

Name

Find the derivative.

1)  $y = (4x + 3)^5$

$$y' = 5(4x + 3)^4 (4) = 20(4x + 3)^4$$

2)  $y = \sqrt{4x + 2}$

$$y' = \frac{1}{2}(4x + 2)^{-\frac{1}{2}} (4) = 2(4x + 2)^{-\frac{1}{2}} = \frac{2}{\sqrt{4x + 2}}$$

3)  $y = (3x^2 + 5x + 1)^{3/2}$

$$y' = \frac{3}{2}(3x^2 + 5x + 1)^{\frac{1}{2}} (6x + 5) = \left(9x + \frac{15}{2}\right)(3x^2 + 5x + 1)^{\frac{1}{2}}$$

4)  $f(x) = \frac{5}{(2x - 3)^4}$

$$= 5(2x - 3)^{-4}$$

$$y' = -20(2x - 3)^{-5} (2) = \frac{-40}{(2x - 3)^5}$$

Solve the problem.

- 5) If the price of a product is given by  $P(x) = \frac{1024}{x} + 2300$ , where  $x$  represents the demand for the product, find the rate of change of price when the demand is 4 (i.e.  $x = 4$ )

$$P(x) = 1024x^{-1} + 2300$$

$$P'(x) = -1024(x)^{-2}$$

$$P'(4) = -1024(4)^{-2} = \frac{-1024}{16} = -64$$

- 6) A ball is thrown vertically upward from the ground at a velocity of 150 feet per second. Its distance from the ground after  $t$  seconds is given by  $s(t) = -16t^2 + 150t$ . How fast is the ball moving 8 seconds after being thrown?

$$s'(t) = -32t + 150$$

$$s'(8) = -32(8) + 150 = -106 \text{ ft/sec}$$

- 7) The total cost to produce  $x$  handcrafted wagons is  $C(x) = 100 + 3x - x^2 + 7x^3$ . Find the marginal cost when  $x = 4$ .

$$C'(x) = 3 - 2x + 21x^2$$

$$C'(4) = 3 - 2(4) + 21(4)^2 = 331$$

- 8) Exposure to ionizing radiation is known to increase the incidence of cancer. One thousand laboratory rats are exposed to identical doses of ionizing radiation, and the incidence of cancer is recorded during subsequent days. The researchers find that the total number of rats that have developed cancer  $t$  months after the initial exposure is modeled by  $N(t) = 1.01t^{2.2}$  for  $0 \leq t \leq 10$  months. Find the rate of growth of the number of cancer cases at the 7th month.

$$N'(t) = 2.2(1.01)t^{1.2}$$

$$N'(7) = 2.2(1.01)(7)^{1.2} = 22.95 \approx 23 \frac{\text{cases}}{\text{month}}$$

- 9) Suppose the demand for a certain item is given by  $D(p) = -3p^2 + 2p + 5$ , where  $p$  represents the price of the item in dollars. Find  $D'(11)$  and interpret your result.

$$D'(11) = -6(11) + 2 = -66 + 2 = -64$$

$$D'(p) = -6p + 2$$

The demand decreases by 64 units for each \$1 increase in price.

- 10) The revenue generated by the sale of  $x$  bicycles is given by  $R(x) = 60.00x - x^2/200$  dollars. Find the marginal revenue when  $x = 1200$  units, and interpret your result.

$$R'(x) = 60 - \frac{2x}{200} = 60 - \frac{x}{100}$$

$$R'(1200) = 60 - \frac{1200}{100} = 60 - 12 = 48 \frac{\text{dollars}}{\text{Bicycle}}$$

For every additional bicycle sold the Revenue increases by \$48.