**Calculus 1 — Exam 2**
**MAT 250, Spring 2012 — D. Ivanšić**

**Name:** _____

*Show all your work!*

Differentiate and simplify where appropriate:

**1.** (6pts) $\dfrac{d}{dx}\left(2x^7 - \dfrac{5}{x^3} + \sqrt[4]{x^7} + e^2\right) =$

**2.** (6pts) $\dfrac{d}{dt}(t^2 + yt)e^t =$

**3.** (8pts) $\dfrac{d}{dx}\dfrac{3x-1}{x^3 - 5x^2 + 17} =$

**4.** (9pts) $\dfrac{d}{dw}\dfrac{w + \sqrt[4]{w}}{w - \sqrt[4]{w}} =$

**5.** (6pts) Let $h(x) = \dfrac{f(x) + g(x)}{f(x)g(x)}$. Find the general expression for $h'(x)$ and simplify.

Find the following limits algebraically.

**6.** (5pts) $\lim_{x\to 3} \dfrac{x^2+x-12}{x^2-10x+21} =$

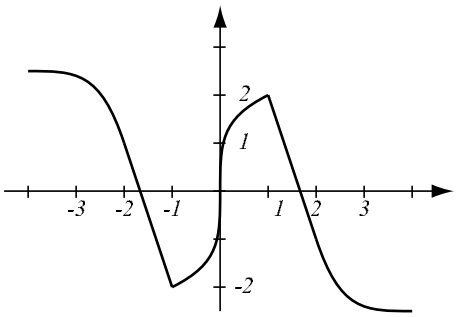
**7.** (7pts) $\lim_{x\to 25} \dfrac{5-\sqrt{x}}{25-x} =$

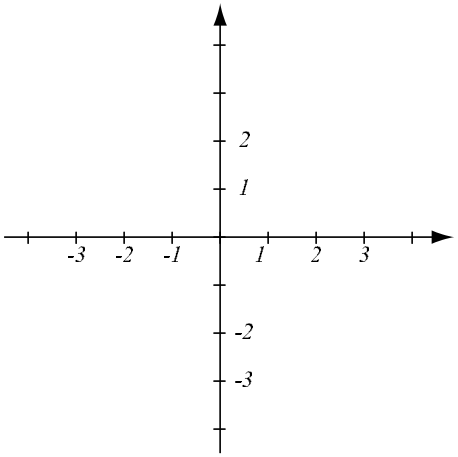
**8.** (7pts) $\lim_{x\to 0} \dfrac{\sin(3x)}{x^2-x} =$

**9.** (10pts) Find $\lim_{x\to 0^+} x^3\left(4+\sin^2\left(\dfrac{1}{x}\right)\right)$. Use the theorem that rhymes with what unkind children do to their peers.

**10.** (12pts) The graph of the function $f(x)$ is shown at right.

a) Find the points where $f'(a)$ does not exist.
b) Use the graph of $f(x)$ to draw an accurate graph of $f'(x)$.
c) Is $f(x)$ odd or even? How about $f'(x)$?




**11.** (16pts) Let $f(x) = \dfrac{x}{x+1}$.
a) Use the limit definition of the derivative to find the derivative of the function.
b) Check your answer by taking the derivative of $f$ using rules.
c) Write the equation of the tangent line to the curve $y = f(x)$ at point $(1, \frac{1}{2})$.

**12.** (8pts) Consider the limit below. It represents a derivative $f'(a)$.
a) Find $f$ and $a$.
b) Use the infomation above and differentiation formulas to find the limit.

$$\lim_{x\to 32} \frac{\sqrt[5]{x}-2}{x-32}$$

**Bonus.** (10pts) We have indicated how to prove $(x^n)' = nx^{n-1}$ for $n \geq 0$. Show that the formula works for integers $n < 0$ as follows: set $n = -k$, and develop the rule for the derivative of $x^{-k}$ with the help of the quotient rule and the rule for positive exponents.

[0]Total points: 200