사다리꼴 방법에서의 오차
(Error in the Trapezoidal Rule)

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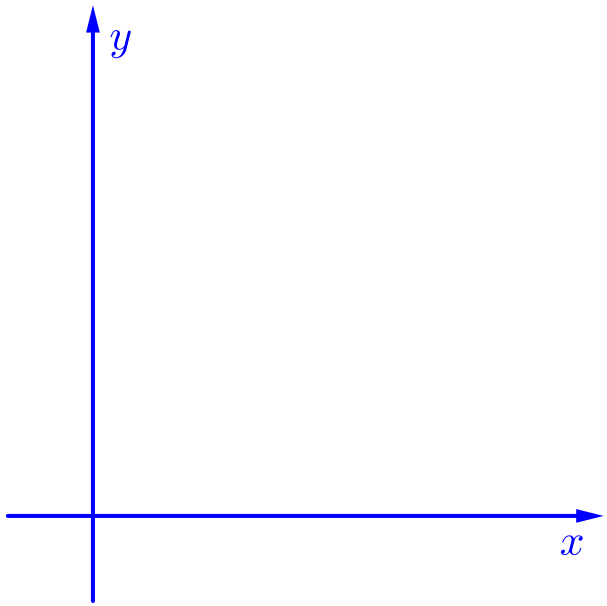
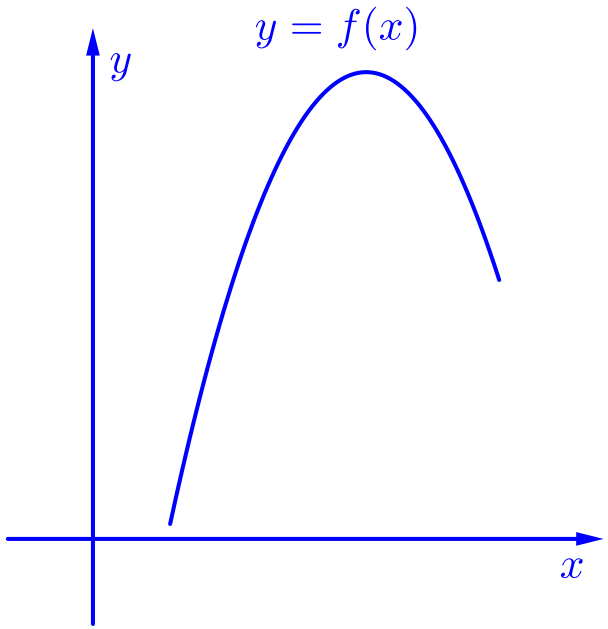


Error in the Trapezoidal Rule

$$|f''(x)| \leq M, \quad x \in [a, b]$$



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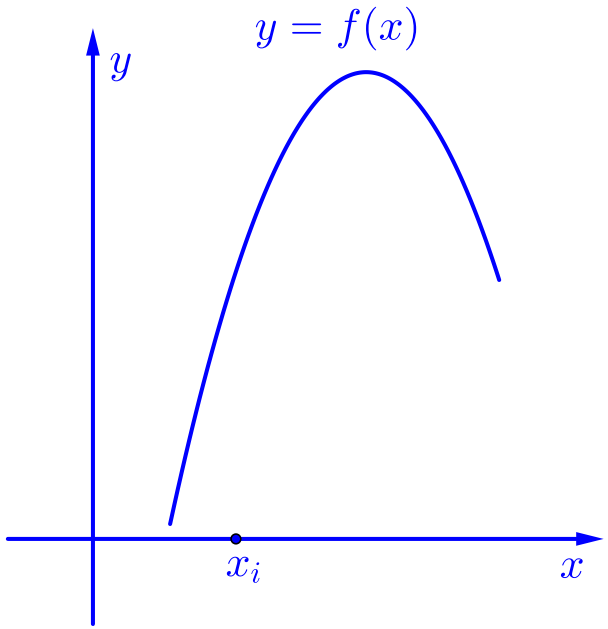

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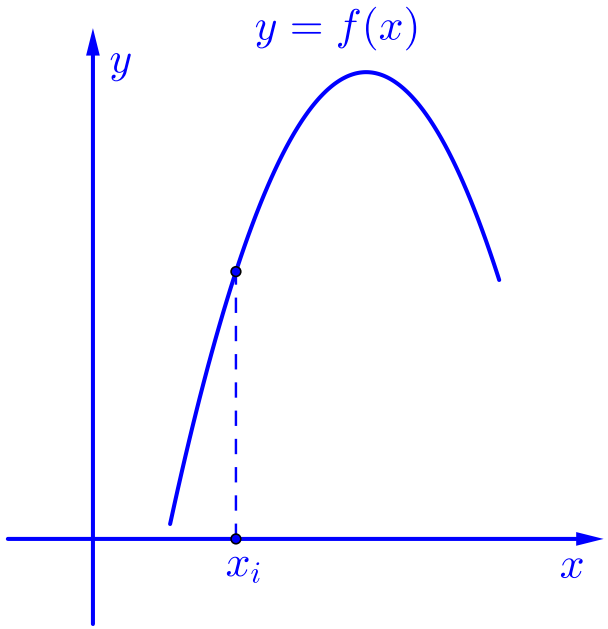

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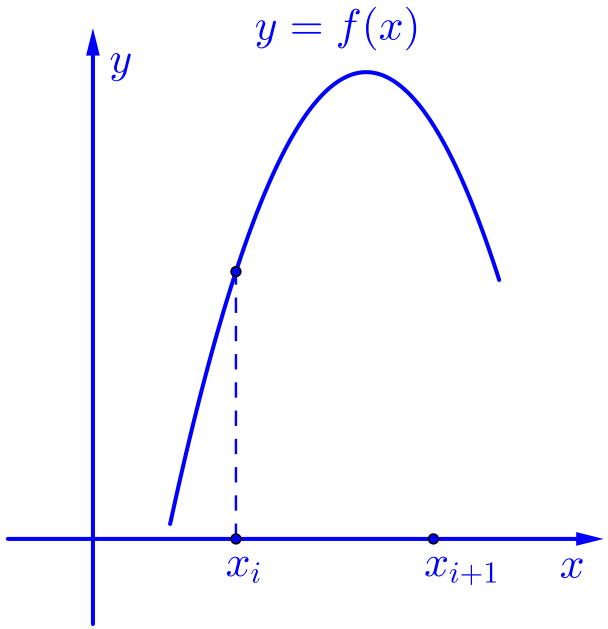

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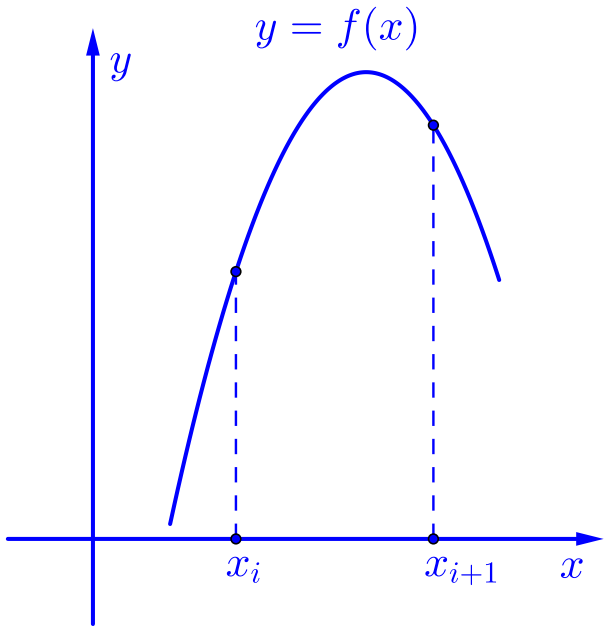

