Part I: Focus on Expressions

1. Rewrite the following expressions so that they are as simple as possible. A simplified expression contains as few terms as possible, as few operations as possible, as few factors as possible, as few parentheses as possible, no negative exponents and as simple as possible an expression under a radical.
   a. \( \left( \frac{x^2 - 2x - 48}{x^2 + 8x + 16} + \frac{3x^2 - 9x}{x^2 - 16} \right) \cdot \frac{6x + 24}{5x + 30} \)
   b. \( \left( \frac{18b - 4c^3}{6b^2c^2} \right)^3 \)
   c. \( \left( \frac{x + 2}{x^2 - x} - \frac{6}{x^2 - 1} \right) + \frac{3}{x^2 + x} \)
   d. \( 3\sqrt{(45w)} - 4\sqrt{(20w)} \)
   e. \( -2(4x - 5)^2 \)

2. Factor each polynomial completely. (Hint: None are prime.)
   a. \( 16x^2y - 64y^3 \)
   b. \( 3x^3 - 18x^2 - 2x + 12 \)
   c. \( 20x^4 - 40x^3 - 25x^2 \)
   d. \( 8x^2 + 73x + 9 \)

Part II: Focus on Equations and Inequalities

3. Solve the following equations
   a. \( |5x - 2| - 3 = 4 \)
   b. \( (x - 2)(x + 1) = 4 \)
   c. \( 4x^2 - 8x - 20 = 0 \), solve using the quadratic formula or completing the square.
   d. \( x = \sqrt{x - 1} + 3 \)
   e. \( \frac{x}{x + 2} - \frac{7}{5 - x} = \frac{14}{x^2 - 3x - 10} \)

4. Solve the following inequality and graph the solution set on the number line below.
   \( -\frac{4}{3}x + 3 \leq \frac{2}{3} \)
In this problem you will solve the system below by two different methods: \[
\begin{cases}
2x - y = -4 \\
x + y = 1
\end{cases}
\]

a. Graph each linear equation on the grid below. Clearly show what method you are using to graph them. **ESTIMATE** the coordinates of the solution point.

b. Use the elimination method or the substitution method to find the **EXACT** solution.

On the graph below show the solution to the system of linear inequalities:

\[
\begin{cases}
y \geq -2x + 5 \\
y \leq \frac{1}{2}x - 3
\end{cases}
\]
Part III: Focus on Functions and Graphs

7. Indicate whether the relation given by \((y + 2)^2 + (x - 2)^2 = 5\) is a function. If it is a function, explain or show why it is a function. If it is not a function, explain why not or give an example to show why it is not a function.

8. Indicate whether the relation graphed below represents \(y\) as a function of \(x\). If it is a function, explain why it is a function. If it is not a function, explain why not or give an example to show why it is not a function.

9. For the radical function \(g(x) = -3 \sqrt{x - 2} + 4\), graphed below:
   a. Indicate on the graph how to solve the equation \(g(x) = 1\).
   b. What is the solution to \(g(x) = 1\)?

10. For the function \(g(x) = -3 \sqrt{x - 2} + 4\), solve \(g(x) = 1\) using symbolic algebra.
11. Create a function machine for \( h(x) = -(x + 3)^2 - 4 \).

\[
\begin{array}{c}
\text{input, } x / \\
\end{array}
\]

\[
\begin{array}{c}
\text{output, } h(x) = \\
\end{array}
\]

12. Consider the function \( f(x) = \left(\frac{1}{3}\right)^x \) graphed below.

a. Indicate on the graph how to evaluate \( f(-1) \).

b. What is the value of \( f(-1) \)?

![Graph](image)

13. For the rational function below, find the domain, the coordinates of the \( y \)-intercept (if any), and the coordinates of the \( x \)-intercepts (if any).

\[ q(x) = \frac{2x^2 - x - 3}{3x^2 + 7x - 6} \]

a. The domain of \( q(x) \):

b. The coordinates of the \( y \)-intercept (if any):

c. The coordinates of the \( x \)-intercepts (if any):
14. Consider the quadratic function \( p(x) = -(x + 2)^2 + 4 \).
   a. What are the coordinates of the vertex?
   b. What are the coordinates of the \( x \)-intercepts, if any?
   c. What are the coordinates of the \( y \)-intercept?
   d. Graph \( p(x) \) on the grid below.

![Graph of \( p(x) \)](image)

   e. On your graph of \( p(x) \), demonstrate graphically how to solve the equation \( p(x) = 3 \). Estimate the solutions, if any.

**Part IV: Focus on Problem Solving**

15. \([Calculator problem]\) The numbers of house calls paid by Medicare are shown in the table below for various years:

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of House Calls (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>1.62</td>
</tr>
<tr>
<td>1997</td>
<td>1.55</td>
</tr>
<tr>
<td>1998</td>
<td>1.48</td>
</tr>
<tr>
<td>1999</td>
<td>1.45</td>
</tr>
<tr>
<td>2000</td>
<td>1.53</td>
</tr>
<tr>
<td>2001</td>
<td>1.60</td>
</tr>
<tr>
<td>2002</td>
<td>1.70</td>
</tr>
<tr>
<td>2003</td>
<td>1.83</td>
</tr>
<tr>
<td>2004</td>
<td>2.06</td>
</tr>
</tbody>
</table>

Let \( N(t) \) represent the number of house calls (in millions) paid by Medicare as a function of the number of years \( t \) since 1995. A quadratic model for the situation is \( N(t) = 0.0204t^2 - 1.504t + 1.754 \).
16. The table below shows the percentage of American adults who smoke for various years since 1970.

<table>
<thead>
<tr>
<th>Years since 1970, $t$</th>
<th>Year</th>
<th>Percent who Smoke, $p(t)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1970</td>
<td>37.4</td>
</tr>
<tr>
<td>10</td>
<td>1980</td>
<td>33.2</td>
</tr>
<tr>
<td>20</td>
<td>1990</td>
<td>25.1</td>
</tr>
<tr>
<td>30</td>
<td>2000</td>
<td>23.1</td>
</tr>
<tr>
<td>35</td>
<td>2005</td>
<td>19.0</td>
</tr>
</tbody>
</table>

a. On the grid below, graph the points $(t, p)$ as accurately as possible. Label the axes appropriately.

b. Write an equation for the linear model $p(t)$.

c. Use your linear model to estimate the percent of Americans who smoke in 2010.
17. Lenka leaves Marina del Rey on her sailboat, Red Ole, for a cruise in Santa Monica Bay. First she sails due south, heading for Catalina Island for a distance of 4 miles. She then tacks and continues heading due west for a some distance. At this point she decides she has to return home and sails straight back to the marina which is a 5 miles away.

How far did she have to sail heading due west?

See the diagram below. Sketches may be useful, but the exact distance must be written in simplest form.