1.) Use the Intermediate Value Theorem to verify that the following equation is solvable, then use Newton’s Method to estimate the value of the solution to four decimal places:

\[(x - 1)^3 = 10 + \sqrt{x}\]

2.) Find the slope and concavity of the graph of \(xy^2 + y = 2\) at \(x = 0\) and \(x = 1\). Sketch the graph of this equation.

3.) The volume \(V\) of a sphere is changing at the rate of \(\pi\) ft.\(^3\)/min. At what rate is the sphere’s surface area \(S\) changing when

a.) \(S = 4\pi\) ft.\(^2\)?  
b.) \(S = 36\pi\) ft.\(^2\)?

4.) Find the height \(h\) and radius \(r\) of a right circular cone of maximum volume which can be inscribed in a sphere of radius 1 ft.

5.) Car B is 30 miles directly east of car A and begins moving west at 90 mph. At the same moment car A begins moving north at 60 mph.

a.) At what rate is the distance between the cars changing after \(t = \frac{1}{5}\) hr. \(t = \frac{1}{3}\) hr.?  
b.) What is the minimum distance between the cars and at what time \(t\) does the minimum distance occur?

6.) Assume that \(x^2 + (5 - y)^3 = 2x + 125\).

a.) Find \(y' = \frac{dy}{dx}\) at the point \((0,0)\) using implicit differentiation.

b.) Solve the original equation for \(y\). Then find \(y' = \frac{dy}{dx}\) at the point \((0,0)\) using ordinary differentiation.

7.) A conical tank (point down) has height 10 ft. and base radius 8 ft. Water begins flowing into the tank at the rate of \(\pi\) ft.\(^3\)/sec. At what rate is the depth \(h\) of the water changing

a.) when \(h = 1\) ft.  
b.) when \(h = 9\) ft.

8.) Assume that \(xy^2 = x + \tan y\). Write \(y'' = \frac{d^2y}{dx^2}\) in terms of \(x\) and \(y\) only.

9.) Use differentials to estimate the value of \((9900)^{\frac{1}{4}}\).
10.) The radius of a sphere is measured with absolute percentage error of at most 4%. Use differentials to estimate the maximum absolute percentage error in computing the sphere’s
   a.) surface area.  
   b.) volume.

The following problem is for recreational purposes only.

11.) Write a formula which will determine the nth term in the following list for \( n = 1, 2, 3, 4, 5, 6, \ldots \). What is the 137th number in this list?

   5, 9, 13, 17, 21, 25, \ldots