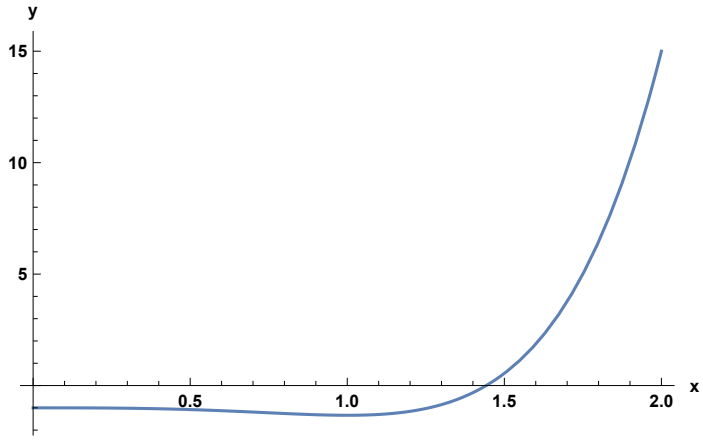
Plot normal equations

e.g. $y = \left(x^3/3 - 1\right)\left(x^3 + 1\right)$

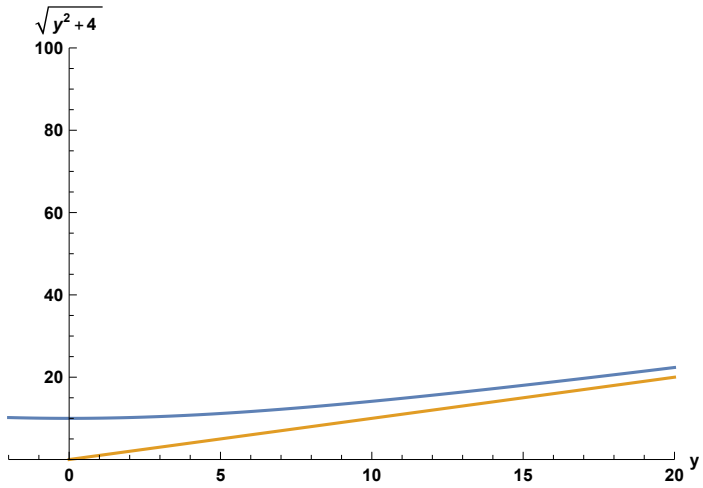
In[•]:=
```
Plot[(x^3/3 - 1) (x^3 + 1), {x, 0, 2}, PlotRange → All, AxesLabel → {"x", "y"}]
```

Out[•]=



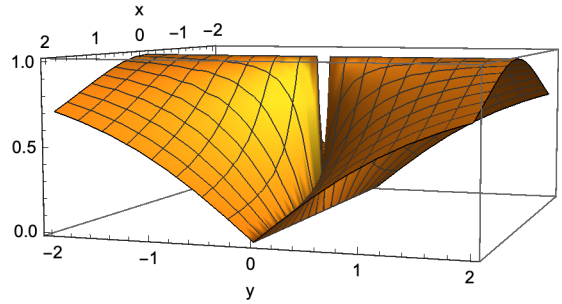
In[•]:=
```
Plot[{√(y^2 + 100), y}, {y, -2, 20},
 PlotRange → {{-2, 20}, {0, 100}}, AxesLabel → {"y", "√(y^2 + 4)"}]
```

Out[•]=



In[•]:=
```
Plot3D[√(y^2)/√(x^2 + y^2), {x, -2, 2}, {y, -2, 2}, PlotRange → All, AxesLabel → {"x", "y"}]
```

