Author 1 _____

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29 – Fundamental Theorem of Calculus

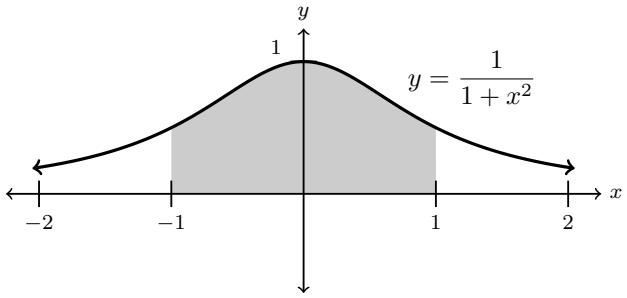
Theorem: Fundamental Theorem of Calculus, Part 2

If f is continuous on $[a, b]$ and F is any antiderivative for f, then

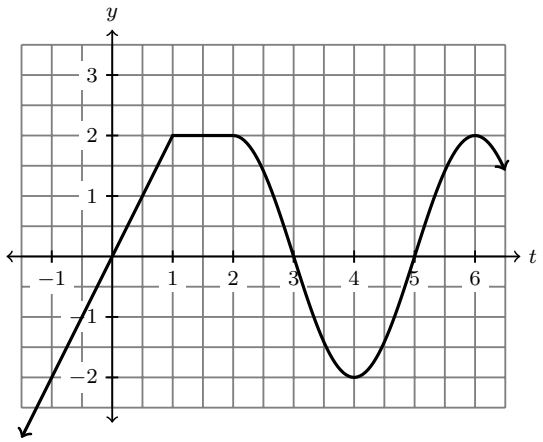
$$\int_a^b f(x)\,dx = F(b) - F(a).$$

1. Compute $\displaystyle\int_0^4 \left(\sqrt{x} - 3e^x\right) dx$.

2. Compute the area of the shaded region below.



3. The graph of $f(t)$ is below. Define $A(x) = \int_{-1}^{x} f(t)dt$.



(a) Find $A(0)$.

$$A(0) = \int_{-1}^{0} f(t)dt$$
$$= \text{area "under } f\text{" from } -1 \text{ to } 0$$
$$=$$

(b) Find $A(1)$.

(c) Find $A(1.5)$.

(d) Find $A(2)$.

(e) Find $A(3)$. (An estimate is fine.)

(f) Find $A(4)$.

(g) Find $A(6)$.

(h) Find $A(-1)$.

Theorem: Fundamental Theorem of Calculus, Part 1

If f is continuous on $[a, b]$, then the area function

$$A(x) = \int_{a}^{x} f(t)\,dt$$

is an antiderivative for f on (a, b). That is, $A'(x) = f(x)$.