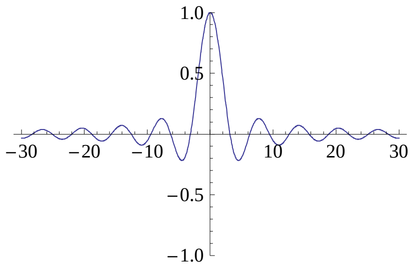
Feladatok

■ 1

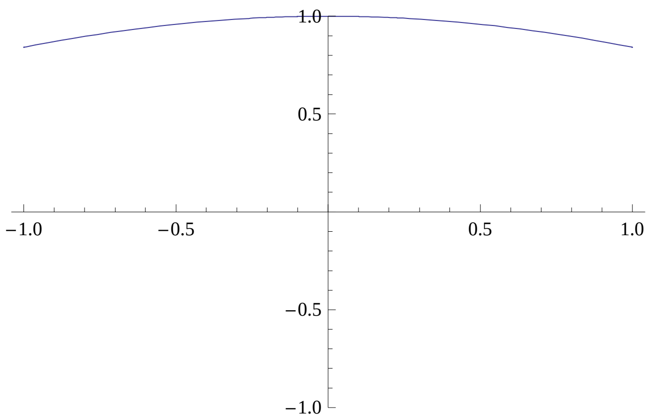
Ábrázoljuk a f[x_]:=Sin[x]/x és a g[x_]:= 1/(2-E^(1/x)) függvényeket. Vizsgáljuk a 0-ban (lok.) és a ∞-ben (asszimp., glob.) is a viseklkedést grafikus és szimbolikus (Limit) eszközökkel!

```
f[x_ ] := Sin[x] / x ;
```

```
Plot[f[x], {x, -30, 30}, PlotRange → {-1, 1}]
```




```
Plot[f[x], {x, -1, 1}, PlotRange → {-1, 1}]
```




```
Limit[f[x], x → 0]
```

```
1
```

```
Limit[f[x], x → Infinity]
```

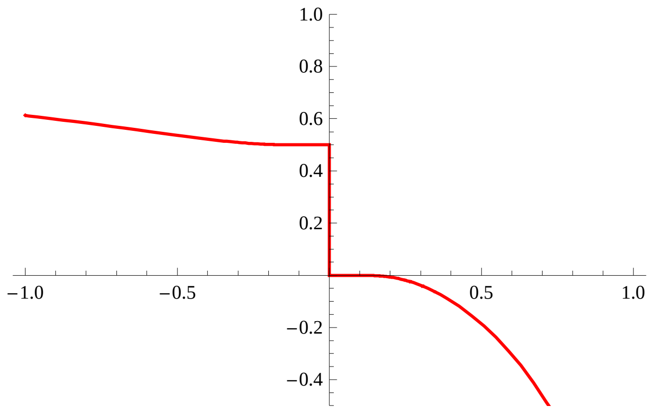
```
0
```

```
g[x_ ] := 1 / (2 - E^ (1 / x))
```

```
?E
```

E is the exponential constant e (base of natural logarithms), with numerical value $\simeq$ 2.71828. ≫

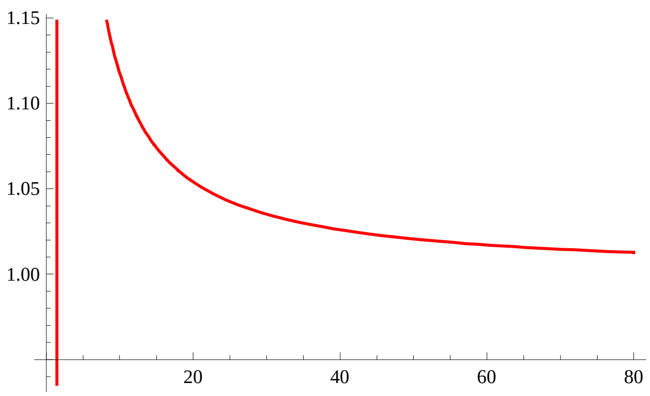
```
Plot[g[x], {x, -1, 1}, PlotRange → {-1/2, 1}, PlotStyle → {Thickness[.005], Red}]
```




```
Limit[g[x], x → 0, Direction → -1]
```

