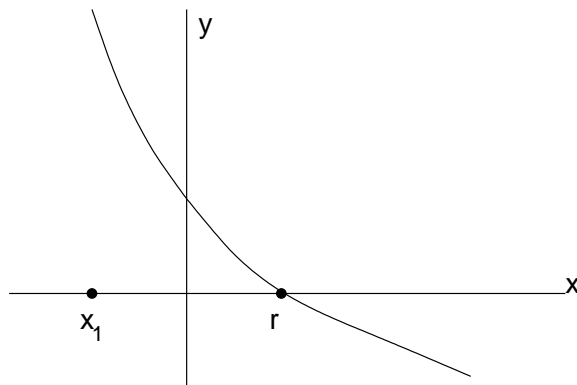Name: _____

1. Find the derivative of

   (a) $y = \dfrac{x + \sin x}{x^2 + \cos x}$

   (b) $y = \ln(x + e^{-x})$

2. (a) Find $\dfrac{dy}{dx}$
   $x^3 + y^3 = xy.$

(b) Find the equation of the tangent line to the curve $x = \sin 2y$ at the point where $x = 1$.

3. (a) Explain Newton's method to find the root r of $f(x) = 0$, where $y = f(x)$ is the graph shown. Starting from the first guess x_1, determine the location on the graph of x_2, x_3.

(b) Use Newton's method to find the solution of $\cos x - \ln x = 0$ in the interval $[0, 2]$ accurate to four decimal places. (Must show all the steps).

4. A water tank is in the shape of a cone with vertical axis and vertex downward. The tank has radius 3 ft and is 5 ft high. At first the tank is full of water, but at time $t = 0$ (in seconds), a small hole at the vertex is opened and the water begins to drain. When the height of the water in the tank has dropped to 3 ft, the water is flowing out at 2 ft^3/s. At what rate, in feet per second, is the water level dropping then?

5. A weather balloon that is rising vertically is observed from a point on the ground 300 ft from the spot directly beneath the balloon. At what rate is the balloon rising when the angle between the ground and the observer's line of sight is 45° and is increasing at 1° per second? (Need to change 1° to radians)