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Practical 14
Runge-Kutta methods

Approximating solution to initial value problems using Runge-Kutta method.

```
In[17]:= RungeKutta[a0_, b0_, h0_, f_, y0_] :=
          Module[{a = a0, b = b0, n, h = h0, xi, k1, k2, k3, k4}, n = (b - a) / h;
           xi = Table[a + (j - 1) X h, {j, 1, n + 1}];
           yi = Table[0, {n + 1}];
           yi[[1]] = y0;
           OutputDetails = {{0, xi[[1]], y0}};
           For[i = 1, i c n, i++,
            k1 = h X f[xi[[i]], yi[[i]]];
            k2 = h X f[xi[[i]] + h / 2, yi[[i]] + k1 / 2];
            k3 = h X f[xi[[i]] + h / 2, yi[[i]] + k2 / 2];
            k4 = h X f[xi[[i]] + h, yi[[i]] + k3];
            yi[[i + 1]] = yi[[i]] + ((k1 + 2 X k2 + 2 X k3 + k4) / 6);
            OutputDetails = Append [OutputDetails,  {i, N [xi [[i + 1]]], N[yi[[i + 1]]]}];];
           Print[NumberForm[
             TableForm  OutputDetails, TableHeadings C  None,  "i", "xi", "yi"    , 6 ; ;
```

(i) y’[x] = f[x,y] = 2 x + y ; y[x0] = y0

```
In[18]:= f [x_, y_] := 2 X x + y
         Print["f(x,y)=", f[x, y]]
         yi = RungeKutta  0, 1, 0.2, f, 1  ;

         f  x,y  =2 x + y

         i    xi     yi
         ────────────────
         0    0.     1
         1    0.2    1.2642
         2    0.4    1.67545
         3    0.6    2.26632
         4    0.8    3.07656
         5    1.     4.15475
```