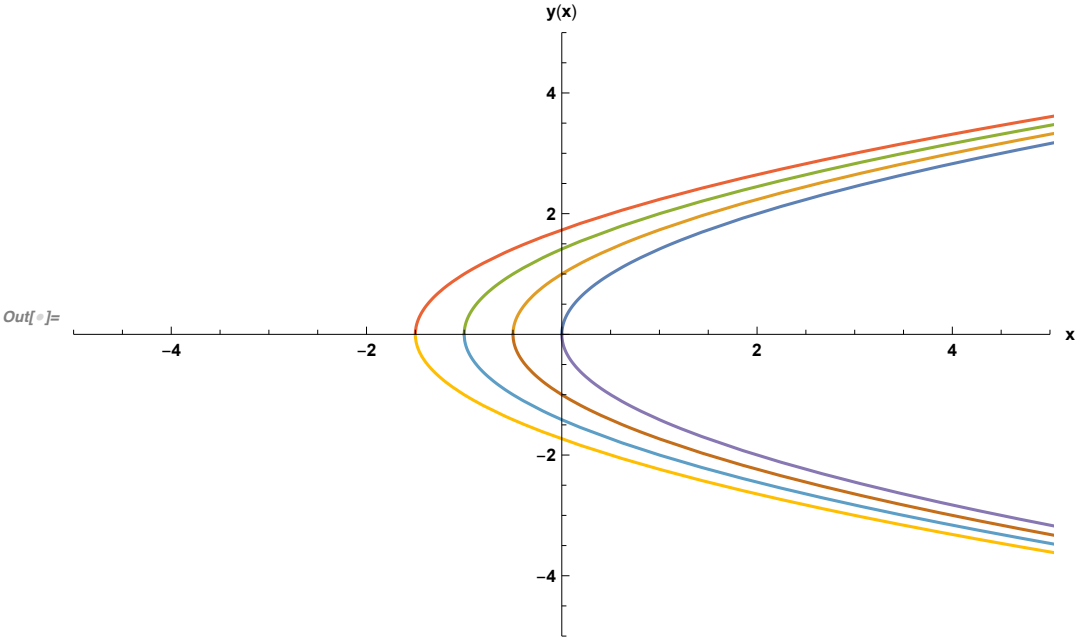
Out[•]=



Plot the implicit solution e.g. $y^2 = 2x + c$

```
In[•]:= Plot[{√(2 x), √(2 x + 1), √(2 x + 2), √(2 x + 3), -√(2 x), -√(2 x + 1), -√(2 x + 2), -√(2 x + 3)},
  {x, -10, 10}, PlotRange → {{-5, 5}, {-5, 5}}, AxesLabel → {"x", "y(x)"}]
```

Out[•]=



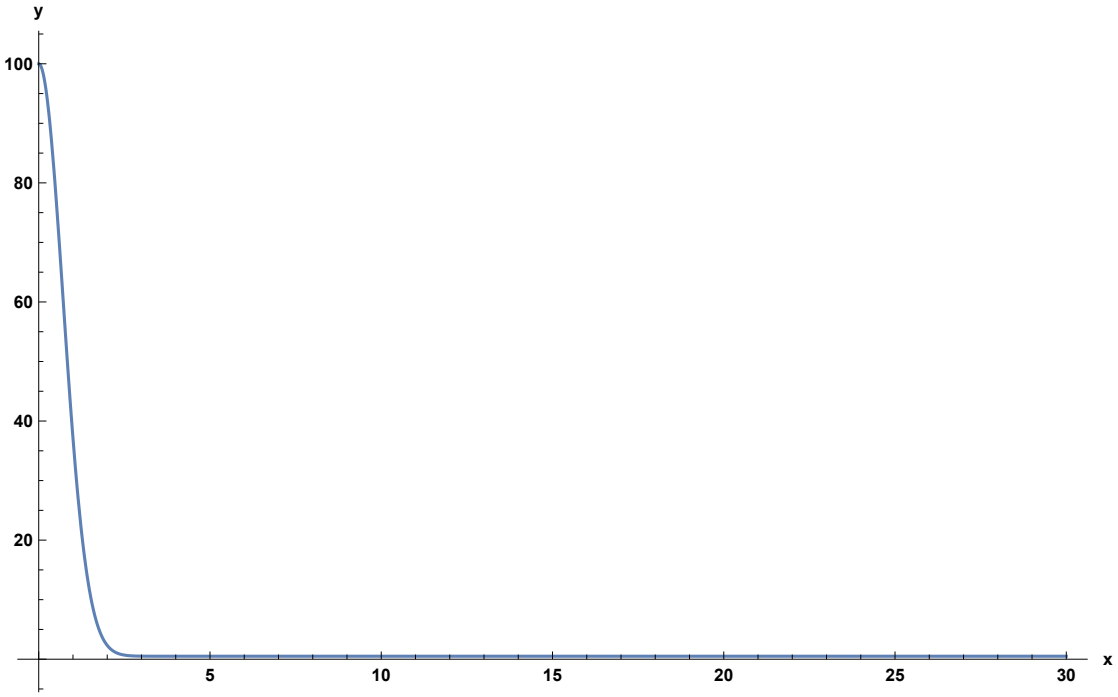
Solve First-Order ODEs

```
In[•]:= s = NDSolve[{y'[x] == x - 2 x y[x], y[0] == 100}, y, {x, 0, 30}]
```

