5-4 day 2 The FUNdamental Theorem of Calculus

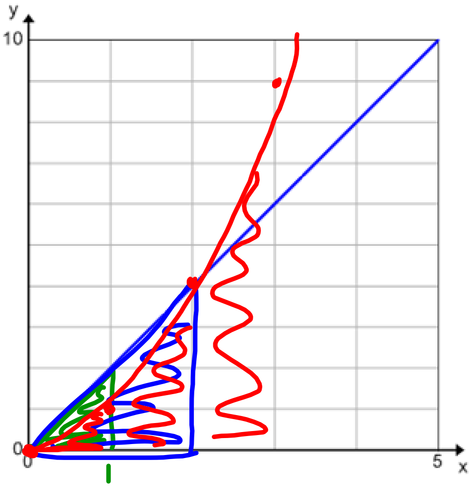
Learning Objectives:

I understand the connection between integral and differential calculus.

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

Nov 19-8:08 AM

Dec 5-12:18 PM



$$f(x) = 2x$$

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

x	g(x)
0	0
1	1
2	4
3	9
4	16
5	25

$g(x) = x^2$

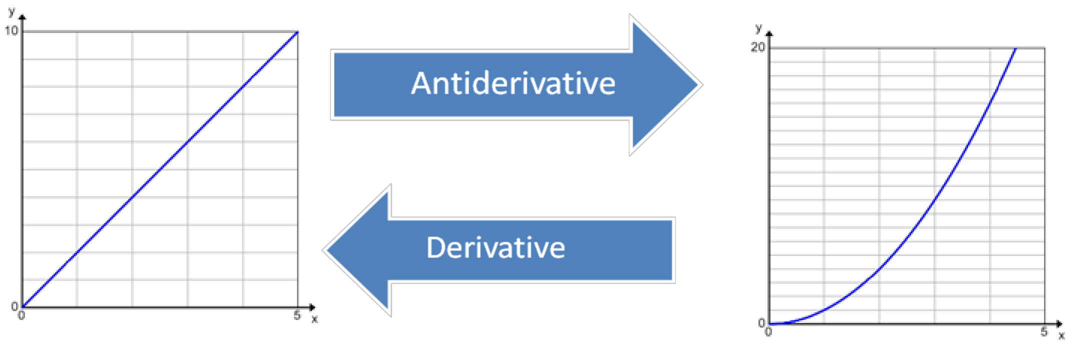
$\frac{1}{2} \cdot 1 \cdot 2$

$\frac{1}{2} \cdot 2 \cdot 4$

$\frac{1}{2} \cdot 3 \cdot 6$

$\frac{1}{2} \cdot 4 \cdot 8$

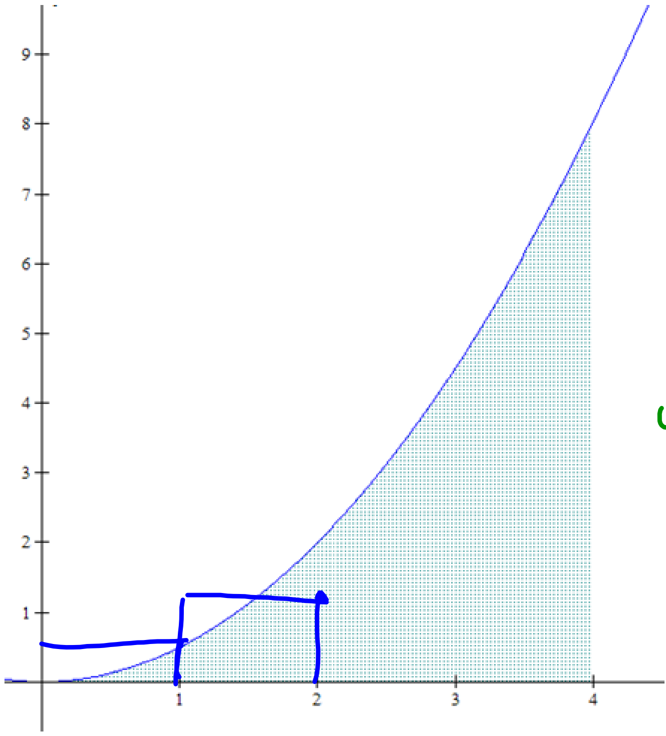
Nov 19-8:08 AM



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

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

Nov 19-8:08 AM



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

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

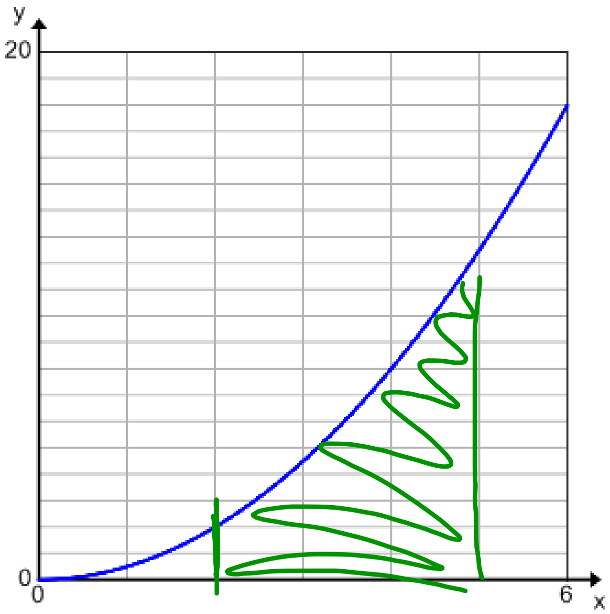
which function has a derivative of $\frac{1}{2}x^2$

