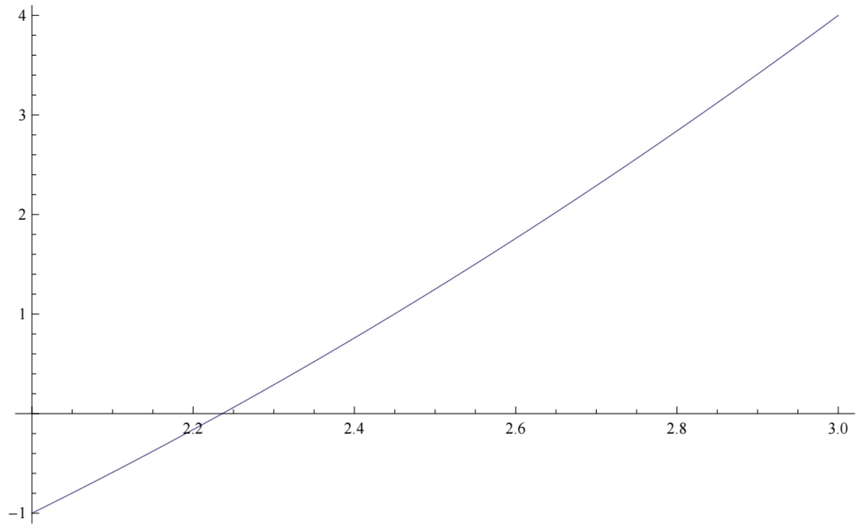
```
In[196]:= f[x_] = x^2 - 5;
a = 2;
b =  3;
e = 0.01;
n = 10;
If[f[a] * f[b] > 0, Print["take another value"],
      For[i = 0, i < n, i ++,
                 p = b - f[b] * (b - a)/(f[b] - f[a]);
                 Print["the root at ", i, "th iteration:", N[p]];

                 If[f[p] * f[b] > 0, a = p, b = p]];];
Plot[f[x], {x, 2, 3}]     I
```

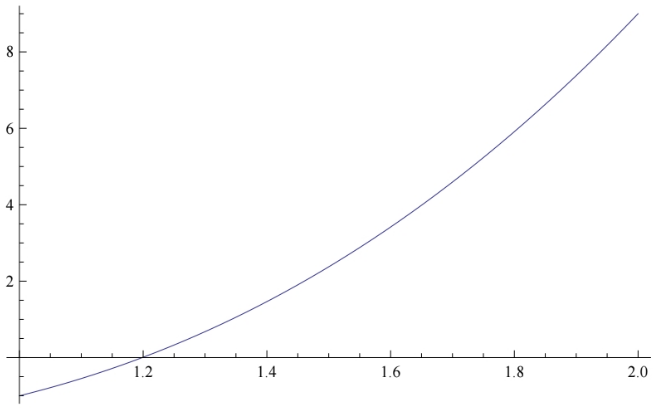
```
the root at 0th iteration:2.2
the root at 1th iteration:2.2381
the root at 2th iteration:2.23596
the root at 3th iteration:2.23607
the root at 4th iteration:2.23607
the root at 5th iteration:2.23607
the root at 6th iteration:2.23607
the root at 7th iteration:2.23607
the root at 8th iteration:2.23607
the root at 9th iteration:2.23607
```

Out[202]= ⅈ



```
f[x_] = x^3 + 2 x^2 - 3 x - 1;
a = 1;
b =  2;
e = 0.01;
n = 10;
Print["the secant method"];
   For[i = 0, i < n, i++,
            p = b - f[b] * (b - a) / (f[b] - f[a]);
            Print["the root at ", i, "th iteration:", N[p]];

             a = b;
            b = p;];
Plot[f[x], {x, 1, 2}]
NSolve[f[x] == 0, x]
```

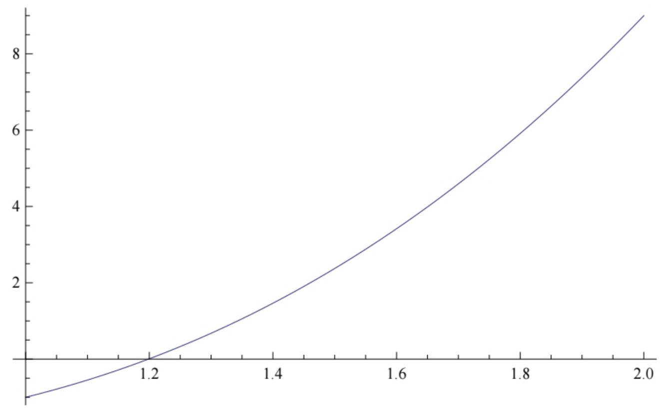
```
the secant method
the root at 0th iteration:1.1
the root at 1th iteration:1.15174
the root at 2th iteration:1.20345
the root at 3th iteration:1.19848
the root at 4th iteration:1.19869
the root at 5th iteration:1.19869
the root at 6th iteration:1.19869
the root at 7th iteration:1.19869
the root at 8th iteration:1.19869
the root at 9th iteration:1.19869
```



