8 $\int \frac{5}{2x+3}\,dx$

$= \frac{5}{2}\ln(2x+3)$

$\frac{1}{2x+3}\cdot 2$

32 $\int_{-2}^{-1} \frac{2}{x^2}\,dx$

$\int_{-2}^{-1} 2x^{-2}\,dx$

$-2x^{-1}$

(1,0)

$-\frac{2}{x}\Big|_{-2}^{-1} = 2-1$

$= 1$

38 $4\int_0^{\pi/3} \cancel{4}\sec x\tan x\,dx$

$4\sec x\Big|_0^{\pi/3} = \frac{4}{\cos x}\Big|_0^{\pi/3} = \frac{4}{\cos\frac{\pi}{3}} - \frac{4}{\cos 0}$

$= 8 - 4 = 4$

Dec 16-10:59 AM

5-4 day 3 The FUNdamental Theorem of Calculus

Learning Objecves:

I can evaluate the derivave of an integral using the Fundamental Theorem of Calculus Part 1.

Nov 20-11:19 AM

Ex1. Evaluate. Check your answer on the graphing calculator

1.) $\int_1^5 (3x^2+4x+1)\,dx$

$= (x^3+2x^2+x)\Big|_1^5 = 176$

2.) $\int_{+2}^{7} \frac{dx}{3x+2} = \frac{1}{3}\ln(3x+2)\Big|_2^7$

$\frac{1}{3}\ln(23) - \frac{1}{3}\ln(8) = \frac{1}{3}\ln\left(\frac{23}{8}\right)$

3.) $\int_0^{\pi/4} \sec^2 x\,dx = \tan x\Big|_0^{\pi/4} = \tan\frac{\pi}{4} - \tan 0$

$= 1 - 0$

$= 1$

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The FUNdamental Theorem of Calculus Part 1

If f(x) is connuous on[a,b], then the

funcon $F(x) = \int_0^x f(t)\,dt$ has a derivave

at every point x in [a,b] and

$$\frac{dF}{dx} = \frac{d}{dx}\left(\int_0^x f(t)\,dt\right) = f(x)$$

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$\frac{d}{dx}\int (4x+2)\,dx =$ $4x+2$

Is true only if: $\frac{d}{dx}\int_0^x (4t+2)\,dt =$ $4x+2$

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Show: $\frac{d}{dx}\int_0^x (4t+2)\,dt = 4x+2$

$\int_0^x (4t+2)\,dt = (2t^2+2t)\Big|_0^x$

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

$= 2x^2+2x$

$\frac{d}{dx}(2x^2+2x) = 4x+2$

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What happens if you change the lower limit?

$$\boxed{\frac{d}{dx}\int_2^x (4t+2)\,dt} = 4x+2$$

$$\int_2^x (4t+2)\,dt = (2t^2+2t)\Big|_2^x$$
$$= 2x^2+2x-12$$
$$\frac{d}{dx}(2x^2+2x-12) = 4x+2$$

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What happens if you change the upper limit?

$$\frac{d}{dx}\int_0^{x^2} (4t+2)\,dt = (2t^2+2t)\Big|_0^{x^2}$$
$$= 2x^4+2x^2$$
$$\frac{d}{dx}(2x^4+2x^2) = 8x^3+4x$$
$$= (4x^2+2)\,2x$$

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Consequence of FTC Part 1

$$\frac{d}{dx}\int_a^{f(x)} g(t)dt = g(f(x))\cdot f'(x)$$

$$\frac{d}{dx}\int_2^{5x^2} (8t+3)dt = [8(5x^2)+3]\cdot 10x$$
$$= (40x^2+3)10x$$
$$= 400x^3+30x$$

Why?

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Ex2. Evaluate

1.) $\frac{d}{dx}\int_a^{3x}(t^2+t+1)\,dt = [(3x)^2+(3x)+1]\,3$

$$= (9x^2+3x+1)\cdot 3$$
$$= 27x^2+9x+3$$

2.) $\frac{d}{dx}\int_{x^2}^{2}\left(\sqrt{3t-4}\right)dt = -\frac{d}{dx}\int_2^{x^2}\sqrt{3t-4}\;dt$

$$= -\sqrt{3x^2-4}\cdot 2x$$
$$= -2x\sqrt{3x^2-4}$$

3.) $\frac{d}{dx}\int_0^{3x^4\sec x}\frac{\sqrt{3\ln t-4e^t\sin t}}{\tan^3 t\cos^{-1} t}dt$

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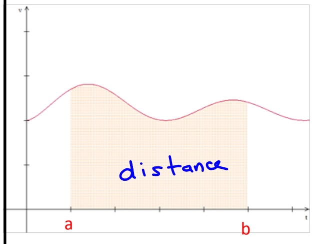

$$\int_a^b v(t)dt$$

displacement of area under the curve from time t = a to time t = b

Explain the meaning of this integral.

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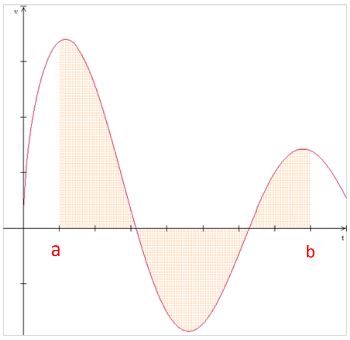

$$\int_a^b v(t)dt$$

(change) displacement in position from time t = a to t = b

Explain the meaning of this integral.

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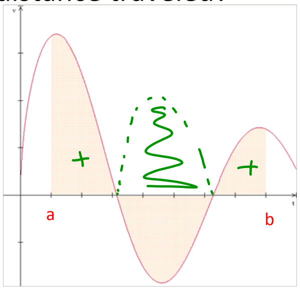
Then how would we find the total distance traveled?



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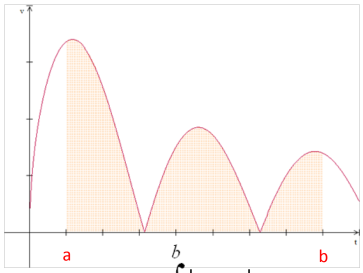

$$\int_a^b |v(t)|\,dt$$

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Displacement $\int_a^b v(t)dt$

From me t=a to me t=b

Total Distance Traveled $\int_a^b |v(t)|\,dt$

From me t=a to me t=b

Nov 20-11:19 AM

Homework

pg 302 # 1-5, 7, 9, 58, 59, 65-70

Nov 20-11:19 AM