(6 each) 1. Find the derivative of y with respect to the given variable.

(a) $y = \sqrt{x}e^{2x}$

(b) $y = \dfrac{\ln x}{3 + \ln x}$

(c) $y = \tan^{-1}(x/3) - 5\sin^{-1}(x/2)$

(d) $y = 5\log_3 x + 10^{\sqrt{x}}$

(9) 2. Use implicit differentiation to find dy/dx if

$$\frac{1}{x} + x\cos y + \sin(2y) = 0$$

(8) 3. Find the differential of the function $y = (x^3 + 4)^{1/3}$

(8) 4. Find the linearization $L(x)$ of $f(x) = \sec(2x)$ at $x = \pi/8$.

(8) 5. Find the derivative of $y = x^{\sin x}$, where $x > 0$. (Suggestion: Use logarithmic differentiation.)

6. Find the absolute maximum and minimum of $f(x) = -2x^3 + 6x^2 - 3$ on the interval [-1,4]. Show your reasoning.

(11) 7. Graph the function below. Determine the local maxima, minima and inflection points as well as intervals of increase and decrease.

(18)

$$y = 10x^3 - x^5$$

8. A paper cup has the shape of a cone with height 12 cm and radius 4 cm (at the top). If water is poured into the cup at 2 cm^3/sec, how fast is the water level rising when the water is 8 cm deep? (Recall that the volume of a cone of height h and radius r is $\pi r^2 h/3$.)

(14)