Math 1120, Section 2 **Calculus** **Test 3**
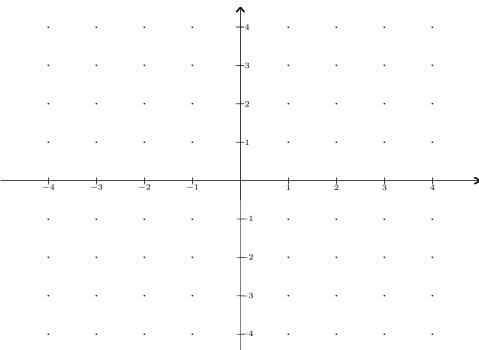
April 10, 2013 **Name** _____

The total number of points available is 145. Throughout this test, **show your work.** Using a calculator to circumvent ideas discussed in class will generally result in no credit.

1. (25 points) Consider the rational function $r(x) = \frac{(x^2-4)(x+3)(x)}{(2x-4)(x^2-9)(x+1)}$. Find the vertical and horizontal asymptotes, and the zeros of the function. Build the sign chart for the function. Sketch the graph on the coordinate system provided. Use the graph to state the intervals over which the function is increasing.

2. (10 points) Find the intervals over which $f(x) = 0.25x + x^{-1}$ is increasing.

3. (10 points) Find the interval(s) over which $g(x) = 2x^3 + 3x^2 - 12x + 7$ is concave upwards.

4. (20 points) Find all critical points of $H(x) = (2x+2)^3 \cdot x^5$. Then identify each critical point as the location of a local maximum, local minimum, or neither.

5. (20 points) If 300 square inches of material is available to make a box with a square base and an open top, find the largest possible volume of the box.

6. (12 points) Find the time it takes for an 8% investment compounded quarterly to triple in value. Round off to the nearest tenth of a year.

7. (12 points) Nuclear Fallout. Strontium 90 (Sr-90) is a radioactive isotope of strontium. It is present in the fallout after a nuclear explosion. It is especially hazardous to human and other animals because, upon ingestion of contaminated food, it is absorbed into the bone structure. Its half-life is 27 years.

   (a) If the concentration of Sr-90 is four times the 'safe' level, in how many years will the concentration be at the safe level?

   (b) If the concentration of Sr-90 is four times the safe level, how many years are needed to reduce the concentration to one third the safe level?

8. (12 points) Find an equation for the line tangent to the graph of $g(x) = x^2 e^{2x}$ at the point $(1, g(1))$.

9. (12 points) Find an interval over which the function $G(x) = \ln(x^2 + 1)$ is concave upwards.

10. (12 points) Find an equation for the line tangent to the graph of $h(x) = \sqrt{x^2 + 3} \cdot (2x - 3)^4 \cdot (3x + 1)^{-1}$ at the point $(1, h(1))$.