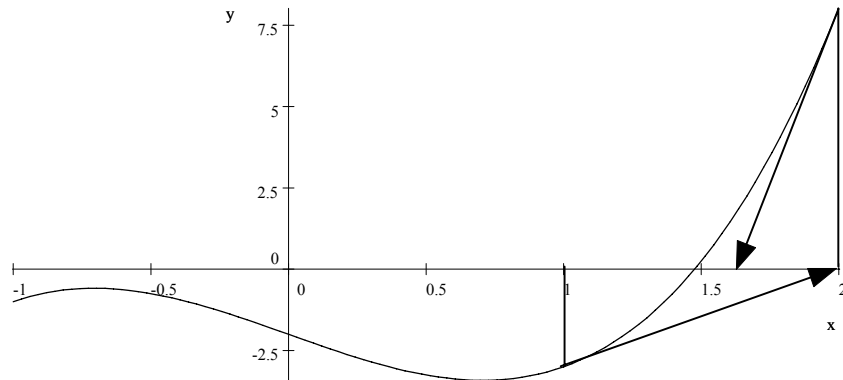


1. We want to find a root of  $f(x) = 2x^3 - 3x - 2$ .

- (a) Starting with a guess of  $x = 1$ , use Newton's Method *by hand* to find the next guess (write down the formula you used and show all work).

$$x_{\text{new}} = x - \frac{2x^3 - 3x - 2}{6x^2 - 3} = 1 - \frac{-3}{3} = 1 + 1 = 2.$$

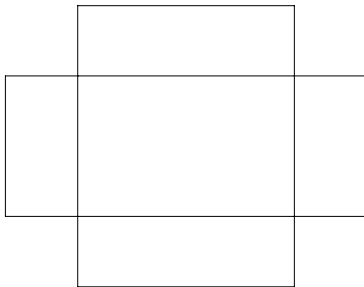
- (b) In the diagram below, show geometrically how, starting with  $x_0 = 1$ , the *next two guesses* are determined.



- (c) Using your calculator and Newton's Method, find the actual root correct to at least *nine* decimal places.

$$x \approx 1.4756865178.$$

2. You start with a piece of cardboard 10 inches wide by 8 inches high, and cut four equal squares out of the four corners (see diagram below). You then fold the sides up on the dotted lines to produce a box (no top). Let  $x$  be the length of the side of the squares you cut out. Find the volume of the box in terms of  $x$ , and use calculus to find the value of  $x$  which maximizes the volume. If you have time, find this maximum volume.



For the box:  $W = 10 - 2x$ ,  $H = 8 - 2x$ ,  $D = x$ . Thus,  $V = (10 - 2x)(8 - 2x)x = 4x^3 - 36x^2 + 80x$ ;  $V' = 12x^2 - 72x + 80 \stackrel{\text{set}}{=} 0$ , or  $3x^2 - 18x + 20 = 0$ . From the quadratic formula, this gives two roots:  $x = 1.472474268$ , and  $x = 4.527525232$ . However, the second one is too big since  $H = 8 - 2x$  would be negative. Choosing  $x = 1.472474268$  gives a maximum volume of  $V \approx 52.5138$