

**Quiz 3      Calculus 1      10/10/2011**

Each problem is worth 5 points. Clear and complete justification is required for full credit.

1. Let  $f(x) = \frac{x+5}{x-1}$ . Find an equation for the line tangent to  $f(x)$  where  $x = 3$ .

$$f'(x) = \frac{(x+5)'(x-1) - (x+5)(x-1)'}{(x-1)^2}$$

$$= \frac{x-1 - x-5}{(x-1)^2}$$

$$= \frac{-6}{(x-1)^2}$$

$$f'(3) = \frac{-6}{(3-1)^2} = \frac{-6}{4} = -\frac{3}{2}$$

∴ the slope of the line tangent is  $-\frac{3}{2}$

$$f(3) = \frac{3+5}{3-1} = \frac{8}{2} = 4$$

If  $y = -\frac{3}{2}x + b$ ,  $(3, 4)$  is on this line

$$\therefore 4 = -\frac{3}{2} \times 3 + b$$

$$b = \frac{17}{2}$$

∴ line tangent to  $f(x)$  where  $x=3$  is  $y = -\frac{3}{2}x + \frac{17}{2}$

*Excellent!*

2. Let  $g(x) = \sqrt{5x^2+4}$ . Find an equation for the line tangent to  $g(x)$  where  $x = 3$ .

$$g(x) = f(h(x))$$

$$h(x) = 5x^2 + 4$$

$$f(x) = \sqrt{x} = x^{1/2}$$

$$g'(x) = f'(h(x)) \cdot h'(x)$$

$$h'(x) = 10x$$

$$f'(x) = \frac{1}{2}x^{-1/2} = \frac{1}{2\sqrt{x}}$$

$$= \frac{1}{2\sqrt{5x^2+4}} \cdot 10x = \frac{5x}{\sqrt{5x^2+4}}$$

$$g'(3) = \frac{15}{\sqrt{45+4}} = \frac{15}{7} = m$$

$$g(3) = \sqrt{5(9)+4} = \sqrt{49} = 7$$

$$y - 7 = \frac{15}{7}(x - 3)$$

*Nice!*