1. Given the following set \( \{-8, 0, 1, 0.36, \sqrt{10}, \frac{30}{7}, \sqrt{49}\} \), list all elements that belong to the set of:
   a) Natural Numbers
   b) Whole Numbers
   c) Integers
   d) Rational Numbers
   e) Irrational Numbers
   f) Real Numbers

2. Find the midpoint of the line segment with endpoints \((-5, 4)\) and \((6, -1)\).

3. a) Find all points with y-coordinate equal to \(-3\) whose distances from \((1, 2)\) are 13 units.
    b) Find all points with x-coordinate equal to 3 whose distances from \((-2, 5)\) are 13 units.

4. Decide whether the given the following relations are functions. State the domain and range of each relation. In the TI screen, assume that Xscl = Yscl = 1 and all boundary points are included.
   a)
   b)
   c)

5. Find the equation of the line passing through \((2, -1)\) and \((10, 5)\).
   Write the equation in slope intercept form.

6. Refer to the graph of the linear function \(y = f(x)\) and answer the following.
   a) \(f(x) = 0\)
   b) \(f(x) < 0\)
   c) \(f(x) > 0\)
   d) \(f(x) \leq 0\)
   e) \(f(x) \geq 0\)
7. Refer to the graph of the quadratic function \( y = f(x) \) and answer the following.
   a) \( f(x) = 0 \)
   b) \( f(x) < 0 \)
   c) \( f(x) \geq 0 \)

   ![Graph of a quadratic function]

   ZEROS
   \[ x = -1 \quad y = 0 \]
   \[ x = -7 \quad y = 0 \]

8. Refer to the graph of the polynomial function \( y = f(x) \) and answer the following.
   a) \( f(x) = 0 \)
   b) \( f(x) \leq 0 \)
   c) \( f(x) > 0 \)

   ![Graph of a polynomial function]

   ZEROS
   \[ x = -4 \quad y = 0 \]
   \[ x = -2 \quad y = 0 \]
   \[ x = 2 \quad y = 0 \]
9. Use your graphing calculator to solve the given equation.

\[ 3\pi + 3.2(x - 7) = \sqrt[3]{-8\pi} + 9.4(x - \sqrt{18}) \]

a) Copy exactly what appears on the TI screen for \( y_1 \), etc.
b) Include a sketch of your calculator graph. c) Give the solution to the equation. 
Round to 4 decimal places if necessary.

10. Farmer Lorainne grows organic broccoli and has fixed costs of $3,000 and variable costs of $0.40 per pound of broccoli produced. If she wants to sell the broccoli at $1.60 per pound, find the cost function, the revenue function, the profit function, and the break-even point.

11. a) Decide analytically whether the function is odd, even, or neither, and b) State whether the graph is symmetric about the origin, \( y \)-axis, or neither
\[ f(x) = 5x^4 + x^3 - x \]

12. a) Decide analytically whether the function is odd, even, or neither, and b) State whether the graph is symmetric about the origin, \( y \)-axis, or neither
\[ f(x) = x^6 - 3x^2 \]

13. Write the function \( g \) whose graph can be obtained from the graph of the function \( f \) by performing the transformations in the given order. Then graph the function \( g \).

a) \( f(x) = \sqrt{x} \); reflect the graph about the \( x \)-axis, then shift it vertically upward 4 units.
b) \( f(x) = x^2 \); shift the graph 3 units to the right, then vertically shrink it by a factor of 0.5.
c) \( f(x) = |x| \); reflect the graph about the \( y \)-axis, then vertically stretch it by a factor of 3.
d) \( f(x) = x^2 - 3 \); shift the graph left 2 units, then shift it vertically downward 5 units.

14. Solve the following absolute equations. Show all important work for the particular method chosen.

a) \( |x - 6| + 3 = 10 \)  
b) \( |x - 6| + 10 = 3 \)  
c) \( |x - 6| + 10 = 10 \)

15. Solve the following absolute inequalities. If a solution exists, write your answer in interval notation. Show all important work for the particular method chosen.

a) \( |x + 8| - 7 \geq 12 \)  
b) \( |x + 8| + 12 \geq -7 \)  
c) \( |x + 8| + 12 \leq -7 \)

16. If \( f(x) = \begin{cases} x^2 & \text{if } x \geq -1 \\ 5 + 4x & \text{if } x < -1 \end{cases} \), evaluate:

a) \( f(-6) \)  
b) \( f(-1) \)  
c) \( f(0) \)  
d) \( f(9) \)
17. Let \( f(x) = x^2 - 5 \) and \( g(x) = 4x + 1 \). Find the following. Simplify the answer completely.
   a) \((f \circ g)(-2)\)  
   b) \((g \circ f)(-2)\)  
   c) \((f \circ g)(x)\)  
   d) \((g \circ f)(x)\)