Out[•]= {{y → InterpolatingFunction[⊞ Domain: {{0., 30.}} Output: scalar]}}

In[•]:=
```
Plot[Evaluate[y[x] /. s], {x, 0, 30}, PlotRange → All, AxesLabel → {"x", "y"}]
```

Out[•]=



Solve the general solution of Second-Order ODEs

In[•]:=
```
s = DSolve[{y''[x] + 2 y[x] + 1 == -2 x }, y, {x, 0, 30}]
```

Out[•]=
$$\left\{\left\{y \to \text{Function}\left[\{x\}, -\frac{1}{2} - x + C[1] \cos\left[\sqrt{2}\ x\right] + C[2] \sin\left[\sqrt{2}\ x\right]\right]\right\}\right\}$$

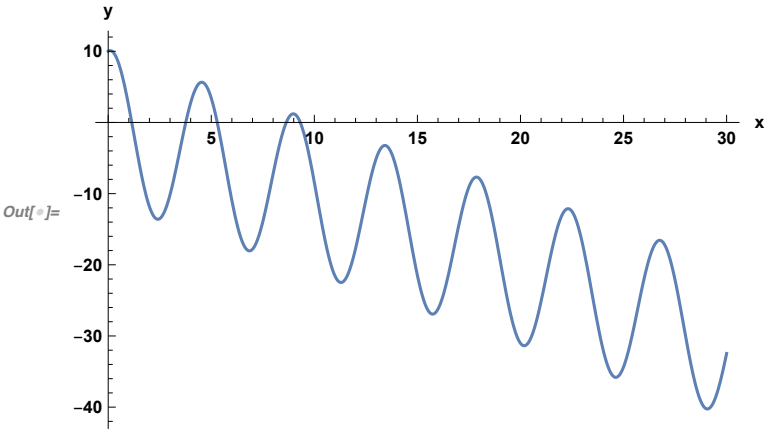
Solve the IVP of Second-Order ODEs

In[•]:=
```
s = DSolve[{y''[x] + 2 y[x] + 1 == -2 x , {y[0] == 10, y'[0] == 2}}, y, {x, 0, 30}]
```

Out[•]=
$$\left\{\left\{y \to \text{Function}\left[\{x\}, \frac{1}{2}\left(-1 - 2 x + 21 \cos\left[\sqrt{2}\ x\right] + 3\sqrt{2} \sin\left[\sqrt{2}\ x\right]\right)\right]\right\}\right\}$$

In[•]:=
```
Plot[Evaluate[y[x] /. s], {x, 0, 30}, PlotRange → All, AxesLabel → {"x", "y"}]
```

