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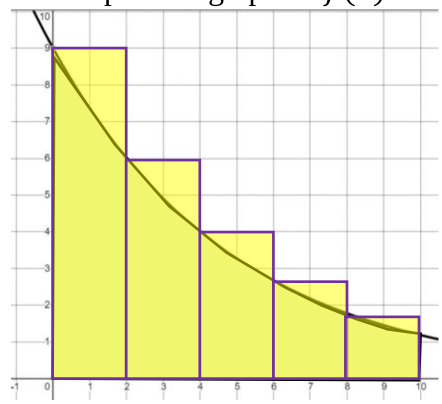
Definite Integrals

Riemann Sums – area under curve found by summing up the area of rectangles

Sample of a graph of $f(x)$



Area $\approx \sum$ area of rectangles

What if the # of rectangles was infinite?

https://animated-mathematics.net/riemann-sums.html

Area =

$$\sum_{k=1}^{n} f(c_k)\Delta x_k$$

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Definition of the Definite Integral

If f is defined on $[a, b]$ and $\lim_{\Delta x \to 0} \sum_{k=1}^{n} f(c_k)\Delta x_k$ exists,

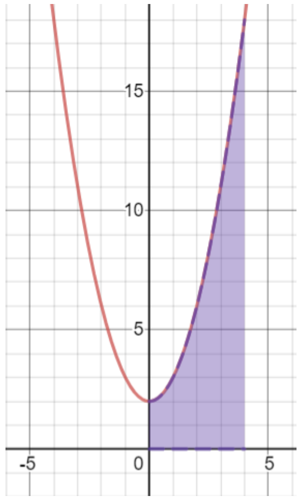
then f is integrable on $[a, b]$ and

$$\lim_{\Delta x \to 0} \sum_{k=1}^{n} f(c_k)\Delta x_k \quad =$$

Set up a definite integral that yields the area of the shaded region.

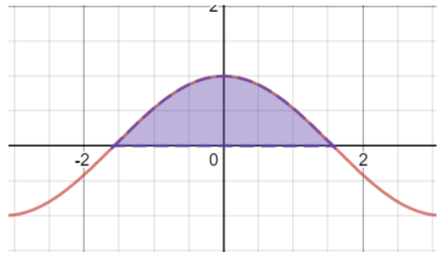
Example 1:

$f(x) = x^2 + 2$



Example 2:

$g(x) = \cos x$



Evaluate the integral (using knowledge of geometric shapes)

Example 1: $\int_3^7 4\, dx$

Example 2: $\int_1^3 (-2x + 4)\, dx$

Evaluate the integral (using knowledge of geometric shapes)

Example 3: $\int_0^4 \sqrt{16 - x^2}\, dx$

Example 4: $\int_{-1}^1 (1 - |x|)\, dx$

Example 5: $\int_{-3}^3 (1 + \sqrt{9 - x^2})\, dx$