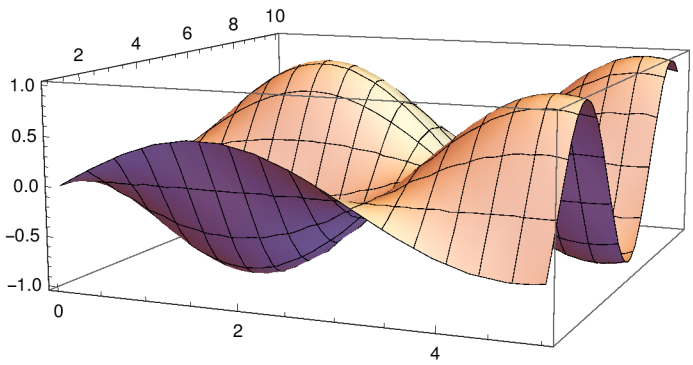
Analiza matematyczna 1
Zajęcia nr 3

Wykres 3D

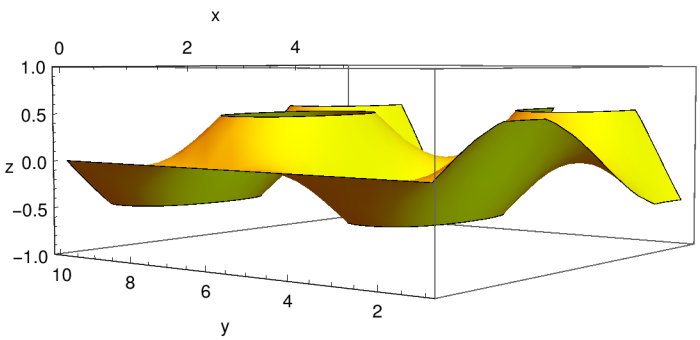
```
? Plot3D
```

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. >>

```
Plot3D[Sin[x] Cos[y], {x, 0, 5}, {y, 1, 10}]
```



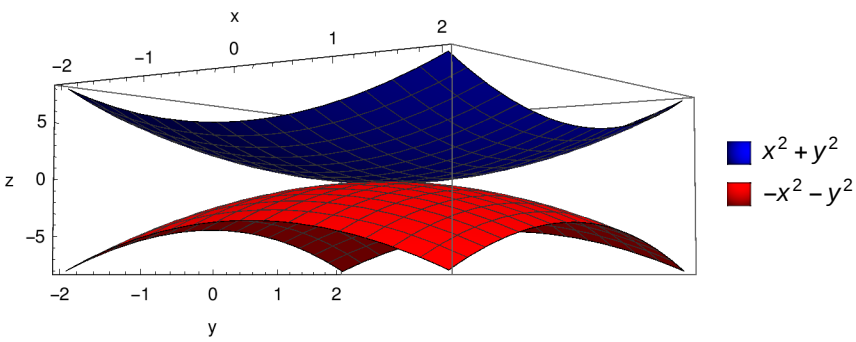
```
Plot3D[Sin[x] Cos[y], {x, 0, 5}, {y, 1, 10},
 Mesh → False,
  PlotStyle → Yellow,
 AxesLabel → {"x", "y", "z"},
 PlotRange → {-1, 1},
  AxesLabel → {"x" , "y", "z"},
 RegionFunction → Function[{x, y, z}, Abs[z] < 0.5]]
```




```
? RegionFunction
```

