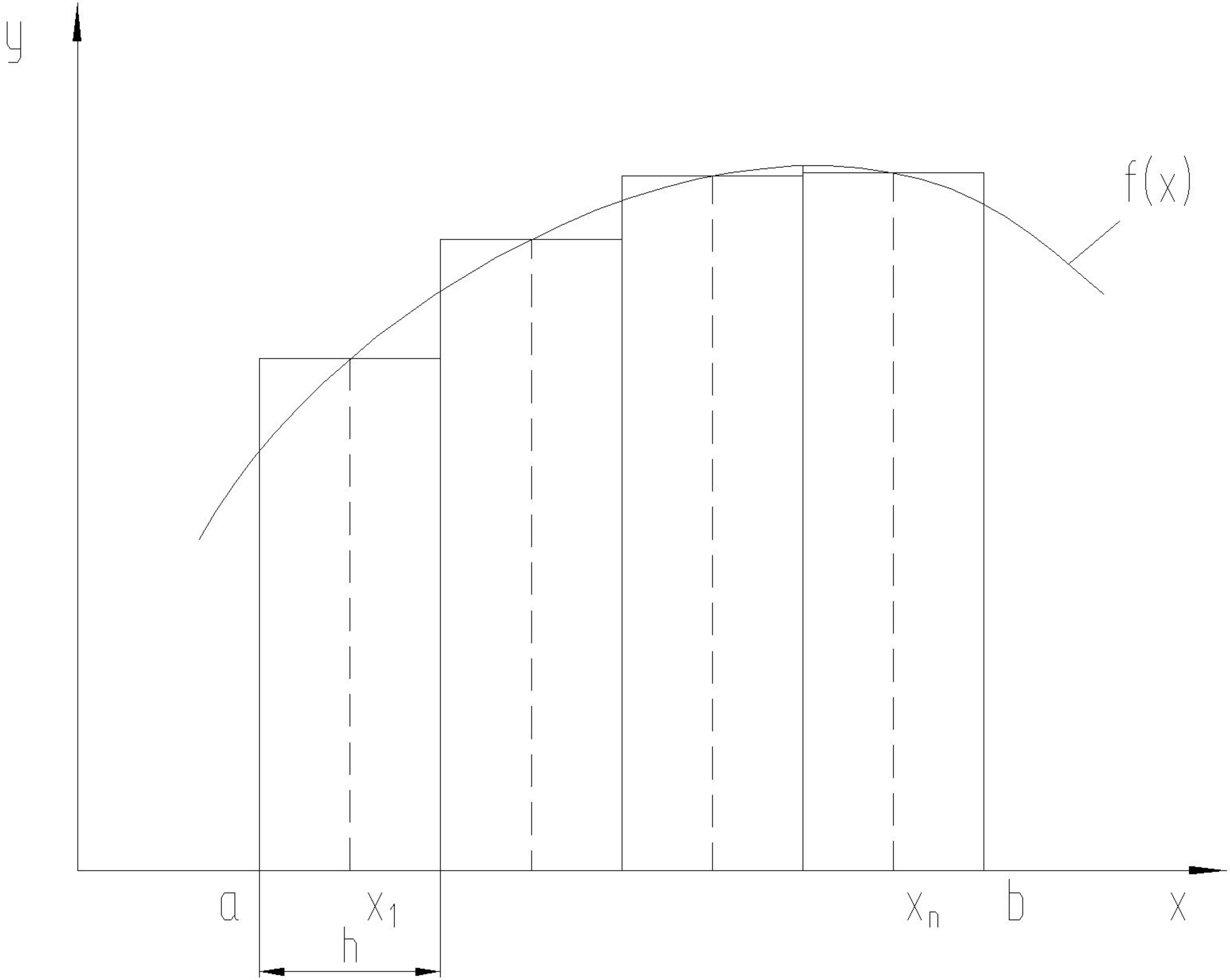
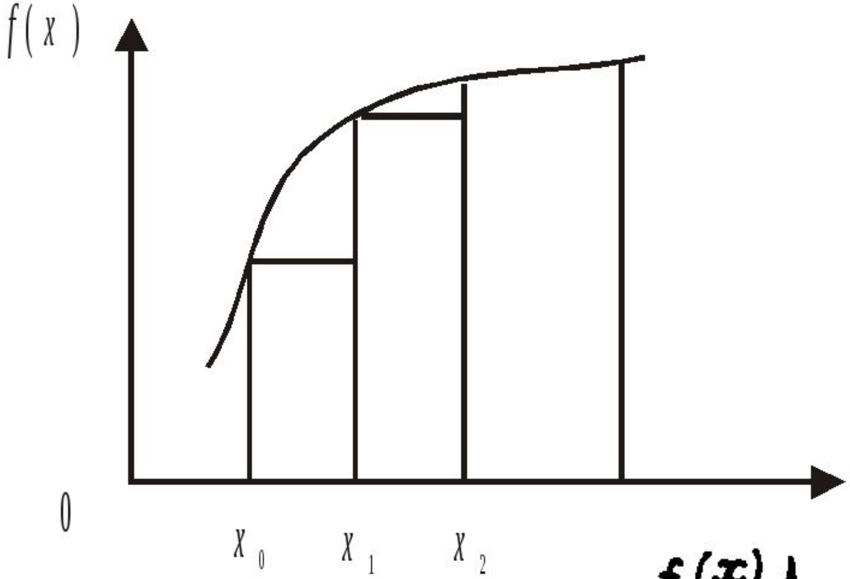
Approximate calculation of definite integrals

