

Differentials

For each problem, find the differential dy .

1) $y = \sqrt{x}$

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

2) $y = x^3 + 2$

$$dy = 3x^2 dx$$

3) $y = \frac{3}{x}$

$$dy = -\frac{3}{x^2} dx$$

4) $y = -x^3 - 1$

$$dy = -3x^2 dx$$

For each problem, find the general formulas for dy and Δy .

5) $y = x^2 + 4x$

$$\begin{aligned} dy &= (2x + 4)dx \\ \Delta y &= 2x\Delta x + (\Delta x)^2 + 4\Delta x \end{aligned}$$

6) $y = \sqrt{x}$

$$\begin{aligned} dy &= \frac{1}{2x^{\frac{1}{2}}} dx \\ \Delta y &= \sqrt{x + \Delta x} - \sqrt{x} \end{aligned}$$

7) $y = \frac{1}{x}$

$$\begin{aligned} dy &= -\frac{1}{x^2} dx \\ \Delta y &= -\frac{\Delta x}{x^2 + x\Delta x} \end{aligned}$$

8) $y = -x^2 + 3$

$$\begin{aligned} dy &= -2x dx \\ \Delta y &= -2x\Delta x - (\Delta x)^2 \end{aligned}$$

For each problem, find dy and Δy , given x_0 and $dx = \Delta x$.

9) $y = -\sqrt{x}; x_0 = 6, dx = \Delta x = -4$

$$\begin{aligned} dy &= \frac{\sqrt{6}}{3} \approx 0.8165 \\ \Delta y &= -\sqrt{2} + \sqrt{6} \approx 1.0353 \end{aligned}$$

10) $y = -x^2 + 4; x_0 = 1, dx = \Delta x = -1$

$$\begin{aligned} dy &= 2 \\ \Delta y &= 1 \end{aligned}$$

11) $y = x^2 + 2x; x_0 = 1, dx = \Delta x = -1$

$$\begin{aligned} dy &= -4 \\ \Delta y &= -3 \end{aligned}$$

12) $y = -x^3 + 1; x_0 = 1, dx = \Delta x = -\frac{3}{2}$

$$\begin{aligned} dy &= \frac{9}{2} = 4.5 \\ \Delta y &= \frac{9}{8} = 1.125 \end{aligned}$$