$$\int x^2 \sin x \, dx$$

$n+1$

$$\int e^x \cos x \, dx$$

$\cos(0) = 1$

12.11 #24

$\sin(38°)$ to 5 decimal places.

$$\sin x = \sum_{n=0}^{\infty} (-1)^n \frac{x^{2n+1}}{(2n+1)!}$$

$$(38°)\left(\frac{\pi}{180}\right)$$

Dec 2-12:09 PM

$$\boxed{\forall x \in |x|<|a|}$$

$$\forall x \in \{x \mid |x|<|a|\}$$

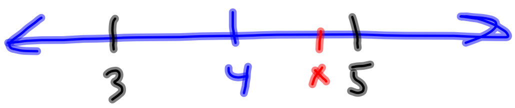
$$\{x \mid -|a| < x < |a|\}$$

$|x-a|$

$|x|$

$$\sum_{n=1}^{\infty} \frac{n(x-4)^n}{n^3+1}$$

Ratio Test: ... $\left|\frac{a_{n+1}}{a_n}\right| \xrightarrow{n\to\infty} |x-4| < 1$



④ $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n x^n}{n+1}$ $R=1,$

$x=-1:$ $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n(-1)^n}{n+1} = \sum_{n=0}^{\infty} \frac{(-1)^{2n}}{n+1}$

I.C.: $(-1,1]$ $\displaystyle= \sum_{n=0}^{\infty} \frac{1}{n+1} \not\longrightarrow$

$x=+1:$ $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n(1)^n}{n+1} = \sum_{n=0}^{\infty} \frac{(-1)^n}{n+1} \longrightarrow$

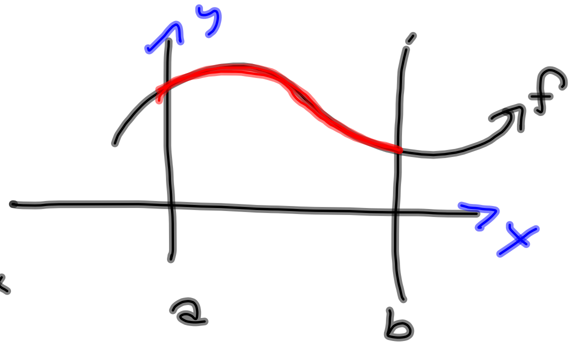
by Alternating Series Criteria.

Arc Length

Rectangular Coords

$y = f(x)$

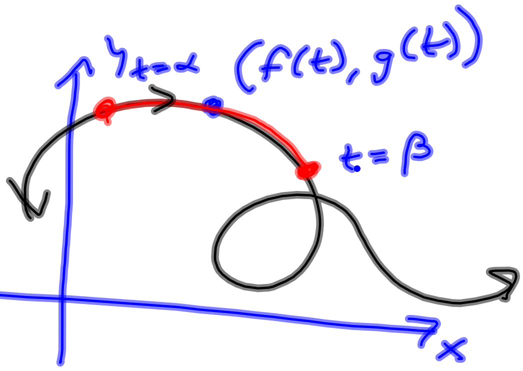
$$L = \int_a^b \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\, dx$$



$x = f(t)$

$y = g(t)$

$$\int_\alpha^\beta \sqrt{f'(t)^2 + g'(t)^2}\, dt$$



$$\int_\alpha^\beta \sqrt{\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2}\, dt$$

$x = f(t)$

$y = g(t)$

what's $\frac{dy}{dx}$? $\qquad \dfrac{\frac{dy}{dt}}{\frac{dx}{dt}}$

§ $r = f(\theta)$ $\qquad x = r\cos\theta$

$= f(\theta)\cos\theta$

$y = f(\theta)\sin\theta$

$$\boxed{\frac{dy}{dx} = \frac{\frac{d}{d\theta}\left[f(\theta)\sin\theta\right]}{\frac{d}{d\theta}\left[f(\theta)\cos\theta\right]}}$$

Arc Length in Polar Coordinates

$$\int_a^b \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}\, d\theta$$

Area in Polar Coordinates

$$\frac{1}{2}\int_a^b r^2\, d\theta = \frac{1}{2}\int_a^b f(\theta)^2\, d\theta$$

