# Final Review - Chapter 3
# (Derivative Rules)

- Find derivatives using the limit defintion.
- Know how to apply the sum, difference, product, quotient, and chain rules.
- Know when to use logarithmic differentiation to find a derivative.

**Example 1:** Find the derivative of $f(x) = 9 + x - 2x^2$ using the definition of the derivative. Then find an equation of the tangent line at the point $(2, 3)$.

**Example 2:** Calculate $y'$.

a) $y = \dfrac{1}{\sqrt{x}} - \dfrac{1}{\sqrt[5]{x^3}}$

b) $y = \dfrac{\tan x}{1 + \cos x}$

**Example 3:** Calculate $y'$.

a) $y = x\cos^{-1} x$

b) $y = (\arcsin(2x))^2$

**Example 4:** Calculate $y'$.

a) $y = e^{x\sec x}$

b) $y = 10^{\tan(\pi\theta)}$

**Example 6:** Find $\frac{dy}{dx}$.

a) $y = \arcsin(e^{2x})$

b) $y = \int_{x^2}^{3} \frac{t+4}{\cos t} dt$

- Find derivatives using implicit differentiation.

**Example 5:** Given $xe^y = y\sin x$ find $y'$.

**Example 6:** Given $y - x\cos y = x^2y$ find $y'$

**Example 7:** Find the derivative of $h(x) = \ln\left(\dfrac{x^2-4}{2x+5}\right)$

**Example 8:** Find the derivative of $y = (\cos x)^x$

**Example 9:** Find the derivative of $y = (x+4)^{\tan(2x)}$

- Solve related rates problems.

**Example 10:** A plane flying horizontally at an altidue of 1 mile and a speed of 500 mi/h passes directly over a radar station. Find the rate at which the distance from the plane to the station is increasing when it is 2 miles away from the station.

**Example 11:** The sides of an equilaterial triangle are increasing at a rate of 10 cm/min. At what rate is the area of the triangle increasing when the sides are 30 cm long? ($A = \frac{\sqrt{3}}{4}(\text{side})^2$)

**Example 12:** The altitude of a triangle is increasing at a rate of 1 cm/min while the area of the triangle is increasing at a rate of 2 $\text{cm}^2$/min. At what rate is the base of the triangle changing when the altitude is 10 cm and the area is 100 $\text{cm}^2$?

**Suggested Probs:** Ch. 2 Rvw, Pg 165 # 39 (a & b) and Ch. 3 Rvw, Pg 267 # 1-39 every other odd, 57, 97, 99