$\{\{x \to -2.91223\}, \{x \to -0.286462\}, \{x \to 1.19869\}\}$

```
f[x_] = x^3 + 2 x^2 - 3 x - 1;
df[x_]  = D[f[x], x];
a = 1;
e = 0.0001;
n = 10;
Print["the newton raphson method"];
    For[i = 0, i < n, i++,
                p = a - f[a]/df[a];
                Print["the root at ", i, "th iteration:", N[p]];
             If[Abs[p - a] > e, Print[e];];
                 a = p;
               ];
Plot[f[x], {x, 1, 2}]
NSolve[f[x] == 0, x]
```

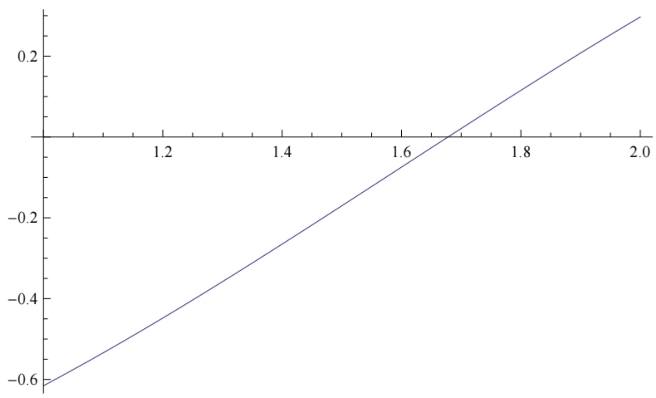
```
the newton raphson method
the root at 0th iteration:1.25
0.0001
the root at 1th iteration:1.20093
0.0001
the root at 2th iteration:1.1987
0.0001
the root at 3th iteration:1.19869
the root at 4th iteration:1.19869
the root at 5th iteration:1.19869
the root at 6th iteration:1.19869
the root at 7th iteration:1.19869
the root at 8th iteration:1.19869
the root at 9th iteration:1.19869
```




```
{{x → -2.91223}, {x → -0.286462}, {x → 1.19869}}
```

```
f[x_] = Log[e, 1 + x] - Cos[x];
df[x_]  = D[f[x], x];
a = 1;
e = 0.0001;
n = 10;
Print["the newton raphson method"];
    For[i = 0, i < n, i ++,
            p = a - f[a]/df[a];
            Print["the root at ", i, "th iteration:", N[p]];
         If[Abs[p - a] > e, Print[p - a];];
            a = p;
         ];
Plot[f[x], {x, 1, 2}]
NSolve[f[x] == 0, x]
```

```
the newton raphson method
the root at 0th iteration:1.78198
0.781977
the root at 1th iteration:1.67702
-0.104954
the root at 2th iteration:1.67795
0.000928761
the root at 3th iteration:1.67795
the root at 4th iteration:1.67795
the root at 5th iteration:1.67795
the root at 6th iteration:1.67795
the root at 7th iteration:1.67795
the root at 8th iteration:1.67795
the root at 9th iteration:1.67795
```




```
NSolve[-Cos[x] - 0.108574 Log[1 + x] == 0, x]
```

```
(*gauss jacobi*)
n = 3;
a = {{5, 2, 1}, {3, 7, 4}, {1, 1, 9}};
MatrixForm[a]
x = {0, 0, 0};
y = {0, 0, 0};
b = {10, 21, 12};
For[k = 1, k ≤ 25, k++,
    For[i = 1, i ≤ n, i++,
    y[[i]] = (b[[i]] - Sum[a[[i, j]] * x[[j]], {j, 1, i - 1}] -
       Sum[a[[i, j]] * x[[j]], {j, i + 1, n}]) / a[[i, i]]];
 For[m = 1, m ≤ n, m++, x[[m]] = N[y[[m]]]]]
For[p = 1, p ≤ n, p++, Print["x[", b, "]=", x[[p]]]]
```