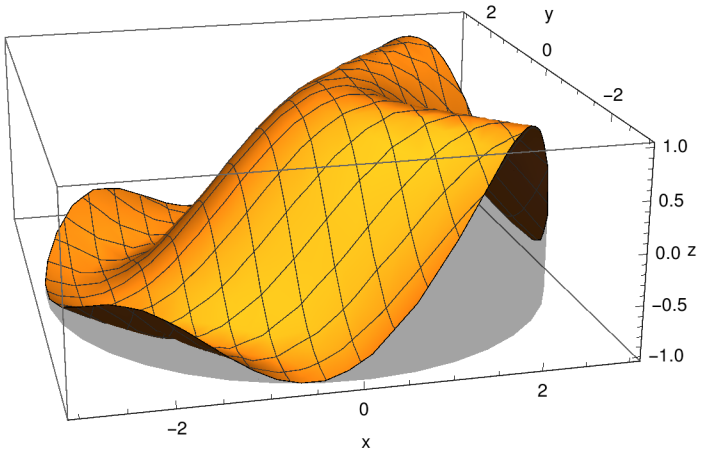
RegionFunction is an option for plotting functions that specifies the region to include in the plot drawn. >>

```
Plot3D[{x^2 + y^2, -x^2 - y^2}, {x, -2, 2}, {y, -2, 2},
  PlotStyle → {Blue, Red},
  AxesLabel → {"x" , "y", "z"},
 PlotLegends → "Expressions"]
```

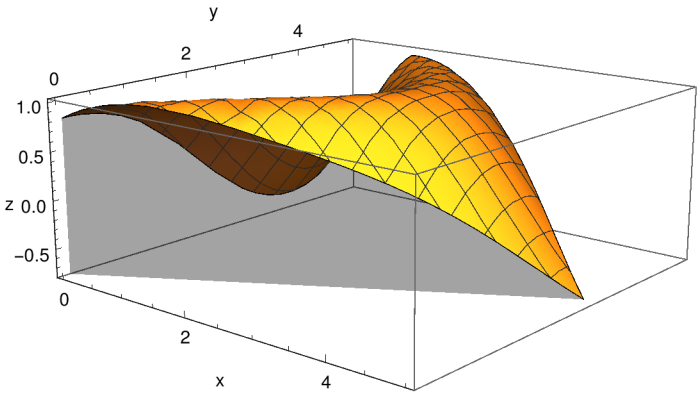


∈ \[Element] (bez spacji)

```
Plot3D[Sin[x + Cos[y]], {x, y} ∈ Disk[{0, 0}, 3],
 Filling → Bottom, AxesLabel → {"x" , "y", "z"}]
```




```
Plot3D[Sin[x + Cos[y]], {x, y} ∈ Polygon[{{0, 0}, {1, 5}, {5, 3}}],
 Filling → Bottom, AxesLabel → {"x" , "y", "z"}]
```

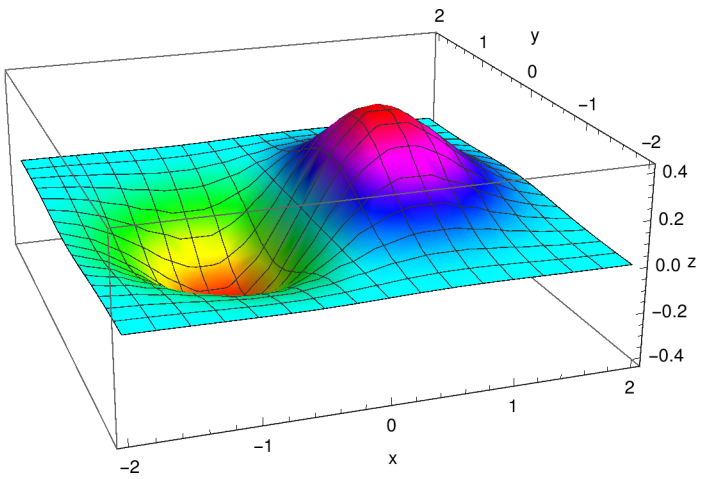


Hue - odcien wykresu

```
? Hue
```

Hue[h] is a graphics directive which specifies that
objects which follow are to be displayed, in a color corresponding to hue h.
Hue[h, s, b] specifies colors in terms of hue, saturation, and brightness.
Hue[h, s, b, a] specifies opacity a. »

```
Plot3D[x / Exp[x^2 + y^2], {x, -2, 2}, {y, -2, 2},
 AxesLabel → {"x" , "y", "z"},
 ColorFunction → Function[{x, y, z}, Hue[z]]
]
```



