Analiza matematyczna 1
Zajęcia nr 1

Proste obliczenia

a+b
a-b
a*b lub a b (ale nie ab! bo ab to nowa zmienna o nazwie “ab”)
a/b
a^b

In[1]:=
```
((1 + 2) 3 - 4 / 2 )^2
```
Out[1]=
```
49
```

Enter - przejście do nowej linii
Enter+Shift - obliczenie wyrażenia

In[*n*] - n-ta wprowadzona formuła
Out[*n*] albo %n - n-ty wynik
% - ostatni wynik

Typy liczb

Integer, Real, Rational, Complex

Head[expr] - zwraca typ

In[2]:=
```
? Head
```

Head[*expr*] gives the head of *expr*. >>

In[3]:=
```
Head[3]
```
Out[3]=
```
Integer
```

In[4]:=
```
Head[3.0]
```
Out[4]= Real

In[5]:=
```
Head[4 / 3]
```
Out[5]= Rational

In[6]:=
```
Head[1 + 3 I]
```
Out[6]= Complex

In[7]:=
```
4 / 3
```
Out[7]= $\frac{4}{3}$

N[*expr*] - zwraca liczbe zmiennoprzecikową
N[*expr,n*] - daje liczbe zmiennoprzecikową z n-cyfrowa dokladnoscia

In[8]:=
```
? N
```

N[*expr*] gives the numerical value of *expr*.
N[*expr*, *n*] attempts to give a result with *n*- digit precision. >>

In[9]:=
```
N[4 / 3]
N[4 / 3, 3]
```
Out[9]= 1.33333

Out[10]= 1.33

In[11]:=
```
N[Pi, 14]
```
Out[11]= 3.1415926535898

Podstawowe funkcje matematyczne

In[12]:=
```
Sin[1.2]
```
Out[12]= 0.932039

Podstawowe funkcje (patrz Patterns -> Basic Math Assistant -> Calculator -> Advanced)

```
Sin[expr], Cos[expr], Tan[expr], Cot[expr], ArcSin[expr] , ArcCos[expr],
Log[expr], Log10[expr],
Exp[expr]
Sqrt[expr]
Power[x, y], x^y
Floor[expr], Ceiling[expr]
Abs[expr]
```

Definiowanie funkcji

In[13]:=
```
f[x_] = x^2 + 1
```
Out[13]= $1 + x^2$

In[14]:=
```
f[3]
```
Out[14]= 10

In[15]:=
```
g[x_, y_] = Sin[x] + Exp[y] + 1
```
Out[15]= $1 + e^y + \mathrm{Sin}[x]$

In[16]:=
```
h[x_Real] = x^2
```
Out[16]= x^2

In[17]:=
```
h[2]
h[2.0]
h[2 / 3]
h[1 + 2 I]
```
Out[17]= h[2]

Out[18]= 4.

Out[19]= $h\left[\frac{2}{3}\right]$

Out[20]= $h[1 + 2\,i]$

Zmienne

Przypisanie wartosci zmiennej

In[21]:=
```
a = 2
b = 5
```
Out[21]= 2

Out[22]= 5

In[23]:=
```
a + b
```
Out[23]= 7

Czyszczenie wartosci zmiennej =. lub Clear[nazwa]

In[24]:=
```
Clear[a]
```
In[25]:=
```
b =.
```

Quit[] - kasuje wszystkie wczesniej wprowadzone definicje

/. x->value

zastapienie w formule zmnienną x wartoscią

In[26]:=
```
x^2 + 1 /. x → 4
```
Out[26]= 17

In[27]:=
```
x^2 + y^3 + 1 /. {x → 4, y → 7}
```
Out[27]= 360

Wykresy

1. Wykres 2D

Plot[f, {x, $x_{\min}$, $x_{\max}$}]

