

**Example 1:** Estimate the value of  $f(8.125)$  for  $f(x) = -2\sqrt[3]{x^2}$

$$f(x) = -2\sqrt[3]{x^2}$$

$$f(x) = -2x^{\frac{2}{3}}$$

$$\frac{df}{dx} = -2x^{-\frac{1}{3}} \left( \frac{2}{3} \right)$$

$$\frac{df}{dx} = -\frac{4}{3} * \frac{1}{\sqrt[3]{x}}$$

$$\frac{df}{dx}(8) = -\frac{4}{3} * \frac{1}{2}$$

$$\frac{df}{dx}(8) = -\frac{2}{3}$$

Now that we know the derivative at 8, we can plug that into a point-slope linear equation:

$$y - y_0 = m(x - x_0)$$

$$y - f(8) = -\frac{2}{3}(x - 8)$$

$$y + 8 = -\frac{2}{3}(x - 8)$$

We can now use that to estimate  $f(8.125)$

$$y + 8 = -\frac{2}{3}(8.125 - 8)$$

$$y = -\frac{2}{3} * \frac{1}{8} - 8$$

$$y = -\frac{1}{12} - 8$$

$$y = -8\frac{1}{12}$$

A good approximation for  $f(8.125)$  is therefore  $-8\frac{1}{12}$