$$\begin{pmatrix} 5 & 2 & 1 \\ 3 & 7 & 4 \\ 1 & 1 & 9 \end{pmatrix}$$

```
x[{10, 21, 12}]=1.
x[{10, 21, 12}]=2.
x[{10, 21, 12}]=1.
```

```
(*(gauss siedel)*)
n = 3;
a = {{5, 2, 1}, {3, 7, 4}, {1, 1, 9}};
MatrixForm[a]
x = {0, 0, 0};
y = {0, 0, 0};
b = {10, 21, 12};
For[k = 1, k ≤ 25, k++,
    For[i = 1, i ≤ n, i++,
    y[[i]] = (b[[i]] - Sum[a[[i, j]] * y[[j]], {j, 1, i - 1}] -
       Sum[a[[i, j]] * y[[j]], {j, i + 1, n}]) / a[[i, i]]];
 For[m = 1, m ≤ n, m++, x[[m]] = N[y[[m]]]]]
For[p = 1, p ≤ n, p++, Print["x[", b, "]=", x[[p]]]]
```

$$\begin{pmatrix} 5 & 2 & 1 \\ 3 & 7 & 4 \\ 1 & 1 & 9 \end{pmatrix}$$

```
x[{10, 21, 12}]=1.
x[{10, 21, 12}]=2.
x[{10, 21, 12}]=1.
```

```
n = 3;
a = {{1, 2, 0}, {1, 3, 3}, {0, 3, 10}};
MatrixForm[a]
x = {0, 0, 0};
y = {0, 0, 0};
b = {10, 17, 22};
For[k = 1, k ≤ 100, k++,
    For[i = 1, i ≤ n, i++,
    y[[i]] = (b[[i]] - Sum[a[[i, j]] * x[[j]], {j, 1, i - 1}] -
      Sum[a[[i, j]] * x[[j]], {j, i + 1, n}]) / a[[i, i]]];
 For[m = 1, m ≤ n, m++, x[[m]] = N[y[[m]]]]]
For[p = 1, p ≤ n, p++, Print["x[", p, "]=", x[[p]]]]
```

$$\begin{pmatrix} 1 & 2 & 0 \\ 1 & 3 & 3 \\ 0 & 3 & 10 \end{pmatrix}$$

```
x[1]=5.20304

x[2]=4.6673

x[3]=1.48046
```

```
n = 3;
a = {{1, 2, 0}, {1, 3, 3}, {0, 3, 10}};
MatrixForm[a]
x = {0, 0, 0};
y = {0, 0, 0};
b = {10, 17, 22};
For[k = 1, k ≤ 100, k++,
    For[i = 1, i ≤ n, i++,
    y[[i]] = (b[[i]] - Sum[a[[i, j]] * y[[j]], {j, 1, i - 1}] -
      Sum[a[[i, j]] * y[[j]], {j, i + 1, n}]) / a[[i, i]]];
 For[m = 1, m ≤ n, m++, x[[m]] = N[y[[m]]]]]
For[p = 1, p ≤ n, p++, Print["x[", p, "]=", x[[p]]]]
```

$$\begin{pmatrix} 1 & 2 & 0 \\ 1 & 3 & 3 \\ 0 & 3 & 10 \end{pmatrix}$$

```
x[1]=2.12023

x[2]=3.94189

x[3]=1.01743
```

Part::partw : Part 4 of {0, 0, 0} does not exist. ≫

Part::partw : Part 4 of {0, 0, 0} does not exist. ≫

Part::partw : Part 4 of {0, 0, 0} does not exist. ≫

General::stop : Further output of Part::partw will be suppressed during this calculation. ≫

Set::partw : Part 4 of $\left\{-\frac{1}{2}, 0, \frac{1}{2}\{0, 0, 0\}[\![4]\!]\right\}$ does not exist. ≫

Set::partw : Part 4 of {−0.5, 0., 0.5 {0., 0., 0.}[[4]]} does not exist. ≫

Set::partw : Part 4 of $\left\{-0.5, \frac{1}{2}(-0.5 + 0.5\{0., 0., 0.\}[\![4]\!]), \frac{1}{2}(0. + \{-0.5, 0., 0.5\{\ll 3 \gg\}[\![4]\!]\}[\![4]\!])\right\}$ does not exist. ≫

General::stop : Further output of Set::partw will be suppressed during this calculation. ≫