Zadanie

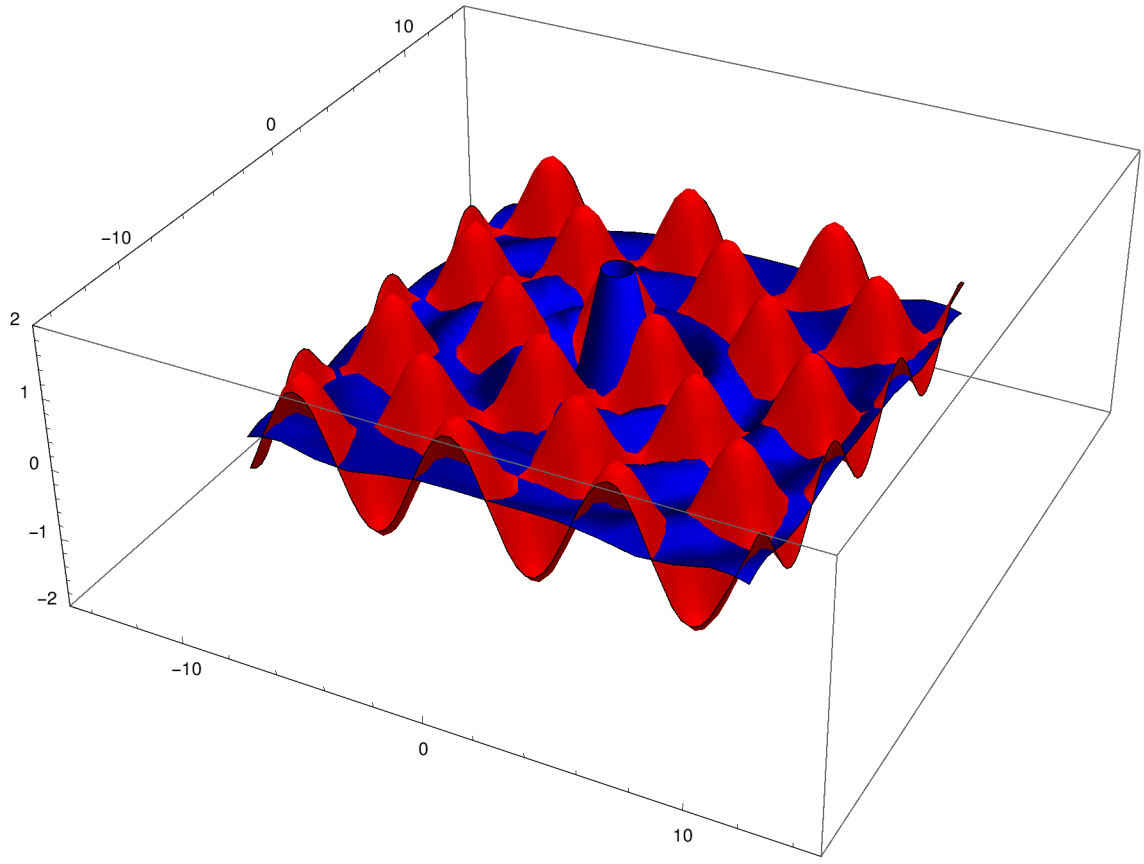
A) zdefiniowac funkcje:

$$F(x, y) = \frac{\sin\left(2\sqrt{x^2+y^2}\right)}{\sqrt{x^2+y^2}}$$

$$G(x, y) = \sin(x)\cos(y)$$

B) Narysowac je na jednym wykresie 3D

- dziedzina x ∈ (-10,10), y ∈ (-10,10)
- zakres osi x: (-15,15), zakres osi y: (-15,15), zakres osi z: (-2,2) (PlotRange)
- tak aby wykresy mialy rozne kolory (PlotStyle)
- usunąć siatkę (Mesh->False)
- dodac parametr RegionFunction z warunkiem |z|<1.5



