Faculty of Business Administration

MAT101-Mathematics I / 2018 Fall

Exercise-5: Derivatives and Applications

1. The revenue (in dollars) from the sale of x plastic planter boxes is given by

$$R(x) = 2x - 0.02x^2 \qquad 0 \le x \le 1000.$$

a) What is the change in revenue if production is changed from 600 planters to 800 planters?

b) What is the average rate of change in revenue for this change in production?

2. Find the indicated quantities for $f(x) = 3x^2$.

a) The slope of the secant line through the points $(1, f(1))$ and $(4, f(4))$ on the graph of $y = f(x)$.

b) The slope of the secant line through the points $(1, f(1))$ and $(1+h, f(1+h))$, $h \neq 0$. Simplify your answer.

c) The slope of the graph at $(1, f(1))$.

3. Find the indicated quantities for $f(x) = 3x^2$.

a) The slope of the secant line through the points $(2, f(2))$ and $(5, f(5))$ on the graph of $y = f(x)$.

b) The slope of the secant line through the points $(2, f(2))$ and $(2+h, f(2+h))$, $h \neq 0$. Simplify your answer.

c) The slope of the graph at $(2, f(2))$.

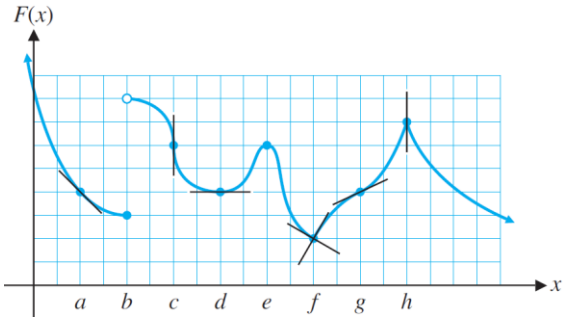
4. Let $f(x) = x^2 + x$.

a) Find the slope of the secant line joining $(1, f(1))$ and $(3, f(3))$

b) Find the slope of the secant line joining $(1, f(1))$ and $(1+h, f(1+h))$.

c) Find the slope of the tangent line at $(1, f(1))$.

5. Use the following graph to determine whether the derivative $F'(x)$ exists at each indicated value of x.



a) at $x = a$ **b)** at $x = b$ **c)** at $x = c$ **d)** at $x = d$

e) at $x = e$ **f)** at $x = f$ **g)** at $x = g$ **h)** at $x = h$

6. Find the derivative of each function.

a) $y = 4$ **b)** $y = 2 + 5t - 8t^3$ **c)** $y = \dfrac{5x^3}{4} - \dfrac{2}{5x^3}$ **d)** $f(x) = \dfrac{5}{9x^7} + 5\sqrt[3]{x}$ **e)** $h(t) = \dfrac{3}{t^{3/5}} - \dfrac{8}{t^{3/2}}$

f) $y = \dfrac{3x-4}{12x^2}$ **g)** $y = \dfrac{1.2}{\sqrt{t}} - 3.6x^{-4} + \sqrt{\pi} + e^2$ **i)** $f(x) = \dfrac{x^3 + 2x^2 - 3x}{x^2}$ **j)** $y = (x^2 - 8)^2$ **k)** $y = \dfrac{x^2 - 3x + 1}{2\sqrt{x}}$

7. A company producing computer components has established that, on average, a new employee can assemble $N(t)$ components per day after t days of on-the-job training, as given by

$$N(t) = \frac{40t - 80}{t}, \ t \geq 2.$$

a) Find the average rate of change of $N(t)$ from 2 days to 5 days.

b) Find the instantaneous rate of change of $N(t)$ at 2 days.

8. A company's total sales (in millions of dollars) t months from now are given by $S(t) = \sqrt{t+4}$. Find and interpret $S(12)$ and $S'(12)$. Use these results to estimate the total sales after 13 months and after 14 months.

9. A marine manufacturer will sell $N(x)$ power boats after spending \$x thousand on advertising, as given by

$$N(x) = 1000 - \frac{3780}{x}, \ 30 \geq x \geq 5.$$

a) Find $N'(x)$.

b) Find $N'(10)$ and $N'(20)$. Write a brief verbal interpretation of these results.