# Math 246 (11-12am), Quiz 2.

*Show all your work! Use the most efficient method you know!*

0. Write your name here:

1. Find the derivative of $f(x) = \sqrt{x}\,(3x^2 - 1)$.

We use Product Rule and $(\sqrt{x})' = \frac{1}{2\sqrt{x}}$ :

$$f'(x) = \frac{1}{2\sqrt{x}}(3x^2-1) + \sqrt{x}\,(3x^2-1)' = \frac{3}{2}x\sqrt{x} - \frac{1}{2\sqrt{x}} + \sqrt{x}\cdot 6x =$$

$$= \frac{15}{2}x\sqrt{x} - \frac{1}{2\sqrt{x}}$$

Answer: $f'(x) = \frac{15}{2}x\sqrt{x} - \frac{1}{2\sqrt{x}}$.

2. The size of some population at moment of time $t$ is given by $N(t) = \frac{1000t}{3\sqrt{t}+1}$. What is instantaneous rate of change of the size of population at the moment $t = 9$?

We need to compute $N'(9)$. We use Quotient Rule and $(\sqrt{t})' = \frac{1}{2\sqrt{t}}$ :

$$N'(t) = \frac{1000(3\sqrt{t}+1) - 1000t\cdot 3\cdot\frac{1}{2\sqrt{t}}}{(3\sqrt{t}+1)^2} = \frac{3000\sqrt{t}+1000-1500\sqrt{t}}{(3\sqrt{t}+1)^2} = \frac{1500\sqrt{t}+1000}{(3\sqrt{t}+1)^2}$$

Thus $N'(9) = \frac{1500\sqrt{9}+1000}{(3\sqrt{9}+1)^2} = \frac{4500+1000}{(9+1)^2} = \frac{5500}{100} = 55$

Answer: the instantaneous rate of change of the size of population at $t=9$ is $55$.

3. Find the slope of the tangent line to the graph of the function $g(x) = \sqrt{3x^2+4}$ with base point $x = 2$.

We are asued to compute $g'(2)$. We use Chain Rule and $(\sqrt{x})' = \frac{1}{2\sqrt{x}}$ :

$$g'(x) = \frac{1}{2\sqrt{3x^2+4}}\cdot(3x^2+4)' = \frac{1}{2\sqrt{3x^2+4}}\cdot(3\cdot 2x) = \frac{3x}{\sqrt{3x^2+4}}$$

Hence $g'(2) = \frac{3\cdot 2}{\sqrt{3\cdot 2^2+4}} = \frac{6}{\sqrt{12+4}} = \frac{6}{\sqrt{16}} = \frac{6}{4} = \frac{3}{2} = 1.5$

Answer: the slope of the tangent line to the graph of $g(x)$ with base point $x=2$ is $\frac{3}{2} = 1.5$.