Homework 2

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2.3.11

$$\begin{array}{l} \sqrt{3} < x < \sqrt{5}; \\ \sqrt{3} - 2 < x - 2 < \sqrt{5} - 2; \\ -\left(2 - \sqrt{3}\right) < x - 2 < \sqrt{5} - 2. \end{array}$$

Since $\sqrt{5} - 2 < 2 - \sqrt{3}$ (check on a calculator if you want), use

$$\delta = \sqrt{5} - 2,$$

which is positive.

2.3.23

$$\begin{split} |f(x) - L| &< \epsilon; \\ |x^2 - 4| &< 0.5; \\ -0.5 &< x^2 - 4 &< 0.5; \\ 3.5 &< x^2 &< 4.5. \end{split}$$

Since everything here is positive, we can take square roots.

$$\sqrt{3.5} < |x| < \sqrt{4.5}.$$

Since $x \approx c = -2$, we can assume that |x| = -x.

$$\sqrt{3.5} < -x < \sqrt{4.5}; -\sqrt{3.5} > x > -\sqrt{4.5}; -\sqrt{4.5} < x < -\sqrt{3.5}; 2 - \sqrt{4.5} < x + 2 < 2 - \sqrt{3.5}; -(\sqrt{4.5} - 2) < x - (-2) < 2 - \sqrt{3.5}.$$

Since $\sqrt{4.5} - 2 < 2 - \sqrt{3.5}$, use

 $\delta = \sqrt{4.5} - 2,$

which is positive.

2.3.39

$$\begin{split} \left|\sqrt{x-5}-2\right| < \epsilon;\\ -\epsilon < \sqrt{x-5}-2 < \epsilon;\\ 2-\epsilon < \sqrt{x-5} < 2+\epsilon. \end{split}$$

Since $\epsilon \approx 0$, everything here is positive, so we can take squares.

$$\begin{split} 4-4\epsilon+\epsilon^2 &< x-5 < 4+4\epsilon+\epsilon^2;\\ 9-4\epsilon+\epsilon^2 &< x < 9+4\epsilon+\epsilon^2;\\ -4\epsilon+\epsilon^2 &< x-9 < 4\epsilon+\epsilon^2;\\ -(4\epsilon-\epsilon^2) &< x-9 < 4\epsilon+\epsilon^2. \end{split}$$

Since $4\epsilon - \epsilon^2 < 4\epsilon + \epsilon^2$, use

$$\delta = 4\epsilon - \epsilon^2.$$

which is positive since $\epsilon \approx 0$.

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