Demos

Mathematica mint általános célú komputeralgebrai rendszer:

Tipikus alklamazások:

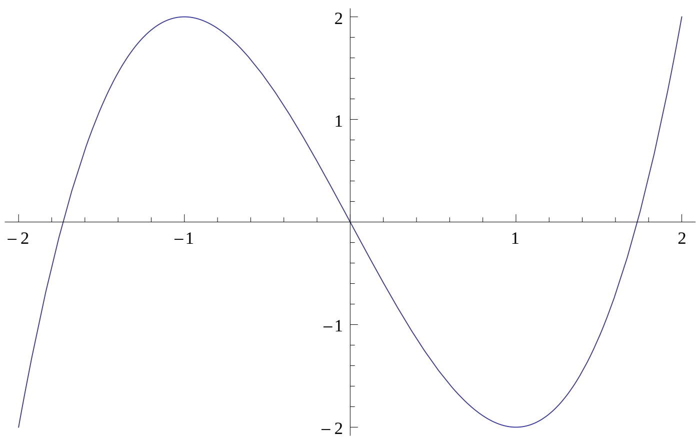
I. vizualizáció, összefüggések grafikus megjelenítése, ak’r dinamikusan is
II. szimbolikus és numerikus számítások (konkrét esetek vizsgálata, nagy adathalmazok)
III. algoritmikus matematika, univerz’lis programozási nyelv

Functions

In[1]:=

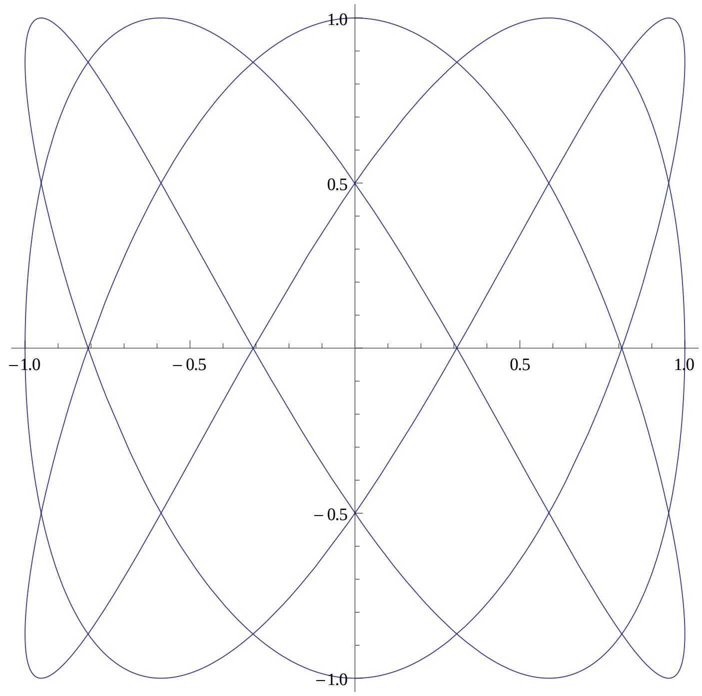
```
Plot[x^3 - 3 x, {x, -2, 2}]
```

Out[1]=



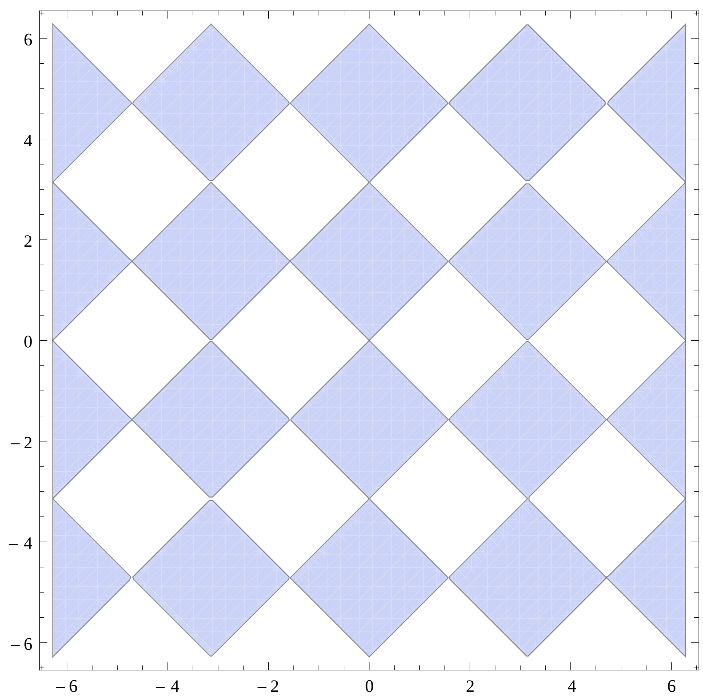
In[2]:= **ParametricPlot[{Cos[3 t], Sin[5 t]}, {t, 0, 2 π}]**