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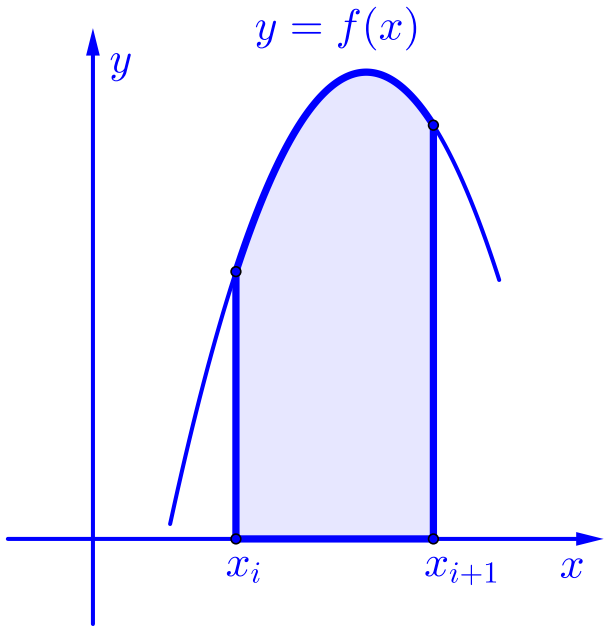

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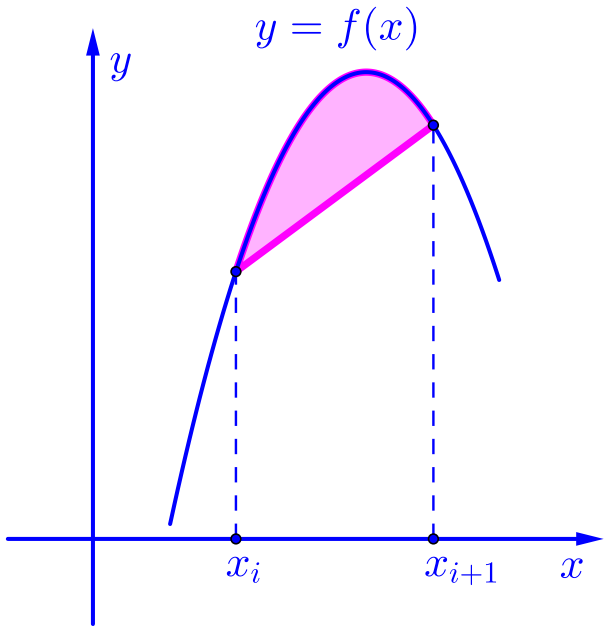

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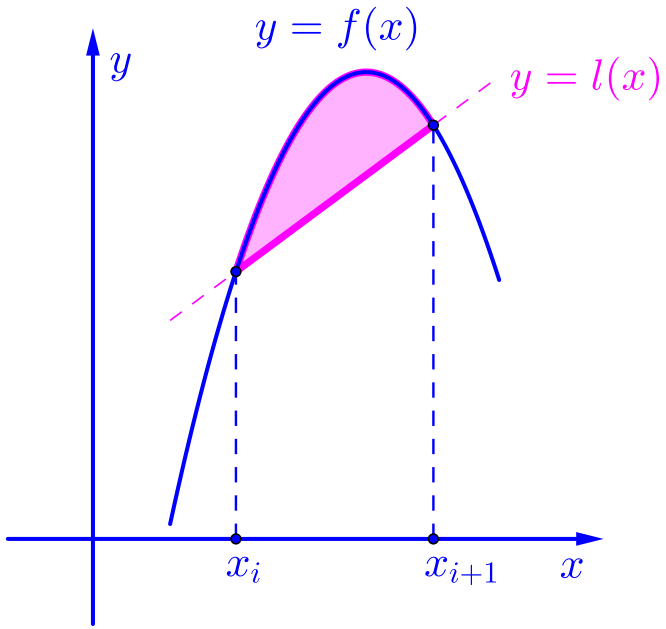

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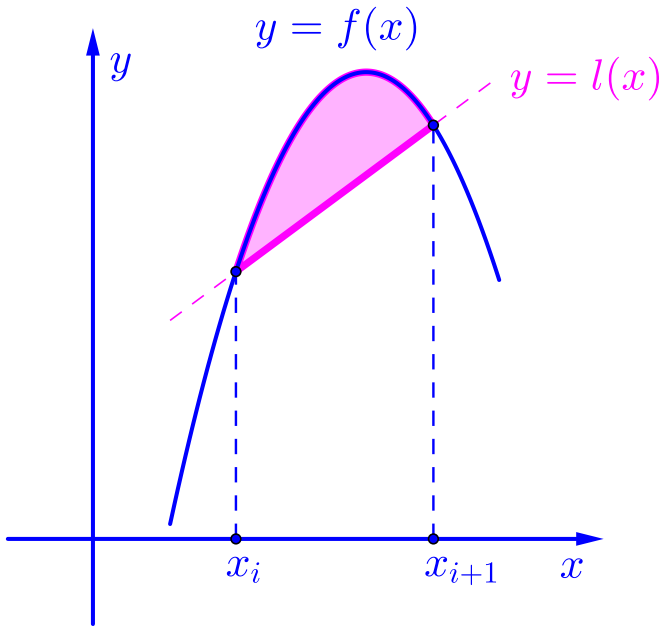

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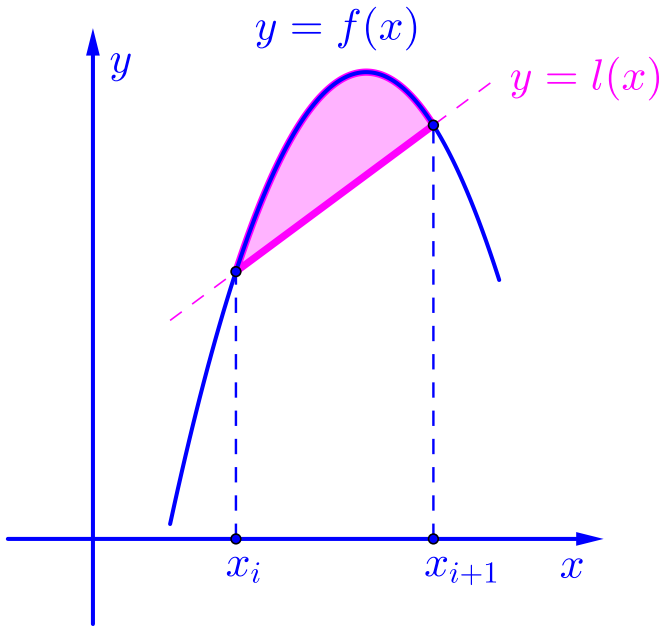

