-7, 4), (-7, 5)\} \)
(b) \( T = \{(-9, -2), (-2, 7), (2, -4), (4, 6)\} \)
Solution:
(a) Not a function. \((-7, 4)\) and \((-7, 5)\)
(b) Function.
\[
\begin{align*}
\text{Domain} &= \{-9, -2, 2, 4\}, \\
\text{Range} &= \{-2, 7, -4, 6\}
\end{align*}
\]

10. Determine whether the equation defines \( y \) as a function of \( x \).
(a) \( x^2 + 2y = 4 \) \quad (b) \( x + y^2 = 9 \)
Solution:
(a) \[
\begin{align*}
2y &= 4 - x^2 \quad \text{Yes} \\
y &= 2 - \frac{1}{2}x^2
\end{align*}
\]
(b) \[
\begin{align*}
y^2 &= 9 - x \\
y &= \pm\sqrt{9 - x} \\
\text{If } x &= 5, \ y = \pm2 \quad \text{No}
\end{align*}
\]

11. Find the domain of the function.
(a) \( f(x) = \frac{1}{x - 3} \) \quad (b) \( g(x) = \sqrt{x - 5} \) \quad (c) \( h(x) = \frac{3}{\sqrt{x - 4}} \)
Solution:
(a) \( \{x : x \neq 3\} \) \quad (b) \( \{x : x \geq 5\} \) \quad (c) \( \{x : x > 4\} \)
12. Use the function to evaluate the indicated expression and simplify.
\[ f(x) = x^2 + 1; \ f(x + 2), \ f(x) + f(2) \]
Solution:
\[ f(x + 2) = (x + 2)^2 + 1 = x^2 + 4x + 5 \]
\[ f(x) + f(2) = (x^2 + 1) + (2^2 + 1) = x^2 + 6 \]

13. Sketch the graph of the piecewise defined function.
\[ f(x) = \begin{cases} 
3 & \text{if } x < 2 \\
 x - 1 & \text{if } x \geq 2 
\end{cases} \]
Solution:

![Graph of piecewise function](image)

Figure 5: Piecewise Defined Function

14. Indicate whether the function is even or odd.
(a) \( g(x) = x^3 + x \)
(b) \( f(x) = x^4 + 3x^2 \)
(c) \( h(x) = x^5 + 1 \)
Solution:
(a) \( g(-x) = (-x)^3 + (-x) \)
\[ = -x^3 - x \]
\[ = -(x^3 + x) \]
\[ = -g(x) \]
ODD

(b) \( f(-x) = (-x)^4 + 3(-x)^2 \)
\[ = x^4 + 3x^2 \]
\[ = f(x) \]
EVEN
(c) \( h(-x) = (-x)^5 + 1 = -x^5 + 1 \)

NEITHER

15. Find the \( x \)-intercepts and \( y \)-intercepts of 
\[ y = x^2 - 9 \]

\( x \)-int: \( x^2 - 9 = 0 \)
\[ x = \pm 3 \]

Solution: \( y \)-int: \( y = 0^2 - 9 \)
\[ y = -9 \]

16. The graph of a function is given.

(a) Indicate the domain and range.

(b) Find the intervals on which the function is increasing and on which it is decreasing.

Solution:
(a) Domain= \(( -\infty, \infty )\), Range= \([-2, \infty )\)
(b) Decreasing \( (-\infty, 0] \), Increasing \([0, \infty )\).