Out[2]=



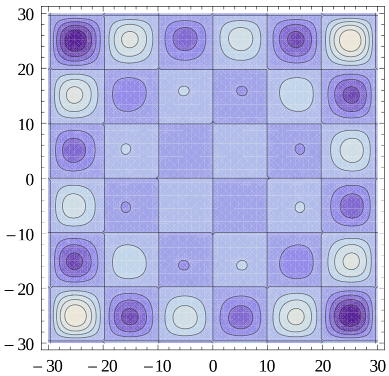
In[3]:= **RegionPlot[Sin[x + y] Sin[x − y] < 0, {x, −2 π, 2 π}, {y, −2 π, 2 π}, PlotPoints → 100]**

Out[3]=



In[39]:=
```
ContourPlot[(x^2 + y^2) Sin[x / π] Sin[y / π],
 {x, -30, 30}, {y, -30, 30}, PlotPoints → 20, ImageSize → {200, 200}]
```

Out[39]=



In[38]:=
```
Plot3D[(x^2 + y^2) Sin[x / π] Sin[y / π],
 {x, -30, 30}, {y, -30, 30}, PlotPoints → 20, ImageSize → {200, 200}]
```

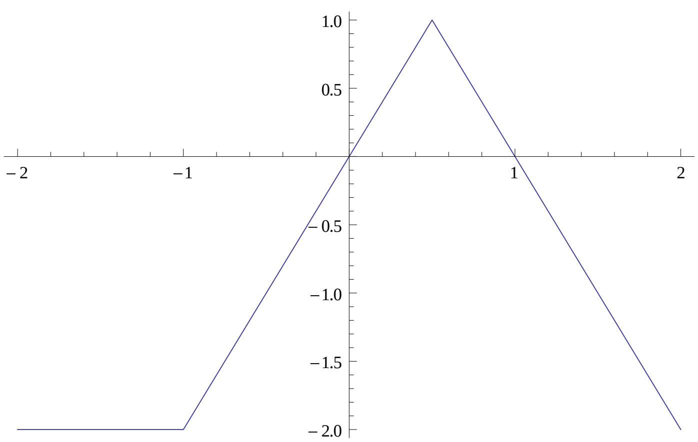
? Oldjuk meg a következô egyenletet:
| x + 1 | — | 2x — 1| = x

In[6]:=
```
Solve[Abs[x + 1] - Abs[2 x - 1] == x, x, Reals]
```

Out[6]= {{x → 0}, {x → 1}}

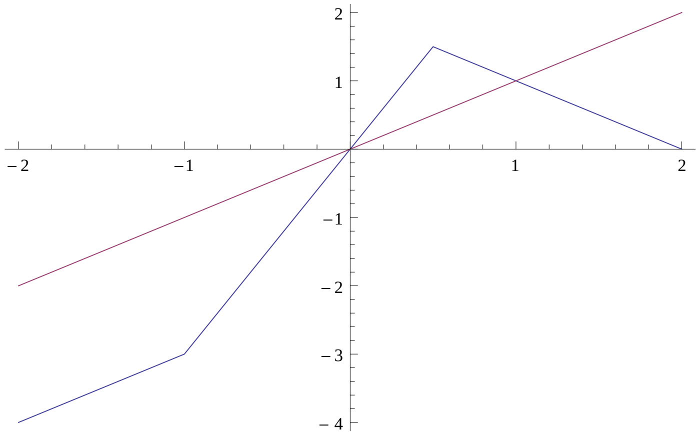
In[7]:=
```
Plot[{Abs[x + 1] - Abs[2 x - 1] - x}, {x, -2, 2}]
```