18. Simplify \( \sqrt{50} - \sqrt{3} \) and write your answer without a negative radicand.

19. Solve the following equations analytically.
   a) \( 3x^2 + 2x = 40 \)  
   b) \( x^2 - 3x - 1 = 0 \)  
   c) \( 3x^2 - 12x + 13 = 0 \)

20. Use the Sign Analysis Method to solve the following inequalities and write your answers in interval notation.
   a) \( x^2 - x > 72 \)  
   b) \( x^2 - x \leq 72 \)

21. The length of a piece of cardboard is five times its width. To make a box with an open lid, a seven inch piece was cut from each corner and the sides were folded up. If \( x \) represents the width of the cardboard, answer the following questions:
   a) What is the restriction on \( x \)?
   b) Determine the volume of the box in terms of \( x \).
   c) For what value(s) of \( x \) will the volume be between 1200 \( \text{in}^3 \) and 1500 \( \text{in}^3 \)?
      *Round to two decimal places if necessary.*

22. The height \( h \) of an object that is traveling vertically subject to only gravity is given by
    \[ h(t) = -16t^2 + v_0 t + h_0, \]
    where \( v_0 \) is the initial velocity and \( h_0 \) is the initial height.
    A projectile is fired straight up from the ground with an initial velocity of 250 feet per second.
    a) Find the time(s) at which the projectile will be 700 feet above the ground.
       *Round to two decimal places if necessary.*
    b) Find the maximum height of the projectile.
       *Round to two decimal places if necessary.*

23. Solve the following equation and its related inequalities graphically.
    For the inequalities, if a solution exists, write your answer in interval notation.
   a) \( x^3 - 24x^2 - 25x + 10 = 0 \)  
   b) \( x^3 - 24x^2 - 25x + 10 \leq 0 \)  
   c) \( x^3 - 24x^2 - 25x + 10 > 0 \)

24. Use a graphing calculator to find a complete graph of the given function. Determine all local extrema.
    Give the ordered pair \((x, y)\) for the local extrema. *Round to two decimal places if necessary. You do not need to sketch the graph.*
    \[ f(x) = -x^3 + 37x^2 - 50x - 70 \]

25. Factor \( P(x) \) into linear factors. \( P(x) = 4x^3 - x^2 - 83x - 60 \); and \( P(-4) = 0 \)
26. For the following polynomial function \( P(x) = 3x^4 - 2x^3 - 7x^2 + x + 12 \), find the maximum number of roots and list all possible rational roots.

27. Find the vertical and horizontal asymptote(s) of the following rational functions.
   
   a) \( f(x) = \frac{x^2 - 36}{2x^2 - 2x - 4} \)  
   b) \( f(x) = \frac{x}{x^3 - 25x^2} \)  
   c) \( f(x) = \frac{9x^2}{x - 1} \)

28. Find the \( x \)-intercept(s) (if any) and the \( y \)-intercept of \( f(x) = \frac{9 - x^2}{x^2 + 4x - 5} \).

29. Solve the following rational equation.
\[
\frac{18}{x^2 - 9} - \frac{1}{x + 3} = \frac{x}{x - 3}
\]

30. Solve the following rational inequalities. Write your answer in interval notation.
   
   a) \( \frac{x - 9}{x - 7} \geq 0 \)  
   b) \( \frac{x + 1}{x^2 + 14x + 45} \leq 0 \)

Perform the given operations and simplify completely. Write your answer with positive exponents only.

31. \( (x^7y^{-6}z^4)^{-3} \)

32. \( \left( \frac{x^8yz^{-4}}{x^9y^9z} \right)^{-1} \)

Solve the given radical equation and its related inequalities graphically. For the inequalities, write your answer in interval notation.

33. a) \( x - 13 = \sqrt{x + 7} \)  
   b) \( x - 13 \leq \sqrt{x + 7} \)  
   c) \( x - 13 \geq \sqrt{x + 7} \)

34. a) \( \sqrt{2x + 5} + \sqrt{x + 2} = 5 \)  
   b) \( \sqrt{2x + 5} + \sqrt{x + 2} \leq 5 \)  
   c) \( \sqrt{2x + 5} + \sqrt{x + 2} \geq 5 \)
ANSWERS FOR PRACTICE MIDTERM

1. a) \( \{1, \sqrt{49}\} \)  
b) \( \{0.1, \sqrt{49}\} \)  
c) \( \{-8.01, \sqrt{49}\} \)  
d) \( \{-8.01, 0.36, \frac{30}{7}, \sqrt{49}\} \)  
e) \( \{\sqrt{10}\} \)
f) \( \{-8.01, 0.36, \sqrt{10}, \frac{30}{7}, \sqrt{49}\} \)

2. \( M_{(x,y)} \left( \frac{1}{2}, \frac{3}{2} \right) \)

3. a) \((-11, -3) \) \& \((13, -3)\)  
b) \((3, 17) \) \& \((3, -7)\)

