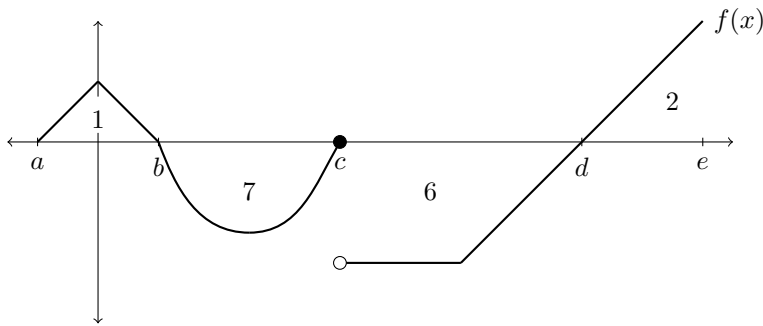


Objectives:

- Find the integral of the absolute value of a given function.
- Interpret the integral of a function's absolute value.

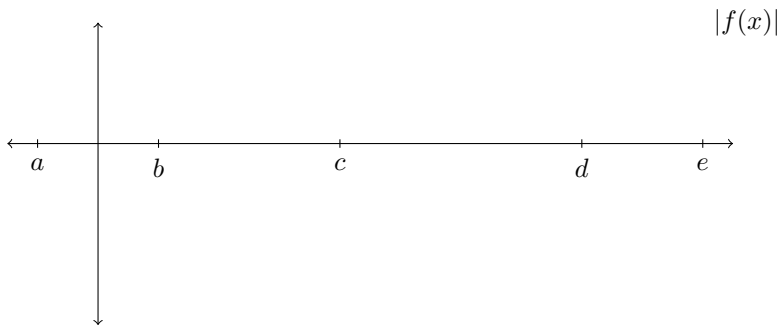
Graphically:



The graph of $f(x)$ is given with areas labeled (e.g. $\int_b^c f(x)dx = 7$).

$$\int_a^e f(x)dx =$$

Graph $|f(x)|$:



$$\int_a^e |f(x)|dx =$$

Write $\int_a^e |f(x)|dx$ in terms of integrals of $f(x)$:

So to find $\int_a^b |f(x)|dx$,

1. Find all points where $f(x) =$ _____
2. Use these points to separate $[a, b]$ into subintervals where $f(x)$ _____ .
3. To calculate $\int_a^b |f(x)|dx$, add the absolute value of the integral of each subinterval.
(Add the integral if $f(x) \geq 0$ on that subinterval and subtract the integral if $f(x) \leq 0$.)

Example: $\int_{-\pi}^{\pi} |\cos(x)|dx$

Interpreting the Integral of Absolute Value

If $v(t)$ represents an object's velocity as a function of time, we know the integral of $v(t)$ represents _____ .

The integral of speed, $|v(t)|$, represents _____ .

Example: The velocity of a boat in miles per hour at x hours after noon is given by $v(x) = x^2 - 4x + 3$.

- (a) What is the total distance traveled by the boat between noon and 4pm?
Hint: $x^2 - 4x + 3 = (x - 3)(x - 1)$

- (b) What is the distance between the boat's starting position at noon and the boat's ending position at 4pm?