Proyecto Genérico

Curso: Sistemas Dinámicos

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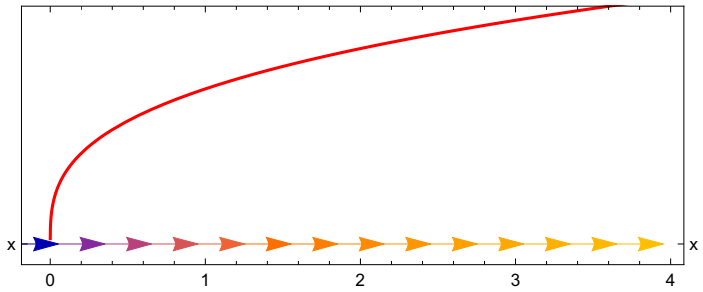
In[1]:=
```
box[{x_, y_}, {X_, Y_}] := Line[{{x, y}, {x, Y}, {X, Y}, {X, y}, {x, y}}];
```

Problema 1.3:

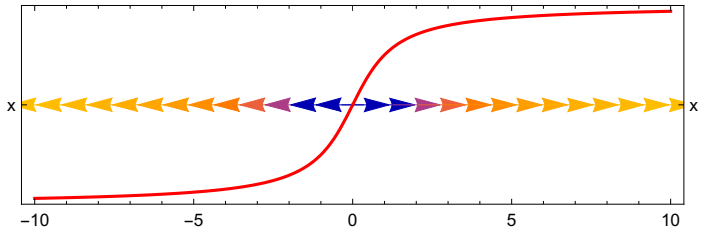
In[2]:=
```
(* a) Diagrama de Fase de: f(x)=x^(1/3) *)
vectF = VectorPlot[{x^(1/3), 0}, {x, -0.1, 4}, {y, -0.1, 1.5},
    AspectRatio → Automatic, FrameTicks → {Automatic, {{0, "x"}}},
    VectorPoints → Table[{value, 0}, {value, -0.1, 4, 0.3}]];
xF = Plot[x^(1/3), {x, -0.1, 4}, PlotStyle → Red];
Show[vectF, xF]
```

Out[4]=



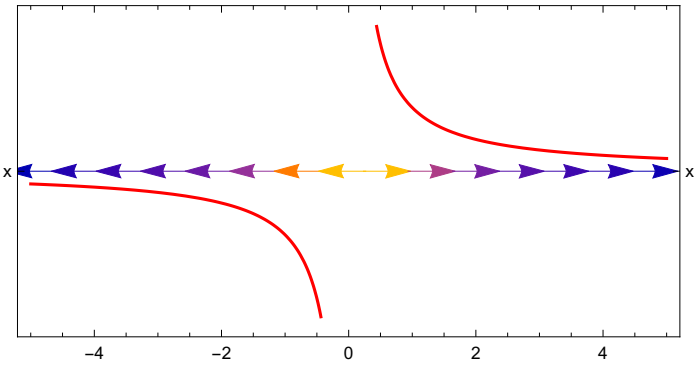
In[5]:=
```
(* b) Diagrama de Fase de: f(x)=2*ArcTan[x] *)
vectArc = VectorPlot[{2 * ArcTan[x], 0}, {x, -10, 10}, {y, -3, 3},
    AspectRatio → Automatic, FrameTicks → {Automatic, {{0, "x"}}},
    VectorPoints → Table[{value, 0}, {value, -10, 10, 0.8}]];
arcTan = Plot[2 * ArcTan[x], {x, -10, 10}, PlotStyle → Red];
Show[vectArc, arcTan]
```

Out[7]=



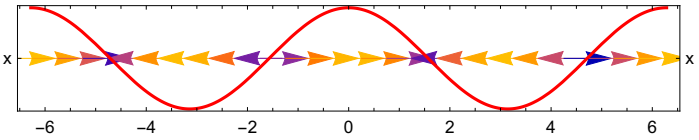
In[8]:=
```
(* c) Diagrama de Fase de: f(x)=1/x *)
vectInv = VectorPlot[{1/x, 0}, {x, -5, 5}, {y, -2.5, 2.5},
    AspectRatio → Automatic, FrameTicks → {Automatic, {{0, "x"}}},
    VectorPoints → Table[{value, 0}, {value, -5, 5, 0.7}]];
xInv = Plot[1/x, {x, -5, 5}, PlotStyle → Red];
Show[vectInv, xInv]
```

