Dec 14-10:11 AM

5-4 day 2 The FUNdamental Theorem of Calculus

Learning Objectives:

I understand the connection between integral and differential calculus.

I can evaluate an integral using the Fundamental Theorem of Calculus Part 2.

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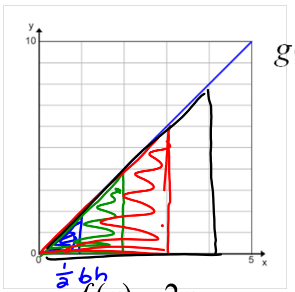
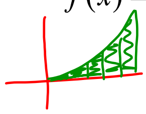


$\frac{1}{2}bh$

$f(x)=2x$



$g(x)=x^2$

$$g(x)=\int_0^x f(t)dt$$

x	g(x)	
0	0	$\int_0^0 f(t)dt$
1	1	$\int_0^1 f(t)dt$
2	4	$\frac{1}{2}\cdot 2\cdot 4$
3	9	$\frac{1}{2}\cdot 3\cdot 6$
4	16	$\frac{1}{2}\cdot 4\cdot 8$
5	25	

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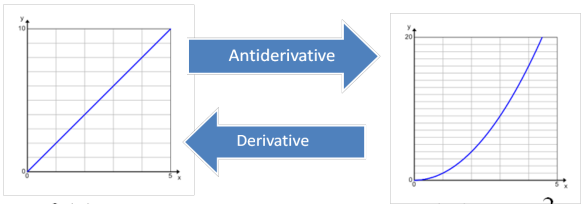

$f(t)=2t$ $g(x)=x^2$

g(x) is the antiderivative of f(t)

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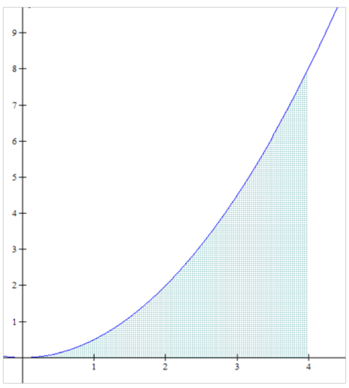

$$y=\frac{1}{2}x^2$$

$$\int_0^4 \frac{1}{2}x^2dx$$ ← derivative

$\frac{1}{6}x^3$ ← finds the area that accumulates

$\frac{1}{6}(4)^3=\frac{64}{6}=\frac{32}{3}$ 10.667

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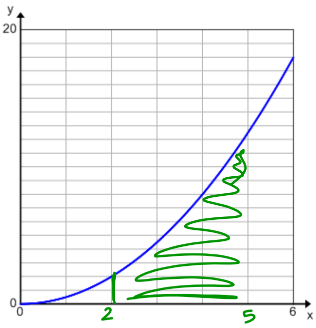

$$y=\frac{1}{2}x^2$$

$$\int_2^5 \frac{1}{2}x^2dx=\int_0^5 \frac{1}{2}x^2dx-\int_0^2 \frac{1}{2}x^2dx$$

$\frac{1}{6}x^3$

$\frac{1}{6}(5)^3-\frac{1}{6}(2)^3$

19.5 units^2

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The FUNdamental Theorem of Calculus Part 2

If f(x) is connuous at every point in [a,b] and if F(x) is the anderivave of f (x) on [a,b], then

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

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Ex1. Evaluate. Check your answer on the graphing calculator

1.) $\int_{-2}^{5}\left(x^2+3x+1\right)dx$

$\left(\frac{1}{3}x^3+\frac{3}{2}x^2+x\right)\Big|_{-2}^{5}$

$\left(\frac{1}{3}\cdot 5^3+\frac{3}{2}\cdot 5^2+5\right)-\left(\frac{1}{3}(-2)^3+\frac{3}{2}(-2)^2+-2\right)$

$=\frac{125}{3}+\frac{75}{2}+5+\frac{8}{3}-\frac{12}{2}+2$

$\frac{133}{3}+\frac{63}{2}+7$

$\frac{266}{6}+\frac{189}{6}+\frac{42}{6}$

$=82.533$

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2.) $\int_{1}^{4}\left(e^{2x}\right)dx$

$\frac{1}{2}e^{2x}\Big|_1^4$

$\frac{1}{2}e^8-\frac{1}{2}e^2$

e^{2x}

$e^{2x}\cdot 2$

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3.) $\int_{0}^{\pi}\sin x\,dx$

$-\cos x\Big|_0^{\pi}$

$-\cos\pi-(-\cos 0)$

$-(-1)-(-1)$

$1+1$

2

$\cos x$

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4.) $\int_{-1}^{3}\frac{dx}{x+5}$

$\ln(x+5)\Big|_{-1}^{3}$

$\ln(8)-\ln(4)=\ln\left(\frac{8}{4}\right)=$

$\ln(2)$

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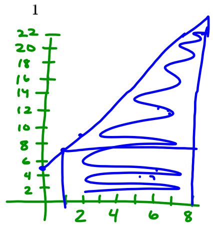
4.) $\int_{1}^{8}(2x+5)dx$



$=\left(x^2+5x\right)\Big|_1^8$

$=8^2+40-1^2-5$

$=98$

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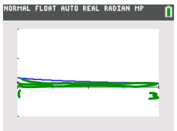
Ex2. Find the area between the curve

$f(x) = \frac{1}{2x+1}$ and the x–axis $\boxed{\frac{1}{2x+1} \cdot 2}$

bounded by 1≤x≤3



$$\int_1^3 \left(\frac{1}{2x+1}\right) dx$$

$$= \frac{1}{2}\ln(2x+1)\Big|_1^3$$

$$= \frac{1}{2}\ln(7) - \frac{1}{2}\ln(3) = \frac{1}{2}\ln\left(\frac{7}{3}\right)$$

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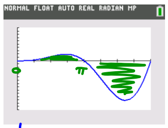
Ex3. Find the area between the curve

$f(x) = x^2 \sin x$ and the x–axis

bounded by 0≤x≤ 2π



$$\int_0^\pi x^2 \sin dx = 5.8696$$

$$\int_\pi^{2\pi} x^2 \sin x dx = 45.3478$$

$$= 51.218 \text{ units}^2 \quad \int_0^{2\pi} \left|x^2 \sin x\right| dx$$

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Homework

pg 302 # 27, 29, 30, 32-35, 38, 39, 42, 43, 45-50

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