1. If \( A = \{x \mid x < 5\} \), \( B = \{x \mid -1 < x \leq 6\} \) and \( C = \{x \mid x > 2\} \), find the indicated sets.

   You may express your answer in either set or interval notation.

   a) \( A \cup B \)

   b) \( A \cap B \)

   c) \( A \cup C \)

   d) \( B \cap C \)

2. Factor the following completely:

   a) \( 8x^3 - 32xy^2 \)

   b) \( x^3 - 2x^2 - 8x \)

3. Find all real solutions to the following. Use the technique of completing the square at least once.

   a) \( x^2 + 2x - 4 = 0 \)

   b) \( 2x^2 + x = 3 \)

   c) \( x^2 - 2x + 5 = 0 \)

   d) \( \frac{1}{x+1} - \frac{2}{x^2} = 0 \)

   e) \( |x - 3| = 5 \)

4. Solve the inequalities. Express your answer in set or interval form.

   a) \( \frac{4}{x} \leq -1 \)

   b) \( |x + 4| > 2 \)

   c) \( 2x^2 + x \geq 1 \)

   d) \( 1 \leq 4 - 3x \leq 16 \)
5. Consider the points $P(5,-1)$ and $Q(3,7)$.
   a) What is the slope of the line through the two points?
   b) What is the equation of the line through the two points, in slope-intercept form?
   c) What is the equation of the line parallel to the line you found in part b), through the point $(0,2)$?
   d) What is the equation of the line perpendicular to the line you found in part b), through the point $(1,1)$?
   e) Is the point $(-2, 27)$ on the line you found above? Is the point $(1, 16)$ on the line? Justify your answers.
   f) What is the distance between the two points?
   g) What is the equation of the circle, centered at $P(5,-1)$, passing through $Q(3,7)$?

6. Which of the points $C(-4,3)$ or $D(3,1)$ is closer to the point $E(-1,2)$?

7. Determine whether the equation $x^2 + y^2 + 2x - 4y - 4 = 0$ represents a circle, a point, or has no graph. If the equation is that of a circle, find its radius and center.

8. A geologist uses a probe to measure the temperature $T$ (in ºC) of the soil at various depths below the surface, and finds that at a depth of $x$ centimeters, the temperature is given by the equation $T = 0.08x - 4$.
   a) True or false: The equation that expresses the temperature of the soil is a quadratic equation.
   b) What is the temperature of the soil at a depth of 1 meter (100 centimeters)?
   c) What do the slope, the $x$-intercept, and the $T$-intercept of the graph of this equation represent?

9. Find the domain of the functions:
   a) $f(x) = \sqrt{x^2 - 16}$
   b) $g(x) = \frac{x}{x^2 - 5x - 6}$

10. Let $g(x) = x^2 + 4$. Evaluate $g(x)$ at the indicated values:
   a) $g(-2)$
   b) $g(1)$
   c) $g(a)$
   d) $g(a + h)$
   e) $g(\frac{1}{x})$
11. Consider the piecewise defined function below:
\[
f(x) = \begin{cases} 
  x^2, & \text{if } x > 2 \\
  x - 1, & \text{if } x < 2 \\
  3, & \text{if } x = 2
\end{cases}
\]

Find \( f(3) \), \( f(2) \), \( f(-1) \). Be sure to show all work.