Out[10]=



In[11]:=
```
(* d) Diagrama de Fase de: f(x)=Cos[x] *)
vectCOS = VectorPlot[{Cos[x], 0}, {x, -2 * π, 2 * π}, {y, -1, 1},
    AspectRatio → Automatic, FrameTicks → {Automatic, {{0, "x"}}},
    VectorPoints → Table[{value, 0}, {value, -2 * π, 2 * π, 0.5}]];
cos = Plot[Cos[x], {x, -2 * π, 2 * π}, PlotStyle → Red];
Show[vectCOS, cos]
```

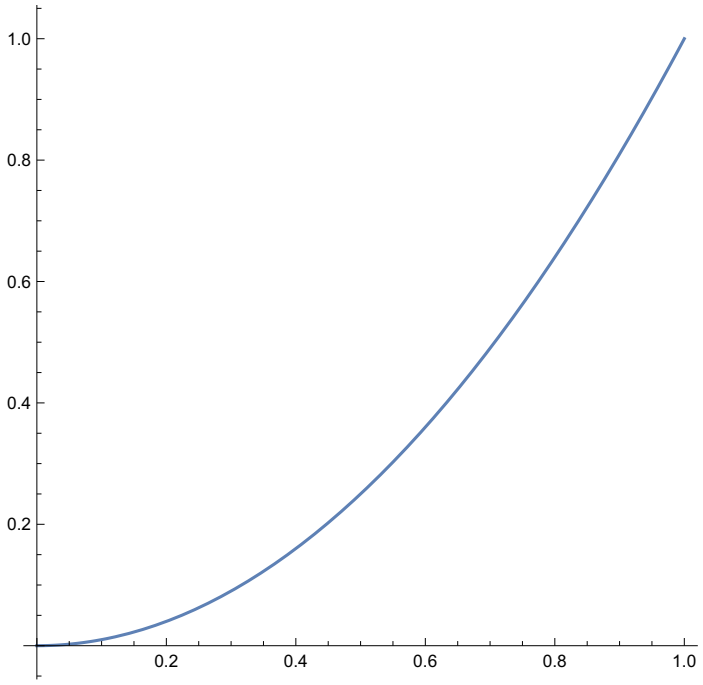
Out[13]=



Problema 2.1

In[14]:=
```
Plot[x^2, {x, 0, 1}, AspectRatio → 1]
```

Out[14]=

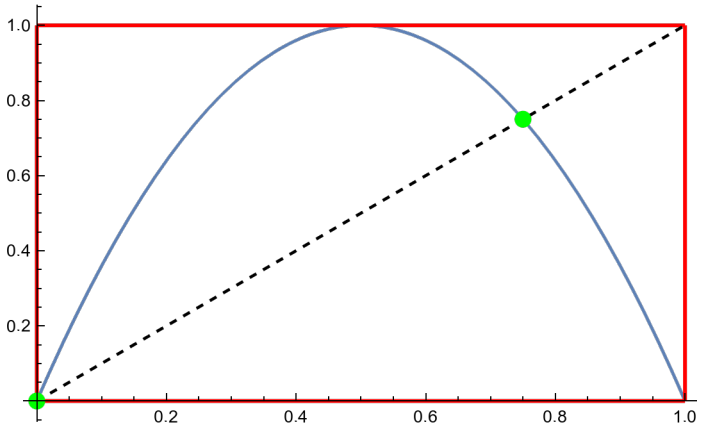


Problema 4.3

In[15]:=
```
cuadratic = Plot[4 * x * (1 - x), {x, 0, 1}];
caja = Graphics[{Red, Thick, box[{0, 0}, {1, 1}]}, AspectRatio → Automatic];
slope = Plot[x, {x, 0, 1}, PlotStyle → {Black, Dashed}];
solutions =
  Graphics[{PointSize[0.025], Point[{{0, 0}, {3/4, 3/4}}, VertexColors → {Green, Green}]}];
```

```
Show[cuadratic, caja, slope, solutions]
```

