4.4 The Fundamental Theorem of Calculus

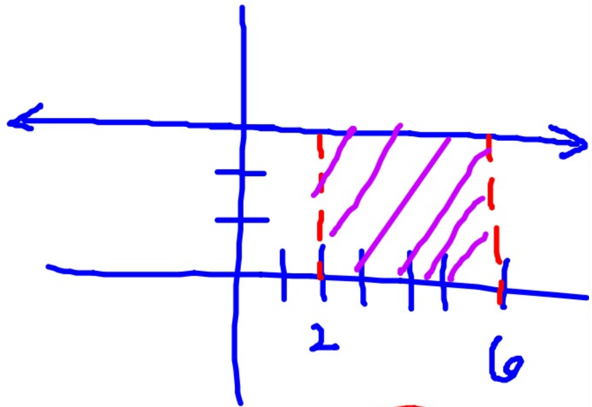
$$\int_2^6 3\,dx$$

$$= 3x + C \Big|_2^6$$

$$= (3\cdot 6 + C) - (3\cdot 2 + C)$$

$$18 + C - 6 - C = 12$$

$f(x) = 3$



12

The "c" cancels out for definite integrals.

THEOREM 4.9 THE FUNDAMENTAL THEOREM OF CALCULUS

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

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

Evaluate the definite integral.

#1

$$\int_0^4 (2x+1)\,dx = x^2 + x \Big|_0^4$$

$$= (4^2+4) - (0^2+0)$$

$$= 20$$

#2 $\int_1^2 (6x^2 + 2x - 3)\,dx$

$= \frac{6x^3}{3} + \frac{2x^2}{2} - 3x = 2x^3 + x^2 - 3x \Big|_1^2$

$(2\cdot 2^3 + 2^2 - 3\cdot 2) - (2\cdot 1^2 + 1^2 - 3(1))$

$(16 + 4 - 6) - (0)$

$\boxed{14}$

#3 $\int_0^2 (2-t)\sqrt{t}\,dt = \int_0^2 \left(2t^{1/2} - t^{3/2}\right)dt$

$= \dfrac{2t^{3/2}}{\frac{3}{2}} - \dfrac{t^{5/2}}{5/2} = \dfrac{4}{3}t^{3/2} - \dfrac{2}{5}t^{5/2}\Big|_0^2$

$\dfrac{4}{3}\cdot 2^{3/2} - \dfrac{2}{5}\cdot 2^{5/2} - 0 = \dfrac{4}{3}\sqrt{8} - \dfrac{2}{5}\sqrt{32}$

$\dfrac{8\sqrt{2}}{3} - \dfrac{8\sqrt{2}}{5} = \dfrac{40\sqrt{2} - 24\sqrt{2}}{15} = \dfrac{16\sqrt{2}}{15}$

4.) $\displaystyle\int_0^{\pi/4} (\sec^2 x - 3\sin x)\,dx$

$$\tan x + 3\cos x \Big|_0^{\pi/4}$$

$$\left(\tan\frac{\pi}{4} + 3\cos\frac{\pi}{4}\right) - \left(\tan 0 + 3\cos 0\right)$$

$$\left(1 + \frac{3\sqrt{2}}{2}\right) - (0+3) = \frac{3\sqrt{2}}{2} - 2$$

#4 $$\int_0^4 |x-1|\,dx$$

DO NOT USE CALCULUS!!
SKETCH AND FIND THE
ANSWER GEOMETRICALLY!