RegionPlot3D

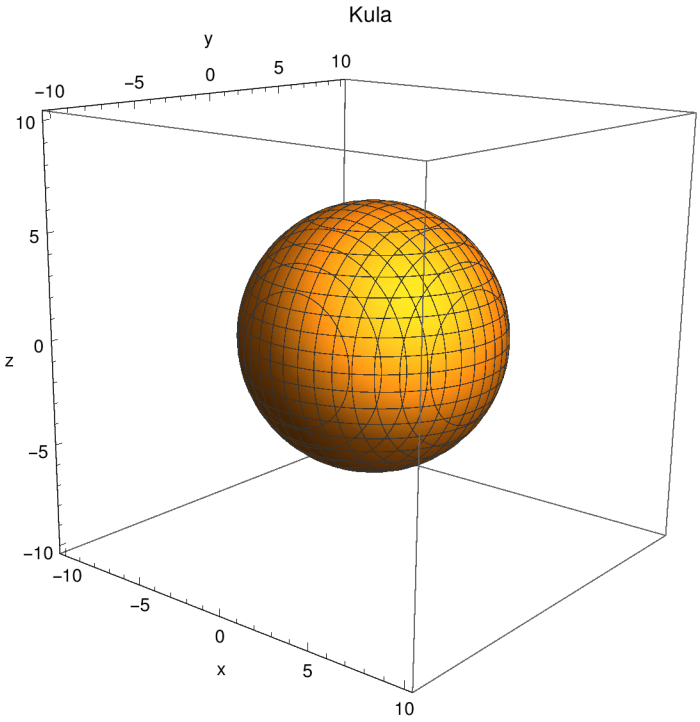
Rysuje bryłę w obszarze, dla którego spełniony jest warunek.

```
? RegionPlot3D
```

RegionPlot3D[$pred$, {x, x_{min}, x_{max}}, {y, y_{min}, y_{max}}, {z, z_{min}, z_{max}}]

makes a plot showing the three–dimensional region in which $pred$ is True. >>

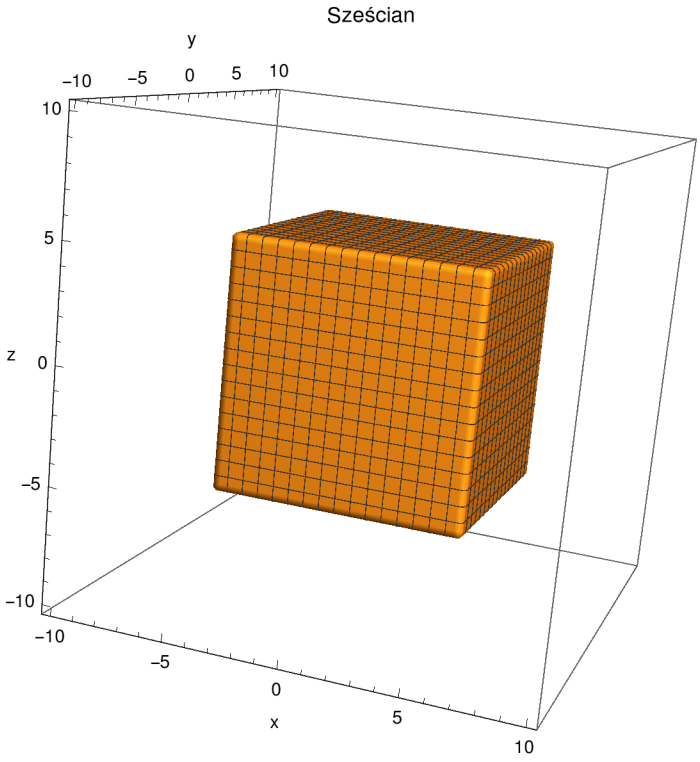
```
RegionPlot3D[x^2 + y^2 + z^2 < 40, {x, -10, 10}, {y, -10, 10}, {z, -10, 10},
  AxesLabel → {"x" , "y", "z"},
  PlotLabel → "Kula",
 PlotPoints → 100]
```




```
? PlotPoints
```