Out[19]=



In[20]:=
```
Solve[{4 * y * (1 - y) == y}, y]
```

Out[20]= $\left\{\{y \to 0\}, \left\{y \to \frac{3}{4}\right\}\right\}$

Problema 4.5

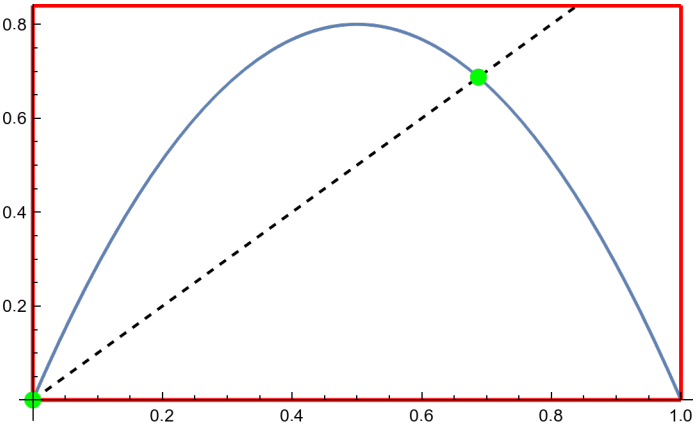
In[21]:=
```
Solve[{3.2 * p * (1 - p) == p}, p]
```

Out[21]= {{p → 0.}, {p → 0.6875}}

In[22]:=
```
cuadratic45 = Plot[3.2 * x * (1 - x), {x, 0, 1}];
caja45 = Graphics[{Red, Thick, box[{0, 0}, {1, 0.84}]}, AspectRatio → Automatic];
slope45 = Plot[x, {x, 0, 1}, PlotStyle → {Black, Dashed}];
solutions45 = Graphics[
   {PointSize[0.025], Point[{{0, 0}, {0.6875, 0.6875}}, VertexColors → {Green, Green}]}];
```

```
Show[cuadratic45, caja45, slope45, solutions45]
```

Out[26]=

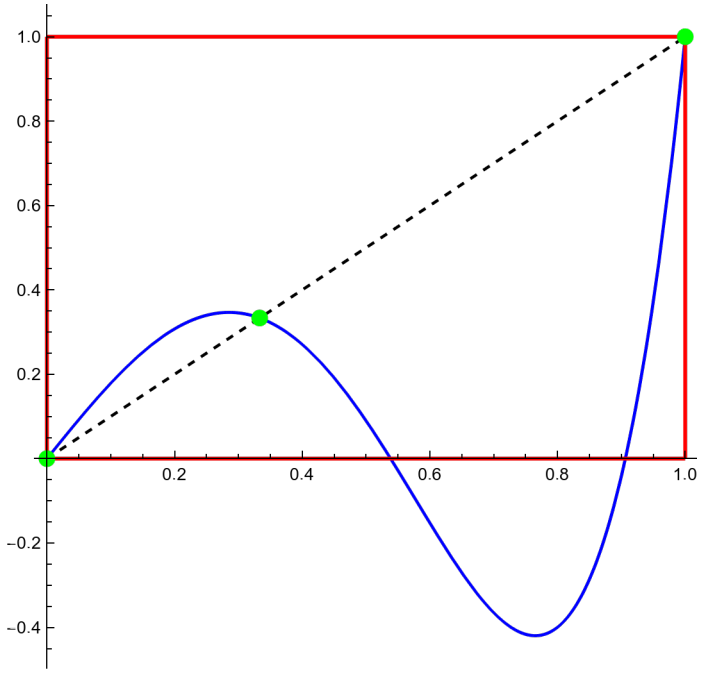


Problema 4.10

In[27]:=
```
(* Tomaremos el polinomio de Legendre restringido al intervalo [0,1] *)
pleg = Plot[LegendreP[5, x], {x, 0, 1}, AspectRatio → 1, PlotStyle → Blue];
caja410 = Graphics[{Red, Thick, box[{0, 0}, {1, 1}]}, AspectRatio → -1];
solutions410 = Graphics[{PointSize[0.025],
    Point[{{0, 0}, {1 / 3, 1 / 3}, {1, 1}}, VertexColors → {Green, Green, Green}]}];

Show[pleg, slope, caja410, solutions410]
```

Out[30]=



In[31]:=
```
Solve[{LegendreP[5, t] == t}, t]
```

Out[31]= $\left\{\{t \to -1\}, \left\{t \to -\frac{1}{3}\right\}, \{t \to 0\}, \left\{t \to \frac{1}{3}\right\}, \{t \to 1\}\right\}$

Problema 6.1

```
(* a) f(x)=-x^3 *)
```

In[32]:=
```
x =.;
Solve[{-x^3 == x}, x]
```

Out[33]= $\{\{x \to 0\}, \{x \to -i\}, \{x \to i\}\}$

In[34]:=
```
D[-x^3 - x, x]
```

Out[34]= $-1 - 3\,x^2$

```
(* b) p(x)=x^3-x *)
```

In[35]:=
```
x =.;
Solve[{x^3 - x == x}, x]
```

Out[36]= $\left\{\{x \to 0\}, \left\{x \to -\sqrt{2}\right\}, \left\{x \to \sqrt{2}\right\}\right\}$

