Review Math 180 materials:
Derivative:
1.   Definition:

2.   Rules:

3.   Implicit Differentiation:

Ex: Differentiate the following functions:

a) $f(x) = 3^{\sin(5x^2+1)}\sqrt{\tan^{-1}(3x)+4x}$

b) $f(x) = \cos^4\left(\dfrac{x^3 - 5x^2 + 1}{\sec^{-1}(3x+1)}\right)$

Ex: Determine $\dfrac{dy}{dx}$ for the expression: $\sin^3\left(x^2+5y^3\right)+e^{x^3y^2}=4$

2.   Anti-derivative:

3.   Fundamental Theorem of Calculus (FTC)

Ex: Integrate the following:

a) $\displaystyle\int \frac{7x-2}{\sqrt[3]{4x+3}}dx$

b) $\displaystyle\int \left(2+\sqrt{x}\right)^{12} dx$

c) $\displaystyle\int x^8 \sqrt[4]{4x^3 +1}dx$

d) $\displaystyle\int_{e/5}^{e^2/5} \frac{dx}{x\left[\ln(5x)+4\right]^7}$

e) $\displaystyle\int \sqrt{2+\sqrt{3x+1}}\,dx$

f) $\displaystyle\int_{0}^{1/3} \frac{\sqrt[5]{\tan^{-1}(3x)}}{1+9x^2}\,dx$

Case1: Product of two different types of functions:
$$\begin{cases} \text{polynomial and exponential functions} \\ \text{polynomial and sine / cosine} \\ \text{polynomial and log} \\ \text{exponential and sine / cosine} \end{cases}$$

Case 2: One function $\begin{cases} \log \\ \textit{Inverse trig functions} \end{cases}$

Case 3: Reduction formulas:

Ex: Integrate the following:

a) $\int (3x-5)e^{2x}dx$

b) $\int (7x^3 - 5x^2 + 3)e^{3x+2}dx$

c) $\int (2x^2 - 5x + 4)\sin(3x)dx$

d) $\quad \int \left(4x^3 - 5x + 2\right)\ln\left(2x\right)dx$

e) $\quad \int e^{3x}\cos\left(4x\right)dx$

f) $\quad \int e^{\sqrt[3]{x}}dx$

g) $\int \cos\left(\sqrt[3]{x}\right) dx$

h) $\int \tan^{-1}(5x) dx$

g) $\int \ln(3x+2) dx$

Ex: a)   Prove the statement: $\displaystyle\int \sec^n x\, dx = \frac{\sec^{n-2} x \tan x}{n-1} + \frac{n-2}{n-1}\int \sec^{n-2} x\, dx$ *for* $n \neq 1$

       b)   Use part (a) to evaluate $\displaystyle\int \sec^5 (4x)\, dx$