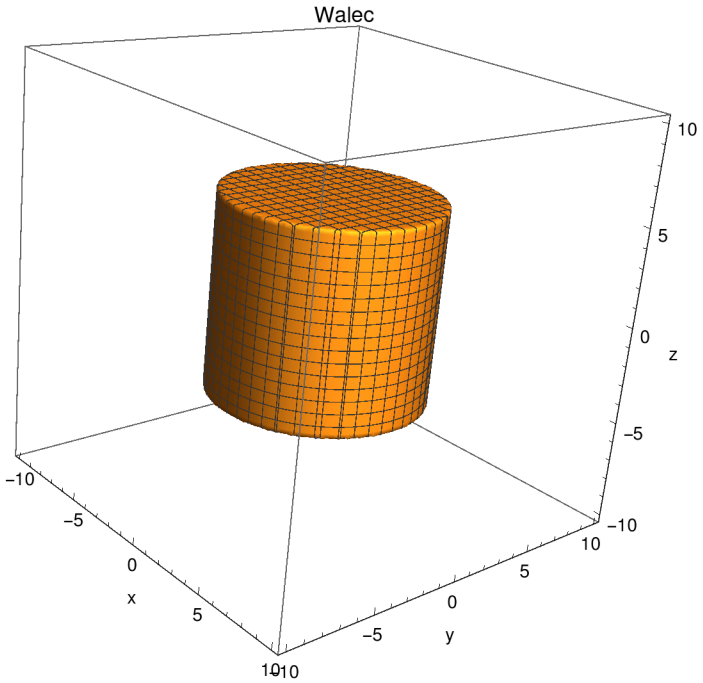
PlotPoints is an option for plotting functions that specifies how many initial sample points to use. ≫

```
RegionPlot3D[x^2 < 30 && y^2 < 30 && z^2 < 30,
 {x, -10, 10}, {y, -10, 10}, {z, -10, 10},
  AxesLabel → {"x" , "y", "z"},
  PlotLabel → "Sześcian",
 PlotPoints → 100]
```



Zadanie

Narysować walec przy użyciu RegionPlot3D



ParametricPlot3D

Krzywa w 3D sparametryzowana przez 1 zmienną lub płaszczyzna w 3D sparametryzowana przez 2 zmienne

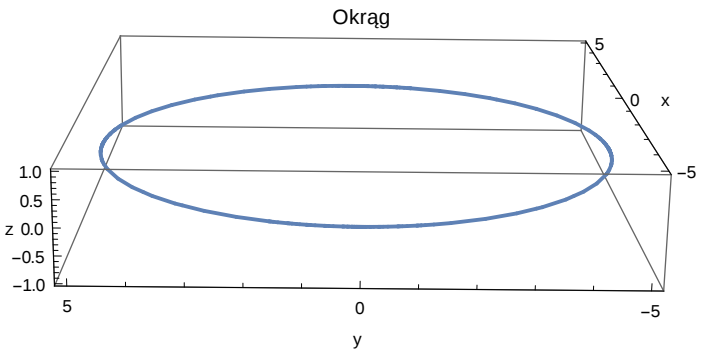
```
? ParametricPlot3D
```

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}.