In[37]:=
```
D[x^3 - 2 * x, x]
```

Out[37]= $-2 + 3\,x^2$

```
(* c) f(x)=-x^3-x *)
```

In[38]:=
```
x =.;
Solve[{-x^3 - x == x}, x]
```

Out[39]= $\left\{\{x \to 0\}, \left\{x \to -i\,\sqrt{2}\right\}, \left\{x \to i\,\sqrt{2}\right\}\right\}$

In[40]:=
```
D[-x^3 - 2 * x, x]
```

Out[40]= $-2 - 3\,x^2$

```
(* d) f(x)=Exp[x-1]*)
```

In[41]:=
```
x =.;
Solve[{Exp[x - 1] == x}, x]
```

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

Out[42]= {{x → 1}}

In[43]:=
```
x =.;
D[Exp[x - 1] - x, x]
```

Out[44]= $-1 + e^{-1+x}$

In[45]:=
```
Exp[-1] - 1 // N
Exp[1] - 1 // N
```

Out[45]= -0.632121

Out[46]= 1.71828

```
(* e) f(x)=Exp[-x] *)
```

In[47]:=
```
x =.;
Solve[{Exp[-x] == x}, x]
```

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

Out[48]= {{x → ProductLog[1]}}

In[49]:=
```
ProductLog[1] // N
-Exp[-0.5671432904097838] // N
```

Out[49]= 0.567143

Out[50]= -0.567143

```
(* f) s(x)=Sin[x] *)
```

In[51]:=
```
x =.;
Solve[{Sin[x] == x}, x]
```

Solve: This system cannot be solved with the methods available to Solve.

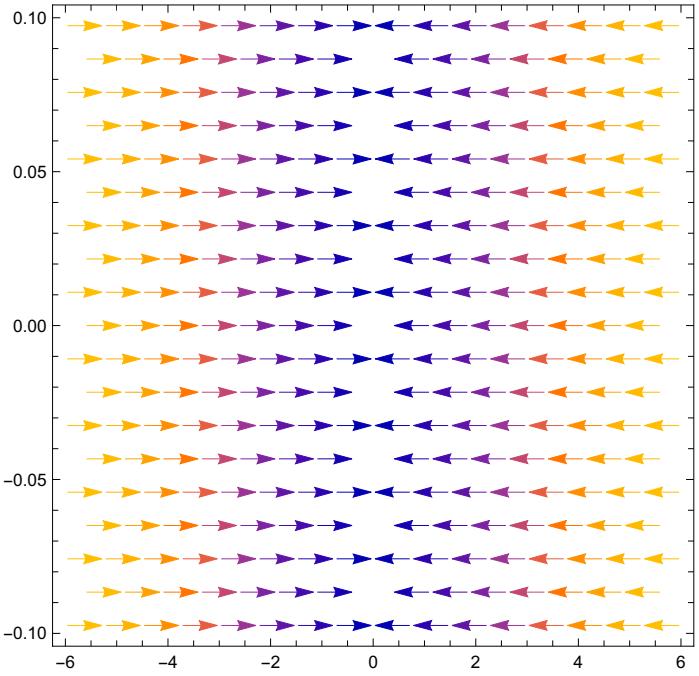
Out[52]= Solve[{Sin[x] == x}, x]

In[53]:=
```
x =.;
D[Sin[x] - x, x]
```

Out[54]= -1 + Cos[x]

In[55]:=
```
VectorPlot[{Sin[x] - x, 0}, {x, -6, 6}, {y, -0.1, 0.1}]
```

Out[55]=




```
(* g) f(x)=-x^(1/3) *)
```

In[56]:=
```
x =.;
Solve[{-x^(1/3) == x}, x]
```

Out[57]= {{x → 0}}

In[58]:=
```
x =.;
D[-x^(1/3) - x, x]
```

Out[59]=
$$-1-\frac{1}{3\,x^{2/3}}$$

```
(* h) f(x)=(-4/π)*ArcTan[x] *)
```

In[60]:=
```
x =.;
NSolve[{(-4/π) * ArcTan[x] == x}, x]
```

NSolve: This system cannot be solved with the methods available to NSolve.