In[28]:=
```
? Plot
```

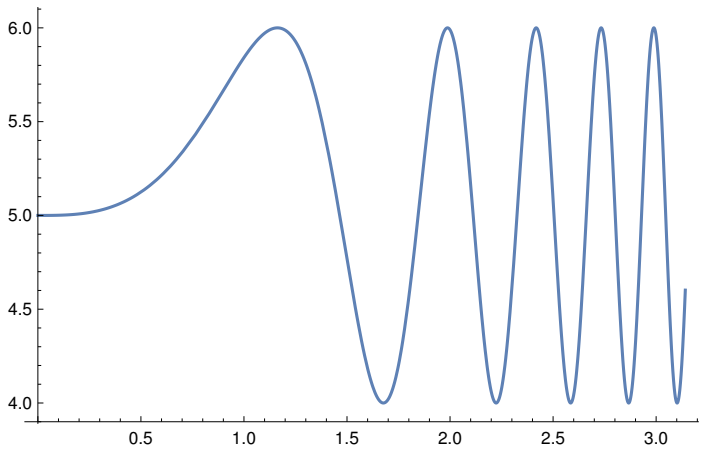
Plot[f, {x, x_{min}, x_{max}}] generates a plot of f as a function of x from x_{min} to x_{max}.
Plot[{f_1, f_2, …}, {x, x_{min}, x_{max}}] plots several functions f_i.
Plot[…, {x} ∈ reg] takes the variable x to be in the geometric region reg. »

In[29]:=
```
s[x_] = Sin[x^3] + 5
```

Out[29]= $5 + \mathrm{Sin}\left[x^3\right]$

In[30]:=
```
Plot[s[x], {x, 0, Pi}]
```

Out[30]=



In[31]:=
```
? PlotLabel
```

PlotLabel is an option for graphics functions that specifies an overall label for a plot. >>

In[32]:=
```
? PlotStyle
```

PlotStyle is an option for plotting and
related functions that specifies styles in which objects are to be drawn. >>

In[33]:=
```
? PlotRange
```

PlotRange is an option for graphics functions that specifies what range of coordinates to include in a plot. >>

In[34]:=
```
? AxesLabel
```

AxesLabel is an option for graphics functions that specifies labels for axes. >>

In[36]:=
```
? AxesOrigin
```

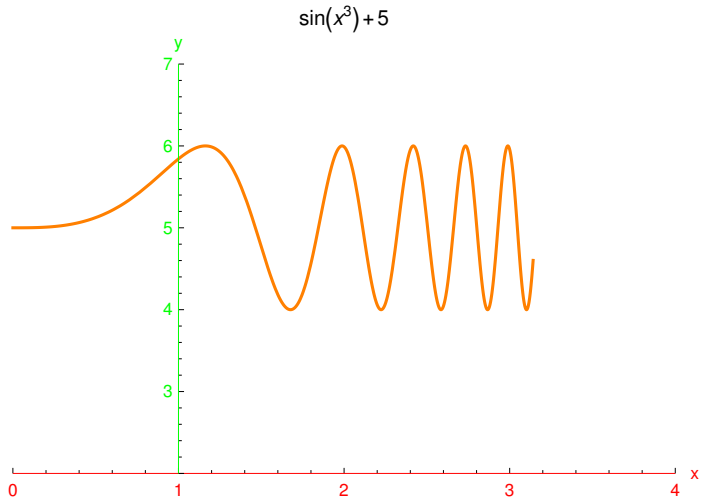
AxesOrigin is an option for graphics functions that specifies where any axes drawn should cross. >>

In[37]:=
```
? AxesStyle
```

AxesStyle is an option for graphics functions that specifies how axes should be rendered. >>

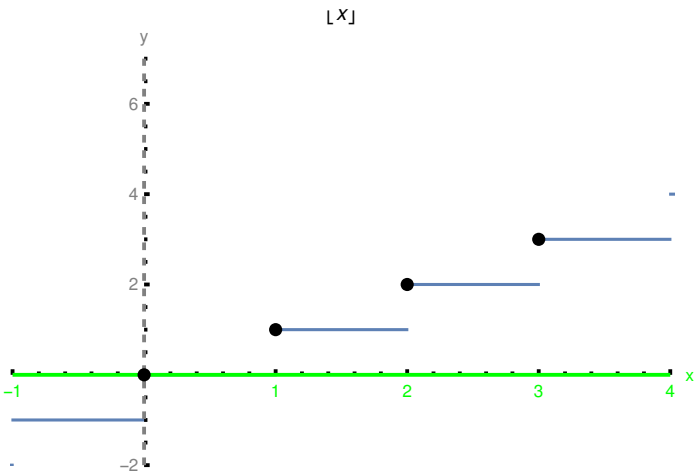
In[38]:=
```
Plot[s[x], {x, 0, Pi},
 PlotLabel → 5 + Sin[x^3],
 PlotStyle → {Orange},
 AxesLabel → {"x", "y"},
 AxesOrigin → {1, 2},
 AxesStyle → {Red, Green},
 PlotRange → {{0, 4}, {2, 7}}]
```

