INSTRUCTIONS: You must show enough work to justify your answer on **ALL** problems. Correct answers with no work (or inconsistent work) shown **will not** receive full credit. **All answers are to be exact; no decimal approximations.** You are **NOT** allowed to use any electronic device for this exam.

1.   Find the domain of the function $f(x) = \dfrac{x + 2}{x^2 - 16}$. Write your answer using interval notation.   (4 pts.)

        Answer _____

2.   Write the equation of the circle in standard form given the following information.   **Put a box around your answer.**

        a.   Center: $(-3, 7)$; Radius: 6   (4 pts.)

        b.   The center is $(2, -5)$ and the point $(-6, 4)$ is a point on the circle.   (6 pts.)

3.   Write the quadratic function $y = 3x^2 - 8x - 5$ in standard form. Then identify the vertex and the axis of symmetry.   (8 pts.)

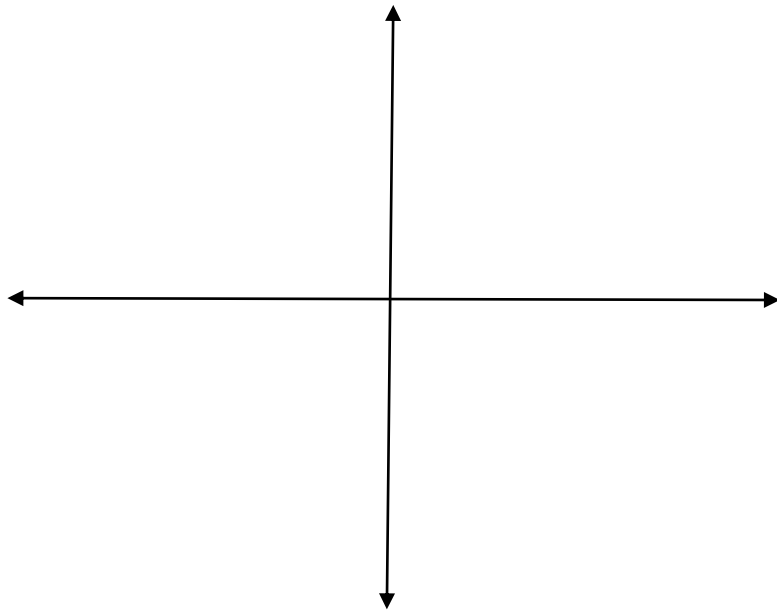   Vertex _____   Axis of Symmetry _____

4. If $g(x) = 2x^2 - 9x$, then find the average rate of change of the function g on the interval $[4, 4 + h]$, where $h > 0$. (8 pts.)

Answer _____

5. If $f(x) = 5x^2 + 2x$ and $g(x) = x - 3$, then find $(f \circ g)(x)$. (5 pts.)

Answer _____

6. Sketch the graph of $h(x) = \sqrt[3]{6x - 18}$. (5 pts.)

7. Sketch the graph of the function $f(x) = 4(x + 7)^2 - 12$ and identify the following.

a.   horizontal shift _____ (2 pts.)

b.   vertical shift _____ (2 pts.)

c.   range of the function _____ (3 pts.)

d.   interval(s) on which the function is increasing _____ (2 pts.)

e.   interval(s) on which the function is decreasing _____ (2 pts.)

f.   value of relative (local) maximum(s) and location(s) _____ (2 pts.)

g.   value of relative (local) minimum(s) and location(s) _____ (2 pts.)

h.   *x*-intercept(s) _____ (5 pts.)

i.   sketch: (3 pts.)
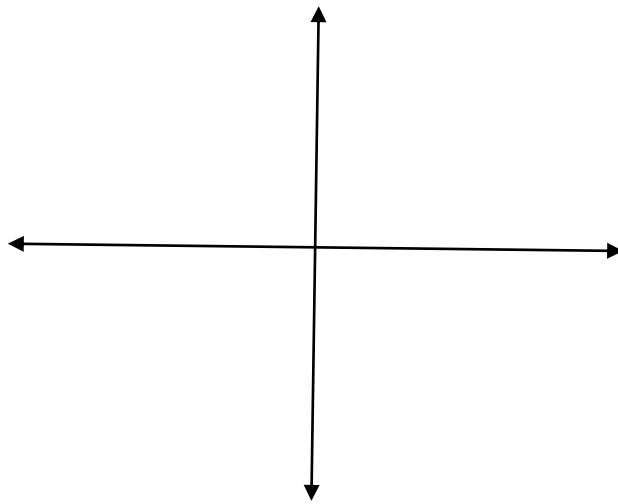
8.   If $g(x) = 2x^4 + 9x^3 - 12x - 28$, then use the Remainder Theorem to find $g(-6)$. (5 pts.)

Answer _____

9.   Identify the possible rational zeros (roots) of the polynomial $h(x) = 3x^3 - 8x^2 - 20x + 16$. Then find the zeros (roots), their multiplicities, and determine what implication the multiplicity of the zero (root) has on the graph of the polynomial. Write a factorization for $h(x)$. Determine the sign of the

infinity that the polynomial values approaches as x approaches positive infinity and negative infinity. Then sketch a graph of the polynomial.   (20 pts.)
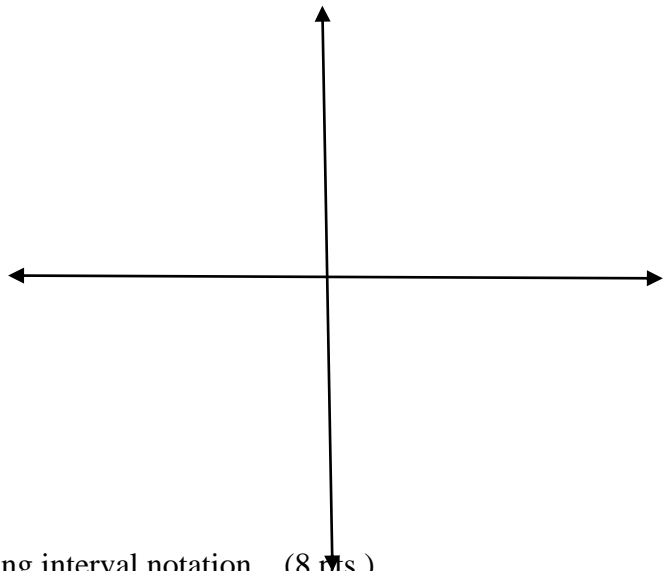
Possible rational zeros (roots) _____

Zero (Root)   Multiplicity   Implication on the Graph

Factorization for $h(x) = $ _____

As $x \to \infty$, $h(x) \to$ _____

As $x \to -\infty$, $h(x) \to$ _____

10.   Solve $\dfrac{x + 6}{4x - 7} \geq 0$.   Write your answer using interval notation.   (8 pts.)

Answer _____

11. Find the zeros (roots) and their multiplicities of $f(x) = x(7x + 12)^3(9 - 4x)^2$. Determine what implication the multiplicity of the zero (root) has on the graph of the polynomial. (6 pts.)

Zero (Root)　　Multiplicity　　Implication on the Graph

12. Find a polynomial p of degree 3 with zeros (roots) $\dfrac{5}{3}$, $4 + \sqrt{5}$ and $4 - \sqrt{5}$ each of multiplicity 1. (8 pts.)

Answer _____