0

```
Plot[g[x], {x, 0, 80}, PlotStyle → {Thickness[.005], Red}]
```




```
Limit[g[x], x → Infinity]
```

1

```
Denominator[g[x]]
```

$2 - e^{\frac{1}{x}}$

```
NSolve[Denominator[g[x]] == 0, x]
```

{{x → 1.4427}}

```
Solve[Denominator[g[x]] == 0, x]
```

Solve::ifun : Inverse functions are being used by Solve, so
some solutions may not be found; use Reduce for complete solution information. ≫

$$\left\{\left\{x \to \frac{1}{\text{Log}[2]}\right\}\right\}$$

■ 2

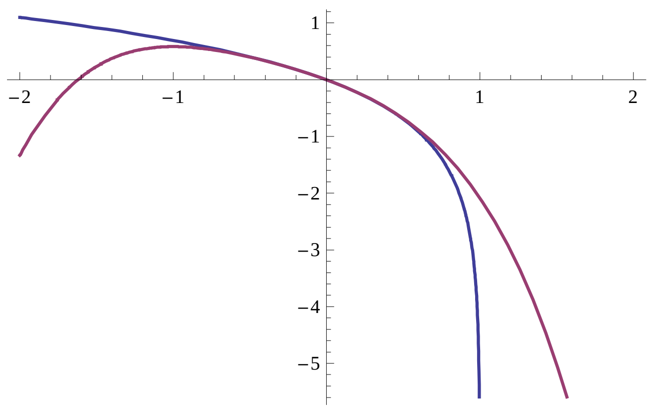
Ábrázoljuk egy ábrán a Log[1-x] függvényt 0 körüli Taylor polinomjaival a [-2,2] intervallumon egy ábrán! Használjuk a Manipulate konstrukciót az interaktív vizualizációhoz, a paraméter legyen a polinom fokszáma dg (0≤dg≤10). Hint: ?Series

```
Normal[Series[Sin[x], {x, 0, 3}]]
```

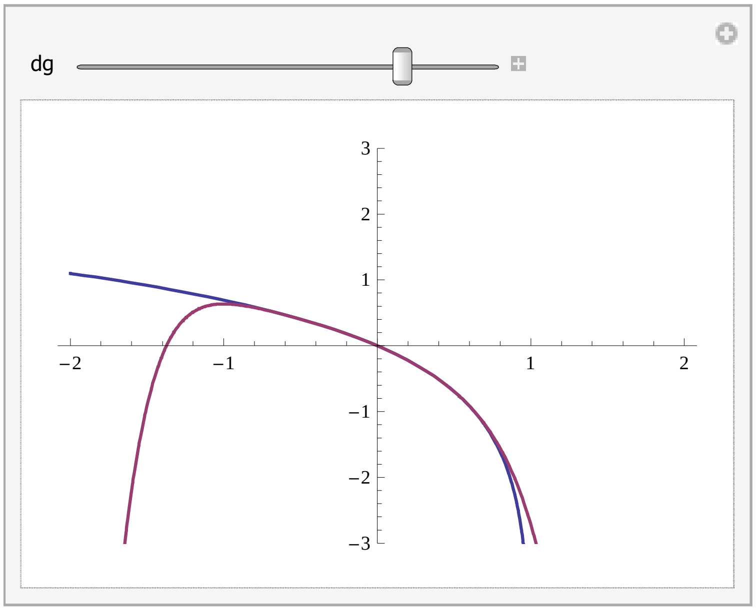
$$x - \frac{x^3}{6}$$

```
In[1]:= h[x_] := Log[1 - x];
```