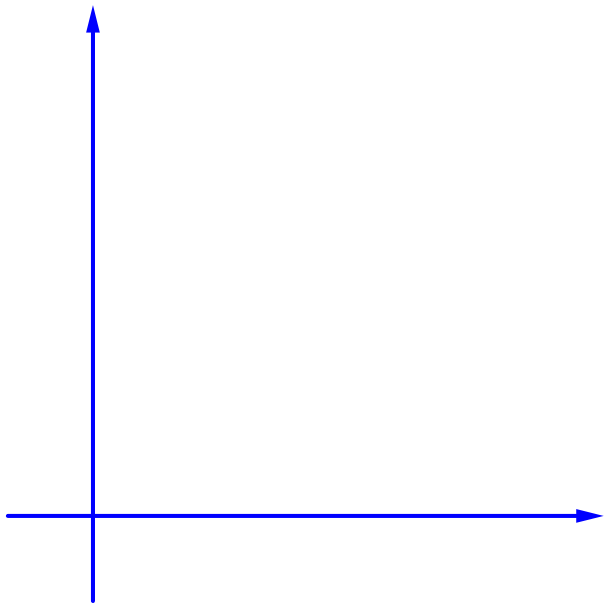

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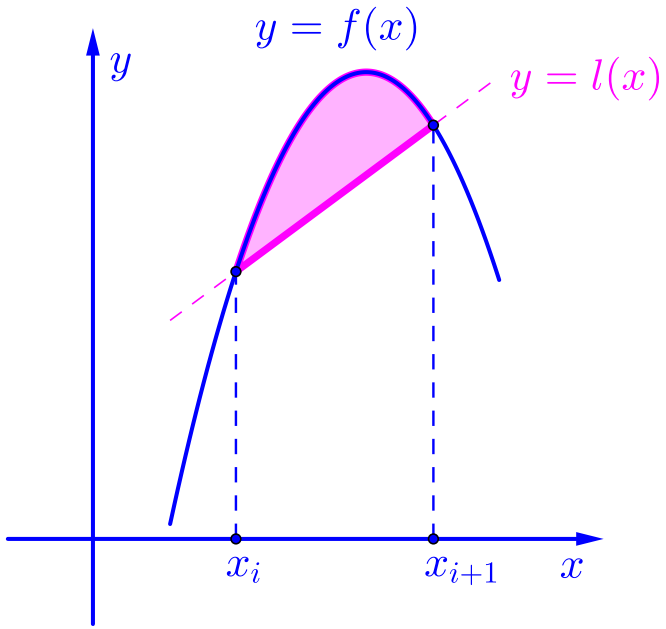

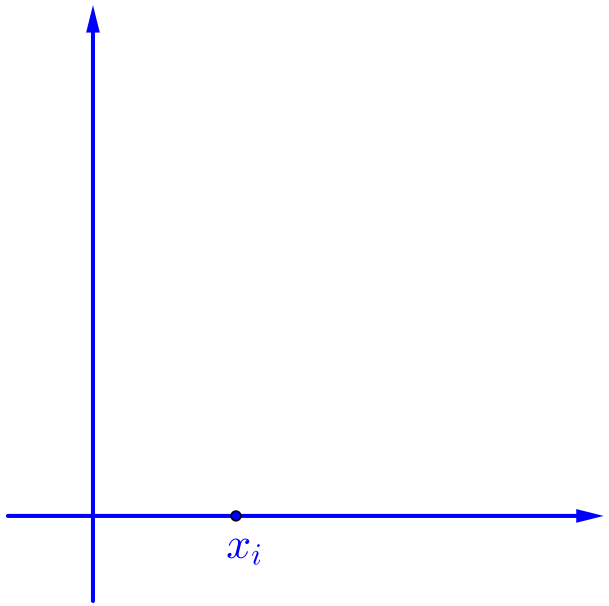

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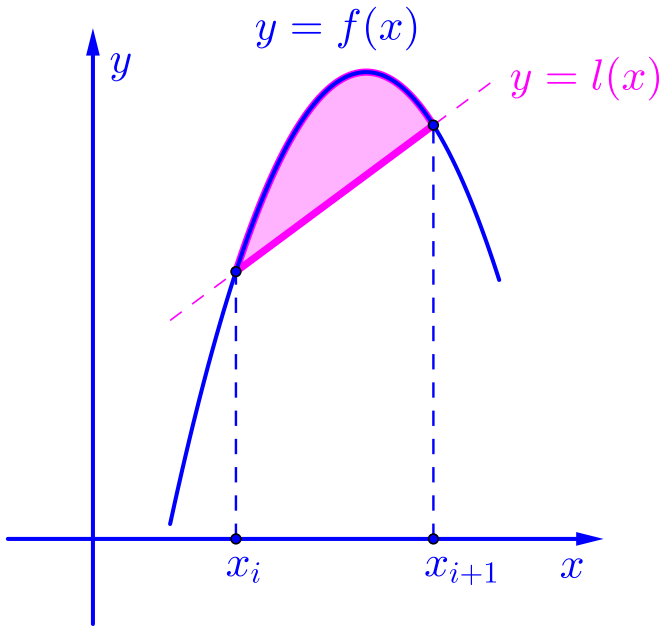

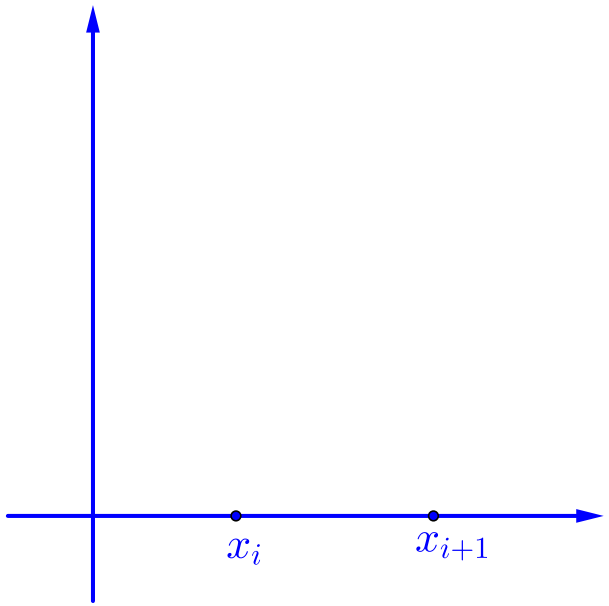

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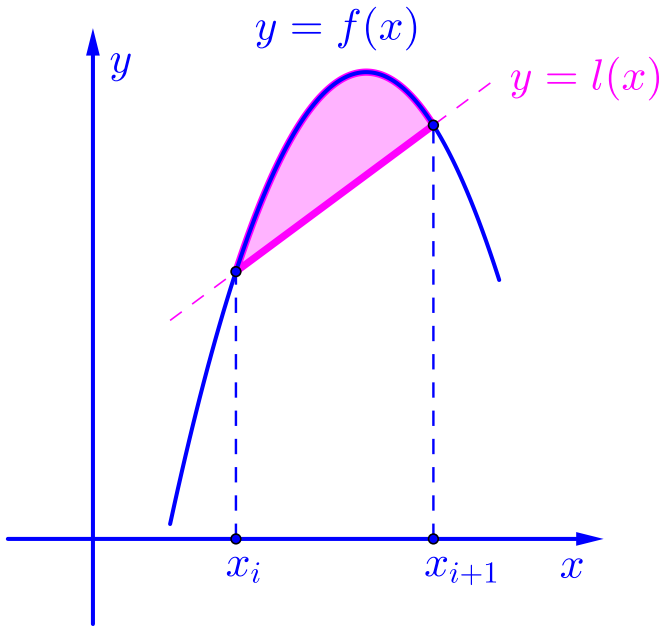