In[44]:=

In[211]:=

```
Clear[x];
sum = 0;
points = {{1, 2}, {2, 5}, {3, 10}}
No = Length[points];
Print["given values of x[i] are as follows : ", y = points[[All, 1]]]
Print["given values of f[x,[i]] are as follows:", f = points[[All, 2]]]
lagrange[No_, n_] := Product[If[Equal[k, n], 1,
                  (x - y[[k]]) / (y[[n]] - y[[k]])], {k, 1, No}]
For[i = 1, i ≤ No, i++,
 sum += (f[[i]] * lagrange[No, i])]
Print[sum]
Print["the polynomial function will be :", Expand[sum]]
Print["Poynomial at x=2.5 is :", sum /. x → 2.5]
```

Out[213]= {{1, 2}, {2, 5}, {3, 10}}

given values of x[i] are as follows : {1, 2, 3}

given values of f[x,[i]] are as follows:{2, 5, 10}

$(2 - x)\ (3 - x) + 5\ (3 - x)\ (-1 + x) + 5\ (-2 + x)\ (-1 + x)$

the polynomial function will be :$1 + x^2$

Poynomial at x=2.5 is :7.25

```
In[86]:= f[x_] = x^2 - 5;
a = 2;
b =  3;
c = 0;
e = 0.01;
n = 10;
Print["bisection"]
If[f[a] * f[b] > 0, Print["take another value"],
      For[i = 0, i < n, i++,
                  c = (b + a)/(2);
                  Print["the root at ", i, "th iteration:", N[p]];
                  If[f[c] * f[b] > 0, a = c, b = c]];];
```

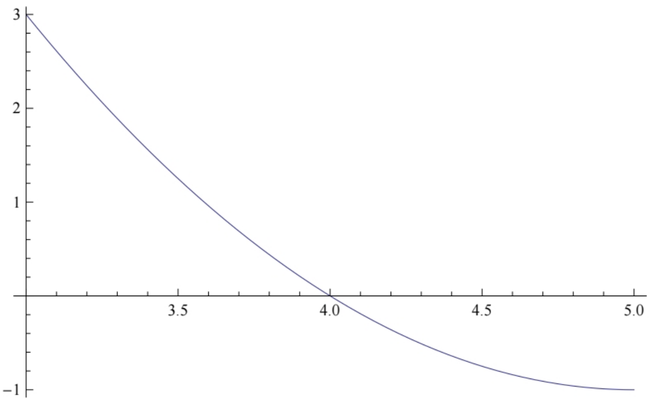
```
bisection
the root at 0th iteration:2.23607
the root at 1th iteration:2.23607
the root at 2th iteration:2.23607
the root at 3th iteration:2.23607
the root at 4th iteration:2.23607
the root at 5th iteration:2.23607
the root at 6th iteration:2.23607
the root at 7th iteration:2.23607
the root at 8th iteration:2.23607
the root at 9th iteration:2.23607
```

```
In[203]:= f[x_] = x^2 - 10 x + 24;
a = 2
b = 5
c = 0;
n = 10;
e = 0.01;
If[f[a] * f[b] > 0, Print["take another value"],
        For[i = 0, i ≤ 10, i++,
                   c = (a + b)/2;
                   Print["the root at ,", i, "th iteration is:,", N[c]];
                  If[Abs[f[c] - f[a]] ≤ e, Break,
                   If[f[c] * f[b] > 0, a = c, b = c]]];];

Plot[f[x], {x, 3, 5}]
```

```
Out[204]= 2

Out[205]= 5
```

```
the root at ,0th iteration is:,3.5
the root at ,1th iteration is:,2.75
the root at ,2th iteration is:,3.125
the root at ,3th iteration is:,3.3125
the root at ,4th iteration is:,3.40625
the root at ,5th iteration is:,3.45313
the root at ,6th iteration is:,3.47656
the root at ,7th iteration is:,3.48828
the root at ,8th iteration is:,3.49414
the root at ,9th iteration is:,3.49707
the root at ,10th iteration is:,3.49707
```

Out[210]=



In[222]:=

```
Clear[x];
sum = 0;
points = {{1, 2}, {2, 5}, {3, 10}}
No = Length[points];
Print["given values of x[i] are as follows : ", y = points[[All, 1]]]
Print["given values of f[x,[i]] are as follows:", f = points[[All, 2]]]
lagrange[No_, n_] := Product[If[Equal[k, n], 1,
                      (x - y[[k]]) / (y[[n]] - y[[k]])], {k, 1, No}]
For[i = 1, i ≤ No, i++,
 sum += (f[[i]] * lagrange[No, i])]
Print[sum]
Print["the polynomial function will be :", Expand[sum]]
Print["Poynomial at x=2.5 is :", sum /. x → 2.5]
```

