1. Find the domain of the following functions. Express your answers in interval notations.

   (a) \( f(x) = \frac{x + 2}{x^2 + 1} \)

   (b) \( g(x) = \frac{7}{\sqrt{x - 9}} \)

   (c) \( k(x) = \frac{\sqrt{6 + x}}{1 - x} \)

2. A utility company charges a base rate of 6 cents per kilowatt-hour for the first 310 kilowatt-hours and 15 cents per kilowatt-hour for all additional electricity usage.

   (a) The amount \( E \) that the utility company charges is a function of the number \( x \) of kilowatt hours used. Express \( E \) as a piecewise defined function of \( x \). Use correct notation.

   (b) How much does the utility company charge if the client uses 355 kilowatt-hours? Write your answer in a complete sentence with appropriate units.

3. Graph the piecewise function

   \[
   f(x) = \begin{cases} 
   -2 & \text{if } 0 < x \leq 3 \\
   9 - 2x & \text{if } 3 < x < 6 \\
   2x - 5 & \text{if } x \geq 6 
   \end{cases}
   \]

   (a) For what value(s) of \( x \) is \( f(x) = 0 \)?

   (b) For what value(s) of \( x \) is \( f(x) = 3 \)?

   (c) For what value(s) of \( x \) is \( f(x) = 7 \)?

4. Solve the following equations. (Be sure to check for extraneous solutions!)

   (a) \( \frac{5}{2x - 2} = \frac{15}{x^2 - 1} \)

   (b) \( \frac{2}{x + 3} - \frac{3}{4 - x} = \frac{2x - 2}{x^2 - x - 12} \)

   (c) \( \frac{x + 5}{x - 2} = \frac{5}{x + 2} + \frac{28}{x^2 - 4} \)

5. In 1990, chicken farms in the United States produced 68 billion eggs, while in 2000 they produced 83.2 billion eggs.

   (a) Compute the net change in egg production between 1990 and 2000.

   (b) Compute the average rate of change in egg production between 1990 and 2000. Include units in your answer.

   (c) Assuming egg production grew linearly, construct a linear function \( E(t) \) that yields the number of eggs (in billions) produced in the U.S., where \( t \) is time in years and \( t = 0 \) corresponds to 1990. Express \( E(t) \) in slope-intercept form.
(d) According to your model, how fast is the egg production changing per year between 2000 and 2005? (Use a complete sentence in your answer with appropriate units.)

6. The graph of the function, \( f(x) \), is given below.

(a) What is the domain of \( f(x) \)? Answer in interval notation.
(b) What is the range of \( f(x) \)? Answer in interval notation.
(c) On what interval(s) is \( f(x) \) increasing? Answer in interval notation.
(d) On what interval(s) is \( f(x) \) decreasing? Answer in interval notation.
(e) What are the coordinates of the local minimum/minima?
(f) Fill in the blank: \( f \) has a local maximum value of __________, attained at \( x = \) __________.

7. Factor the following expressions completely. Be mindful of the variables used!

(a) \( 16x^2 + 24x + 9 \)
(b) \( 8t^2 + 10t + 3 \)
(c) \( 7w^2 - 33w - 10 \)
(d) \( 6(x + 2)(x - 4)^3 - (x + 2)^2(8)(x - 4)^2 \)

8. Simplify the following compound expressions. (A compound expression is completely simplified when there is no fraction within a fraction and numerator and denominator are completely factored.)

(a) \( \frac{5}{a+h-2} - \frac{3}{a-2} \)
(b) \( \frac{2 - \frac{4}{9+h}}{h} \)

9. Calculate and simplify the difference quotient \( \frac{f(a+h) - f(a)}{h} \) for

(a) \( f(x) = 3x^2 + 8 \)
(b) \( f(x) = 2x^2 - 5x + 3 \)
(c) \( f(x) = \frac{3}{2x - 1} \)