Out[61]=
$$\text{NSolve}\left[\left\{-\frac{4\,\text{ArcTan}[x]}{\pi}==x\right\},\,x\right]$$

In[62]:=
```
x =.;
D[-(4*ArcTan[x])/π - x, x]
```

Out[63]=
$$-1-\frac{4}{\pi\,(1+x^2)}$$

In[64]:=
```
-1 - 4/π // N
```

Out[64]=
```
-2.27324
```

Problema 7.2

In[65]:=
```
r =.;
Solve[{r * x * (1 - x) == x}, x]
```

Out[66]=
$$\left\{\{x\to 0\},\left\{x\to\frac{-1+r}{r}\right\}\right\}$$

In[67]:=
```
D[r * x * (1 - x), x]
```

Out[67]=
```
r (1 - x) - r x
```

Problema 14.2

In[68]:=
```
AbsArg[1 - 4 * I] // N
AbsArg[1/2 + 3/4 * I] // N
```

Out[68]=
```
{4.12311, -1.32582}
```

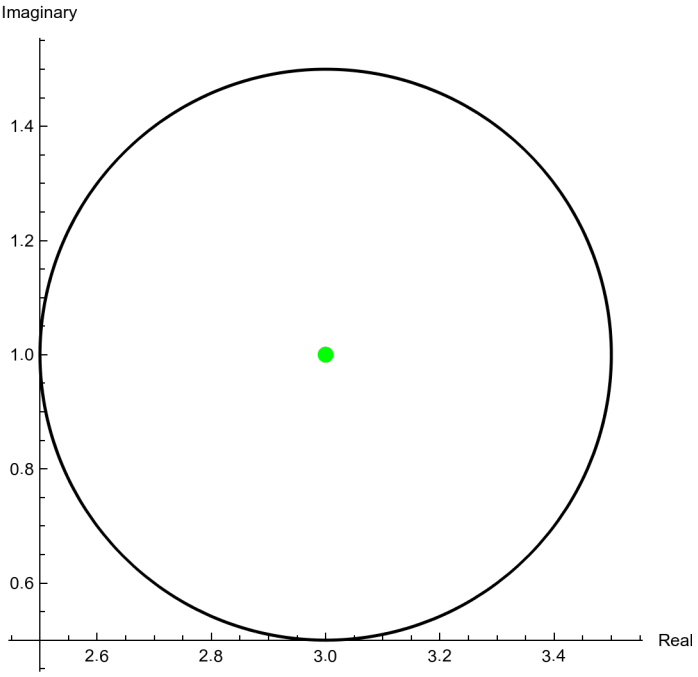
Out[69]=
```
{0.901388, 0.982794}
```

Problema 14.3

In[70]:=
```
(* Para 3+i, radio 1/2 *)
bola1 = ParametricPlot[{0.5 * Cos[t] + 3, 0.5 * Sin[t] + 1},
   {t, 0, 10}, PlotStyle → Black, AxesLabel → {"Real", "Imaginary"}];
center1 = Graphics[{PointSize[0.025], Point[{{3, 1}}, VertexColors → {Green}]}];

Show[bola1, center1]
```

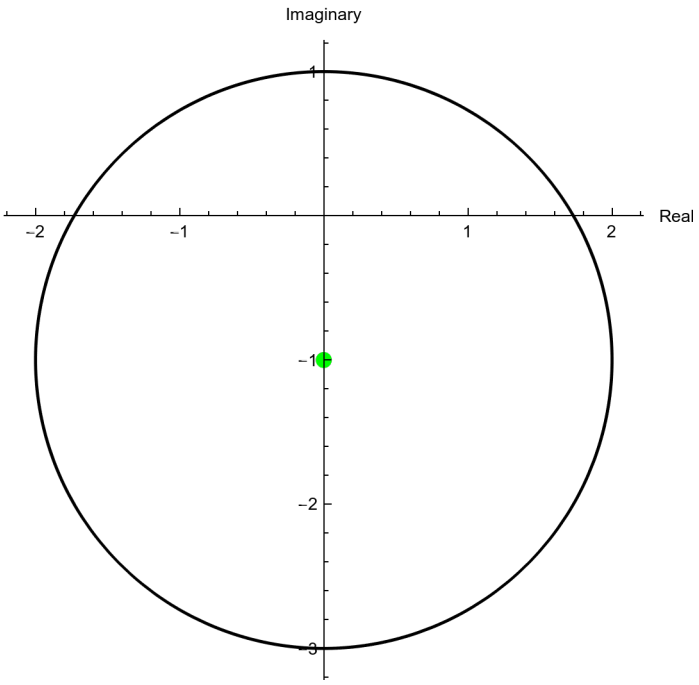
Out[72]=



In[73]:=
```
(* Para -i, radio 2 *)
bola2 = ParametricPlot[{2 * Cos[t], 2 * Sin[t] - 1},
   {t, 0, 10}, PlotStyle → Black, AxesLabel → {"Real", "Imaginary"}];
center2 = Graphics[{PointSize[0.025], Point[{{0, -1}}, VertexColors → {Green}]}];

Show[bola2, center2]
```

