

Section 9.4 Extra Credit

#38] $f(x) = 3 - 7\sqrt{x}$

Step 1: $f(x+h) = 3 - 7\sqrt{x+h}$

Step 2: $f(x+h) - f(x) = 3 - 7\sqrt{x+h} - (3 - 7\sqrt{x}) = 7\sqrt{x} - 7\sqrt{x+h}$

Step 3: $\frac{f(x+h) - f(x)}{h} = \frac{7\sqrt{x} - 7\sqrt{x+h}}{h}$

Rationalize the numerator (See Appendix)

$$= \frac{7\sqrt{x} - 7\sqrt{x+h}}{h} \left(\frac{7\sqrt{x} + 7\sqrt{x+h}}{7\sqrt{x} + 7\sqrt{x+h}} \right) = \frac{7^2 x - 7^2 (x+h)}{h(7\sqrt{x} + 7\sqrt{x+h})}$$

$$= \frac{-7^2 h}{7h(\sqrt{x} + \sqrt{x+h})} = \frac{-7}{\sqrt{x} + \sqrt{x+h}}$$

Step 4: $\lim_{h \rightarrow 0} \frac{-7}{\sqrt{x} + \sqrt{x+h}} = \frac{-7}{\sqrt{x} + \sqrt{x}} = \frac{-7}{2\sqrt{x}}$