Осипов Н.С., ПМ - 1801
2.3.3.a2
Метод секущих
как дискретная модификация метода Ньютона;
Простейшие аппроксимации частных производных.

In[598]:=
```
secMeth[f_, x_, app_] := Module[{G = ConstantArray[0, {Length@x, Length@x}],
    x0 = ConstantArray[app, Length@x], ξ = app, xk, mode = 0, k = 1, Ginv, res, test},
   xk = x0;
   While[mode == 0,

    For[i = 1, i ≤ Length@f, i++,
     For[j = 1, j ≤ Length@x, j++,
      G[[i, j]] = D[f[[i]], x[[j]]]]];

    Ginv = Inverse@G;
    res = xk - Ginv.f;

    For[i = 1, i ≤ Length@x, i++,
     res = (res /. x[[i]] :→ xk[[i]])];

    test = 0;
    For[i = 1, i ≤ Length@x, i++,
     If[Abs[res[[i]] - xk[[i]]] < ξ , test++]];

    If[test == Length@x, mode = 1, xk = res; k++]];
   {res, "iters = " <> ToString[k]}];
```

In[612]:=
```
exf1 = {x1^2 + x2, x1 + x2 + 6};
exx1 = {x1, x2};
secMeth[exf1, exx1, 0.001]
```

Out[614]=
```
{{-2., -4.}, iters = 6}
```

In[628]:=
```
({x1^2 + x2, x1 + x2 + 6} /. x1 :> -2.000000000028333`) /. x2 :> -3.999999999971667`
```

Out[628]=
$$\{1.41664 \times 10^{-10}, 0.\}$$

In[618]:=
```
exf2 = {7 * x1 * x2 + 2 * x1^2 - 4 * x2^2, x1^2 - 5 * x1 * x2 + x2 + 11};
exx2 = {x1, x2};
secMeth[exf2, exx2, 0.001]
```

Out[620]=
```
{{-1., -2.}, iters = 7}
```

In[625]:=
```
({7 * x1 * x2 + 2 * x1^2 - 4 * x2^2, x1^2 - 5 * x1 * x2 + x2 + 11} /. x1 :> -1.0000000000749885`) /.
 x2 :> -1.9999999994029627`
```

Out[625]=
$$\{6.72313 \times 10^{-9}, 2.98232 \times 10^{-9}\}$$

In[629]:=
```
exf3 = {Sin[x1 + x2] - 1.6 * x1, x1^2 + x2^2 - 1};
exx3 = {x1, x2};
secMeth[exf3, exx3, 0.001]
```

Out[631]=
```
{{0.616307, 0.787506}, iters = 18}
```

In[632]:=
```
({Sin[x1 + x2] - 1.6 * x1, x1^2 + x2^2 - 1} /. x1 :> 0.6163066467111622`) /.
 x2 :> 0.7875062648775043`
```

Out[632]=
$$\{-1.50158 \times 10^{-12}, 1.67533 \times 10^{-12}\}$$

In[605]:=
```
exf4 = {x1^2 + x2 - x3 + 7, x1 + x2 + x3 - 1, x1 + x2^2 + x3^2 - 63};
exx4 = {x1, x2, x3};
secMeth[exf4, exx4, 0.01]
```

Out[607]=
```
{{2., -6., 5.}, iters = 9}
```

In[633]:=
```
(({x1^2 + x2 - x3 + 7, x1 + x2 + x3 - 1, x1 + x2^2 + x3^2 - 63} /. x1 :> 2.0000004792643984`) /.
   x2 :> -6.0000002396321985`) /. x3 :> 4.999999760367801`
```

Out[633]=
$$\{1.91706 \times 10^{-6}, 8.88178 \times 10^{-16}, 9.58529 \times 10^{-7}\}$$