Out[7]=



In[8]:= `Plot[{Abs[x + 1] - Abs[2 x - 1], x}, {x, -2, 2}]`

Out[8]=



Algebra,Number Theory

? Mi lesz az abcd szorzat maximuma,
ha a, b, c, d poz. egesz számok és a + b + c + d = 18?

max abcd , ha a+b+c+d=18

In[23]:= `Maximize[{a b c d, a + b + c + d == 18, a > 0, b > 0, c > 0, d > 0}, {a, b, c, d}]`

Out[23]= $\left\{\frac{6561}{16}, \left\{a \to \frac{9}{2}, b \to \frac{9}{2}, c \to \frac{9}{2}, d \to \frac{9}{2}\right\}\right\}$

In[24]:= `N[%[[1]]]`

Out[24]= 410.063

In[25]:= `Maximize[{a b c d, a + b + c + d == 18, a > 0, b > 0, c > 0, d > 0}, {a, b, c, d}, Integers]`

Out[25]= {400, {a → 4, b → 4, c → 5, d → 5}}

In[30]:=
```
T = Select[Flatten[Table[{a, b, c, 18 - (a + b + c)}, {a, 1, 18}, {b, a, 18}, {c, b, 18}], 2],
  #[[4]] >= #[[3]] &]
```

Out[30]= {{1, 1, 1, 15}, {1, 1, 2, 14}, {1, 1, 3, 13}, {1, 1, 4, 12}, {1, 1, 5, 11}, {1, 1, 6, 10}, {1, 1, 7, 9}, {1, 1, 8, 8}, {1, 2, 2, 13}, {1, 2, 3, 12}, {1, 2, 4, 11}, {1, 2, 5, 10}, {1, 2, 6, 9}, {1, 2, 7, 8}, {1, 3, 3, 11}, {1, 3, 4, 10}, {1, 3, 5, 9}, {1, 3, 6, 8}, {1, 3, 7, 7}, {1, 4, 4, 9}, {1, 4, 5, 8}, {1, 4, 6, 7}, {1, 5, 5, 7}, {1, 5, 6, 6}, {2, 2, 2, 12}, {2, 2, 3, 11}, {2, 2, 4, 10}, {2, 2, 5, 9}, {2, 2, 6, 8}, {2, 2, 7, 7}, {2, 3, 3, 10}, {2, 3, 4, 9}, {2, 3, 5, 8}, {2, 3, 6, 7}, {2, 4, 4, 8}, {2, 4, 5, 7}, {2, 4, 6, 6}, {2, 5, 5, 6}, {3, 3, 3, 9}, {3, 3, 4, 8}, {3, 3, 5, 7}, {3, 3, 6, 6}, {3, 4, 4, 7}, {3, 4, 5, 6}, {3, 5, 5, 5}, {4, 4, 4, 6}, {4, 4, 5, 5}}