Surface Area of solid of revolution:

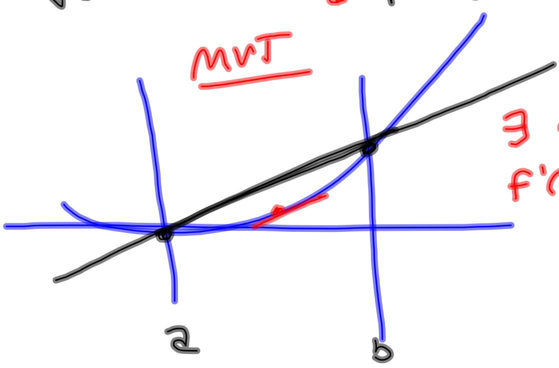
$2\pi\int x\, ds$ around y-axis $\qquad$ OR $\qquad 2\pi\int y\, ds$ around x-axis.

$x = g(y)$? OR $y = f(x)$?

$2\pi\int_a^b g(y)\, ds \qquad 2\pi\int_a^b x\, ds$

$2\pi\int_a^b g(y)\sqrt{1+\left(\frac{dx}{dy}\right)^2}\, dy \qquad 2\pi\int_a^b x\sqrt{1+\left(\frac{dy}{dx}\right)^2}\, dx$

MVT



$\exists\, c \in (a,b) \ni$

$f'(c) = \frac{f(b)-f(a)}{b-a}$

$$y' + \underline{P(x)}\, y = Q(x)$$

I.F. $I(x) = e^{\int P(x)\,dx}$

$$\underline{(I(x)y)'} = I(x)y' + I(x)P(x)y = I(x)Q(x)$$

$$y' + x^2 y = 2x+5$$

$$e^{\int x^2 dx} = e^{\frac{x^3}{3}}$$

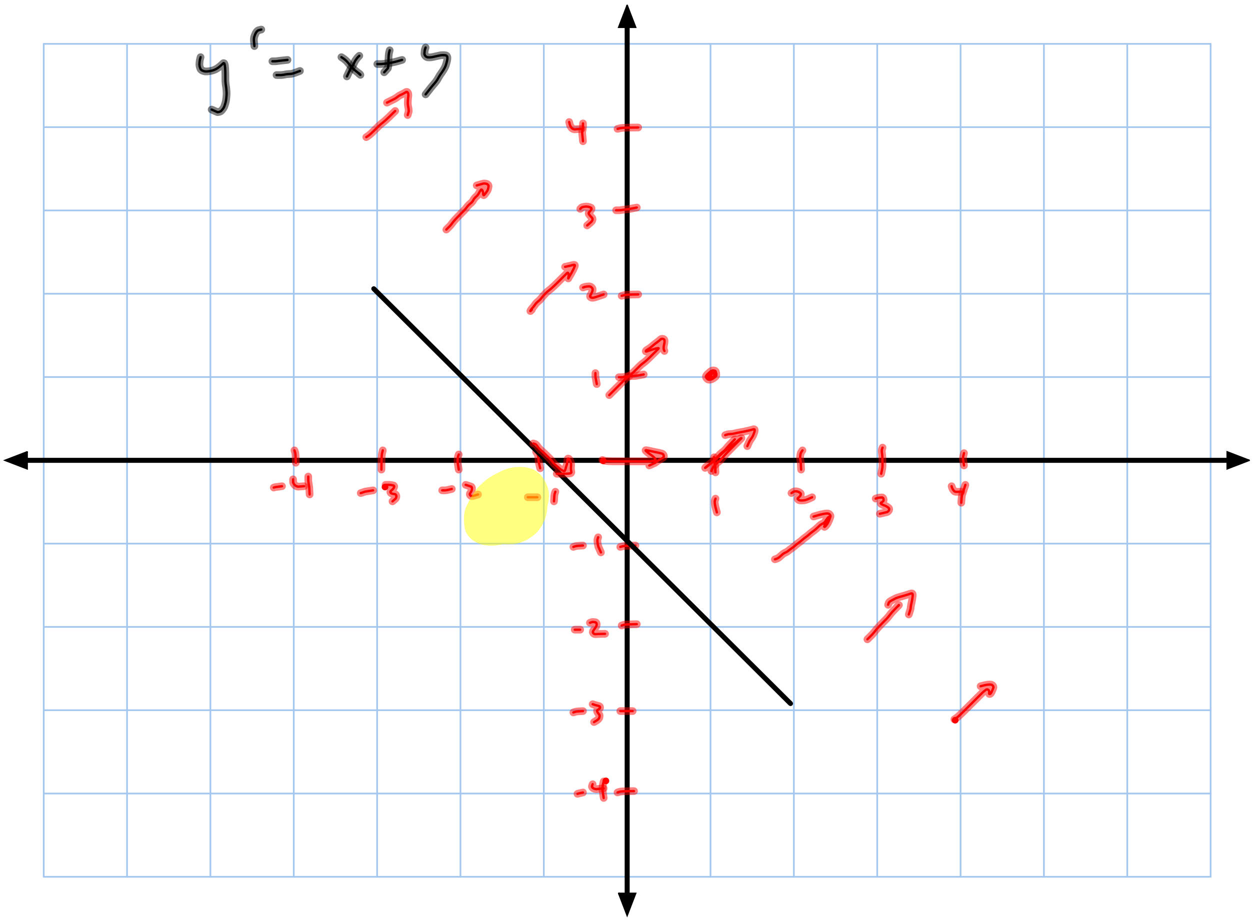
$$\underbrace{e^{\frac{x^3}{3}} y' + e^{\frac{x^3}{3}} \cdot x^2 y}_{\left(e^{\frac{x^3}{3}} y\right)'} = e^{\frac{x^3}{3}}(2x+5)$$

