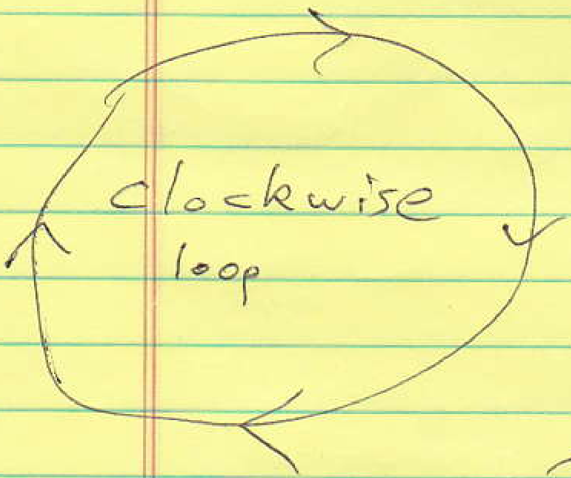
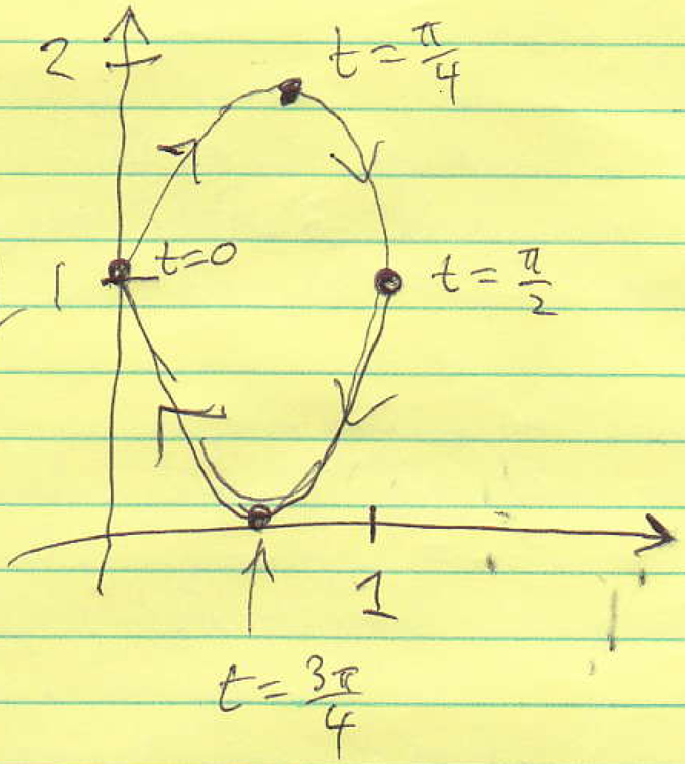
Parametric Curve

$x = \sin t$
$y = 1 + \sin(2t)$

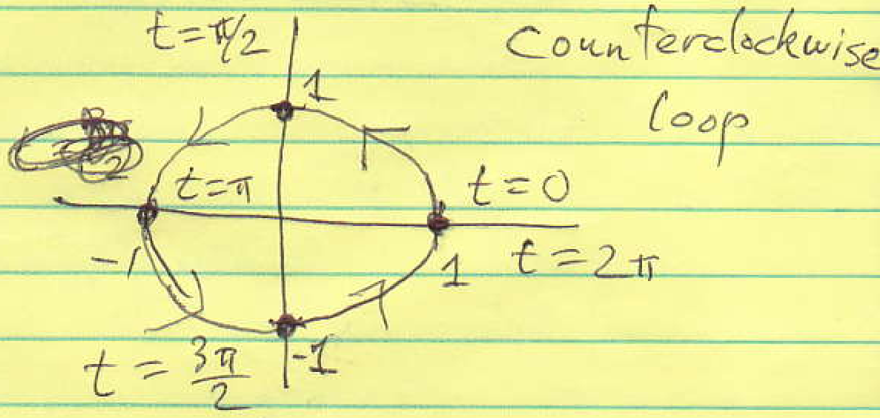
(We use radians!)