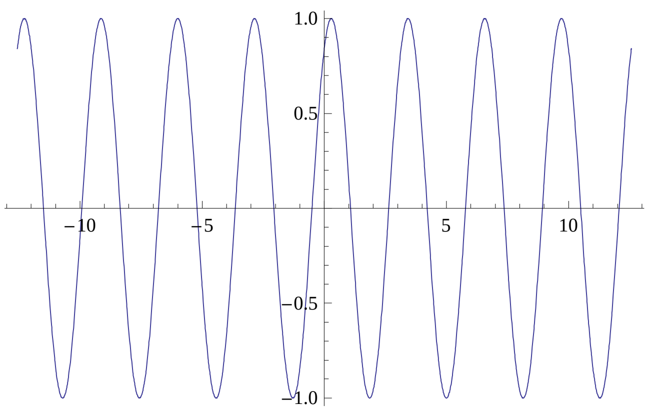
```
Plot[Evaluate[{h[x], Normal[Series[h[x], {x, 0, 4}]]}],
 {x, -2, 2}, PlotStyle → {Thickness[.005]}]
```



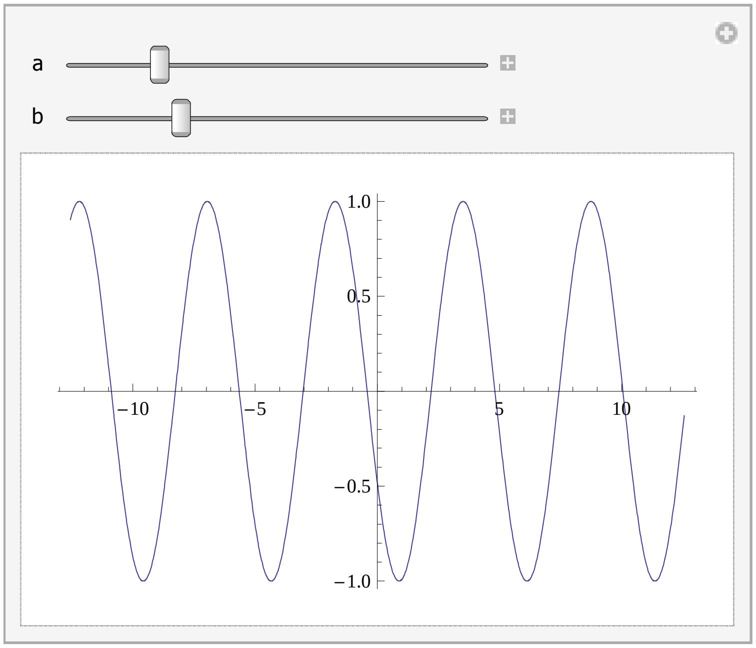
```
Manipulate[Plot[Evaluate[{h[x], Normal[Series[h[x], {x, 0, dg}]]}],
  {x, -2, 2}, PlotStyle → {Thickness[.005]}, PlotRange → {-3, 3}], {dg, 0, 10, 1}]
```




```
Plot[Sin[2 x + 1], {x, -4 Pi, 4 Pi}]
```



```
Manipulate[Plot[Sin[a x + b], {x, -4 Pi, 4 Pi}], {a, -2, 2, .2}, {b, -1, 1, .1}]
```



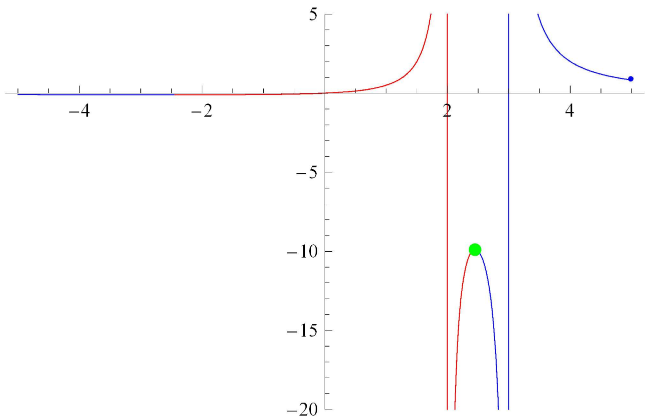
■ 3

f[x]:=x/(x^2-5x+6) Ábrázoljuk, lok. glob, limeszek derivált mon., szimb. szám is! stb.