$$\frac{1}{6}x^3 \Big|_0^4$$

$$\frac{1}{6}\cdot 4^3 - \frac{1}{6}\cdot 0^3 = \frac{64}{6}$$

$$= 10.667$$

Nov 19-8:08 AM



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

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

$$\frac{1}{6}x^3 \Big|_2^5$$

$= 19.5$ units^2

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

Nov 19-8:08 AM

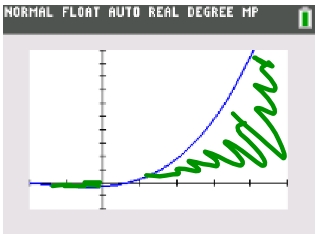
The FUNdamental Theorem of Calculus Part 2

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

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

Nov 19-8:08 AM

Ex1. Evaluate. Check your answer on the graphing calculator



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

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

$$\left[\frac{1}{3}\cdot 5^3 + \frac{3}{2}\cdot 5^2 + 5\right] - \left[\frac{1}{3}(-2)^3 + \frac{3}{2}(-2)^2 + (-2)\right] = 82.833 \text{ units}^2$$

Nov 19-8:08 AM

2.) $\int_1^4 \left(e^{2x}\right) dx$

find the function whose derivative

e^{2x} $\quad e^{2x} \cdot 2$ is e^{2x}

$= \left[\frac{1}{2} e^{2x}\right] \Big|_1^4 = \frac{1}{2} e^8 - \frac{1}{2} e^2$

Nov 19-8:08 AM

3.) $\int_0^{\pi} \sin x dx$

find the function whose derivative is $\sin x$

$= -\cos x \Big|_0^{\pi} = -\cos \pi + \cos 0$

$= 1 + 1$

$= 2$

Nov 19-8:08 AM

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

find $f(x)$ whose derivative is $\frac{1}{x+5}$

$$= \ln(x+5)\Big|_{-1}^{3} = \ln 8 - \ln 4$$

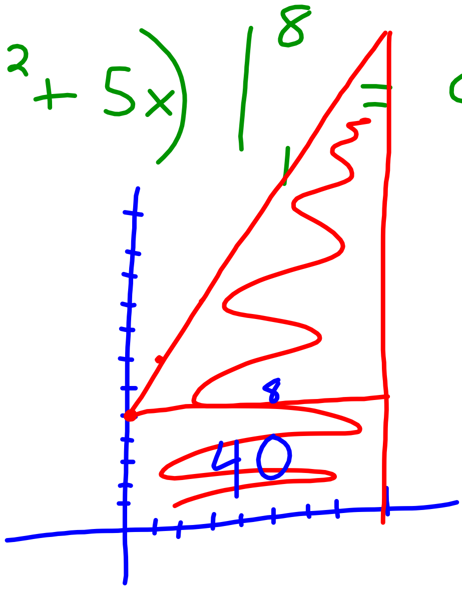
$$\ln\left(\tfrac{8}{4}\right)$$

$$= \ln 2$$

Nov 19-8:08 AM

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

$$(x^2+5x)\Big|_{1}^{8} = 98$$

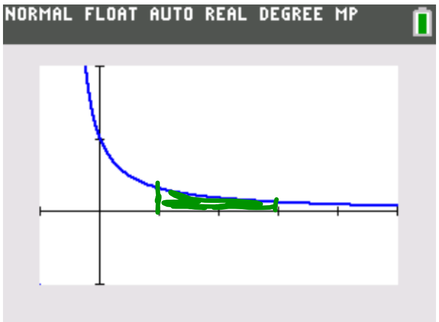


Nov 19-8:08 AM

Ex2. Find the area between the curve

$f(x)=\frac{1}{2x+1}$ and the x–axis

bounded by $1 \le x \le 3$



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

$$= .424 \text{ units}^2$$

$$\left[\frac{1}{2}\ln(2x+1)\right]\Big|_1^3$$

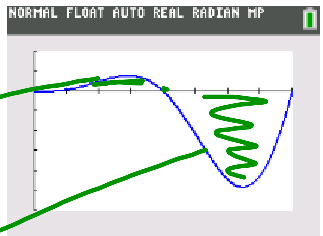
Nov 19-8:08 AM

Ex3. Find the area between the curve

\+

$f(x)=x^2 \sin x$ and the x–axis

bounded by $0 \le x \le 2\pi$



$$\int_0^\pi (x^2 \cdot \sin x)\, dx$$

$$= 5.8696$$

$$\int_\pi^{2\pi} (x^2 \cdot \sin x)\, dx$$

$$= 45.3478$$

$$+ \overline{}$$

$$51.218 \text{ units}^2$$

Nov 19-8:08 AM

Homework

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

Nov 19-8:08 AM