Let $\Delta x = \frac{b-a}{n}$, and let $x_i = a + i\Delta x$.

Midpoint rule:

Let $\overline{x}_i = \frac{1}{2}(x_{i-1} + x_i) =$ midpoint of $[x_{i-1}, x_i]$.

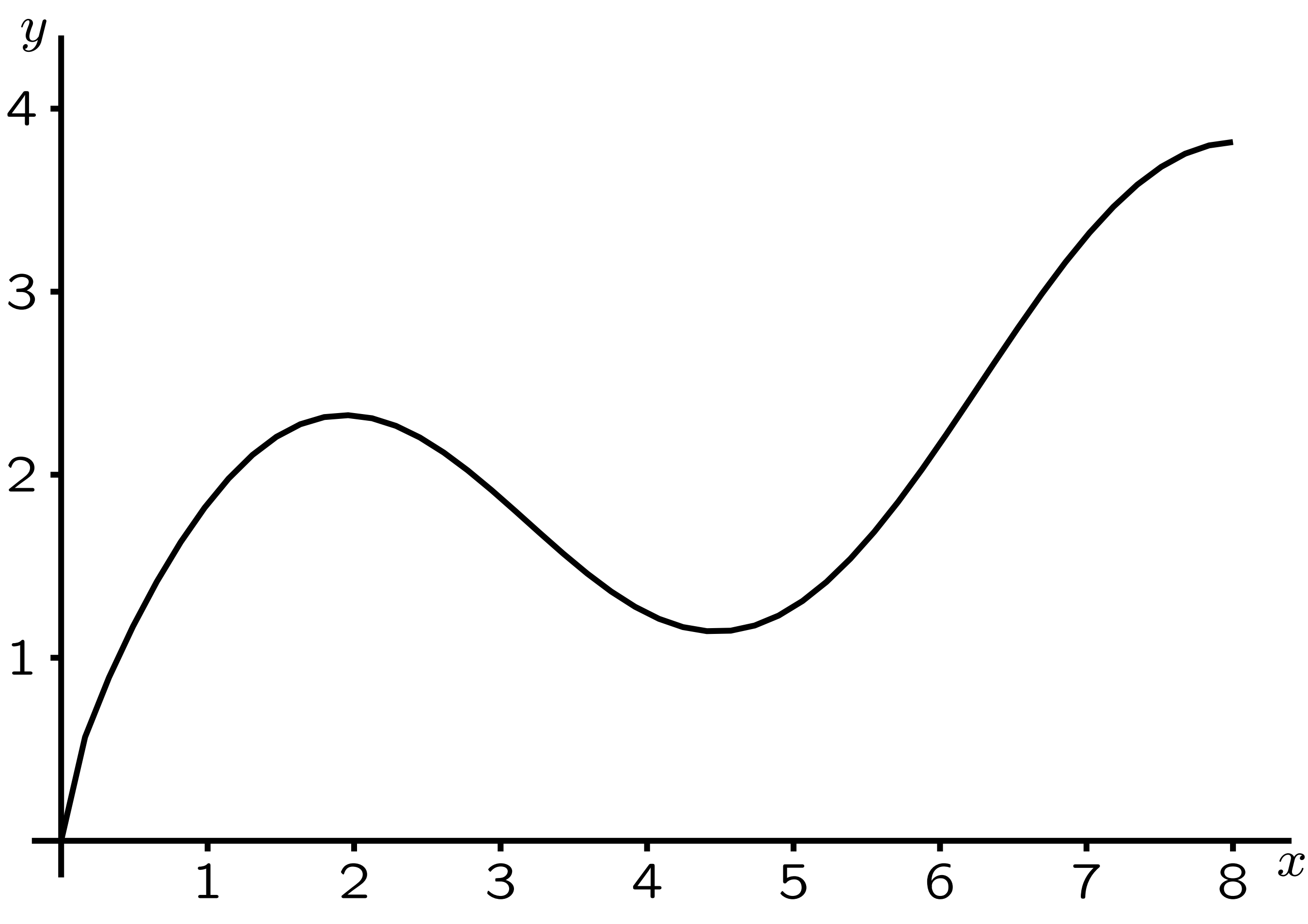
$$\int_a^b f(x)\,dx \approx \Delta x\,[f(\overline{x}_1) + f(\overline{x}_2) + \cdots + f(\overline{x}_n)]$$