Színezzük a grafikont az előjel, monotonitás, stb. szerint, egészítsük ki az ábrát nev pontokkal (lok max, infl. pont stb.)
Hint: ColorFunction

```
f[x_] := x / (x^2 - 5 x + 6)

MyColorFunction3[x_, y_] := If[(D[f[z], z] /. z → x) > 0, Red, Blue]

D[z^2, z]

2 z

D[z^2, z] /. z -> 2

4

MyColorFunction3[1, 1]

RGBColor[1, 0, 0]
```

```
Plot[f[x], {x, -5, 5}, PlotRange → {-20, 5}, ColorFunction → MyColorFunction3,
 ColorFunctionScaling → False, Epilog → {Green, PointSize[.02], Point[{Sqrt[6], -9.898}]}]
```




```
Solve[D[f[x], x] == 0]
```

$\{\{x \to -\sqrt{6}\}, \{x \to \sqrt{6}\}\}$

```
f[x] /. Solve[D[f[x], x] == 0]
```

$\left\{-\frac{\sqrt{6}}{12 + 5\sqrt{6}}, \frac{\sqrt{6}}{12 - 5\sqrt{6}}\right\}$

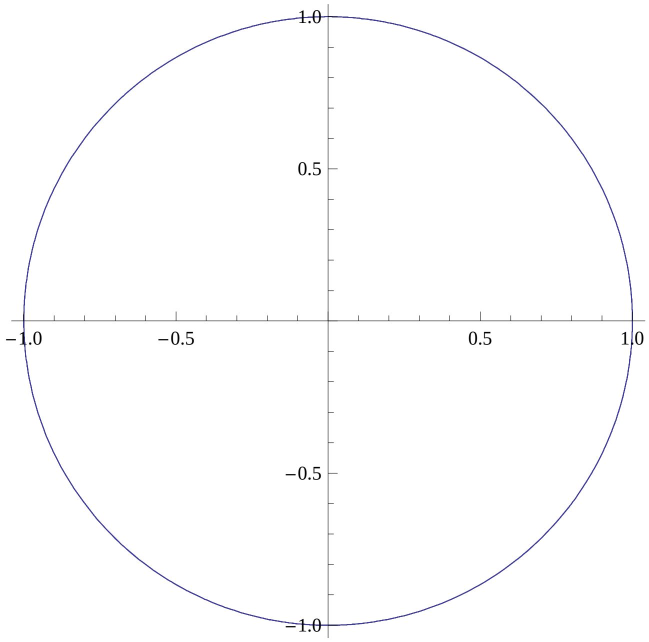
```
N[%]
```

{-0.101021, -9.89898}

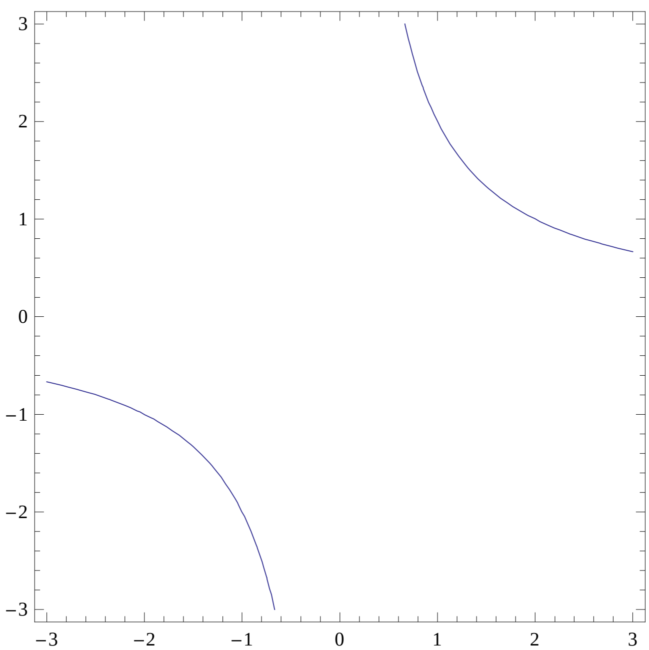
Ábrázolások 2

Alap: Plot, ListPlot
Variánsok:

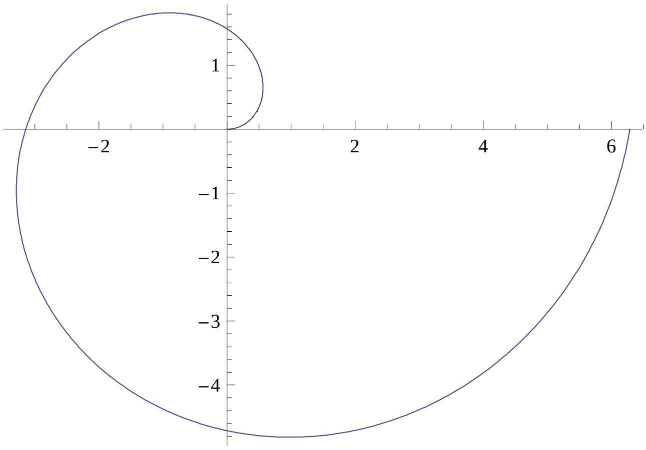
```
ParametricPlot[{Cos[t], Sin[t]}, {t, -2 Pi, 2 Pi}]
```




```
ContourPlot[x y == 2, {x, -3, 3}, {y, -3, 3}]
```



```
PolarPlot[ϕ, {ϕ, 0, 2 π}]
```



3D-s variánsok:

```
Plot3D[(x^2 + y^2) Exp[-x^2 - y^2], {x, -2, 2}, {y, -2, 2}]
```

```
ParametricPlot3D[{Cos[t], Sin[t], t}, {t, 0, 2 Pi}, Boxed → True, Axes -> False]
```

Ábrázoljunk különböző (algebrai) görbéket, pl. kör, hiperbola, lemniszkáta, cusp etc.
Keressünk rá a helpben a térgörbék, felületek ábrázolására! Ábrázoljunk pl. a csavargörbét, síkot, félgömböt stb.

```
ParametricPlot3D[ {s, t / 2, Cos[s] Sin[t]}, {s, -2 Pi, 2 Pi}, {t, -2 Pi, 2 Pi}]
```

```
Context[ParametricPlot]
```

```
System`
```

```
? ParametricPlot3D
```

ParametricPlot3D[$\{f_x, f_y, f_z\}$, $\{u, u_{min}, u_{max}\}$] produces a three-dimensional space curve parametrized by a variable u which runs from u_{min} to u_{max}.
ParametricPlot3D[$\{f_x, f_y, f_z\}$, $\{u, u_{min}, u_{max}\}$, $\{v, v_{min}, v_{max}\}$] produces a three-dimensional surface parametrized by u and v.
ParametricPlot3D[$\{\{f_x, f_y, f_z\}, \{g_x, g_y, g_z\} \ldots\} \ldots$] plots several objects together. ≫

■ 4

Ábrázoljuk egy kétváltozós függvény szintvonalait, ill. parciális deriváltjainak 0-szintvonalait! Oldjuk meg szimbolikusan/numerikusan a stacionárius pontokat karakterizáló egyenletrendszert! (ÉT!)

F[x_ , y_]:=(x^2 + y^2) Exp[-x^2 - y^2]
G[x_ , y_]:=(10x y+x^2+3y^2) Exp[1-x^2-y^2]
H[x_, y_]:=-2 Sqrt[x^2+y^2]+x^4+y^2 - 0.4 x

```
F[x_ , y_ ] := (x^2 + y^2) Exp[-x^2 - y^2]
```

```
Options[ContourPlot]
```

```
ContourPlot[F[x, y], {x, -5, 5}, {y, -5, 5}, ContourShading -> False,
 Contours → {1 / 10}, PlotPoints → 200, WorkingPrecision → 25]
```