Out[75]=



Problema 14.4

In[76]:=
```
z =.;
Solve[{z^2 == 8}, z]
```

Out[77]= $\left\{\left\{z \to -2\sqrt{2}\right\}, \left\{z \to 2\sqrt{2}\right\}\right\}$

In[78]:=
```
z =.;
Solve[{z^3 == 8}, z]
```

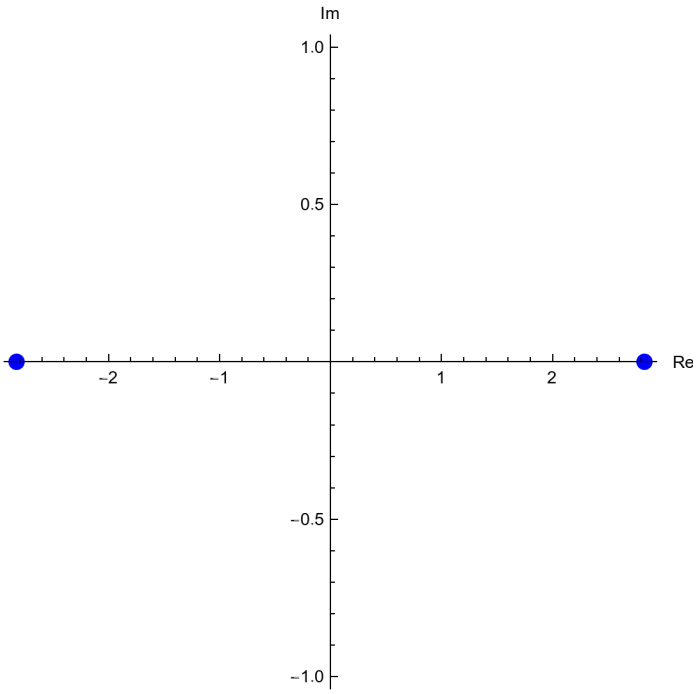
Out[79]= $\{\{z \to 2\}, \{z \to -2(-1)^{1/3}\}, \{z \to 2(-1)^{2/3}\}\}$

In[80]:=
```
z =.;
Solve[{z^# == 1}, z] & /@ Range[2, 6]
```

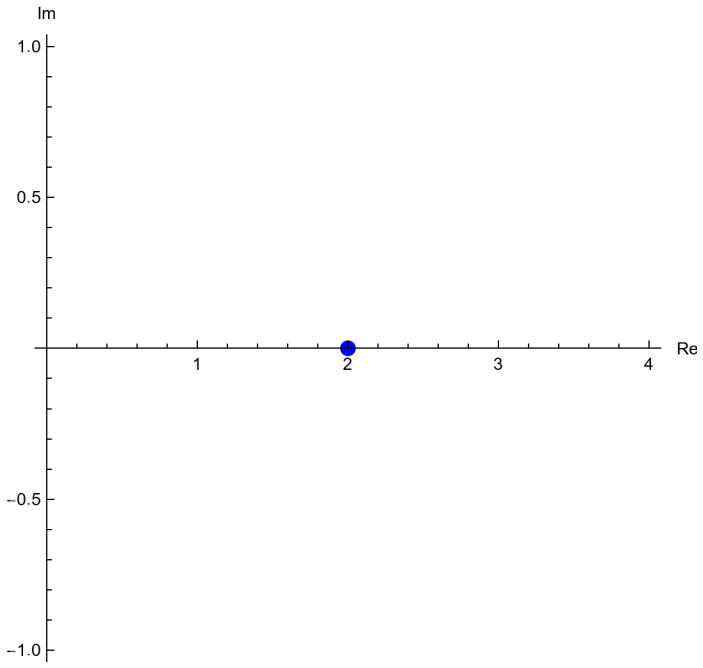
Out[81]= $\{\{\{z \to -1\}, \{z \to 1\}\}, \{\{z \to 1\}, \{z \to -(-1)^{1/3}\}, \{z \to (-1)^{2/3}\}\}, \{\{z \to -1\}, \{z \to -i\}, \{z \to i\}, \{z \to 1\}\},$
$\{\{z \to 1\}, \{z \to -(-1)^{1/5}\}, \{z \to (-1)^{2/5}\}, \{z \to -(-1)^{3/5}\}, \{z \to (-1)^{4/5}\}\},$
$\{\{z \to -1\}, \{z \to 1\}, \{z \to -(-1)^{1/3}\}, \{z \to (-1)^{1/3}\}, \{z \to -(-1)^{2/3}\}, \{z \to (-1)^{2/3}\}\}\}$