Out[38]=



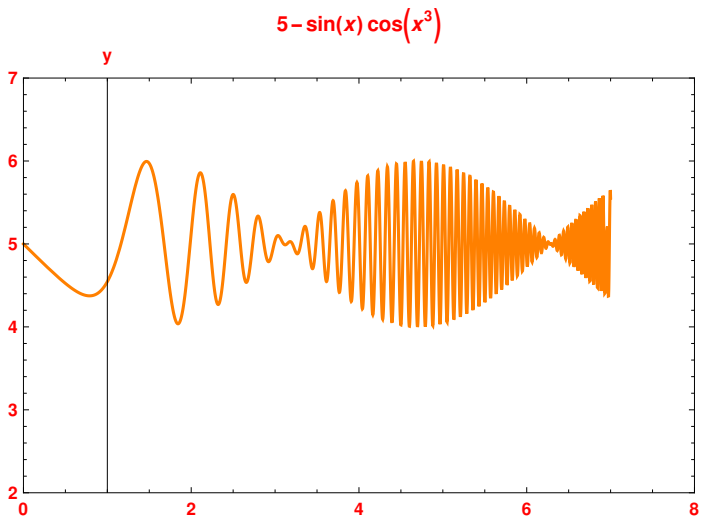
In[39]:=
```
Plot[Floor[x], {x, -2, 7},
 PlotLabel → Floor[x],
 AxesLabel → {"x", "y"},
 Epilog →
  {PointSize[0.02], Point[{0, 0}], Point[{1, 1}], Point[{2, 2}], Point[{3, 3}]},
 AxesStyle → {Directive[Thick, Green], Directive[Thick, Dashed, Gray]},
 PlotRange → {{-1, 4}, {-2, 7}}]
```

Out[39]=



In[40]:=
```
Plot[5 - Sin[x] Cos[x^3], {x, 0, 7},
 PlotLabel → 5 - Sin[x] Cos[x^3],
 LabelStyle → Directive[Bold, Red],
 PlotStyle → {Orange},
 AxesLabel → {"x", "y"},
 AxesOrigin → {1, 2},
 Frame → True,
 PlotRange → {{0, 8}, {2, 7}}]
```

Out[40]=



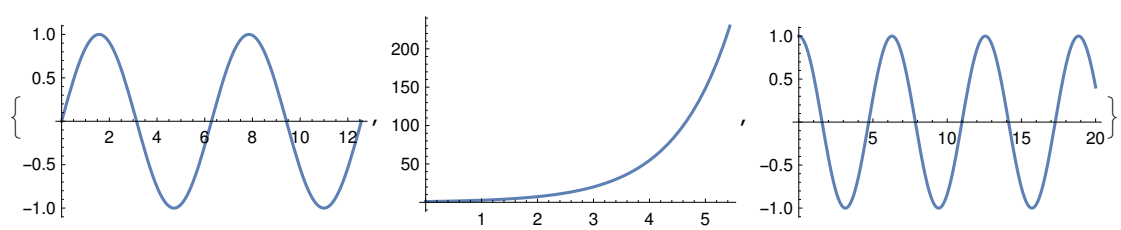
In[41]:=
```
? Directive
```

Directive[g_1, g_2, …] represents a single graphics directive composed of the directives g_1, g_2, …. ≫

Lista wykresow

In[42]:=
```
{Plot[Sin[x], {x, 0, 4 Pi}], Plot[Exp[x], {x, 0, 2 E}], Plot[Cos[x], {x, 0, 20}]}
```