In[28]:= `Length[T]`

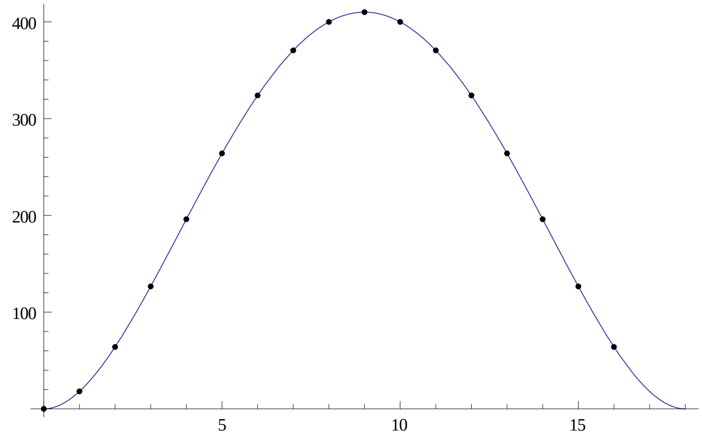
Out[28]= 47

In[31]:= `Map[Times @@ # &, T]`

Out[31]= {15, 28, 39, 48, 55, 60, 63, 64, 52, 72, 88, 100, 108, 112, 99, 120, 135, 144, 147, 144, 160, 168, 175, 180, 96, 132, 160, 180, 192, 196, 180, 216, 240, 252, 256, 280, 288, 300, 243, 288, 315, 324, 336, 360, 375, 384, 400}

In[32]:=
```
Plot[((y)^2 (18 - y)^2) / 16, {y, 0, 18},
 Epilog → Point[Table[{j, ((j)^2 (18 - j)^2) / 16}, {j, 0, 16}]]]
```

Out[32]=



In[33]:=
```
Maximize[{((y)^2 (18 - y)^2) / 16, 0 < y < 18}, y]
```

Out[33]= $\left\{\frac{6561}{16}, \{y \to 9\}\right\}$

■ D-Geometry

In[34]:=
```
A1 = {0, 0}; B1 = {5, 0}; C1 = {4, 3} ;
```

In[15]:=
```
LEqu[{p1_, p2_}, {q1_, q2_}] := {q2 - p2, p1 - q1}.{x - p1, y - p2} == 0;
```

In[16]:=
```
BS[P1_, P2_, P3_] := Module[{P}, P = Norm[P3 - P1] / (Norm[P2 - P1] + Norm[P3 - P1]) P2 +
    Norm[P2 - P1] / (Norm[P3 - P1] + Norm[P2 - P1]) P3; Line[{P1, P}]]
```

In[17]:=
```
BSE[P1_, P2_, P3_] := Module[{P}, P = Norm[P3 - P1] / (Norm[P3 - P1] + Norm[P2 - P1]) P2 +
    Norm[P2 - P1] / (Norm[P3 - P1] + Norm[P2 - P1]) P3; LEqu[P, P1]]
```

In[18]:=
```
Solve[{BSE[A1, B1, C1], BSE[B1, C1, A1]}, {x, y}]
```

Out[18]= $\left\{\left\{x \to \frac{45}{10 + \sqrt{10}}, y \to \frac{15}{10 + \sqrt{10}}\right\}\right\}$

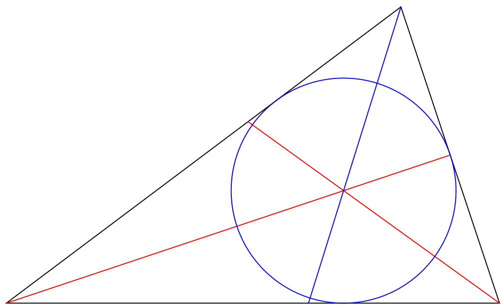
In[19]:=
```
IC[P1_, P2_, P3_] := Module[{O, S}, S = (Norm[P2 - P1] + Norm[P3 - P1] + Norm[P3 - P2]) / 2;
  O = {x, y} /. Solve[{BSE[P1, P2, P3], BSE[P2, P3, P1]}, {x, y}][[1]];
  Circle[O, Sqrt[(S - Norm[P2 - P1]) (S - Norm[P3 - P1]) (S - Norm[P3 - P2]) / S]]]
```

In[20]:=
```
IC[A1, B1, C1]
```

Out[20]= $\text{Circle}\left[\left\{\frac{45}{10 + \sqrt{10}}, \frac{15}{10 + \sqrt{10}}\right\}, \left(-5 + \frac{1}{2}\left(10 + \sqrt{10}\right)\right)\sqrt{\frac{2\left(-\sqrt{10} + \frac{1}{2}\left(10 + \sqrt{10}\right)\right)}{10 + \sqrt{10}}}\right]$