4. a) Is a function. Domain: \(( -\infty, \infty )\) Range: \((-\infty, 2]\)
   
b) Is NOT a function. Domain: \([ -5, \infty )\) Range: \((-\infty, \infty)\)
   
c) Is NOT a function. Domain: \([-7, 7]\) Range: \([-1, 1]\)

5. \( y = \frac{3}{4}x - \frac{5}{2} \)

6. a) \( x = -1 \)  
b) \(( -1, \infty)\)  
c) \(( -\infty, -1)\)  
d) \([1, \infty)\)  
e) \(( -\infty, -1]\)

7. a) \( \{-7, -1\} \)  
b) \(( -7, -1)\)  
c) \(( -\infty, -7) \cup [-1, \infty)\)

8. a) \( \{-4, -2, 2\} \)  
b) \(( -\infty, -4] \cup [-2, 2]\)  
c) \((-4, -2) \cup (2, \infty)\)

9. a) \( y_1 = 3\pi + 3.2(x - 7) - 5\sqrt{(-8\pi)} - 9.4\left(x - \sqrt{18}\right) \) or \( y_1 = 3\pi + 3.2(x - 7) \) & \( y_2 = 5\sqrt{(-8\pi)} + 9.4\left(x - \sqrt{18}\right) \)
   
b) \*depending on your answer for part a*
   
c) \( x \approx 4.6470 \)

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10. Cost function: \( C(x) = 0.40x + 3000 \)  
Revenue function: \( R(x) = 1.60x \)  
Profit function: \( p(x) = 1.20x - 3000 \)  
Break-Even Point: \( x = 2500 \text{ lbs} \)

11. a) Neither  
b) Neither

12. a) Even  
b) Y-axis

13. a) \( g(x) = -\sqrt{x} + 4 \)  
b) \( g(x) = \frac{1}{2}(x - 3)^2 \)  
c) \( g(x) = |x| \)  
d) \( g(x) = (x + 2)^2 - 8 \)

14. a) \( \{-13\} \)  
b) \( \emptyset \)  
c) \( \{6\} \)

15. a) \( (-\infty, -27] \cup [11, \infty) \)  
b) \( (-\infty, \infty) \)  
c) \( \emptyset \)

16. a) -19  
b) 1  
c) 0  
d) 81

17. a) 44  
b) -3  
c) 16x^2 + 8x - 4  
d) 4x^2 - 19

18. \(-5\sqrt{6}\)

19. a) \( \left\{ \frac{10}{3}, -4 \right\} \)  
b) \( \left\{ \frac{3 \pm \sqrt{13}}{2} \right\} \)  
c) \( \left\{ \frac{6 \pm i\sqrt{3}}{3} \right\} \)

20. a) \( (-\infty, -8) \cup (9, \infty) \)  
b) \( [-8, 9] \)

21. a) \( x > 14 \text{ in} \)  
b) \( V(x) = 7(5x - 14)(x - 14) \)  
c) \( 16.50 \text{ in}^3 < x < 17.01 \text{ in}^3 \)

22. a) \( \{3.65 \text{ sec}, 11.97 \text{ sec}\} \)  
b) 976.56 ft

23. a) \( \{-1.2939, 0.3093, 24.9846\} \)  
b) \( (-\infty, -1.2939] \cup [0.3093, 24.9846] \)  
c) \( (-1.2939, 0.3093) \cup (24.9846, \infty) \)

24. Minimum: \( (0.69, -87.21) \)  
Maximum: \( (23.97, 6218.03) \)
25. \[ P(x) = (x + 4)(x - 5)(4x + 3) \]

26. Maximum number of roots: 4  Possible rational roots: \[ \pm \left\{ \frac{1}{3}, \frac{2}{3}, 1, \frac{4}{3}, 2, 3, 4, 6, 12 \right\} \]

27. a) Vertical Asymptotes: \( x = 2, x = -1 \)  Horizontal Asymptote: \( y = \frac{1}{2} \)
   
   b) Vertical Asymptote: \( x = 25 \), \( x = 0 \)  Horizontal Asymptote: \( y = 0 \)
   
   c) Vertical Asymptote: \( x = 1 \)  Horizontal Asymptote: \( \text{none} \)

28. \( x \)-intercepts: \( x = \pm 3 \)  \( y \)-intercept: \( y = -\frac{9}{5} \)

29. \( x = -7 \)

30. a) \( (-\infty, 7) \cup [9, \infty) \)  b) \( (-\infty, -9) \cup (-5, -1] \)

31. \[ \frac{y^{18}}{x^{21}z^{12}} \]

32. \[ x^{16}y^{8}z^{5} \]

33. a) \( \{18\} \)  b) \( [-7, 18] \)  c) \( [18, \infty) \)

34. a) \( \{2\} \)  b) \( [-2, 2] \)  c) \( [2, \infty) \)