



Differentials Errors and Approximation Ex14.1 Q9(xv)

$$\begin{aligned}\text{Let } x &= 81, \quad x + \Delta x = 80 \\ \Delta x &= 80 - 81 \\ &= -1\end{aligned}$$

$$\begin{aligned}\text{Let } y &= x^{\frac{1}{4}} \\ \frac{dy}{dx} &= \frac{1}{4(81)^{\frac{3}{4}}} \\ &= \frac{1}{108} \\ &= 0.00926\end{aligned}$$

$$\begin{aligned}\Delta y &= \left(\frac{dy}{dx} \right)_{x=81} \times (\Delta x) \\ &= (0.00926)(-1) \\ &= -0.00926\end{aligned}$$

$$\begin{aligned}(80)^{\frac{1}{4}} &= y + \Delta y \\ &= x^{\frac{1}{4}} - 0.00926 \\ &= (81)^{\frac{1}{4}} - 0.00926 \\ &= 3 - 0.00926\end{aligned}$$

$$(80)^{\frac{1}{4}} = 2.99074$$

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$$\begin{aligned}\text{Let } x &= 27, \quad x + \Delta x = 29 \\ \Delta x &= 29 - 27 \\ &= 2\end{aligned}$$

$$= 2$$

Let $y = x^{\frac{1}{3}}$

$$\frac{dy}{dx} = \frac{1}{3(x)^{\frac{2}{3}}}$$

$$\left(\frac{dy}{dx}\right)_{x=27} = \frac{1}{3(27)^{\frac{2}{3}}}$$

$$= \frac{1}{27}$$

$$= 0.03704$$

$$\Delta y = \left(\frac{dy}{dx}\right)_{x=27} \times (\Delta x)$$

$$= (0.03704)(2)$$

$$\Delta y = 0.07408$$

$$(28)^{\frac{1}{3}} = y + \Delta y$$

$$= x^{\frac{1}{3}} + 0.07408$$

$$= (27)^{\frac{1}{3}} + 0.07408$$

$$= 3 + 0.07408$$

$$(29)^{\frac{1}{3}} = 3.07408$$

$$\begin{aligned}\text{Let } x &= 64, \quad x + \Delta x = 66 \\ \Delta x &= 66 - 64 \\ &= 2\end{aligned}$$

$$\begin{aligned}\text{Let } y &= x^{\frac{1}{3}} \\ \frac{dy}{dx} &= \frac{1}{3(x)^{\frac{2}{3}}} \\ \left(\frac{dy}{dx}\right)_{x=64} &= \frac{1}{3(64)^{\frac{2}{3}}} \\ &= \frac{1}{48} \\ &= 0.020833\end{aligned}$$

$$\begin{aligned}\Delta y &= \left(\frac{dy}{dx}\right)_{x=64} \times (\Delta x) \\ &= (0.020833)(2) \\ &= 0.041666\end{aligned}$$

$$\begin{aligned}(66)^{\frac{1}{3}} &= y + \Delta y \\ &= x^{\frac{1}{3}} + 0.041666 \\ &= (64)^{\frac{1}{3}} + 0.041666 \\ &= 4 + 0.041666\end{aligned}$$

$$(66)^{\frac{1}{3}} = 4.041666$$

***** END *****