

The Method of Solutions Equations

António Saraiva -- 2009-03-17

ajps2@hotmail.com

This applies only for real solutions. Instead of solving the equation we solve the solutions equations.

$$x^2 - 5x + 6 = 0 ; \quad \text{solutions: a, b}$$

$$\begin{cases} a + b = 5 \\ ab = 6 \end{cases}$$

Program:

```
a = 10
FOR n=1 TO 10000 STEP 1
  b = 6 / a
  a = 5 - b
  PRINT a, b
NEXT n
```

$$x^3 - 9x^2 + 26x - 24 = 0 ; \quad \text{solutions a, b, c}$$

$$\begin{cases} a + b + c = 9 \\ ab + ac + bc = 26 \\ abc = 24 \end{cases}$$

Program:

```
a = 10
b = 20
FOR n=1 TO 10000 STEP 1
  c = 9 - a - b
  b = (26 - ac) / (a + c)
  a = 24 / b / c
  PRINT a, b, c
NEXT n
```

$$x^4 - 10x^3 + 35x^2 - 50x + 24 = 0 ; \text{ solutions } a, b, c, d$$

$$\begin{cases} a + b + c + d = 10 \\ ab + ac + ad + bc + bd + cd = 35 \\ (a + b)cd + ab(c + d) = 50 \\ abcd = 24 \end{cases}$$

Program:

```

a = 10
b = 20
c = 30
FOR n=1 TO 10000 STEP 1
d = 10 - a - b - c
c = (35 - ab - bd - ad)/(a + b + d)
b = (50 - acd)/(cd + a(c + d))
a = 24/b/c/d
PRINT a, b, c, d
NEXT n

```

Complex solutions:

$$n^2 + 2n + 10 = 0 ; \text{ solutions: } a = x + iy, b = x - iy$$

$$\begin{cases} 2x = -2 \\ x^2 + y^2 = 10 \end{cases}$$

$$n^3 - 2n^2 + 2n - 40 = 0 ; \text{ solutions: } a, b = x + iy, c = x - iy$$

$$\begin{cases} a + 2x = 2 \\ 2ax + x^2 + y^2 = 2 \\ a(x^2 + y^2) = 40 \end{cases}$$

$$n^4 - 3n^3 + 4n^2 - 42n + 40 = 0 ; \text{ solutions: } a, b, c = x + iy, d = x - iy$$

$$\begin{cases} a + b + 2x = 3 \\ ab + 2ax + 2bx + x^2 + y^2 = 4 \\ (a + b)(x^2 + y^2) + 2abx = 42 \\ ab(x^2 + y^2) = 40 \end{cases}$$