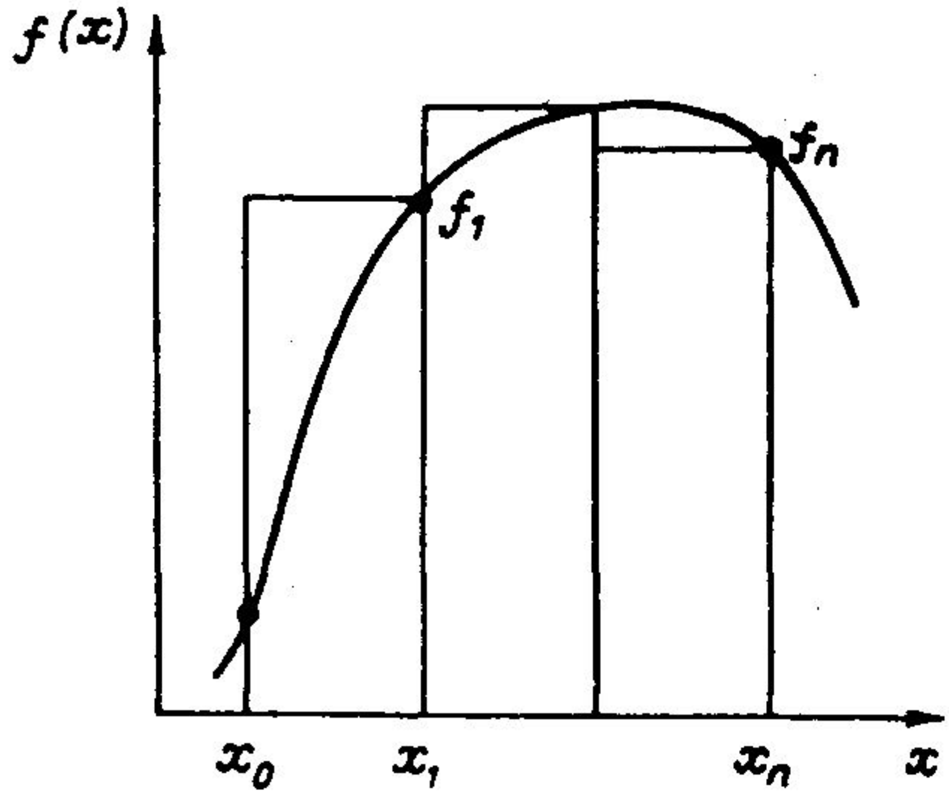
1. analytical method for integrals calculating
2. calculating integrals using the rectangle method
3. calculating integrals using the trapezoid method
4. calculating integrals using the parabolas method