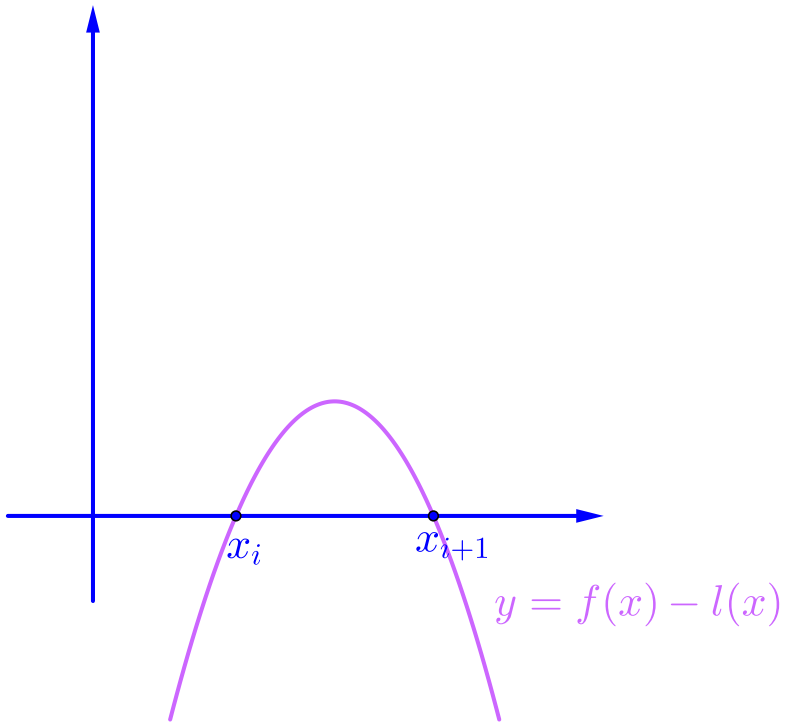

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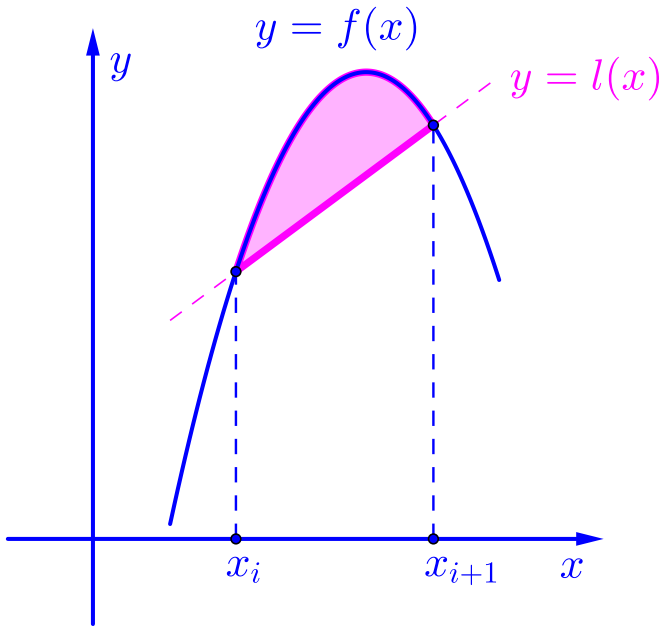

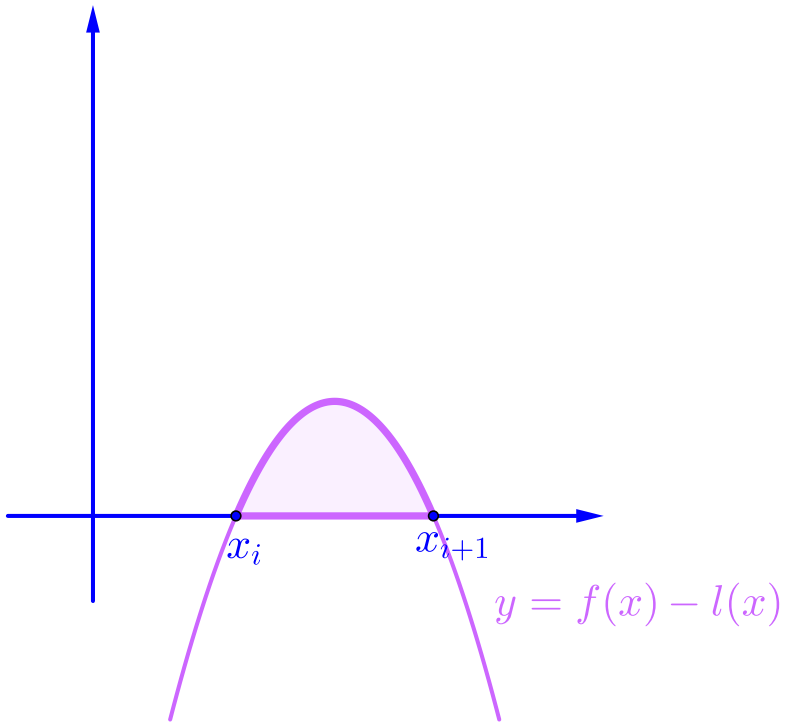

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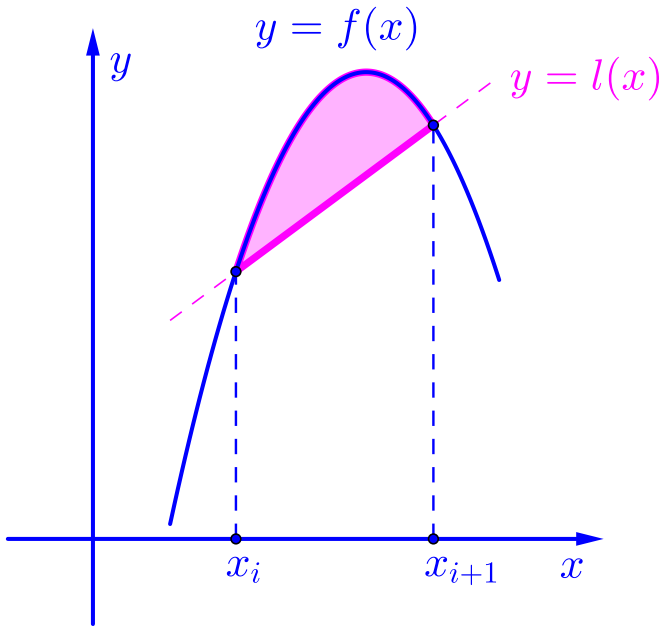

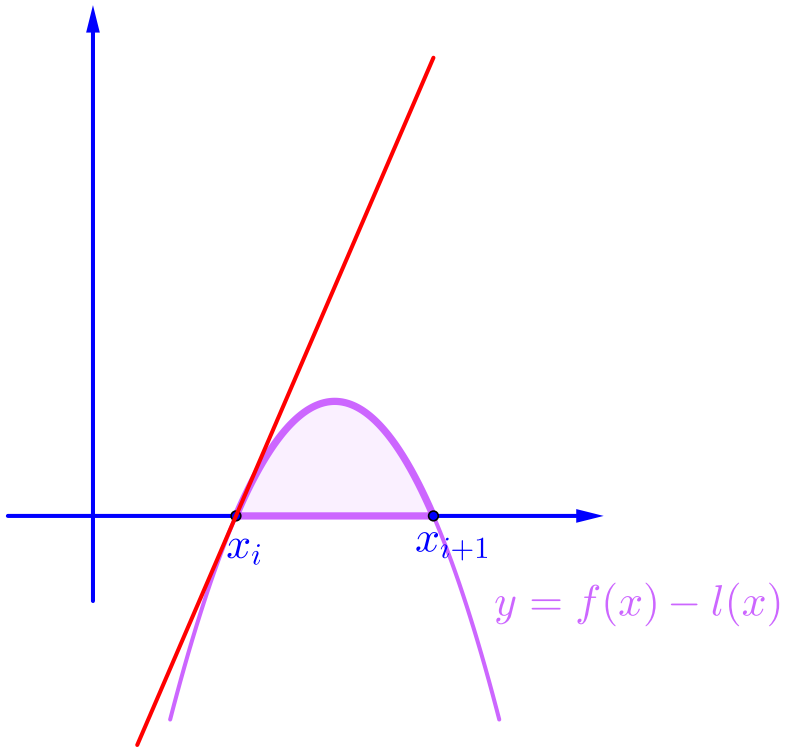

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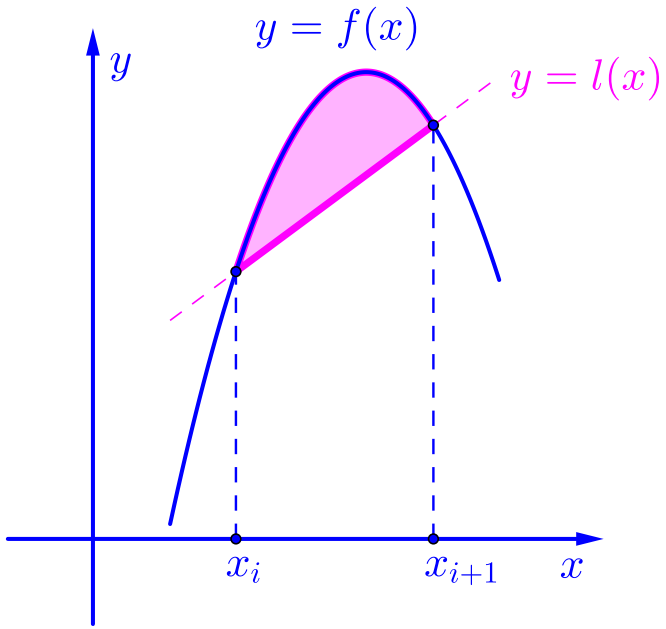