Out[42]=

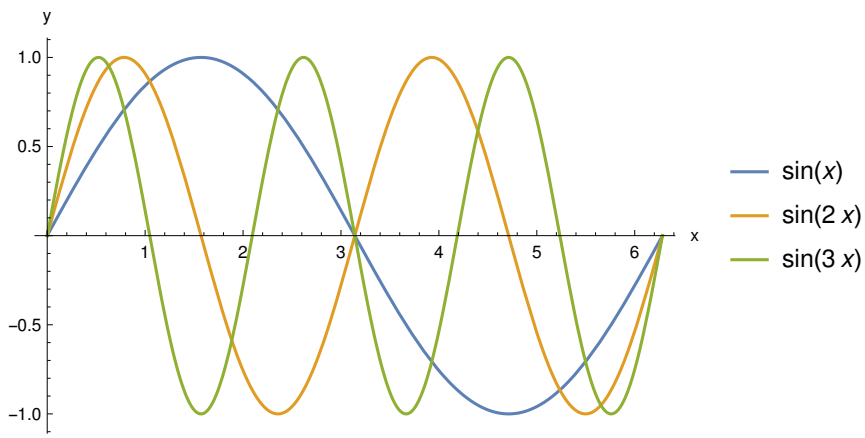


In[67]:=

2. Wykres kilku funkcji

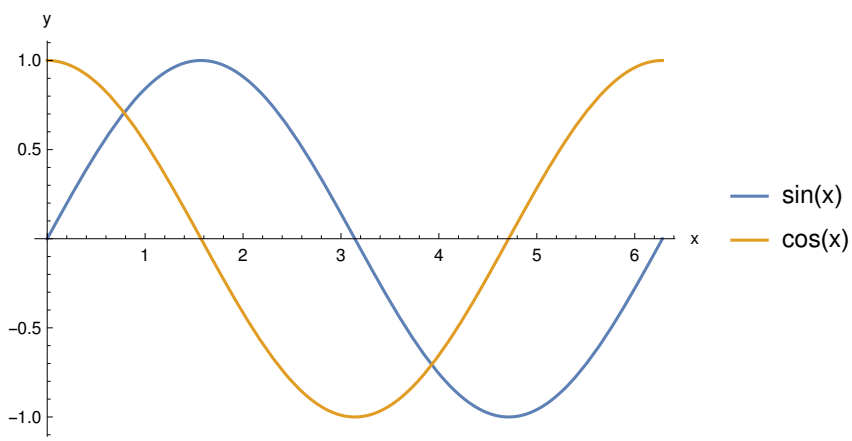
In[43]:=
```
Plot[{Sin[x], Sin[2 x], Sin[3 x]}, {x, 0, 2 Pi},
 PlotLegends → "Expressions", AxesLabel → {"x", "y"}]
```

Out[43]=



In[44]:=
```
Plot[{Sin[x], Cos[x]}, {x, 0, 2 Pi},
 AxesLabel → {"x", "y"}, PlotLegends → {"sin(x)", "cos(x)"}]
```

Out[44]=



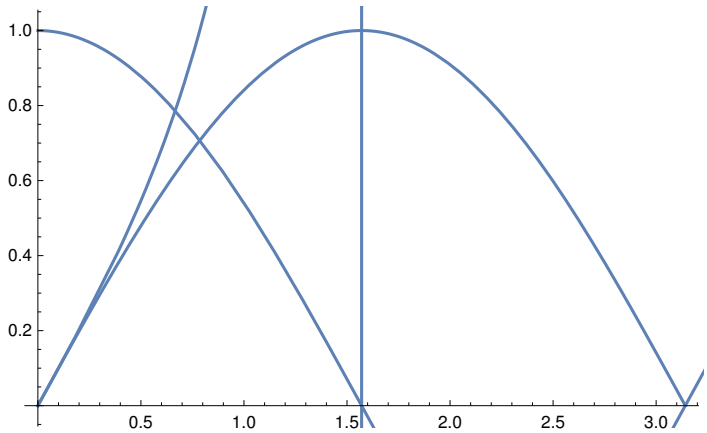
In[45]:=
```
? Show
```

Show[*graphics*, *options*] shows graphics with the specified options added.