Out[224]= {{1, 2}, {2, 5}, {3, 10}}

```
given values of x[i] are as follows : {1, 2, 3}
given values of f[x,[i]] are as follows:{2, 5, 10}
(2 - x) (3 - x) + 5 (3 - x) (-1 + x) + 5 (-2 + x) (-1 + x)
```

the polynomial function will be :$1 + x^2$

```
Poynomial at x=2.5 is :7.25
```

```
In[1]:= a = Input["enter the left hand point of the interval"]
        b = Input["enter the right hand point of the interval"]
        h = b - a;
        f[x_] := 1/x;
        tz = (h/2) * ((f[x] /. x → a) + (f[x] /. x → b));
        Print["trapezoidal estimate is:", tz]
Out[1]= 2
Out[2]= 4
        trapezoidal estimate is: 3/4
```

```
In[40]:= a = Input["enter the left hand point of the interval"]
         b = Input["enter the right hand point of the interval"]
         h = (b - a) / 2;
         c = (a + b) / 2
         f[x_] := 1/x;
         tz = (h/3) * (f[a] + 4 f[a + h] + f[b]);
         Print["simpson estimate is:", tz]
Out[40]= 2
Out[41]= 4
Out[43]= 3
         simpson estimate is: 25/36
```

```
In[47]:= a = Input["enter the left hand point of the interval"]
         b = Input["enter the right hand point of the interval"]
         h = b - a;
         f[x_] := 1 / (x^2);
         tz = (h/2) * (f[a] + f[b]);
         Print["trapezoidal estimate is:", tz]
Out[47]= 1
Out[48]= 2
         trapezoidal estimate is: 5/8
```

```
In[53]:= a = Input["enter the left hand point of the interval"]
         b = Input["enter the right hand point of the interval"]
         h = (b - a) / 2;
         c = (a + b) / 2
         f[x_] := 1 / (x^2);
         tz = (h/3) * (f[a] + 4 f[a + h] + f[b]);
         Print["simpson estimate is:", tz]
Out[53]= 1
Out[54]= 2
Out[56]= 3/2
```

simpson estimate is: $\frac{109}{216}$

```
In[79]:= a = Input["enter the left hand point of the interval"]
         b = Input["enter the right hand point of the interval"]
         h = (b - a) / 2;
         c = (a + b) / 2
         f[x_] := Sin[x];
         tz = (h/3) * (f[a] + 4 f[a + h] + f[b]);
         Print["simpson estimate is:", N[tz]]
Out[79]= 1
Out[80]= 2
Out[82]= 3/2
         simpson estimate is:0.956791
```

```
In[73]:= a = Input["enter the left hand point of the interval"]
         b = Input["enter the right hand point of the interval"]
         h = b - a;
         f[x_] := Sin[x];
         tz = (h/2) * (f[a] + f[b]);
         Print["trapezoidal estimate is:", N[tz]]
Out[73]= 1
Out[74]= 2
         trapezoidal estimate is:0.875384
```

In[1]:=
```
f[x_, y_] = (y - x) / (y + x);
y[1] = 1;
x[1] = 0;
h = 0.02;
For[i = 1, i < 7, i++, x[i + 1] = x[i] + h;
        y[i + 1] = y[i] + h * (f[x[i], y[i]]);
 Print[{x[i], y[i]}]]
```

```
{0, 1}
{0.02, 1.02}
{0.04, 1.03923}
{0.06, 1.05775}
{0.08, 1.0756}
{0.1, 1.09283}
```

In[31]:=
```
f[x_, y_] = x * (y + 1);
y[1] = 1;
x[1] = 0;
h = 0.2;
For[i = 1, i < 7, i++, x[i + 1] = x[i] + h;
        y[i + 1] = y[i] + h * (f[x[i], y[i]]);
 Print["at x=", x[i], "\tvalue is\t:", {x[i], y[i]}]]
```

```
at x=0    value is    :{0, 1}
at x=0.2    value is    :{0.2, 1.}
at x=0.4    value is    :{0.4, 1.08}
at x=0.6    value is    :{0.6, 1.2464}
at x=0.8    value is    :{0.8, 1.51597}
at x=1.    value is    :{1., 1.91852}
```