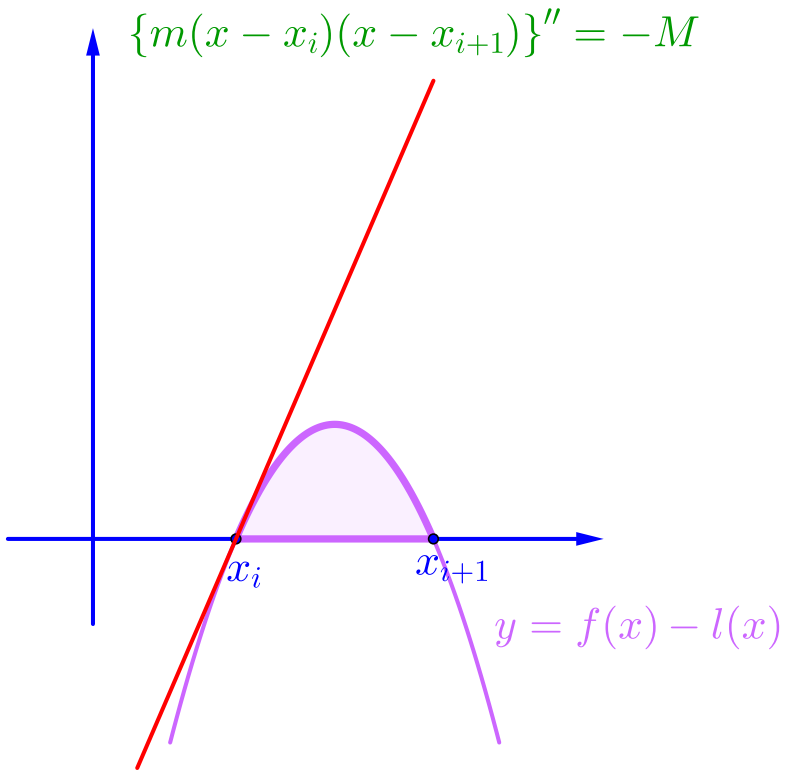

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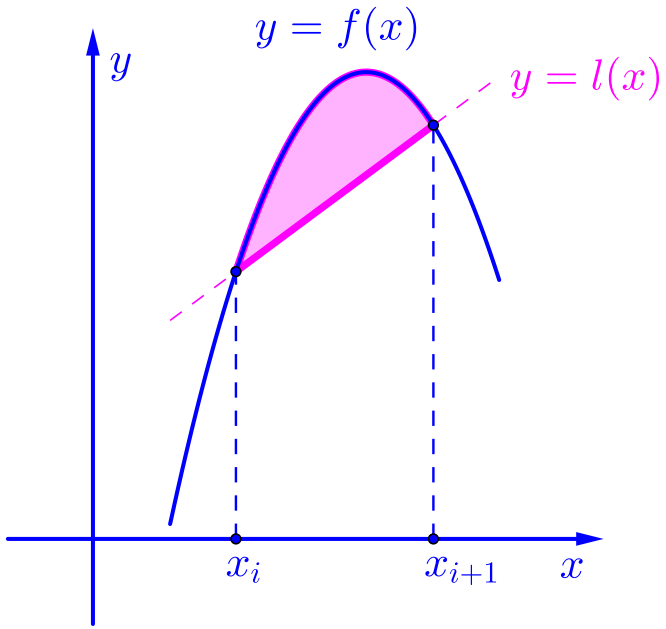
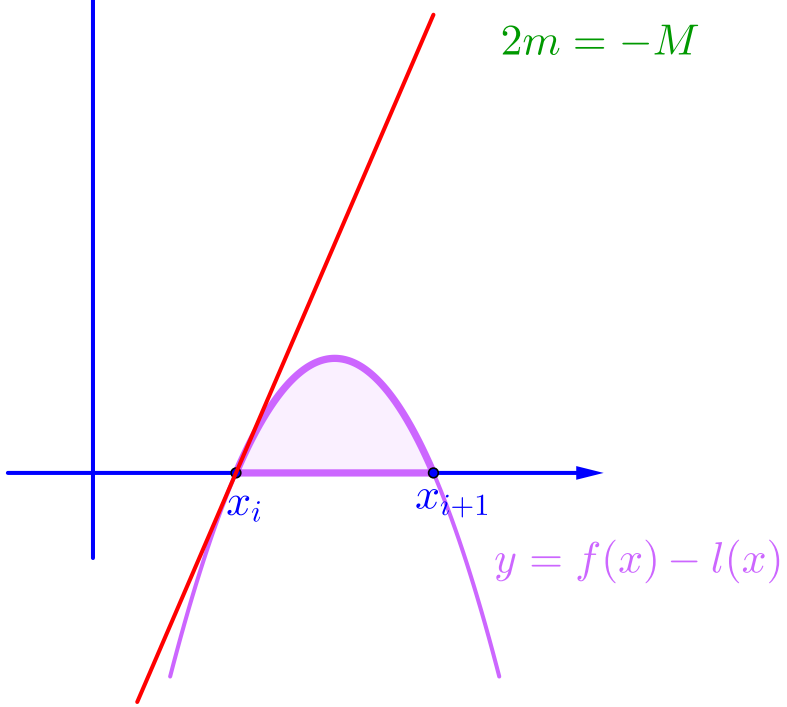


$\{m(x - x_i)(x - x_{i+1})\}'' = -M$

$2m = -M$



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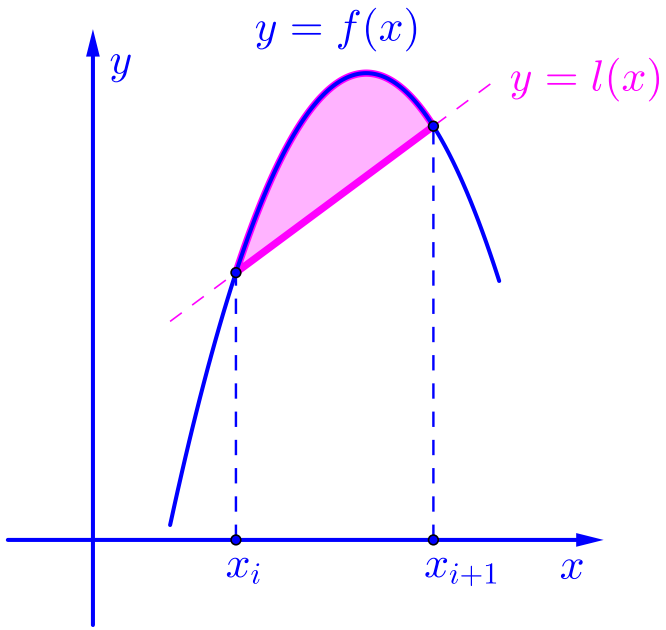