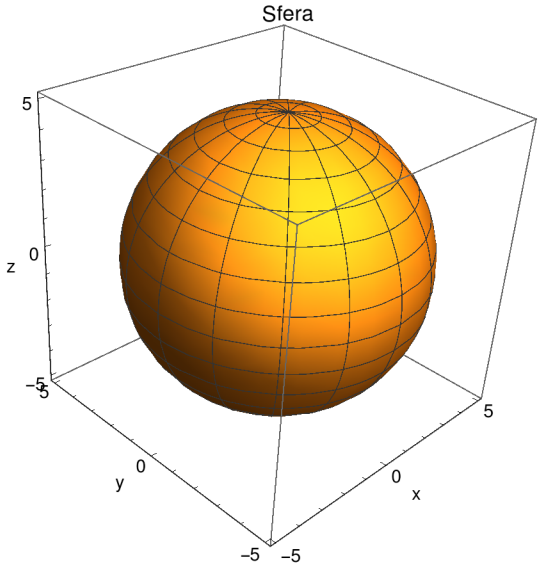
ParametricPlot3D[{f_x, f_y, f_z}, {u, u_{min}, u_{max}}, {v, v_{min}, v_{max}}] produces a three–dimensional surface parametrized by u and v.

ParametricPlot3D[{{f_x, f_y, f_z}, {g_x, g_y, g_z} …} …] plots several objects together. >>

```
ParametricPlot3D[{5 Cos[ϕ ] , 5 Sin[ϕ], 0}, {ϕ, 0, 2 Pi},
  AxesLabel → {"x" , "y", "z"},
  PlotLabel → "Okrąg"]
```

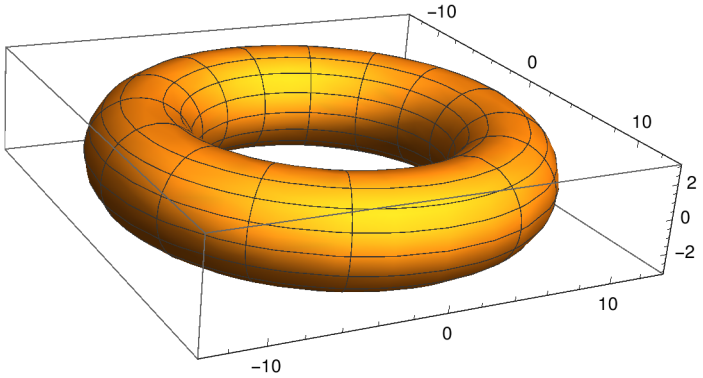



```
ParametricPlot3D[
 {5 Cos[ϕ ] Sin[θ], 5 Sin[ϕ] Sin[θ], 5 Cos[θ]}, {ϕ, 0, 2 Pi}, {θ, 0, Pi},
  AxesLabel → {"x" , "y", "z"},
  PlotLabel → "Sfera"]
```



Zadanie

Narysować torus przy użyciu ParametricPlot3D



Granice

```
? Limit
```

Limit[*expr* , $x \to x_0$] finds the limiting value of *expr* when x approaches x_0. >>

```
Limit[Sin[x] / x, x → Infinity]
```

0

Założenie:

```
Limit[x^a, x → Infinity, Assumptions → a < 0]
```

0

```
Limit[x^a, x → Infinity, Assumptions → a == 0]
```

1

```
Limit[x^a, x → Infinity, Assumptions → a > 0]
```

∞

Granice prawostronne i lewostronne

lewostronne:

```
Limit[1 / x, x → 0, Direction → 1]
```

$-\infty$

prawostronne:

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

∞

Zadanie

policzyc granice

a) $\lim_{n\to\infty} \left(1+\frac{1}{n}\right)^n$

b) $\lim_{n\to\infty} \frac{\sin(n!)}{\sqrt{n}}$

c) $\lim_{n\to\infty} \sqrt{1+n} - \sqrt{n}$

d) $\lim_{n\to\infty} \frac{1}{n^q}$ dla q>0

e) $\lim_{n\to\infty} \frac{(2n+1)!-(2n-1)!}{(2n)!\,n!}$

f) $\lim_{n\to\infty} \frac{c^n}{n^k}$ dla c>1

g) $\lim_{x\to\infty} \sin(x)$

h) $\lim_{x\to 0} \frac{\sin(x)}{x}$