$0 \le t \le \pi$



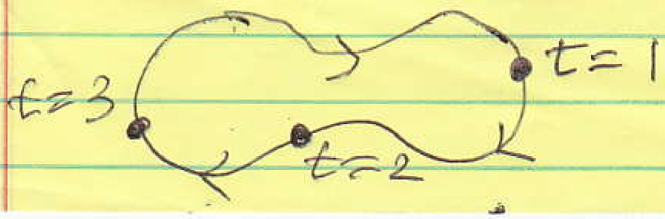


$x = \cos t$
$y = \sin t$
$0 \le t \le 2\pi$

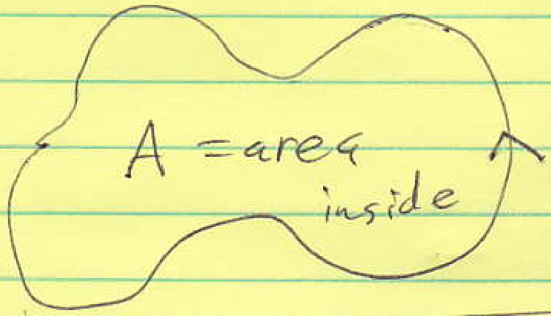


You can distinguish  from 

just by labelling 3 pts on the curve

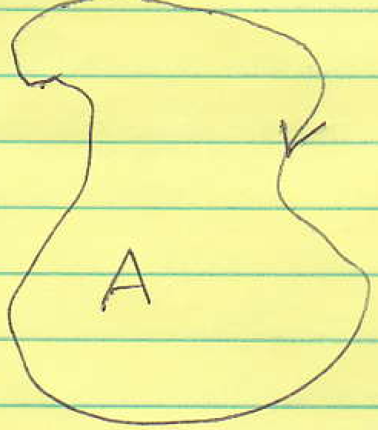


The orientation (↺ vs ↻) matters for our area formulas.