Show[g_1, g_2, …] shows several graphics combined. ≫

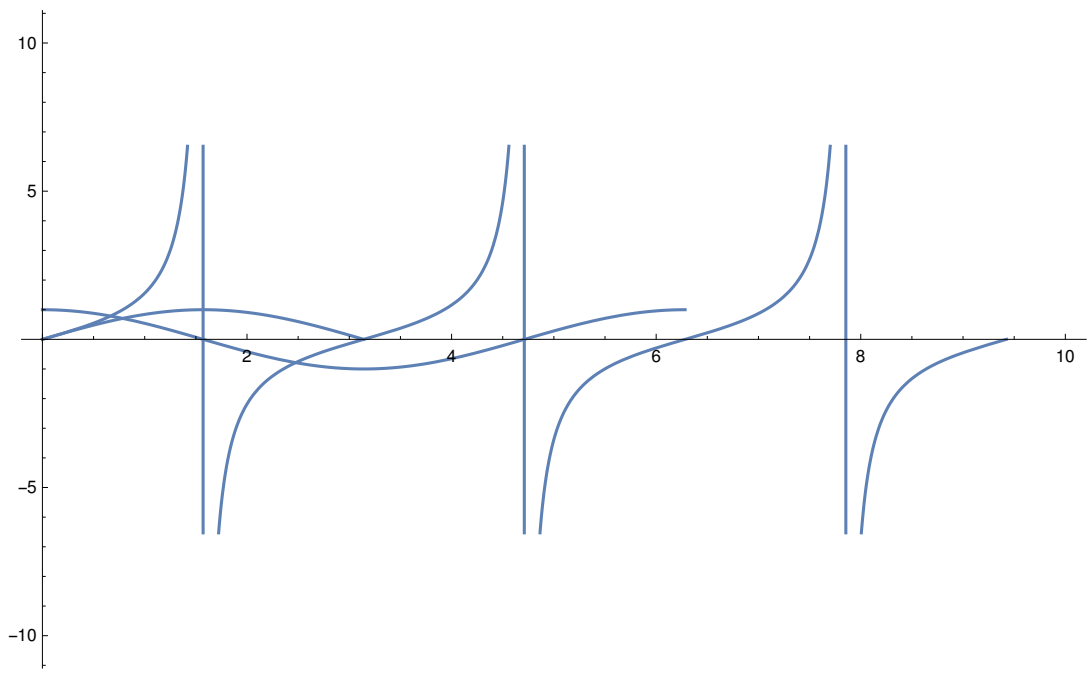
In[46]:=
```
splot := Plot[Sin[x], {x, 0, Pi}]
cplot := Plot[Cos[x], {x, 0, 2 Pi}]
tplot := Plot[Tan[x], {x, 0, 3 Pi}]

Show[splot, cplot, tplot]
```

Out[49]=



In[50]:=
```
Show[splot, cplot, tplot, PlotRange → {{0, 10}, {-10, 10}}]
```

Out[50]=



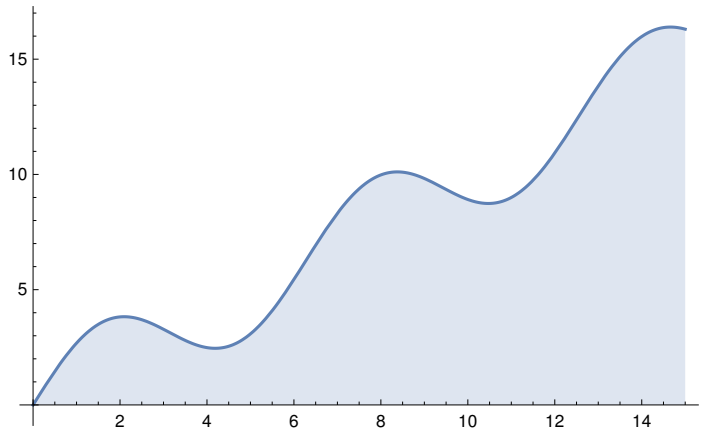
3. Wypelnienie

In[51]:=
```
? Filling
```

Filling is an option for ListPlot, Plot, Plot3D, and related
functions that specifies what filling to add under points, curves, and surfaces. >>

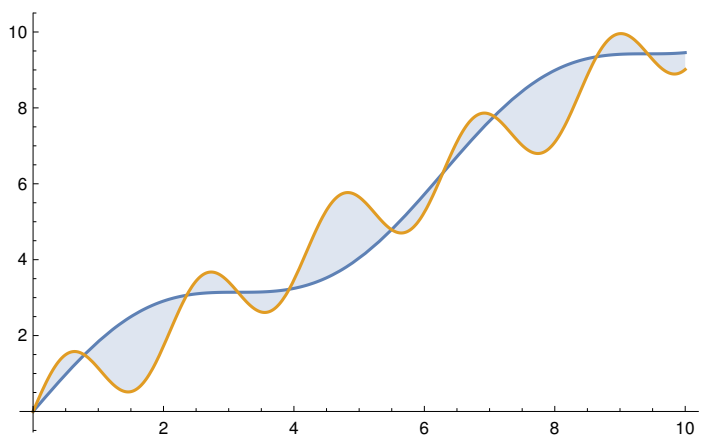
In[52]:=
```
Plot[2 Sin[x] + x, {x, 0, 15}, Filling → Bottom]
```

Out[52]=



In[53]:=
```
Plot[{Sin[x] + x, Sin[3 x] + x}, {x, 0, 10}, Filling → {1 → {2}}]
```