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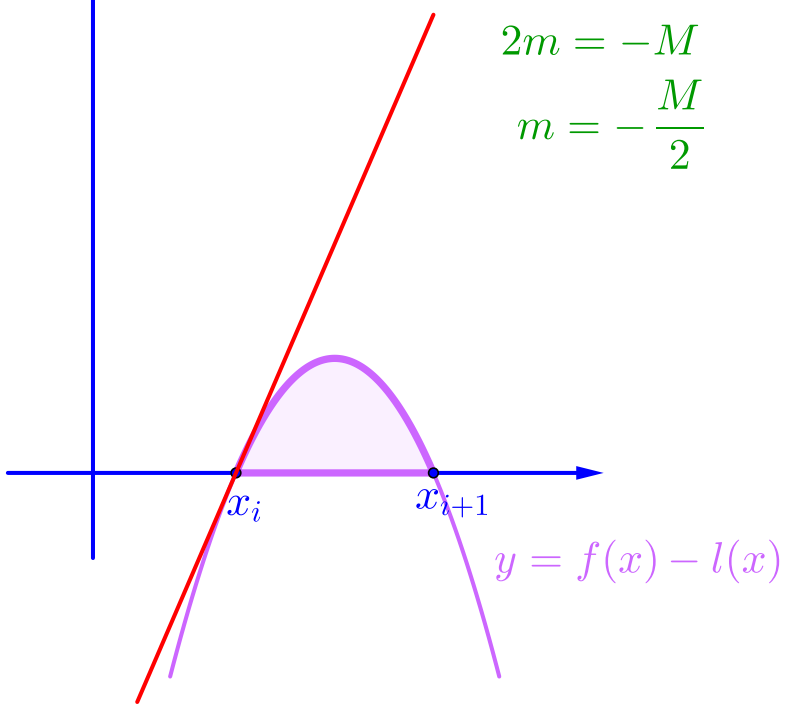

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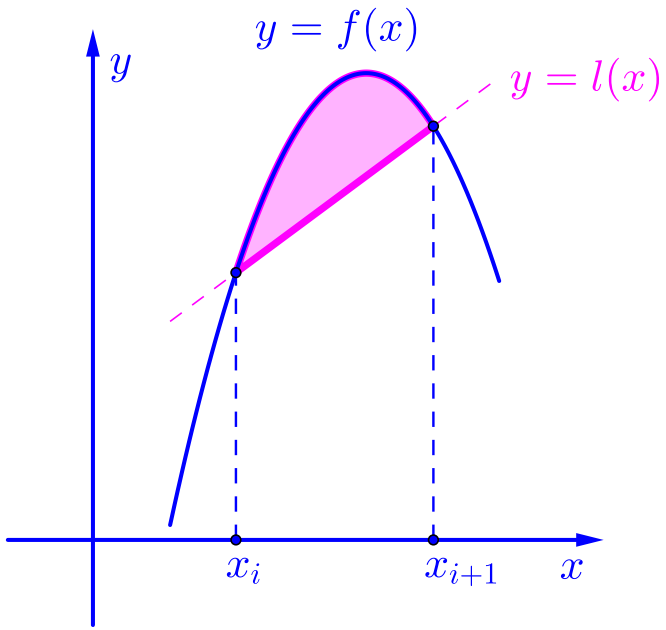

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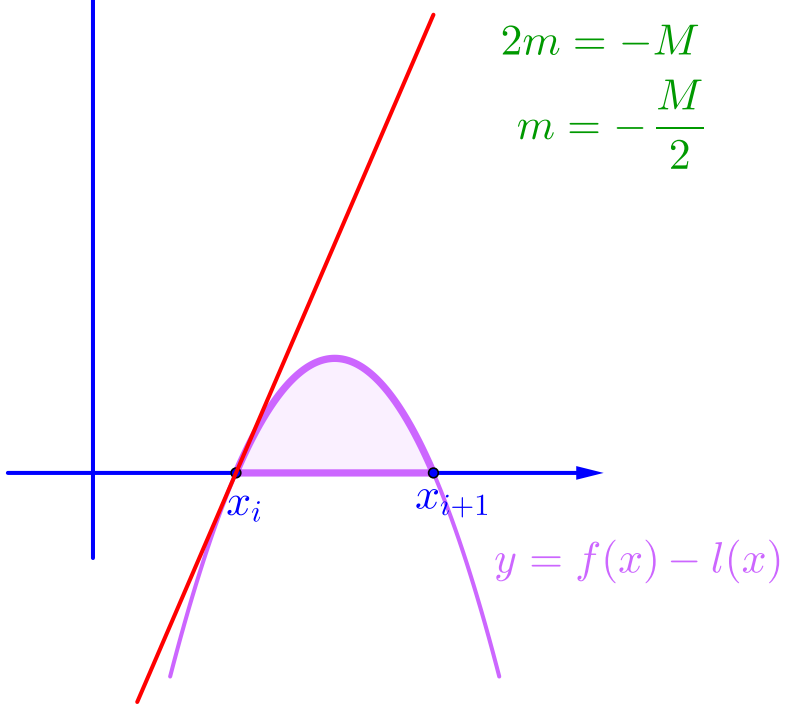

$$\int_{x_i}^{x_{i+1}} \left\{ -\frac{M}{2}(x - x_i)(x - x_{i+1}) \right\} dx$$

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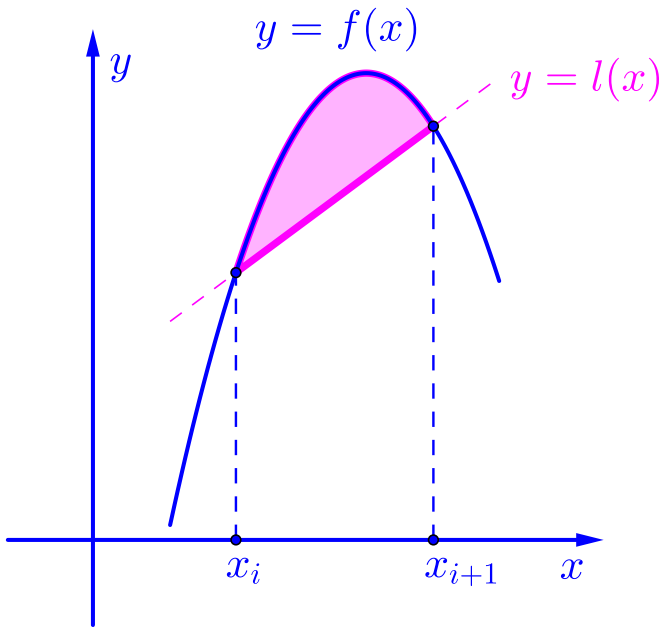

