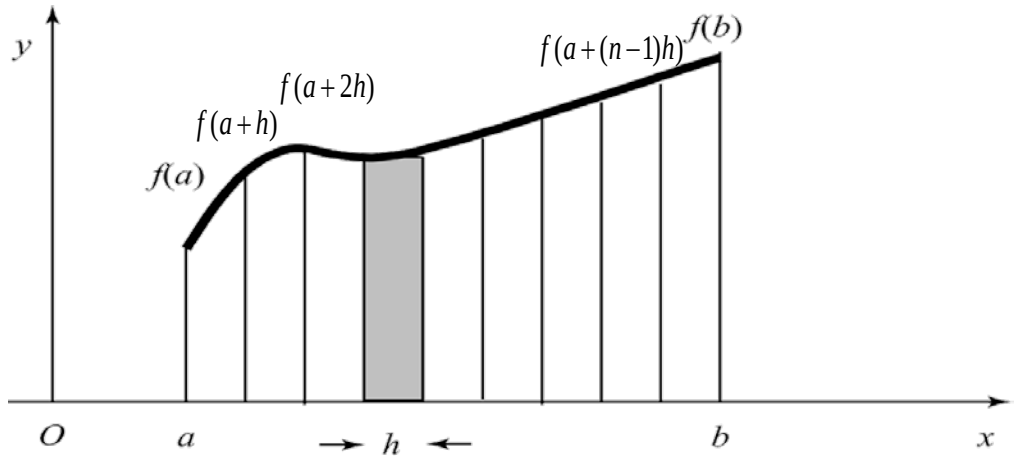
梯形法计算函数的定积分

- 如果不用**函数指针**编程…

$$y_1 = \int_0^1 (1+x^2)\mathrm{d}x$$

$$y_2 = \int_0^3 \frac{x}{1+x^2}\mathrm{d}x$$



n为区间等分数　　$h = \frac{b-a}{n}$

$$y = \frac{h}{2}(f(a)+f(a+h)) + \frac{h}{2}(f(a+h)+f(a+2h)) + \ldots + \frac{h}{2}(f(a+(n-1)h)+f(b))$$

$$= \frac{h}{2}(f(a)+2f(a+h)+2f(a+2h)+\ldots+2f(a+(n-1)h)+f(b))$$

$$= h(\frac{f(a)+f(b)}{2} + \sum_{i=1}^{n-1} f(a+i\cdot h))$$

梯形法计算函数的定积分

- 计算函数F1的定积分

$$y_1 = \int_0^1 (1 + x^2)\mathrm{d}x$$

$$y = h(\frac{f(a) + f(b)}{2} + \sum_{i=1}^{n-1} f(a + i \cdot h)) \qquad h = \frac{b-a}{n}$$

$$f_1(x) = 1 + x^2$$

```
float IntegralF1(float a, float b)
{
      float s, h;
      int n = 100, i;
      s = (F1(a) + F1(b)) / 2;
      h = (b - a) / n;
      for (i=1; i<n; i++)
      {
         s =  s + F1(a + i * h);
      }
      return s * h;
}
```

```
float F1(float x)
{
   return 1 + x * x;
}
```

```
y1 = IntegralF1(0.0, 1.0);
```

梯形法计算函数的定积分

- 计算函数F2的定积分

$$y_2 = \int_0^3 \frac{x}{1+x^2}\,dx$$

$$y = h\left(\frac{f(a)+f(b)}{2} + \sum_{i=1}^{n-1} f(a+i\cdot h)\right) \qquad h = \frac{b-a}{n}$$

$$f_2(x) = \frac{x}{1+x^2}$$

```
float IntegralF2(float a, float b)
{
      float s, h;
      int n = 100, i;
      s = (F2(a) + F2(b)) / 2;
      h = (b - a) / n;
      for (i=1; i<n; i++)
      {
         s =  s + F2(a + i * h);
      }
      return s * h;
}
```

```
float F2(float x)
{
   return x /(1 + x * x);
}
```

```
y1 = IntegralF2(0.0, 3.0);
```

函数指针的典型应用

- 用函数指针编写计算任意函数定积分的**通用**函数

$$y = h(\frac{f(a)+f(b)}{2} + \sum_{i=1}^{n-1} f(a+i\cdot h)) \qquad h = \frac{b-a}{n}$$

```
float Integral(float (*f)(float), float a, float b)
{
   float s, h;
   int n = 100, i;
   s = ((*f)(a) + (*f)(b)) / 2;
   h = (b - a) / n;
   for (i=1; i<n; i++)
   {
      s = s + (*f)(a + i * h);
   }
   return s * h;
}
```

$$y = \int_a^b f(x)\mathrm{d}x$$

$$f_1(x) = 1 + x^2$$

$$f_2(x) = \frac{x}{1+x^2}$$

```
y1 = Integral(F1, 0.0, 1.0);
y2 = Integral(F2, 0.0, 3.0);
```