In[26]:=
```
f[x_, y_] = x + y;
y[1] = 1;
x[1] = 0;
h = 0.1;
For[i = 1, i < 7, i++, x[i + 1] = x[i] + h;
        y[i + 1] = y[i] + h * (f[x[i], y[i]]);
 Print["at x=", x[i], "\tvalue is\t:", {x[i], y[i]}]]
```

```
at x=0    value is    :{0, 1}
at x=0.1    value is    :{0.1, 1.1}
at x=0.2    value is    :{0.2, 1.22}
at x=0.3    value is    :{0.3, 1.362}
at x=0.4    value is    :{0.4, 1.5282}
at x=0.5    value is    :{0.5, 1.72102}
```

```
In[41]:= f[x_, y_] = 4 * Exp[0.5 * x] - 0.5 * y;
y[1]  = 2;
x[1] = 0;
h = 1;
For[i = 1, i < 7, i++, x[i + 1]  = x[i] + h;
        y[i + 1] = y[i] + h * (f[x[i], y[i]]);
 Print["at x=", x[i], "\tvalue is\t:", {x[i], y[i]}]]
```

```
at x=0    value is    :{0, 2}

at x=1    value is    :{1, 5.}

at x=2    value is    :{2, 9.09489}

at x=3    value is    :{3, 15.4206}

at x=4    value is    :{4, 25.637}

at x=5    value is    :{5, 42.3747}
```

```
In[6]:= f[x_, y_] = -2 * y;
x1 = 0;
y1 = 3;
h = 0.2;
For[i = 1, i ≤ 5, i++,
 k1 = N[f[x1, y1]];
 k2 = N[f[x1 + h / 2, y1 + k1 * h / 2]];
 y2 = N[y1 + k2 * h];
 x1 = x1 + h;
 Print["the value at x=", x1, ":y=", y2];
 y1 = y2;
]
```

```
the value at x=0.2:y=2.04

the value at x=0.4:y=1.3872

the value at x=0.6:y=0.943296

the value at x=0.8:y=0.641441

the value at x=1.:y=0.43618
```

```
In[1]:= f[x_, y_] = (y - x) / (y + x);
y[1] = 1;
x[1] = 0;
h = 0.02;
For[i = 1, i < 7, i++, x[i + 1] = x[i] + h;
        y[i + 1] = y[i] + h * (f[x[i], y[i]]);
 Print[{x[i], y[i]}]]
{0, 1}
{0.02, 1.02}
{0.04, 1.03923}
{0.06, 1.05775}
{0.08, 1.0756}
{0.1, 1.09283}
```

```
In[66]:= f[x_, y_] = x * (y + 1);
y[1] = 1;
x[1] = 0;
h = 0.2;
For[i = 1, i < 7, i++, x[i + 1] = x[i] + h;
        y[i + 1] = y[i] + h * (f[x[i], y[i]]);
 Print["at x=", x[i], "\tvalue is\t:", {x[i], y[i]}]]
at x=0    value is    :{0, 1}
at x=0.2    value is    :{0.2, 1.}
at x=0.4    value is    :{0.4, 1.08}
at x=0.6    value is    :{0.6, 1.2464}
at x=0.8    value is    :{0.8, 1.51597}
at x=1.    value is    :{1., 1.91852}
```

```
In[26]:= f[x_, y_] = x + y;
y[1] = 1;
x[1] = 0;
h = 0.1;
For[i = 1, i < 7, i++, x[i + 1] = x[i] + h;
        y[i + 1] = y[i] + h * (f[x[i], y[i]]);
 Print["at x=", x[i], "\tvalue is\t:", {x[i], y[i]}]]
at x=0    value is    :{0, 1}
at x=0.1    value is    :{0.1, 1.1}
at x=0.2    value is    :{0.2, 1.22}
at x=0.3    value is    :{0.3, 1.362}
at x=0.4    value is    :{0.4, 1.5282}
at x=0.5    value is    :{0.5, 1.72102}
```

```
In[71]:= f[x_, y_] = 4 * Exp[0.5 * x] - 0.5 * y;
y[1] = 2;
x[1] = 0;
h = 1;
For[i = 1, i < 6, i++, x[i + 1] = x[i] + h;
        y[i + 1] = y[i] + h * (f[x[i], y[i]]);
  Print["at x=", x[i], "\tvalue is\t:", {x[i], y[i]}]]
```

```
at x=0    value is    :{0, 2}

at x=1    value is    :{1, 5.}

at x=2    value is    :{2, 9.09489}

at x=3    value is    :{3, 15.4206}

at x=4    value is    :{4, 25.637}
```