2 CALCULATING INTEGRALS USING THE RECTANGLE METHOD

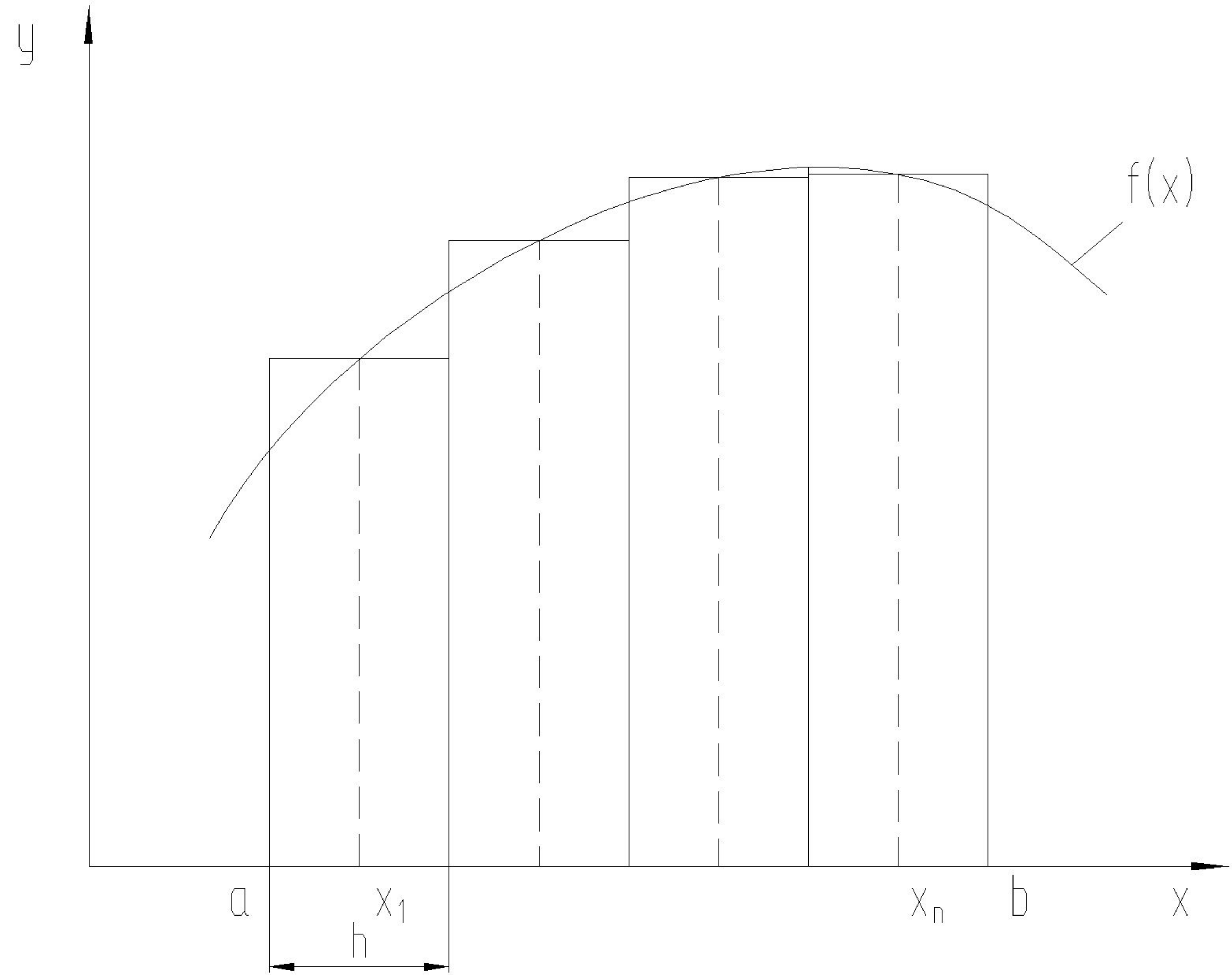

y
f(x)
a
x_1
x_n
b
x
h



f(x)
0
x0
x1
x2



f(x)
f1
fn
x0
x1
xn
x



y
f(x)
a
x1
h
xn
b
x

CALCULATING INTEGRALS USING THE RECTANGLE METHOD

- $y=f(x)$

continuous and differentiable on the [a; b]

