Texas A&M University


# Sections 2.7, 3.1

**Exercise 1.** Find the equation of the tangent line to the curve

$$y = \frac{x}{x-1}$$

at the point $(0, 0)$.

**Definition:** The slope to the curve $y = f(x)$ at $x = a$ is given by

$$m = \lim_{x \to a} \frac{f(x) - f(a)}{x - a} = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}.$$

**Exercise 2.** (12p 144) If an arrow is shot uppward on the moon with a velocity of 58m/s, its height (in meters) after $t$ seconds is given by

$$h(t) = 58t - 0.83t^2$$

1. Find the velocity of the arrow after 1s.

2. Find the velocity of the arrow when $t = a$.

3. when will the arrow hit the moon?

4. With what velocity will the arrow hit the moon?

**Exercise 3.** (22p145) Let $\overrightarrow{r}(t) = (t^2 - t + 2)\mathbf{i} + 4t^2\mathbf{j}$.

1. Find the vector tangent to the curve given by the graph of $\overrightarrow{r}(t)$ at the point where $t = 2$.

2. Find parametric equations for the tangent line to the curve at the point where $t = 2$.

**Definition – Derivatives:** Let $f$ be a function defined on an open interval containing $a$,
the derivative of $f$ at $x = a$, written $f'(a)$ or $\frac{\mathrm{d}f}{\mathrm{d}x}(a)$ is

$$f'(a) = \lim_{h\to 0} \frac{f(a+h) - f(a)}{h} = \lim_{x\to a} \frac{f(x) - f(a)}{x - a}$$

is the limit exists.
If the limit exists, we say that $f$ is differentiable at $x = a$.

**Remark:**

**Exercise 4.** Using the definition of the derivative Find $f'(a)$ for $f(x) = \frac{2}{\sqrt{3-x}}$.

**Exercise 5.** Using the definition of the derivative find the derivative $f'(a)$ of $f(x) = x^3 - x^2 + 1$

**Exercise 6.** Using the definition of the derivative find the derivative $f'(a)$ of $f(x) = \frac{1}{(x)^2}$

**Exercise 7.** Let

$$f(x) = \begin{cases} 2x+1 & \text{if } x > 1 \\ x^2+2 & \text{if } x \leqslant 1 \end{cases}$$

1. Is $f$ continuous at $x = 1$?
2. Is $f$ differentiable at $x = 1$?