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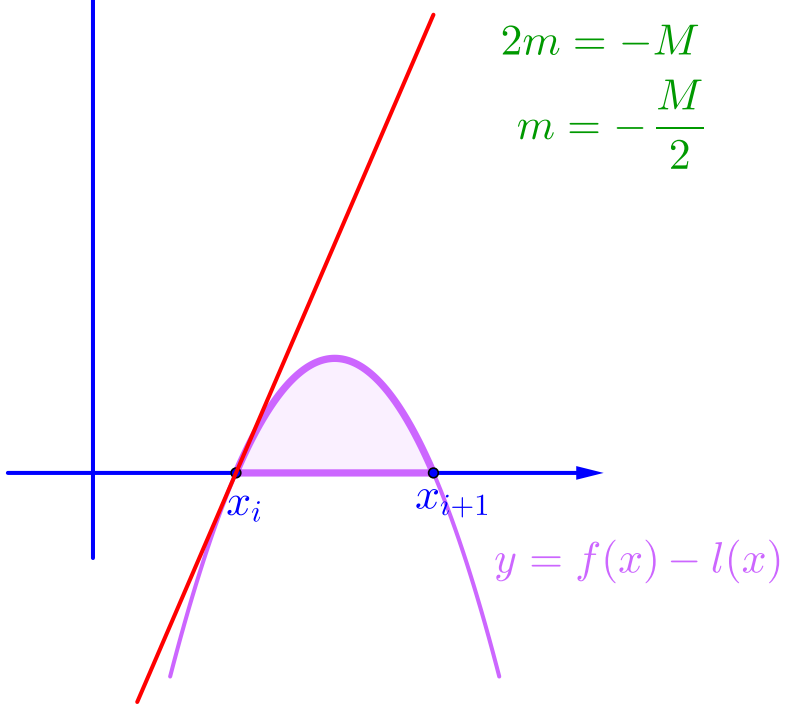

$$\int_{x_i}^{x_{i+1}} \left\{ -\frac{M}{2}(x - x_i)(x - x_{i+1}) \right\} dx = M \frac{(x_{i+1} - x_i)^3}{12}$$

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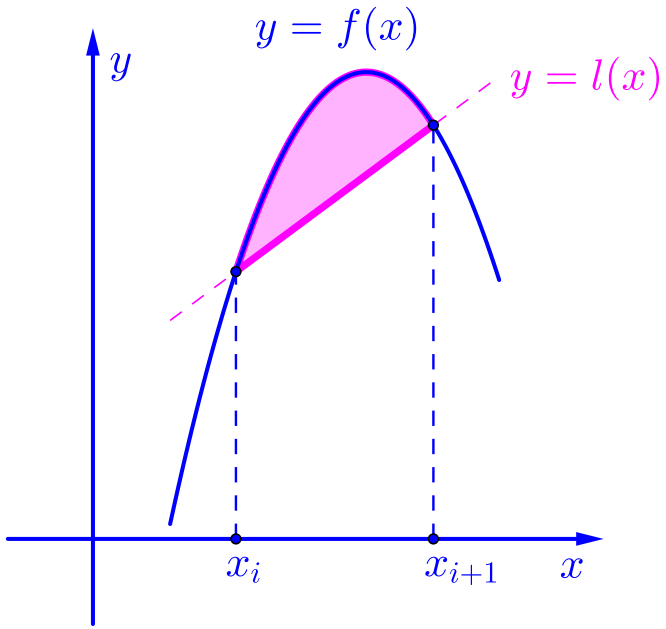

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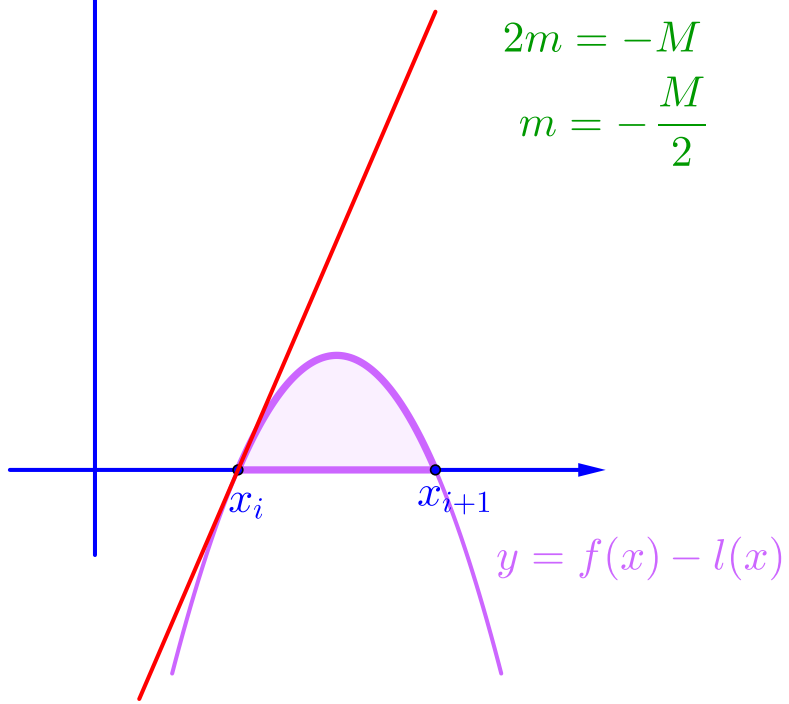

$$\int_{x_i}^{x_{i+1}} \left\{ -\frac{M}{2}(x-x_i)(x-x_{i+1}) \right\} dx = M\frac{(x_{i+1}-x_i)^3}{12} = M\frac{(b-a)^3}{12n^3}$$

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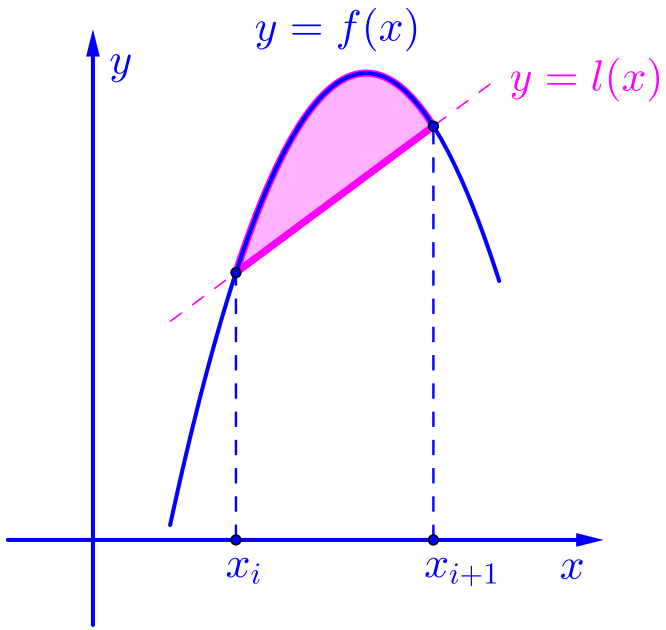

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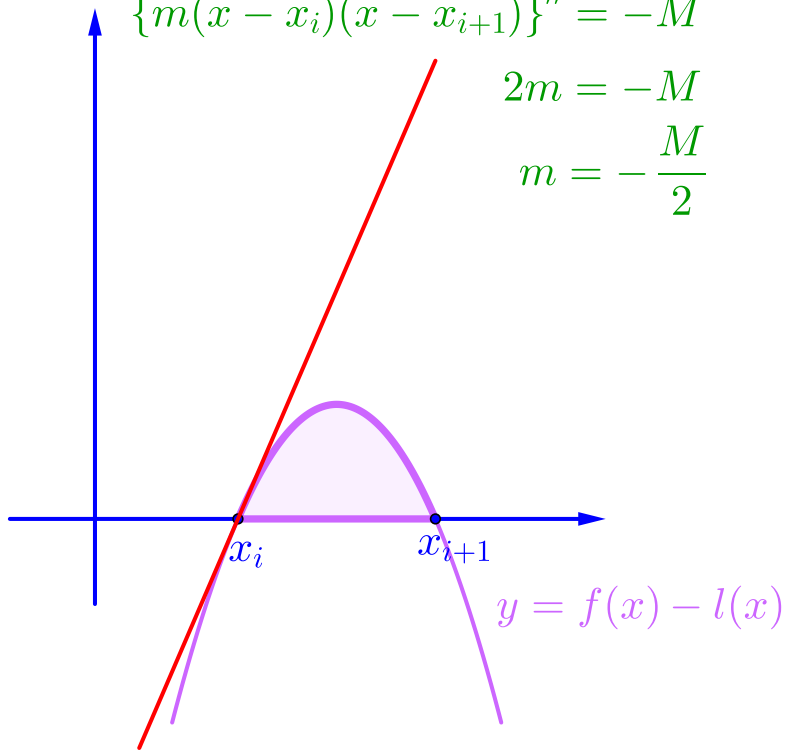

$$T_n = \sum_{i=1}^{n} \left\{ \Delta x \times \frac{f(x_{i-1}) + f(x_i)}{2} \right\}$$

$$\int_{x_i}^{x_{i+1}} \left\{ -\frac{M}{2}(x - x_i)(x - x_{i+1}) \right\} dx = M \frac{(x_{i+1} - x_i)^3}{12} = M \frac{(b-a)^3}{12n^3}$$

