

Calculators, Mobile telephones and Pagers ARE NOT ALLOWED.

Answer ALL of the following questions.

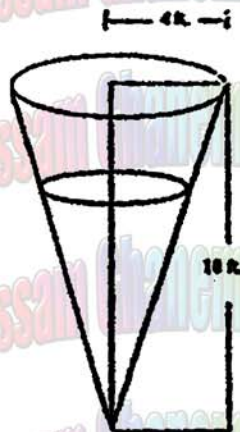
All items are weighted equally at 5 points each.

1. If  $y$  is a function of  $x$  defined implicitly by

$$\cos(xy) + 2y + y^2 \tan x = 3,$$

then find the equation of the tangent line to the graph of  $y$  when  $x = 0$ .

2. A water tank has the shape of an inverted right circular cone of depth 10 ft. and base radius 4 ft. (see the figure). Water is removed from the tank at a rate of 5 ft./min. How fast is the water level falling when the depth of water in the tank is 6 ft.?



3. Use differentials to approximate the value of  $(2.03)\sqrt{(2.03)^2 - 3}$ .

4. Let  $f(x) = \frac{x^2}{(x-1)^2}$

(a) Show that  $f'(x) = \frac{-2x}{(x-1)^3}$  and  $f''(x) = \frac{2(2x+1)}{(x-1)^4}$ .

(b) Find the intervals on which  $f$  is increasing and the intervals on which  $f$  is decreasing. Find the local extrema, if any.

(c) Find the intervals on which  $f$  is concave upward and the intervals on which  $f$  is concave downward. Find the points of inflection, if any.

(d) Find the vertical and horizontal asymptotes for the graph of  $f$ , if any.

(e) Sketch the graph of  $f$  indicating the  $x$  and  $y$  intercepts, local extrema, points of inflection, concavity and asymptotes.

Good Luck