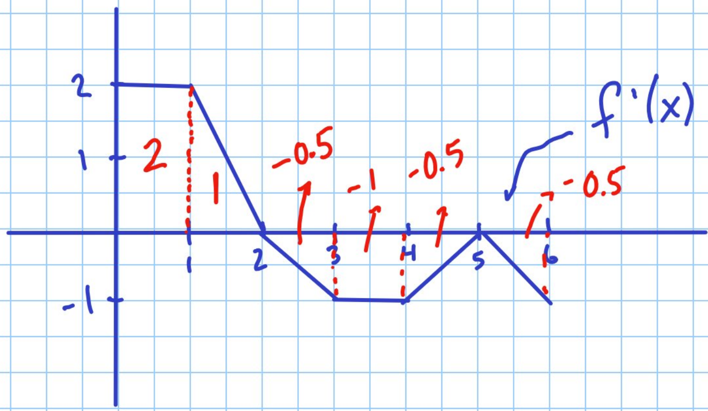
WARMUP

Fill in the table given the graph of $f'(x)$.

x	$y=f(x)$
0	3
1	5
2	6
3	5.5
4	4.5
5	4
6	3.5



Area under $f'(x)$ on $[a,b]$ represents total change of f on $[a,b]$.

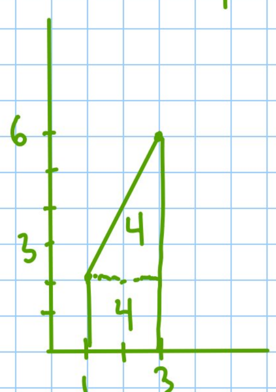
Section 5.4 Theorems About Definite Integrals

Theorem 5.1 Fundamental Theorem of Calculus

If f is continuous on $[a,b]$ and $f(t)=F'(t)$, meaning F is an antiderivative of f, then

$$\int_a^b f(t)\,dt = F(b)-F(a)$$

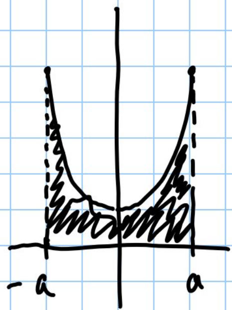
ex: $\displaystyle\int_1^3 2x\,dx = 8$



$$\int_1^3 2x\,dx = \left[x^2\right]_1^3 = 3^2-1^2 = 9-1 = 8$$

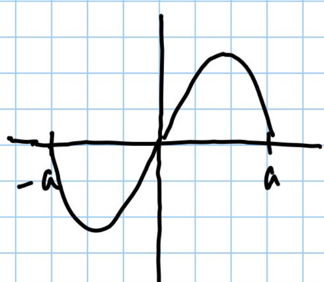
If f is even, then $\int_{-a}^{a} f(x)\,dx = 2\int_{0}^{a} f(x)\,dx$

y-axis symmetry



If f is odd, then $\int_{-a}^{a} f(x)\,dx = 0$

origin symmetry



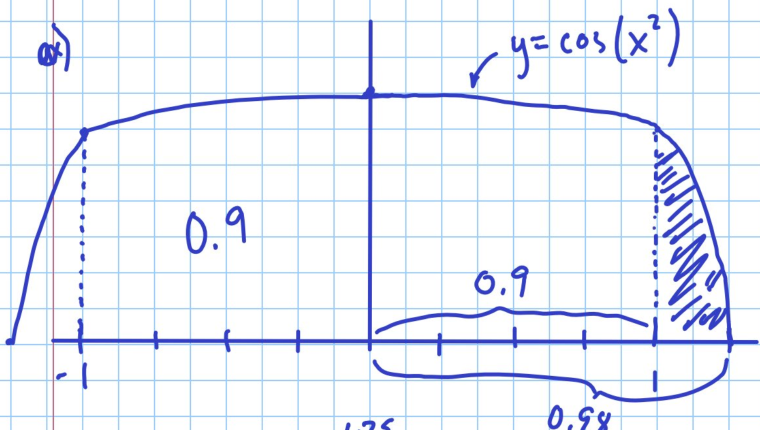
ex: $\int_{-100}^{100} \sin x\,dx = 0$

Theorem 5.2 If a, b, and c are any numbers and f is continuous, then

1) $\int_{a}^{b} f(x)\,dx = -\int_{b}^{a} f(x)\,dx$

2) $\int_{a}^{c} f(x)\,dx = \int_{a}^{b} f(x)\,dx + \int_{b}^{c} f(x)\,dx$

a)



$\int_{0}^{1.25} \cos(x^2)\,dx = 0.98$

$\int_{0}^{1} \cos(x^2)\,dx = 0.9$

a) $\int_{1}^{1.25} \cos(x^2)\,dx = 0.98 - 0.9 = 0.08$

b) $\int_{-1.25}^{1.25} \cos(x^2)\,dx = 2\int_{0}^{1.25} \cos(x^2)\,dx = 2 \cdot 0.98 = 1.96$

c) $\int_{1.25}^{-1} \cos(x^2)\,dx \approx -\int_{-1}^{1.25} \cos(x^2)\,dx = -(0.9 + 0.98) = -1.88$

Theorem 5.3 Let f and g be continuous and let c be a constant

1) $\int_a^b (f(x) \pm g(x))\,dx = \int_a^b f(x)\,dx \pm \int_a^b g(x)\,dx$

2) $\int_a^b (cf(x))\,dx = c\int_a^b f(x)\,dx$

ex: $\int_a^b f(x)\,dx = 8 \qquad \int_a^b g(x)\,dx = -2$

a) $\int_a^b (f(x) + g(x))\,dx = 6$

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