Trapezoidal rule:

$$\int_a^b f(x)\,dx \approx \frac{\Delta x}{2}\,[f(x_0) + 2f(x_1) + 2f(x_2) + \cdots + 2f(x_{n-1}) + f(x_n)]$$

Simpson's rule: n must be even.

$$\int_a^b f(x)\,dx \approx \frac{\Delta x}{3}\,[f(x_0) + 4f(x_1) + 2f(x_2) + 4f(x_3) + \cdots + 2f(x_{n-2}) + 4f(x_{n-1}) + f(x_n)]$$


y
4
3
2
1
1
2
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4
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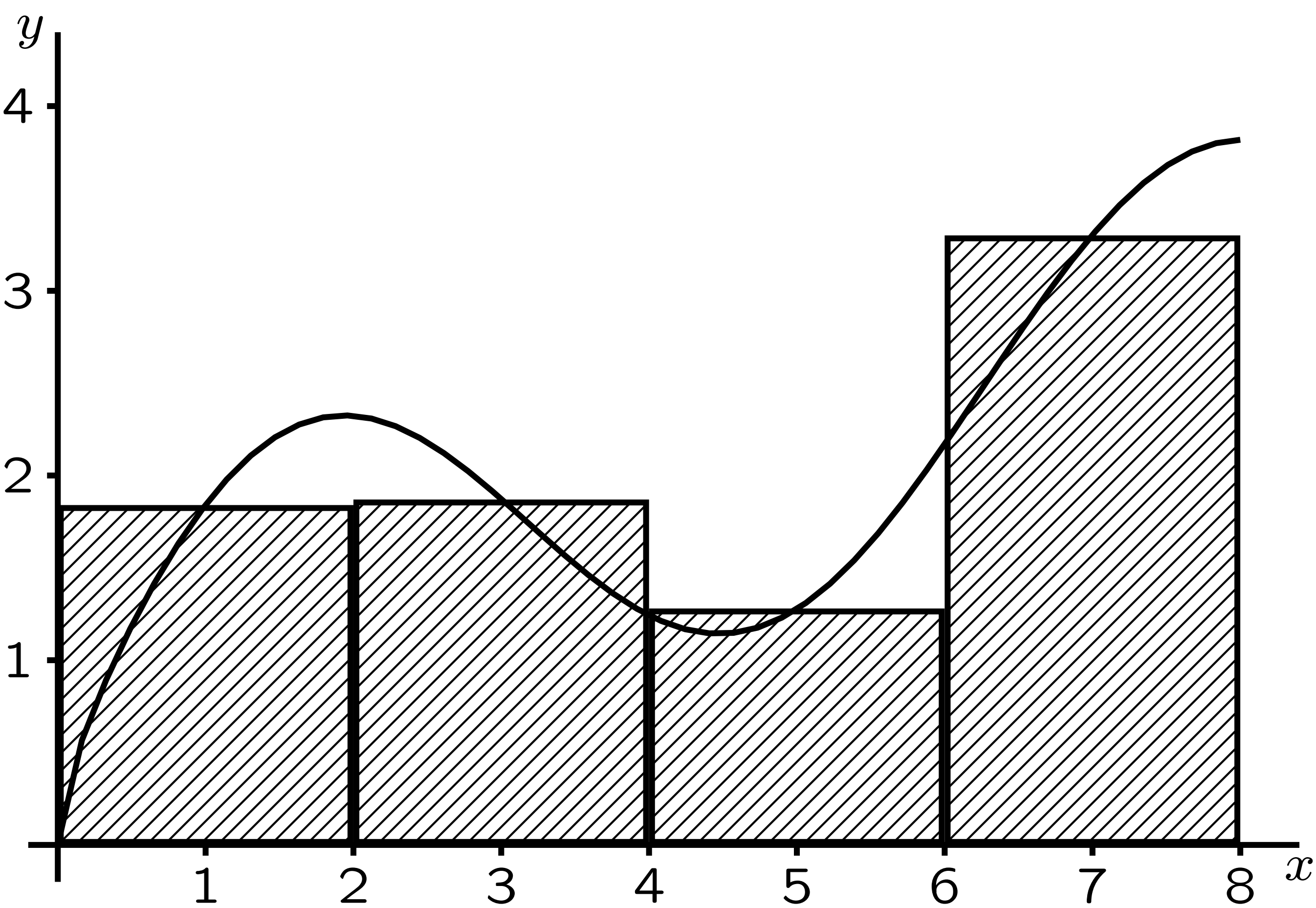
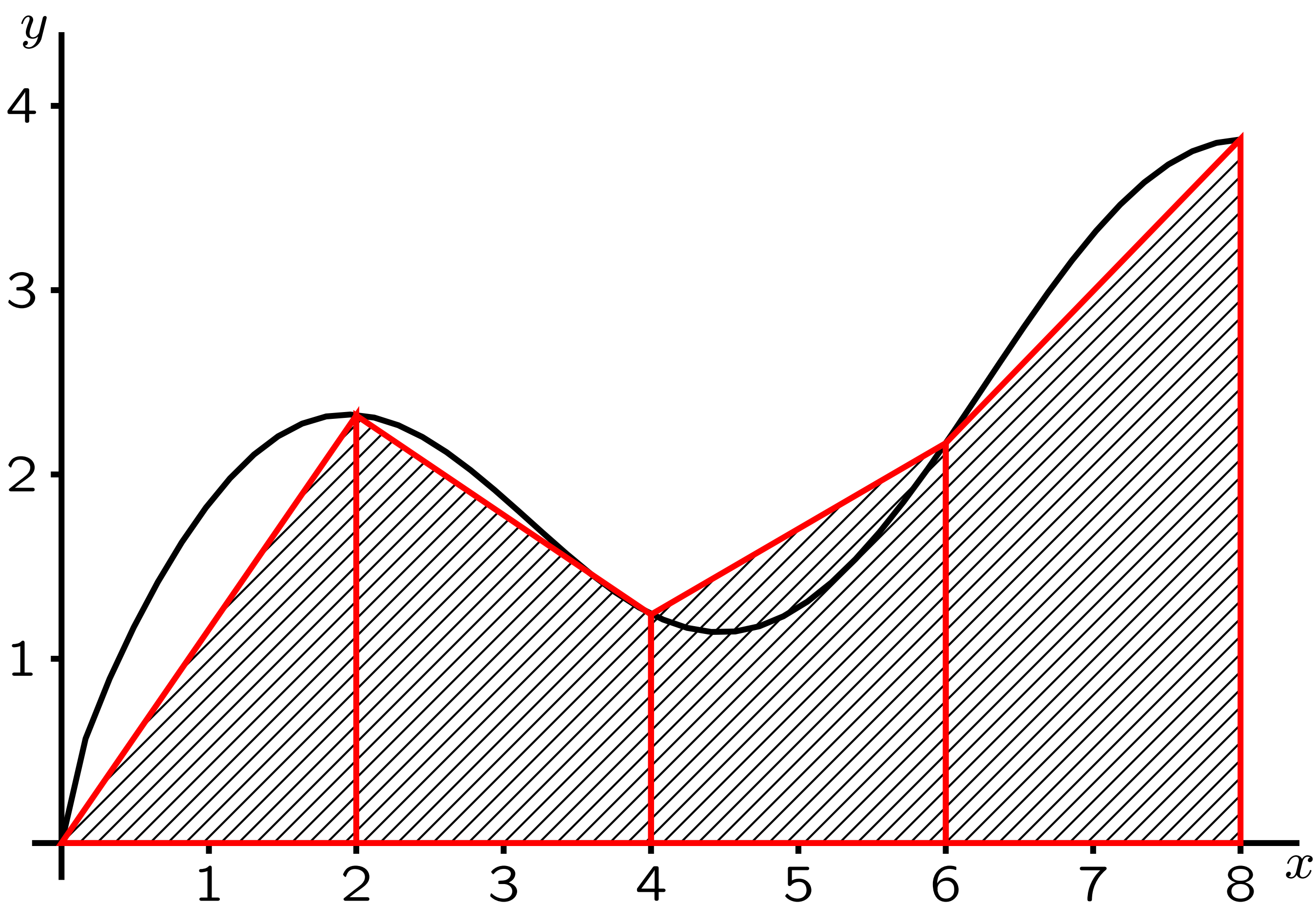
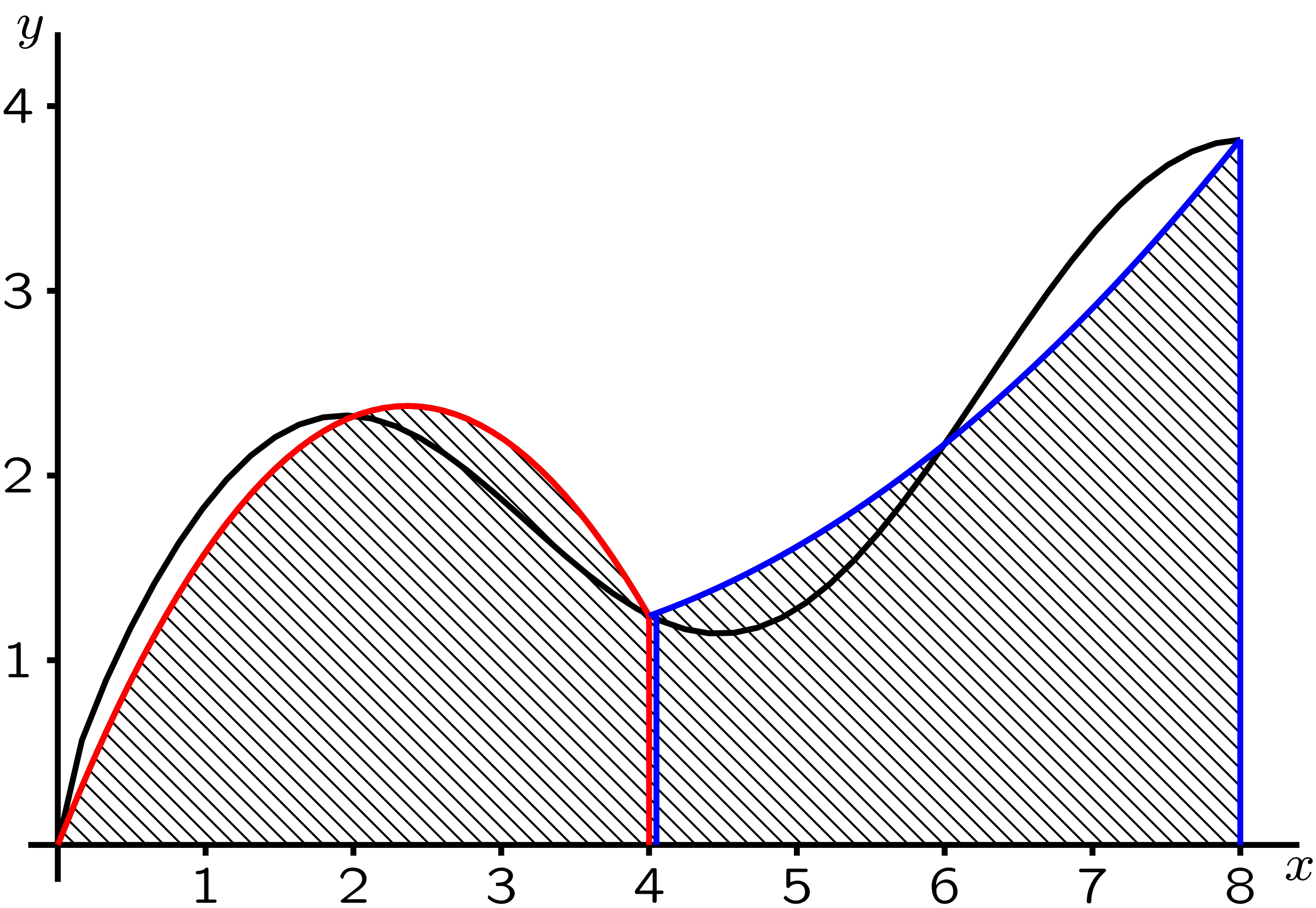
6
7
8
x



$n = 4$, midpoint rule



$n = 4$, trapezoidal rule



$n = 4$, Simpson's rule