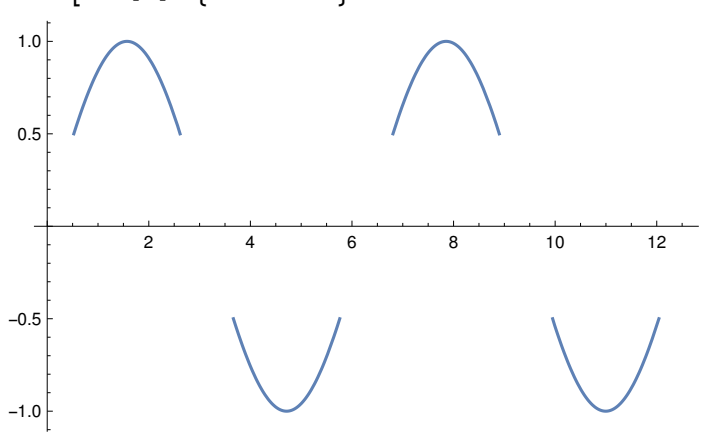
Out[53]=



4. RegionFunction

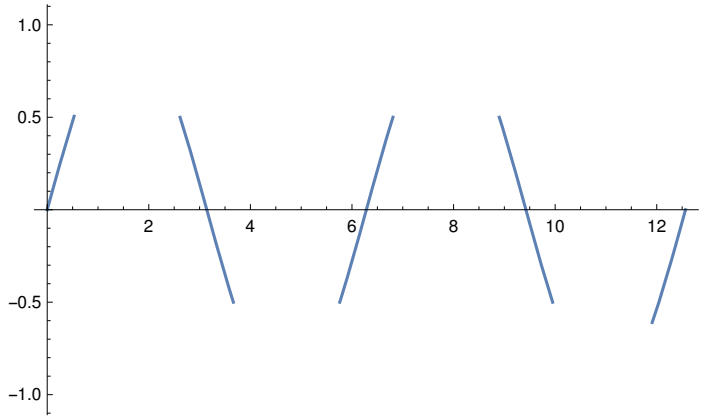
In[54]:=
```
Plot[Sin[x], {x, 0, 4 Pi}, RegionFunction → Function[{x, y}, Abs[y] > 0.5]]
```

Out[54]=



In[55]:=
```
Plot[Sin[x], {x, 0, 4 Pi}, RegionFunction → Function[{x, y}, Abs[y] < 0.5]]
```

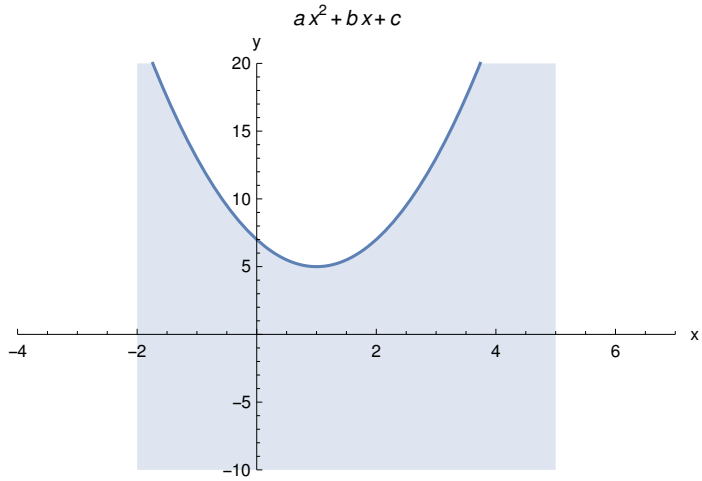
Out[55]=



Zadanie

A) zdefiniowac funkcje:
$f(x) = a\,x\text{^}2 + b\,x + c$

B) Narysowac ją dla zadanych wartosci a, b, c rownych odpowiednio 2, -4, 7 (/. ->)
- dziedzina x ∈(-2,5)
- dodac tytul (PlotLabel)
- zakres osi x: (-4,7), zakres osi y: (-10,20) (PlotRange)
- z wypelnieniem od dolu (Filling)
- opisac osie (AxesLabel)



In[56]:=
```
f[x_] := a x^2 + b x + c
```

In[57]:=
```
Plot[f[x] /. {a → 2, b → -4, c → 7}, {x, -2, 5},
 PlotLabel → a x^2 + b x + c,
 Filling → Bottom,
 AxesLabel → {"x", "y"},
 PlotRange → {{-4, 7}, {-10, 20}}]
```

Out[57]=