The Fundamental Theorem of Calculus - Derivatives
(Differentiating a Definite Integral)

Integrate the given integral using the Fundamental Theorem of Calculus for Area to find $F(x)$, and then differentiate $F(x)$ to find $F'(x)$.

1) $F(x) = \int_1^x (t-3)\,dt$

$) = \frac{1}{2}t^2 - 3t \Big|_1^x$

$F(x) - F(1)$

$- 3x) - \left(\frac{1}{2} - 3\right)$

$^2 - 3x + 2.5$

$x - 3$

2) $F(x) = \int_{x^2}^2 (t-3)\,dt$

$F(x) = \frac{1}{2}t^2 - 3t \Big|_{x^2}^2$

$F(2) - F(x^2)$

$F(x) = (-4) - \left(\frac{1}{2}x^4 - 3x^2\right)$

$F(x) = -4 - \frac{1}{2}x^4 + 3x^2$

$F'(x) = -2x^3 + 6x = -2x(x^2 - $

3) $F(x)=\int_{1}^{\sin x}(3u-5)\,du$

$x) = \frac{3}{2}u^2 - 5u \Big|_{1}^{\sin(x)}$

$(\sin(x)) - F(1)$

$^2(x) - 5\sin(x) + 3.5$

$\sin(x)\cdot\cos(x) - 5\cos(x)$

$os(x)\left(3\sin(x) - 5\right)$

4) $F(x)=\int_{\sin x}^{3}(3u-5)\,du$

$F'(x) = -\cos(x)\left(3\sin(x) - 5\right.$

$F(x) = \frac{3}{2}u^2 - 5u \Big|_{\sin(x)}^{3}$

$F(3) - F(\sin(x))$

$F(x) = \frac{27}{2} - 15 - \left(\frac{3}{2}\sin^2(x) - \right.$

$F(x) = \frac{-3}{2} - \frac{3}{2}\sin^2(x) + 5\sin$

$F'(x) = -3\sin(x)\cdot\cos(x) + 5c$

$= -\cos(x)\left(3\sin(x) - 5\right.$

Examine your answers to problems #1 though 4. Is there a short-cut method to finding $F'(x)$ for problems 5 and 6?

5) $F(x) = \int_1^{x^3} \left(t^2 + t\right) dt$

$'(x) = 3x^2(x^6 + x^3) - 0(1^2 + 1)$

$x) = 3x^2(x^6 + x^3)$

6) $F(x) = \int_{\tan x}^{5} \left(t^2 + t\right) dt$

$F'(x) = 0(5^2 + 5) - \sec^2(x)$

$F'(x) = -\sec^2(x)(\tan^2(x) +$

The Fundamental Theorem of Calculus for Derivatives
(Differentiating a Definite Integral)

$$D_x\left[\int_{h(x)}^{g(x)} f(t)\,dt\right] = f(g(x))\cdot g'(x) - f(h(x))\cdot h'(x)$$

Find $F'(x)$ using the Fundamental Theorem of Calculus for Derivatives.

1) $F(x) = \int_1^x (t^2 + 2t - 5)\,dt$

$F'(x) = 1\cdot(x^2+2x-5)$

$= x^2+2x-5$

2) $F(x) = \int_{x^3}^4 \sin^3 t \cos t\,dt$

$F'(x) = -3x^2 \sin^3(x^3)\cos(x^3)$

3) $F(x)=\int_1^{x^2}\left(5t^4+2t^2-4t\right)dt$

$F'(x)=2x\left(5x^8+2x^4-4x^2\right)$

4) $F(x)=\int_8^{x^2}\sqrt{s^3+5}\,ds$

$F'(x)=2x\sqrt{x^6+5}$

5) $F(x)=\int_1^{2x^4-3x}(5u-7)\,du$

$F'(x)=(8x^3-3)\left(5(2x^4-3x)-7\right)$

$=(8x^3-3)(10x^4-15x-7)$

6) $F(x)=\int_{3x-4}^{9}(u\sec u)\,du$

$F'(x)=-3\left((3x-4)\cdot\sec(3x-\right.$

7) $F(x) = \int_1^{\tan x} \frac{1}{1+t^2}\, dt$

$(x) = \sec^2(x)\left(\frac{1}{1+\tan^2(x)}\right)$

8) $F(x) = \int_{\cos x}^{2} \tan u \, du$

$F'(x) = \sin(x) \cdot \tan(\cos($

9) $F(x) = \int_1^{\sin x^3} \left(t^2 + t\right) dt$

$(x^3) \cdot 3x^2\left(\sin^2(x^3) + \sin(x^3)\right)$

10) $F(x) = \int_{\tan x}^{\sec x} \left(t^3 - 3t^2\right) dt$

$F'(x) = \sec(x)\tan(x)\left(\sec^3(x) - 3\sec^2($

$\sec^2(x)\left(\tan^3(x) - 3\tan^2(x)\right)$

Calculus I Name ________________

Wkst - Fundamental Th. of Calculus - Derivative Block ______ Date ______

$$D_x\left[\int_{h(x)}^{g(x)} f(t)\,dt\right] = f(g(x))\cdot g'(x) - f(h(x))\cdot h'(x)$$

Find $F'(x)$ using the Fundamental Theorem of Calculus - Derivatives.

1) $F(x)=\int_1^x (t^3+2t-4)\,dt$

$F'(x) = x^3+2x-4$

2) $F(x)=\int_4^{\sin x} (u^2-2)\,du$

$F'(x)=\cos(x)\left(\sin^2(x)-2\right)$

3) $F(x)=\int_2^{x^2+1}\sqrt{2+\sin u}\,du$

$F'(x)=2x\sqrt{2+\sin(x^2+1)}$

4) $F(x)=\int_{x^2}^{2}\cos(4s)\,ds$

$F'(x) = -2x\cos(4x^2)$

5) $F(x)=\int_{2x^2+x}^{1}\sqrt{1+s^4}\,ds$

$) = -(4x+1)\sqrt{1+(2x^2+x)^4}$

6) $F(x)=\int_{\sin x}^{\cos x} u^2\,du$

$F'(x) = -\sin(x)\cdot\cos^2(x) - \cos(x)\cdot$