$$A = \int_{loop} x \, dy$$

$$A = -\int_{loop} y \, dx$$

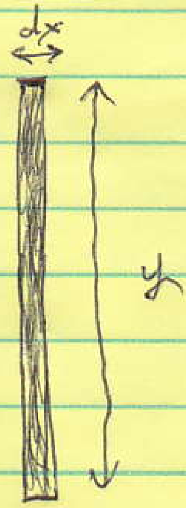


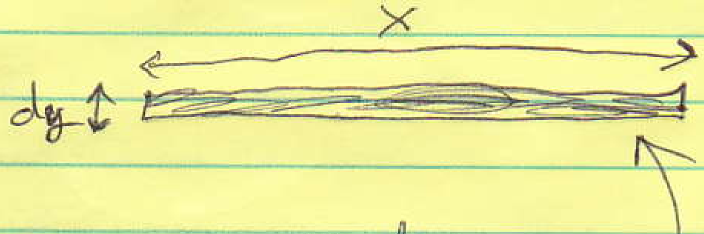
$$A = -\int_{loop} x \, dy$$

$$A = \int_{loop} y \, dx$$

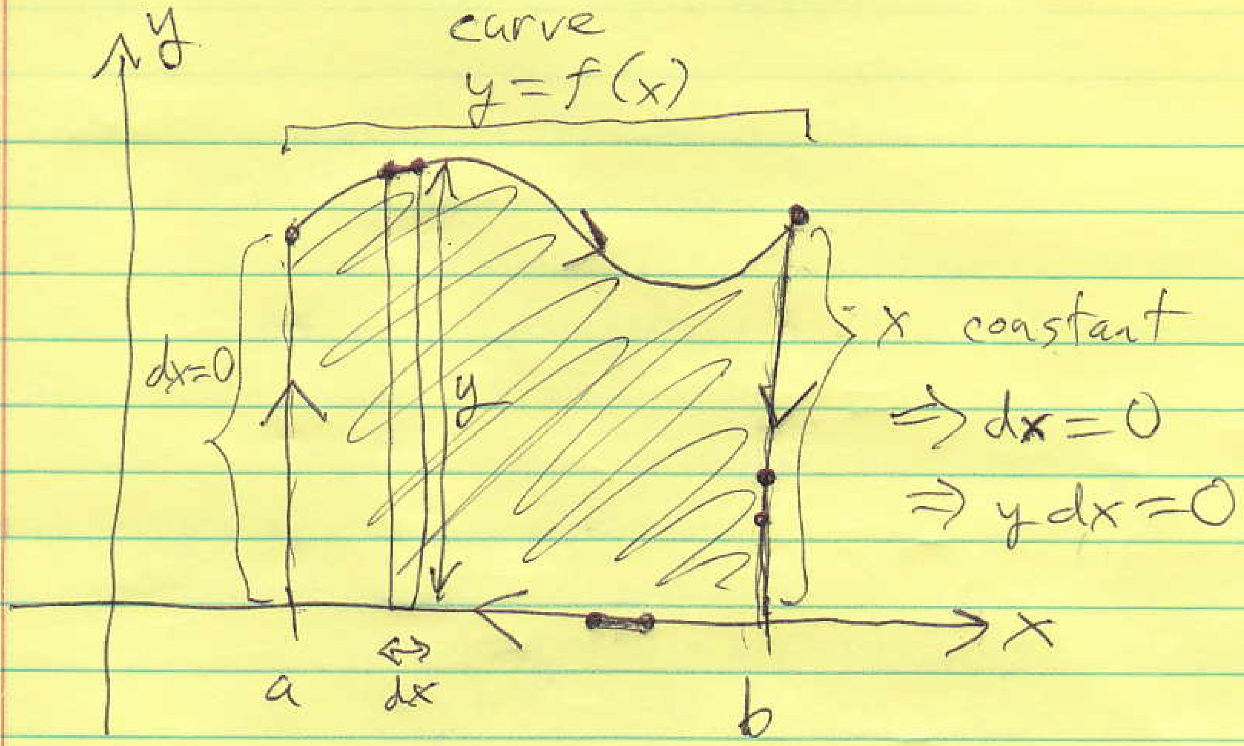
y dx

area:





x dy = area



area $A = \int_a^b f(x)\,dx = \int_a^b y\,dx$

$\boxed{\text{bottom side: } y = 0 \Rightarrow y \cdot dx = 0}$

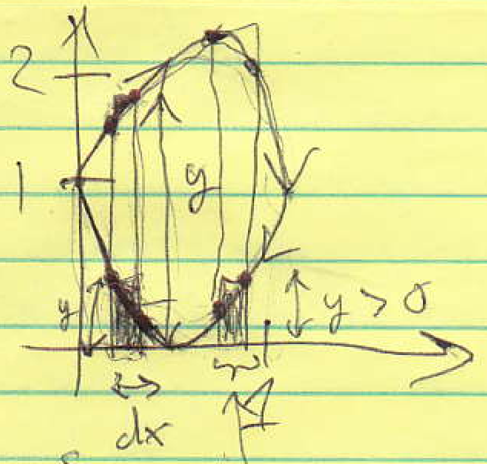
$A = \int_{loop} y\,dx$

Note: loop is clockwise

$x = \sin t$

$y = 1 + \sin(2t)$

$0 \leq t \leq \pi$



$\text{area} = \int_{loop} \underbrace{y\,dx}$

$dx < 0$

$y \cdot dx < 0$

$y = 1 + \sin(2t)$

$dx = (\sin t)'\,dt$

top $\{dx > 0$

bottom $\{dx < 0$

$x = \sin t \qquad y = 1 + \sin(2t)$

$0 \le t \le \pi \qquad$ clockwise loop

area inside loop $= \int_{\text{loop}} y\,dx$

$= \int_0^{\pi} (1 + \sin(2t))(\cos t)\,dt$

HW: Estimate this with Simpson's Rule ($N=10$).