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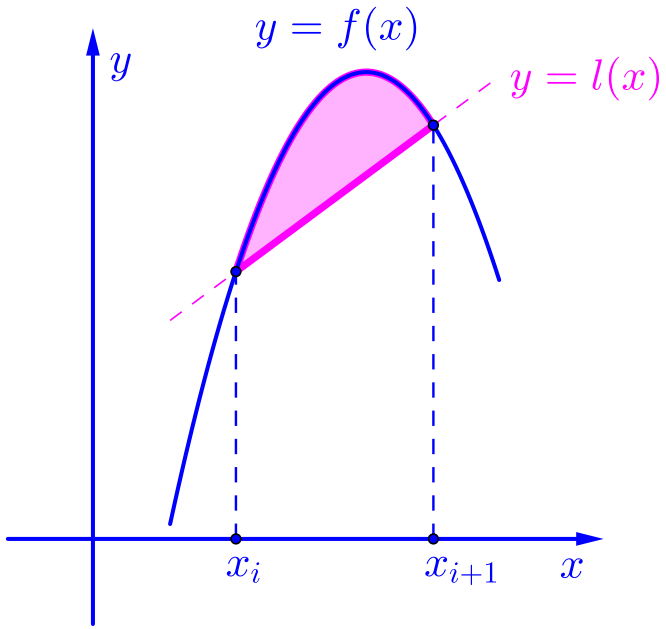

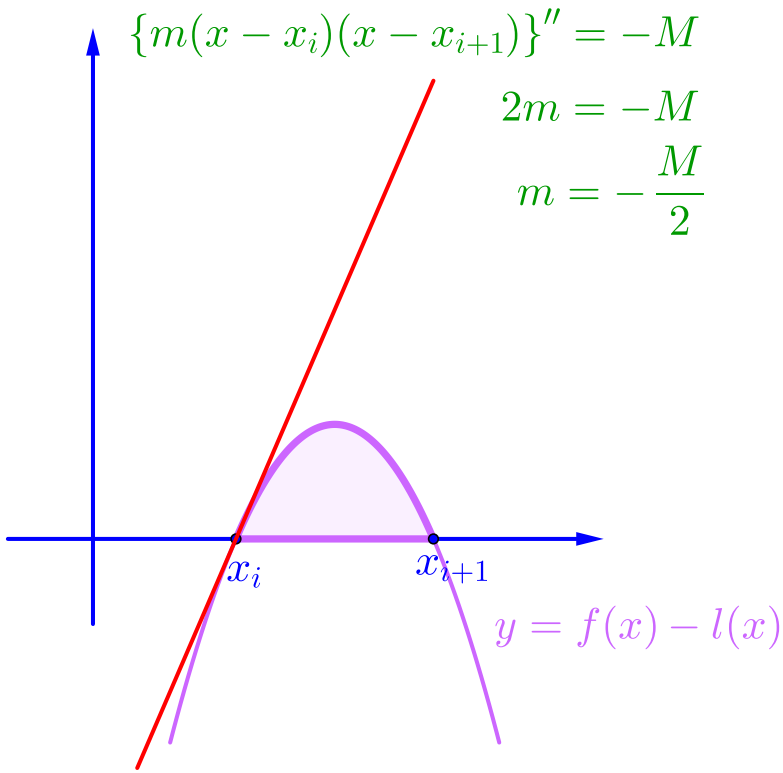

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$$\therefore \left| \int_a^b f(x)dx - T_n \right| \le M \frac{(b-a)^3}{12n^2}$$

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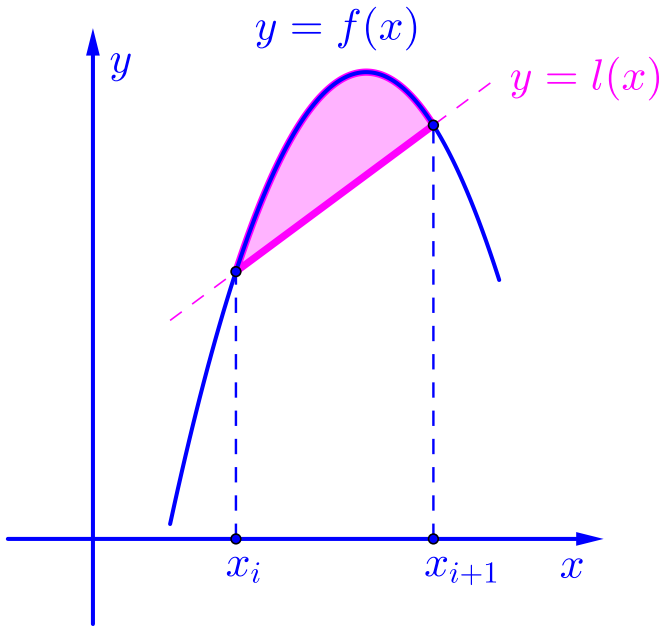

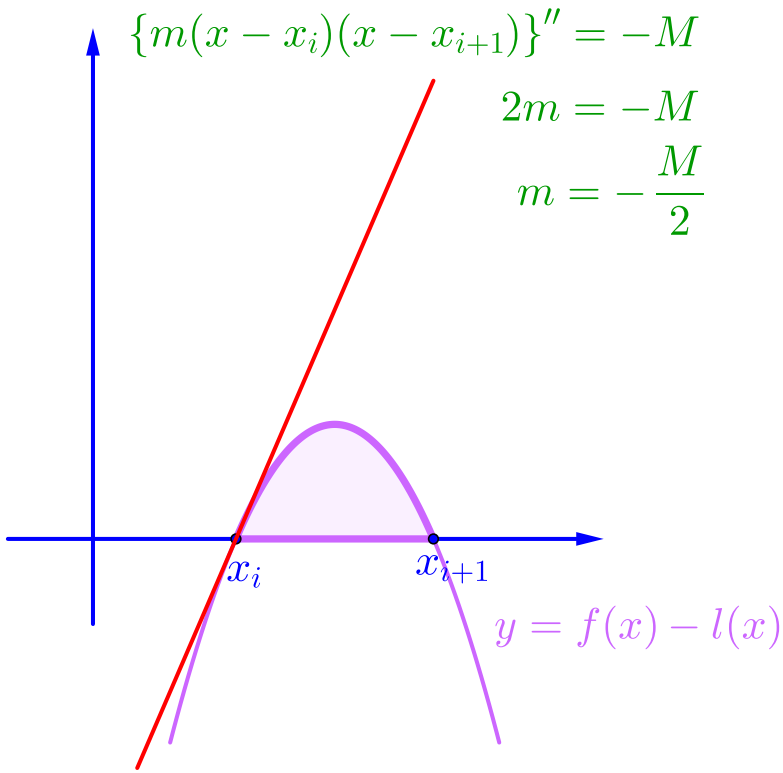

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$$\therefore \left| \int_a^b f(x)dx - T_n \right| \le M \frac{(b-a)^3}{12n^2}$$