AP Calculus BC

Lesson 4.1 Critical points, extreme values, review

1. Find the maximum value of the function $f(x) = -2x^2 + 4x + 1$.

2. Find the minimum and maximum value of the function $f(x) = -2x^2 + 4x + 1$ on the interval [0,4]

3. Find the x-values at which the function $f(x) = 2x^3 + 9x^2 - 24x - 7$ has any local maximum or minimum values.

4. Find the maximum and minimum values of the function $f(x) = 4\sin^2(2x) + 7$ on the interval $[0, \pi]$.

5. Find the x-coordinates of all critical points on the function $f(x) = \sqrt[3]{2x^2 - 5} + 4$.

6. Given the curve generated by $y^3 + 3x^2y + 13 = 0$

   a) Find $\frac{dy}{dx}$

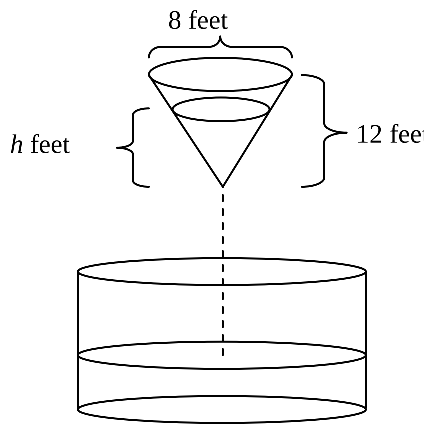
   b) Write an equation for the line tangent to the curve at the point (2, -1)

   c) Find the point(s) on the curve where the tangent line is horizontal.

7. Use differentials to estimate the allowable percentage error in measuring the radius r of a sphere if the volume is to be calculated correctly to within 6%.

(The volume V of a sphere of radius r is $V = \frac{4}{3}\pi r^3$.)

8. (1995AB5BC3) As shown in the figure at right, water is draining from a conical tank with height 12 feet and diameter 8 feet into a cylindrical tank that has a base with area 400π square feet. The depth h, in feet, of the water in the conical tank is changing at the rate of $(h-12)$ feet per minute.
(The volume of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.)



(a) Write an expression for the volume of water in the conical tank as a function of h.

(b) At what rate is the volume of water in the conical tank changing when $h = 3$? Indicate units of measure.

(c) Let y be the depth, in feet, of the water in the cylindrical tank. At what rate is y changing when $h = 3$? Indicate units of measure.