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

$$\int d\left(e^{\frac{x^3}{3}} y\right) = \boxed{\int e^{\frac{x^3}{3}}(2x+5)\,dx}$$

$$e^{\frac{x^3}{3}} y =$$

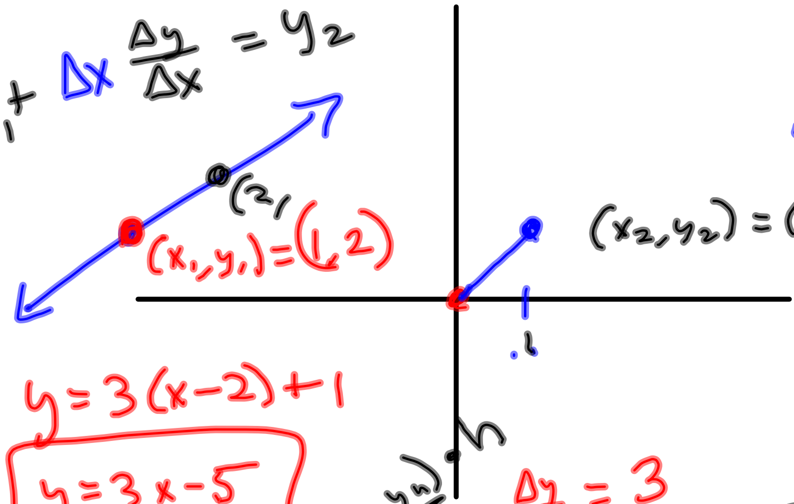
Requires Integration by Parts.


y' = x + y
4
3
2
1
-1
-2
-3
-4
-4
-3
-2
-1
1
2
3
4

$\boxed{y' = f(x)}$

$y' =$

$y_1 + \Delta x \frac{\Delta y}{\Delta x} = y_2$



$y = 3(x-2)+1$

$\boxed{y = 3x - 5}$

$m = \frac{\Delta y}{\Delta x} = 3$

$y_{n+1} = y_n + f(x_n, y_n) \cdot h$

$y' = \boxed{1 - xy} \to f(x,y)$

$y(0) = 0$

$h = .1$

$y'(0,0) = 1$

$y_2 = y_1 + f(x_1, y_1)\, h$

$y_2 = 0 + 1 \cdot .1 = .1$

$y_2 = 5$

$= 2 + 3 \cdot 1$

$y_2 = 2 + 3 \cdot .1$

$= y_1 + f(x_1, y_1) \cdot h$