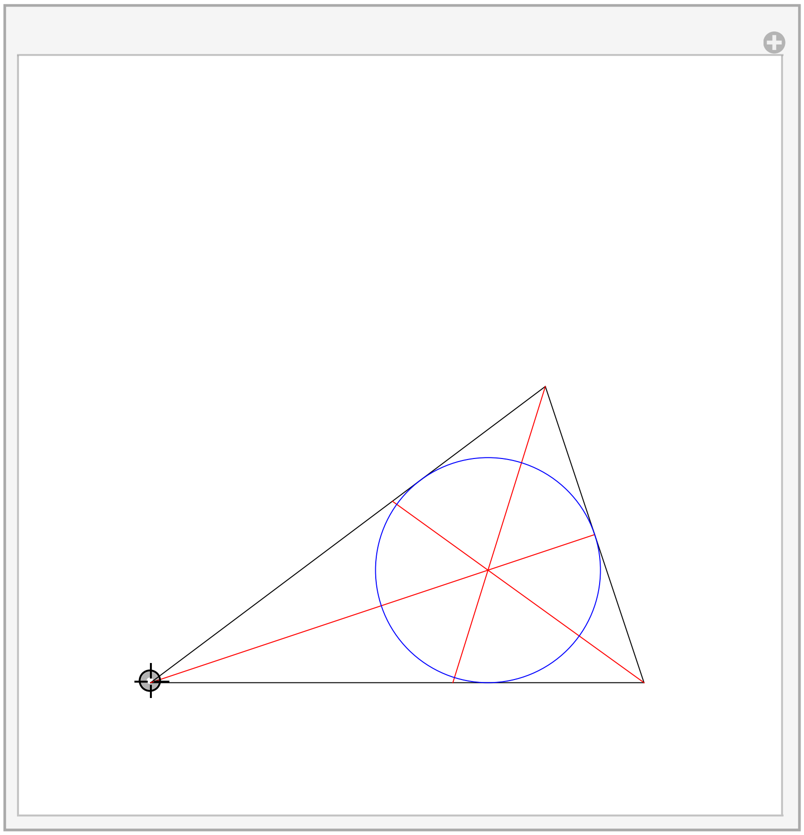
In[21]:=
```
Show[Graphics[{Line[{A1, B1, C1, A1}], Red, BS[A1, B1, C1], BS[B1, C1, A1], Blue,
   BS[C1, B1, A1], IC[A1, B1, C1]}], AspectRatio → 1, PlotRange → {{-1, 6}, {-1, 6}}]
```

Out[21]=



In[22]:=
```
Manipulate[Show[Graphics[{Line[{A, B1, C1, A}], Red,
    BS[A, B1, C1], BS[B1, C1, A], BS[C1, B1, A], Blue, IC[A, B1, C1]}],
  AspectRatio → 1, PlotRange → {{-1, 6}, {-1, 6}}], {{A, {0, 0}}, Locator}]
```

Out[22]=



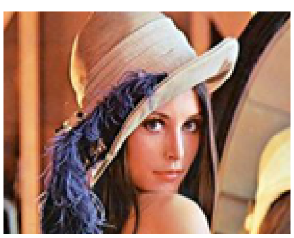
▪ Fun

In[9]:=
```
?Plot3D
```

Plot3D[f, {x, x_{min}, x_{max}}, {y, y_{min}, y_{max}}] generates a three-dimensional plot of f as a function of x and y.
Plot3D[{f_1, f_2, ...}, {x, x_{min}, x_{max}}, {y, y_{min}, y_{max}}] plots several functions. ≫

In[10]:=
```
Import["ExampleData/lena.tif"]
```

Out[10]=



In[11]:=
```
pic = Reverse[ExampleData[{"TestImage", "Lena"}, "Data"] / 255.];
```

In[13]:=
```
ListPlot3D[Table[((x - 2)^2 + (y + 1)^2) Exp[-((x - 2)^2 + (y + 1)^2)], {x, -5, 5, .1}, {y, -5, 5, .1}],
  Mesh → None, VertexColors → {pic[[5;; -5;; 5, 5;; -5;; 5]]},
  Lighting → "Neutral", PlotRange → {0, 1}, Boxed -> False, Axes → False]
```