Math 141- Midterm Exam #2 - October 24, 2007

1. (50 points) Find $\frac{dy}{dx}$. You do not need to simplify your answers.

a.
$$y = x \cos(x)$$

b.
$$y = \tan(x^2 + 1)$$

c.
$$y = \frac{\sqrt{x}}{x^3 + 1}$$

d.
$$y = \ln(5x - 15)$$

e.
$$y = 3^x$$

f. $y = x^{10} - 9x^3 + 15x - 3$

g. $y = \sin^3(x^2)$

 $h. y = (\sin x)^x.$

i.
$$y = \sqrt{\frac{(x^2+1)^5 e^x x^9}{x^2+2}}$$

 $j. \sin(xy) = 5x$

2. (10 points) Find the equation of the tangent line to the curve

$$2x - xy^2 = -6$$

at the point (3, 2).

3. (10 points) Find the linear approximation to the function $f(x) = x^{3/4}$ at x=16. Then use this linear approximation to estimate $15^{3/4}$.

4. (5 points) Evaluate this limit by first expressing it as a derivative:

$$\lim_{h \to 0} \frac{\sqrt[4]{16 + h} - 2}{h}.$$

5. (10 points) Let r(x) = f(g(h(x))), where h(1) = 2, h'(2) = -1, g(2) = 3, h'(1) = 4, g'(2) = 5, and f'(3) = 6. Find r'(1).

6. (15 points) The angle of elevation of the sun is decreasing at a rate of 0.25 radians/hour. How fast is the length of the shadow cast by a 4 foot tall pole increasing when the angle of elevation of the sun is $\pi/6$? (FYI: $\cos(\pi/6) = \sqrt{3}/2$, $\sin(\pi/6) = 1/2$.)