The Fundamental Theorem of Calculus Part 1 (FTC 1)
If a function f is continuous on the closed interval [a, b] and F is an antiderivative of f on the interval (a, b), then

$$\int_a^b f(x)\,dx = F(b) - F(a)$$

Mean Value Theorem for Integrals (Freeze-Thaw)
If f is continuous on the closed interval [a, b], then there exists a number c in the closed interval [a, b] such that

$$\int_a^b f(x)\,dx = f(c)(b - a)$$

The Definition of the **Average Value of a Function** on an Interval
If f is integrable on the closed interval [a, b], then the

Average Value of f on the interval is $\frac{1}{b-a}\int_a^b f(x)\,dx$

The Fundamental Theorem of Calculus Part 2 (FTC 2)
If f is continuous on an open interval I containing a, then, for every x in the interval,

then ∀x on the interval, $\frac{d}{dx}\left[\int_a^x f(t)dt\right] = f(x)$.

Let $f(t) = 3t^2 - 4t$

$$\frac{d}{dx}\int_3^{2x} f(t)\,dt = \frac{d}{dx}\int_3^{2x}\left(3t^2 - 4t\right)dt = \frac{d}{dx}\left[t^3 - 2t^2\right]_3^{2x} = \frac{d}{dx}\left[\left(8x^3 - 8x^2\right) - (27 - 18)\right]$$

$$= \frac{d}{dx}\left[8x^3 - 8x^2 - 9\right] = 24x^2 - 16x = 2\left(12x^2 - 8x\right) = 2\left(3(2x)^2 - 4(2x)\right) = \boxed{2f(2x)}$$

In general:

$$\boxed{\frac{d}{dx}\int_a^{g(x)} f(t)\,dt = f\left(g(x)\right)\bullet g'(x)}.$$

AP Calculus BC 1 Assignment 137 Tuesday, November 17, 2015 Hour Name

Calculator Active

1.	$f(x) = \int_{22}^{\sin(5x)} \sqrt{1-t^2}\, dt$ Find f '(x)	
2.	Find the average value of $f(x) = 3\sin(4x) + 7x^4$ on [2, 6]. Make your answer accurate to 3-decimal places.	
3.	$f(x) = \int_{5x}^{9} \tan^2(7t^3)\, dt$ Find f '(x)	
4.	$\int \sec^2 2x \tan 2x\, dx$	
5.	$3xy^2 + 2x - 4y = \sin y$ Find $\frac{dy}{dx}$	
6.	Sand enters a processing plant at the rate of $E(t) = 90 + 45\cos\frac{t^2}{18}$ tons/hour, where t = 0 at 8:00 AM. The plant's hours of operation are from 8:00 AM to 4:00 PM. Find E'(5). Using proper units, interpret your answer in the context of the problem.	
7.	$g(x) = x^3 - 3x$ is defined on (-3, 3) Show your Work and Find the x-coordinate(s) of the Maxima. Justify your answer.	