Zadanie 1

In[172]:=

```
demoivre[z_, n_] := Map[
  Function[
   k,
   Simplify[ ∛Abs[z] (Cos[(Arg[z] + 2 k π)/n] + i Sin[(Arg[z] + 2 k π)/n])]],
  Range[0, n - 1]
 ]
```

In[174]:=

```
Print["{w ∈ ℂ | w^n = z} = ", demoivre[8, 3]]
```

$\{w \in \mathbb{C} \mid w^n = z\} = \{2, -1 + i\sqrt{3}, -1 - i\sqrt{3}\}$

Zadanie 2

In[168]:=

```
arguments = π / 12 Range[15];
tableData = Table[{x, Sin[x], Cos[x], Tan[x]}, {x, arguments}];

Grid[Prepend[tableData, {"x", "sin(x)", "cos(x)", "tan(x)"}], Frame → All]
```

Out[170]=

x	$\sin(x)$	$\cos(x)$	$\tan(x)$
$\frac{\pi}{12}$	$\frac{-1+\sqrt{3}}{2\sqrt{2}}$	$\frac{1+\sqrt{3}}{2\sqrt{2}}$	$2-\sqrt{3}$
$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$
$\frac{\pi}{4}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	1
$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
$\frac{5\pi}{12}$	$\frac{1+\sqrt{3}}{2\sqrt{2}}$	$\frac{-1+\sqrt{3}}{2\sqrt{2}}$	$2+\sqrt{3}$
$\frac{\pi}{2}$	1	0	ComplexInfinity
$\frac{7\pi}{12}$	$\frac{1+\sqrt{3}}{2\sqrt{2}}$	$-\frac{-1+\sqrt{3}}{2\sqrt{2}}$	$-2-\sqrt{3}$
$\frac{2\pi}{3}$	$\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$	$-\sqrt{3}$
$\frac{3\pi}{4}$	$\frac{1}{\sqrt{2}}$	$-\frac{1}{\sqrt{2}}$	-1
$\frac{5\pi}{6}$	$\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$-\frac{1}{\sqrt{3}}$
$\frac{11\pi}{12}$	$\frac{-1+\sqrt{3}}{2\sqrt{2}}$	$-\frac{1+\sqrt{3}}{2\sqrt{2}}$	$-2+\sqrt{3}$
π	0	-1	0
$\frac{13\pi}{12}$	$-\frac{-1+\sqrt{3}}{2\sqrt{2}}$	$-\frac{1+\sqrt{3}}{2\sqrt{2}}$	$2-\sqrt{3}$
$\frac{7\pi}{6}$	$-\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$
$\frac{5\pi}{4}$	$-\frac{1}{\sqrt{2}}$	$-\frac{1}{\sqrt{2}}$	1

Zadanie 3

In[143]:=

```
vectorAnalysis = Function[{w, v},
   {
    Print["|w| = ",
     Norm[w],
     If[IntegerQ[Norm[w]], "", " ≈ " <> ToString[N[Norm[w]]]]
    ];

    Print["|v| = ",
     Norm[v],
     If[IntegerQ[Norm[v]], "", " ≈ " <> ToString[N[Norm[v]]]]
    ];

    Print["w ∘ v = ",
     w.v,
     If[IntegerQ[w.v], "", " ≈ " <> ToString[N[w.v]]]
    ];

    Print["∢(w,v) = ",
     ArcCos[w.v / (Norm[w] Norm[v])], " ≈ ", N[ArcCos[w.v / (Norm[w] Norm[v])]]];
   };
  ];
```

In[144]:=

```
w = {1, 2, 3, 4, 5};
v = {6, 7, 8, 9, 10};

vectorAnalysis[w, v]
```

$|\mathbf{w}| = \sqrt{55} \approx 7.4162$

$|\mathbf{v}| = \sqrt{330} \approx 18.1659$

$\mathbf{w} \circ \mathbf{v} = 130$

$\sphericalangle(\mathbf{w},\mathbf{v}) = \text{ArcCos}\left[\frac{13\sqrt{\frac{2}{3}}}{11}\right] \approx 0.265542$

Zadanie 4

In[126]:=

```
radii = Table[0.1 RandomInteger[100], {k, 1, 100}];
```

In[139]:=

```
circumference[r_] := 2 π r /; r > 0
area[r_] := π r^2 /; r > 0

tableData = Table[{r, circumference[r], area[r]}, {r, radii}];
Grid[Prepend[tableData, {"r", "C (2πr)", "A (πr^2)"}], Frame → All]
```

