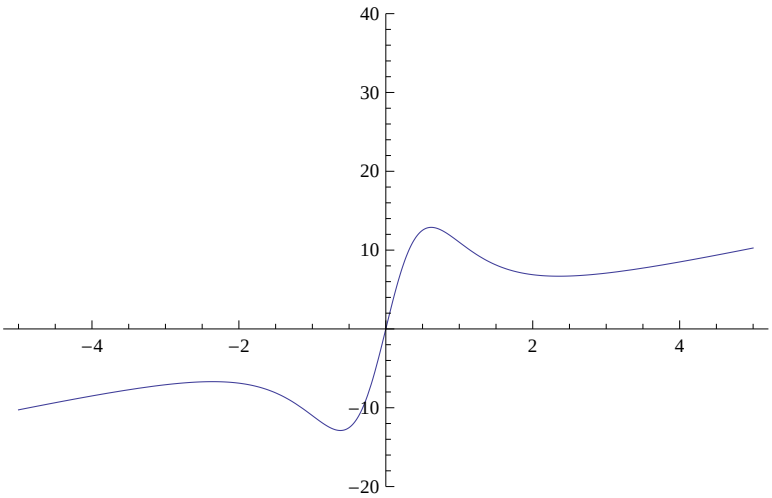
MAT129 Test 2 (Spring 2016): Stewart 2.2-2.6, 2.8, 3.1

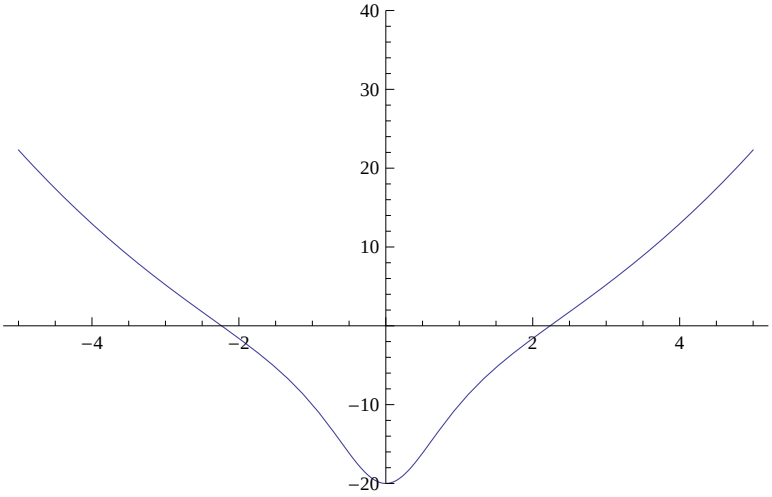
Name:

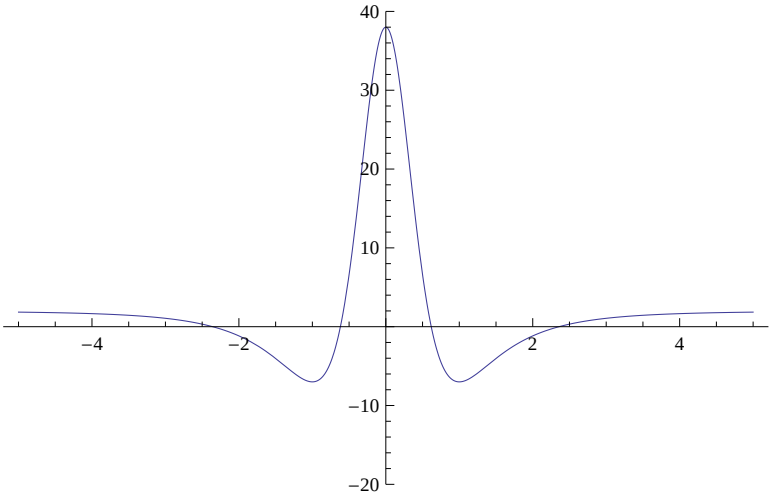
Directions: All problems are equally weighted. Show your work! Answers without justification will likely result in few points. Your written work also allows me the option of giving you partial credit in the event of an incorrect final answer (but good reasoning). Indicate clearly your answer to each problem (e.g., put a box around it). **Good luck!**

Problem 1: Use the limit definition of the derivative function to find the derivative of $f(x) = \frac{1}{x^2}$. Explain all steps.

Problem 2: With as many reasons as you can think of, decide which graph is the function $f(x)$, which the derivative $f'(x)$, and which the second derivative $f''(x)$:







Problem 3: Use your differentiation rules to calculate the derivatives of the following functions:

a. $F(x) = \sin(x)\cos(x) + x^3$

b. $G(x) = \dfrac{x}{\sin(x)}$

c. $H(x) = \sin(3x + 2) - \sqrt{x}$

Problem 4: Suppose that **you know only** the derivatives of $\sin(x)$ and $\cos(x)$, the power rule, the quotient rule, and the chain rule. Show how to compute the derivative of $f(x) = \tan(\frac{1}{x})$ using only these tools.

Problem 5: Do just one of the following two balloon problems (your choice):

a. A hot air balloon rising vertically is tracked by an observer located 2 miles from the lift-off point. At a certain moment, the angle between the observer's line-of-sight and the horizontal is $\frac{\pi}{6}$, and it is changing at a rate of 0.2 radians/minute. How fast is the balloon rising at this moment?

b. A large spherical balloon is being blown up with air at a constant rate (in liters per minute). At the moment that it reaches a diameter of 1 meter, its radius is increasing at a rate of 1 cm per minute. How fast is the air being blown into the balloon? (The volume of a sphere is $V = \frac{4}{3}\pi r^3$).

Problem 6: Consider the cubic function $f(x) = x^3 + 3x^2 - 9x + 2$ on the interval [-5,2].

a. Find all extrema (local and global) of the function on this interval, and all critical points.

b. Explain how you know that you've found them all – the global extrema in particular.

c. Sketch f based on your work.