In[82]:=
```
(* a) *)
Graphics[
 {PointSize[0.025], Point[{{-2 * √2 , 0}, {2 * √2 , 0}}, VertexColors → {Blue, Blue}]},
 Axes → True, AxesLabel → {"Re", "Im"}, AspectRatio → 1]
(* b) *)
Graphics[{PointSize[0.025], Point[{{2, 0}}, VertexColors → {Blue}]},
 Axes → True, AxesLabel → {"Re", "Im"}, AspectRatio → 1]
(* c) *)
(* 2 *)
Graphics[{PointSize[0.025], Point[{{-1, 0}, {1, 0}}, VertexColors → {Blue, Blue}]},
 Axes → True, AxesLabel → {"Re", "Im"}, AspectRatio → 1]
(* 3 *)
Graphics[{PointSize[0.025], Point[{{1, 0}}, VertexColors → {Blue}]},
 Axes → True, AxesLabel → {"Re", "Im"}, AspectRatio → 1]
(* 4 *)
Graphics[{PointSize[0.025],
   Point[{{-1, 0}, {1, 0}, {0, -1}, {0, 1}}, VertexColors → {Blue, Blue, Blue, Blue}]},
 Axes → True, AxesLabel → {"Re", "Im"}, AspectRatio → 1]
(* 5 *)
Graphics[{PointSize[0.025], Point[{{1, 0}}, VertexColors → {Blue}]},
 Axes → True, AxesLabel → {"Re", "Im"}, AspectRatio → 1]
(* 6 *)
Graphics[{PointSize[0.025], Point[{{-1, 0}, {1, 0}}, VertexColors → {Blue, Blue}]},
 Axes → True, AxesLabel → {"Re", "Im"}, AspectRatio → 1]
```