Out[142]=

r	C $(2\pi r)$	A (πr^2)
7.6	47.7522	181.458
8.9	55.9203	248.846
0.8	5.02655	2.01062
1.7	10.6814	9.0792
0.2	1.25664	0.125664
8.8	55.292	243.285
5.	31.4159	78.5398
4.1	25.7611	52.8102
6.4	40.2124	128.68
0.2	1.25664	0.125664
9.7	60.9469	295.592
9.2	57.8053	265.904
0.4	2.51327	0.502655
7.2	45.2389	162.86
3.7	23.2478	43.0084
3.2	20.1062	32.1699
2.9	18.2212	26.4208
5.3	33.3009	88.2473
5.3	33.3009	88.2473
6.4	40.2124	128.68
1.7	10.6814	9.0792
8.7	54.6637	237.787
6.9	43.354	149.571
0.2	1.25664	0.125664
2.	12.5664	12.5664
10.	62.8319	314.159
3.7	23.2478	43.0084
5.	31.4159	78.5398
0.3	1.88496	0.282743
3.5	21.9911	38.4845
4.9	30.7876	75.4296
2.5	15.708	19.635
1.	6.28319	3.14159
0.1	0.628319	0.0314159
7.	43.9823	153.938
5.1	32.0442	81.7128
7.7	48.3805	186.265
9.4	59.0619	277.591
1.8	11.3097	10.1788
2.6	16.3363	21.2372
5.3	33.3009	88.2473
2.6	16.3363	21.2372
8.3	52.1504	216.424
9.7	60.9469	295.592
2.3	14.4513	16.619

8.8	55.292	243.285
5.9	37.0708	109.359
2.1	13.1947	13.8544
3.9	24.5044	47.7836
9.3	58.4336	271.716
0.7	4.39823	1.53938
0.2	1.25664	0.125664
3.2	20.1062	32.1699
5.7	35.8142	102.07
1.5	9.42478	7.06858
2.1	13.1947	13.8544
3.	18.8496	28.2743
1.2	7.53982	4.52389
4.	25.1327	50.2655
7.	43.9823	153.938
7.4	46.4956	172.034
2.2	13.823	15.2053
0.1	0.628319	0.0314159
6.5	40.8407	132.732
7.1	44.6106	158.368
2.9	18.2212	26.4208
0.7	4.39823	1.53938
7.4	46.4956	172.034
7.5	47.1239	176.715
6.9	43.354	149.571
5.3	33.3009	88.2473
1.5	9.42478	7.06858
1.	6.28319	3.14159
9.6	60.3186	289.529
2.6	16.3363	21.2372
0.8	5.02655	2.01062
6.9	43.354	149.571
5.5	34.5575	95.0332
9.	56.5487	254.469
10.	62.8319	314.159
4.4	27.646	60.8212
9.	56.5487	254.469
9.7	60.9469	295.592
9.	56.5487	254.469
7.5	47.1239	176.715
6.6	41.469	136.848
6.1	38.3274	116.899
4.3	27.0177	58.088
10.	62.8319	314.159
2.6	16.3363	21.2372
9.	56.5487	254.469
5.1	32.0442	81.7128
4.9	30.7876	75.4296
1.9	11.9381	11.3411
1.5	9.42478	7.06858
8.	50.2655	201.062
1.6	10.0531	8.04248
2.4	15.0796	18.0956
8.5	53.4071	226.98
5.6	35.1858	98.5203

Zadanie 5

In[175]:=

```
coprimeAnalysis = Function[{m, n},
   If[! IntegerQ[m] || ! IntegerQ[n],
    Print["Both m and n must be integers"];
    Return[];
   ];

   gcd = GCD[m, n];
   division = N[m / n, 9];
   min = Min[m, n];
   max = Max[m, n];
   range = Range[min, max];
   rangeString = "[" <> ToString[min] <> ", " <> ToString[max] <> "]";
   randomNumber = RandomInteger[{min, max}];

   Print["m = ", m, ", n = ", n, "\n"];

   If[gcd ≠ 1,
    Print["gcd(m,n) = ", gcd, " ≠ 1, so m and n are not coprimes"],

    Print["gcd(m,n) = 1, so m and n are coprimes\n" ];
    Print["m/n = ", N[m / n, 9]];
    Print["I = ", rangeString];
    Print["{n ∈ ℕ | n ∈ I} = ", range];
    Print["|I| = ", max - min];
    Print["Random k ∈ ℤ such that k ∈ I: \nk = ", randomNumber]
   ];
  ];
```

In[176]:=

```
coprimeAnalysis[7.5, 35]
```

```
Both m and n must be integers
```

In[177]:=

```
coprimeAnalysis[7, 35]
```

```
m = 7, n = 35

gcd(m,n) = 7 ≠ 1, so m and n are not coprimes
```

In[178]:=

```
coprimeAnalysis[7, 31]
```

$m = 7, \; n = 31$

$\gcd(m,n) = 1$, so m and n are coprimes

$\frac{m}{n} = 0.225806452$

$I = [7, 31]$

$\{n \in \mathbb{N} \mid n \in I\} =$
$\{7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31\}$

$|I| = 24$

Random $k \in \mathbb{Z}$ such that $k \in I$:
$k = 24$