$$\int_a^b f(x)dx\ ,\varepsilon$$

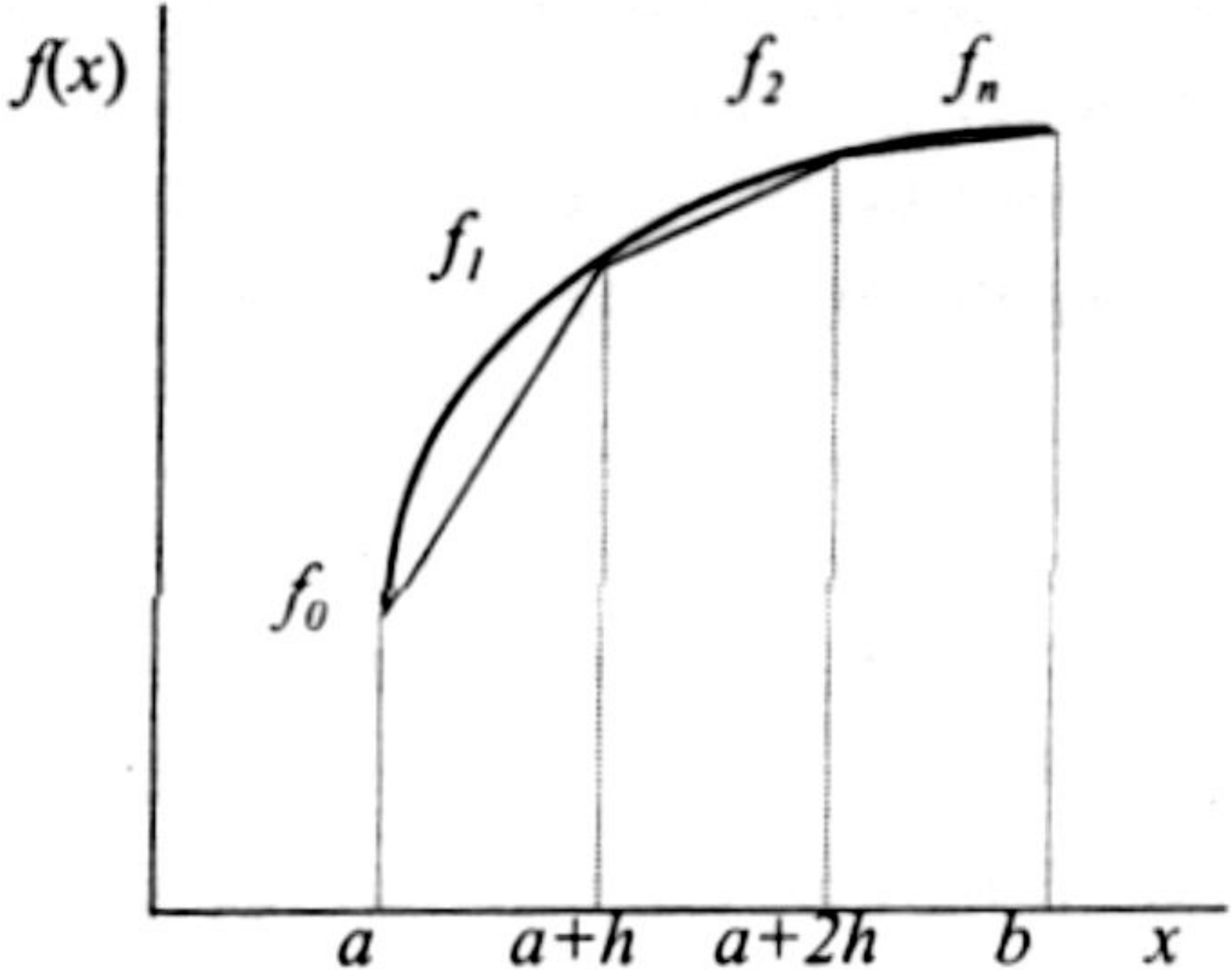
$$m = max\left(|f'(a)|, |f'(b)|, \left|f'\left(\frac{a+b}{2}\right)\right|\ \right),\ h = \sqrt{12 \cdot \frac{\varepsilon}{m(b-a)}}$$

$$n = \frac{b-a}{h},\ h = \frac{b-a}{n}$$

x				…		
y				…		

$$\int_a^b f(x)dx = h\left(\boldsymbol{f}\left(\boldsymbol{a}+\frac{\boldsymbol{h}}{\boldsymbol{2}}\right)+\boldsymbol{f}\left(\boldsymbol{a}+\frac{\boldsymbol{3h}}{\boldsymbol{2}}\right)\ +\cdots+\boldsymbol{f}\left(\boldsymbol{b}-\frac{\boldsymbol{h}}{\boldsymbol{2}}\right)\right)$$

CALCULATING INTEGRALS USING THE TRAPEZOID METHOD


f(x)
f2
fn
f1
f0
a
a+h
a+2h
b
x

CALCULATING INTEGRALS USING THE TRAPEZOID METHOD

- y=f(x) continuous and differentiable on the [a; b]

$$\int_a^b f(x)dx \;, \varepsilon$$

$$m = max\left(|f''(a)|, |f''(b)|, \left|f''\left(\frac{a+b}{2}\right)\right| \right), h = \sqrt{12 \cdot \frac{\varepsilon}{m(b-a)}}$$

$$n = \frac{b-a}{h}, h = \frac{b-a}{n}$$

x				…		
y				…		

$$\int_a^b f(x)dx = h\left(\frac{\boldsymbol{f(a)}}{2} + \boldsymbol{f(a+h)} + \boldsymbol{f(a+2h)} + \cdots + \boldsymbol{f(b-h)} + \frac{\boldsymbol{f(b)}}{2}\right)$$

THE SIMPSON METHOD

THE SIMPSON METHOD

y=f(x)

- continuous and differentiable on the [a; b]

$$\int_a^b f(x)dx \text{ , } \varepsilon$$

$$m = max\left(|f''''(a)|, |f''''(b)|, \left|f''''\left(\frac{a+b}{2}\right)\right| \right),\ h = \sqrt[4]{180 \cdot \frac{\varepsilon}{m(b-a)}}$$

$$n = \frac{b-a}{h},\ h = \frac{b-a}{n}$$

x						…		
y						…		

$$\int_a^b f(x)dx = \frac{h}{3}\left(f(a) + 4(\boldsymbol{f(a+h) + f(a+3h) + f(a+5h)} + \cdots) + 2(\boldsymbol{f(a+2h) + f(a+4h) + f(a+6h)} + \cdots) + \boldsymbol{f(b)}\right)$$