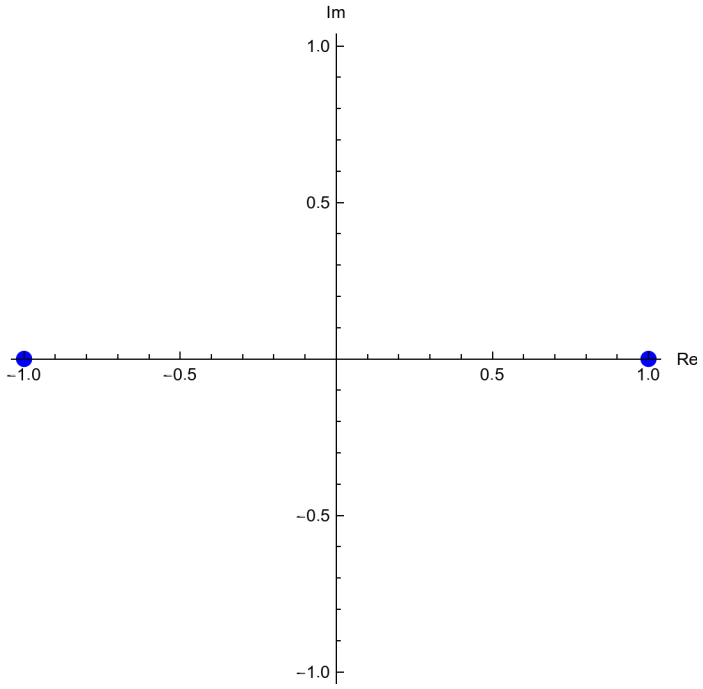
Out[82]=



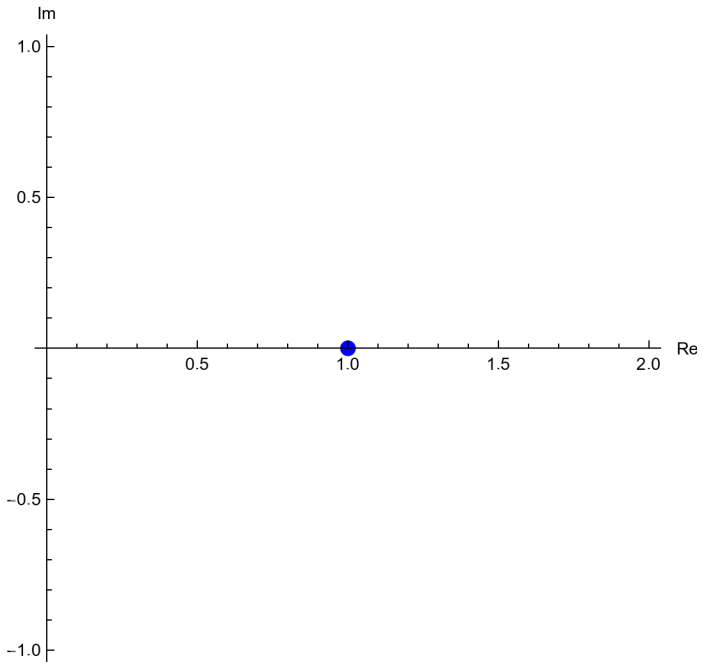
Out[83]=



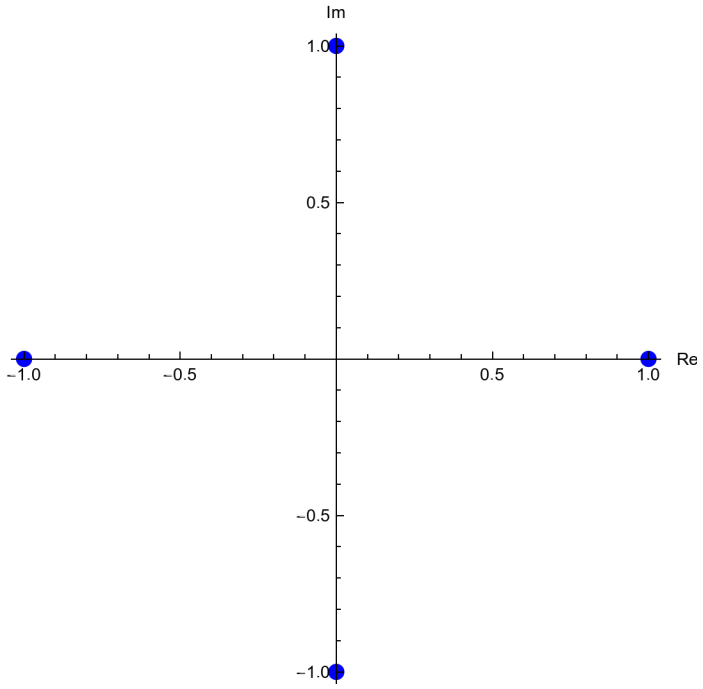
Out[84]=



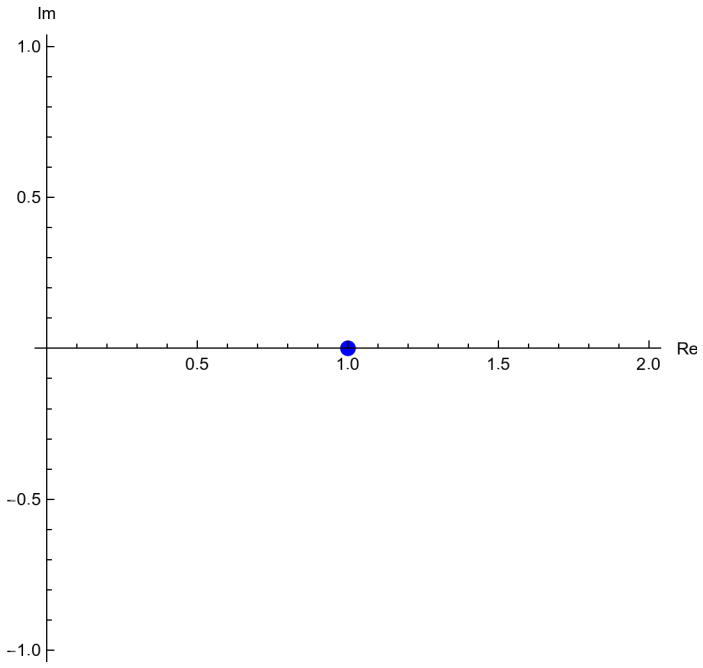
Out[85]=



Out[86]=



Out[87]=



Out[88]=