Out[•]=



Solve the BVP of Second-Order ODEs

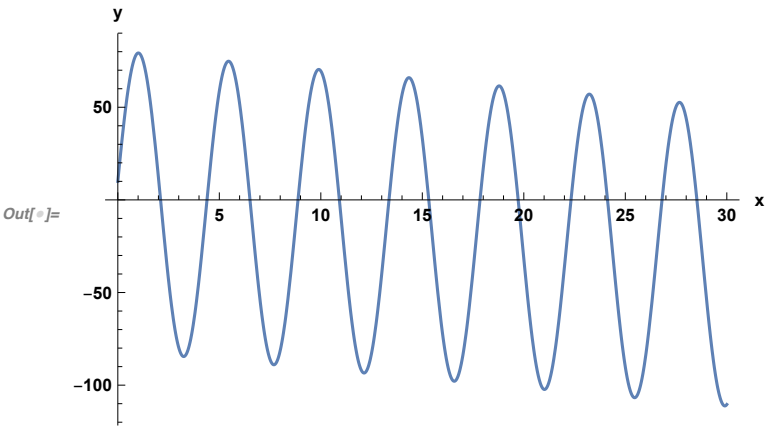
In[•]:=
```
s = DSolve[{y''[x] + 2 y[x] + 1 == -2 x , {y[0] == 10, y'[1] == 2}}, y, {x, 0, 30}]
```

Out[•]=

$$\left\{\left\{y \to \text{Function}\left[\{x\},\ \frac{1}{2}\left(-1-2x+21\cos\left[\sqrt{2}\,x\right]+3\sec\left[\sqrt{2}\right]\left(\sqrt{2}+7\sin\left[\sqrt{2}\right]\right)\sin\left[\sqrt{2}\,x\right]\right)\right]\right\}\right\}$$

In[•]:=
```
Plot[Evaluate[y[x] /. s], {x, 0, 30}, PlotRange → All, AxesLabel → {"x", "y"}]
```

Out[•]=



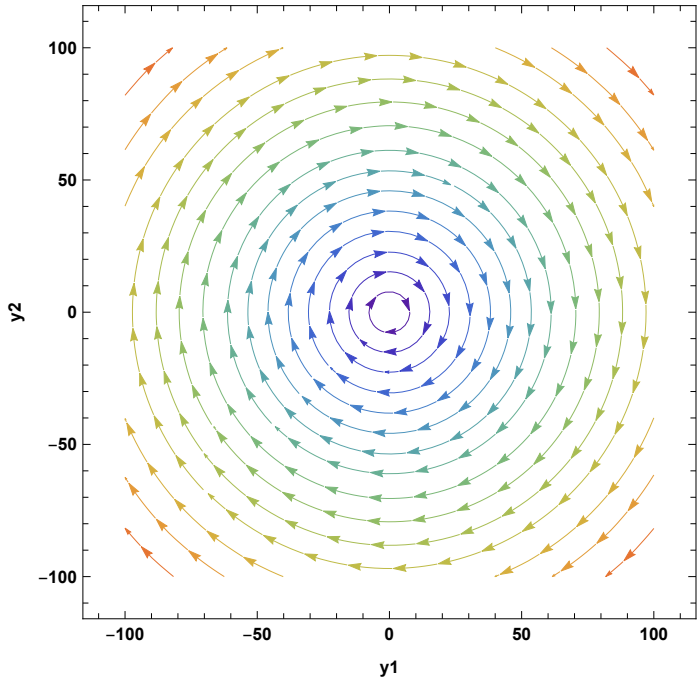
Plot the phase portait a system of 1st-Order ODEs

In[40]:=
```
(*example 1*)
```

In[41]:=
```
w1 = w2 = 10;
```

In[42]:=
```
StreamPlot[{w1 * y2, -w2 * y1}, {y1, -100, 100}, {y2, -100, 100},
 StreamColorFunction → "Rainbow", FrameLabel → {"y1", "y2"}]
```

Out[42]=



In[43]:=
```
(*example 2*)
```

In[44]:=
```
w1 = 15; w2 = 5;
```

In[45]:=
```
StreamPlot[{w1 * y2, -w2 * y1}, {y1, -100, 100}, {y2, -100, 100},
 StreamColorFunction → "Rainbow", FrameLabel → {"y1", "y2"}]
```

Out[45]=