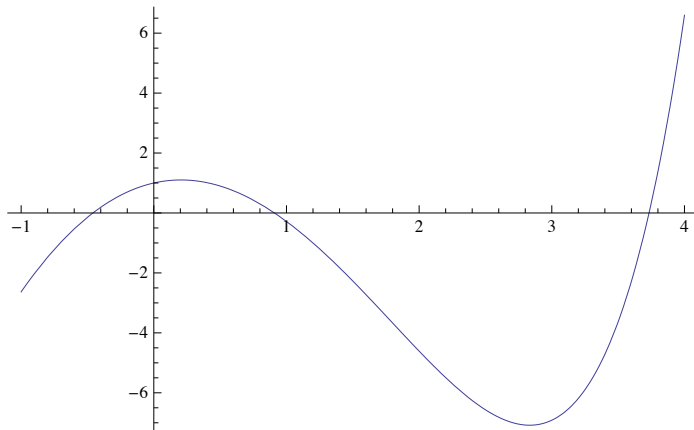


■ Primer 1

**Plot**[Exp[x] - 3 x^2, {x, -1, 4}]



**FindRoot**[Exp[x] - 3 x^2, {x, 4}]

{x → 3.73308}

**FindRoot**[Exp[x] - 3 x^2, {x, 1}]

{x → 0.910008}

**FindRoot**[Exp[x] - 3 x^2, {x, 0}]

{x → -0.458962}

**NSolve**[Exp[x] - 3 x^2 == 0, x]

NSolve::ifun:

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

{{x → -0.458962}, {x → 0.910008}, {x → 3.73308}}

**NSolve**[Reduce[Exp[x] - 3 x^2 == 0, x, Reals], x]

{{x → 0.910008}, {x → -0.458962}, {x → 3.73308}}

**Solve**[Exp[x] - 3 x^2 == 0, x]

Solve::ifun:

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

{{{x → -2 ProductLog[- $\frac{1}{2\sqrt{3}}$ ]}}

{x → -2 ProductLog[ $\frac{1}{2\sqrt{3}}$ ]}, {x → -2 ProductLog[-1, - $\frac{1}{2\sqrt{3}}$ ]}}

**Solve**[Reduce[Exp[x] - 3 x^2 == 0, x, Reals], x]

{{{x → -2 ProductLog[- $\frac{1}{2\sqrt{3}}$ ]}}

{x → -2 ProductLog[ $\frac{1}{2\sqrt{3}}$ ]}, {x → -2 ProductLog[-1, - $\frac{1}{2\sqrt{3}}$ ]}}

**ProductLog[0.4]**

0.297168

**Solve[0.4 == x \* Exp[x], x]**

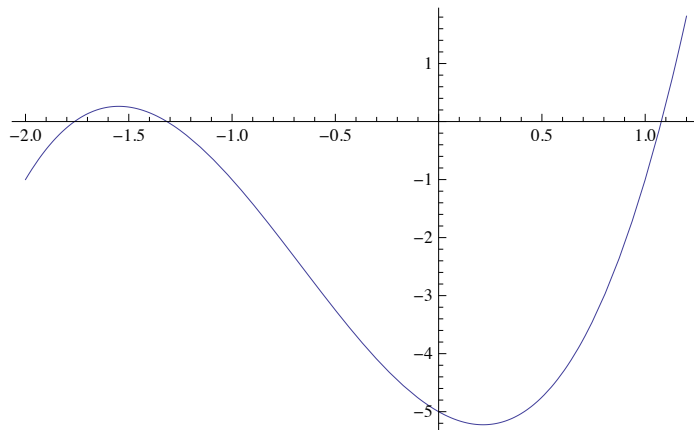
NSolve::ifun :

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

{{x → 0.297168}}

## ■ Primer 2

**Plot[2 x^3 + 4 x^2 - 2 x - 5, {x, -2, 1.2}]**



**FindRoot[2 x^3 + 4 x^2 - 2 x - 5, {x, 1}]**

{x → 1.07816}

**NSolve[2 x^3 + 4 x^2 - 2 x - 5 == 0, x]**

{{x → -1.76271}, {x → -1.31545}, {x → 1.07816}}

**Solve[2 x^3 + 4 x^2 - 2 x - 5 == 0, x]**

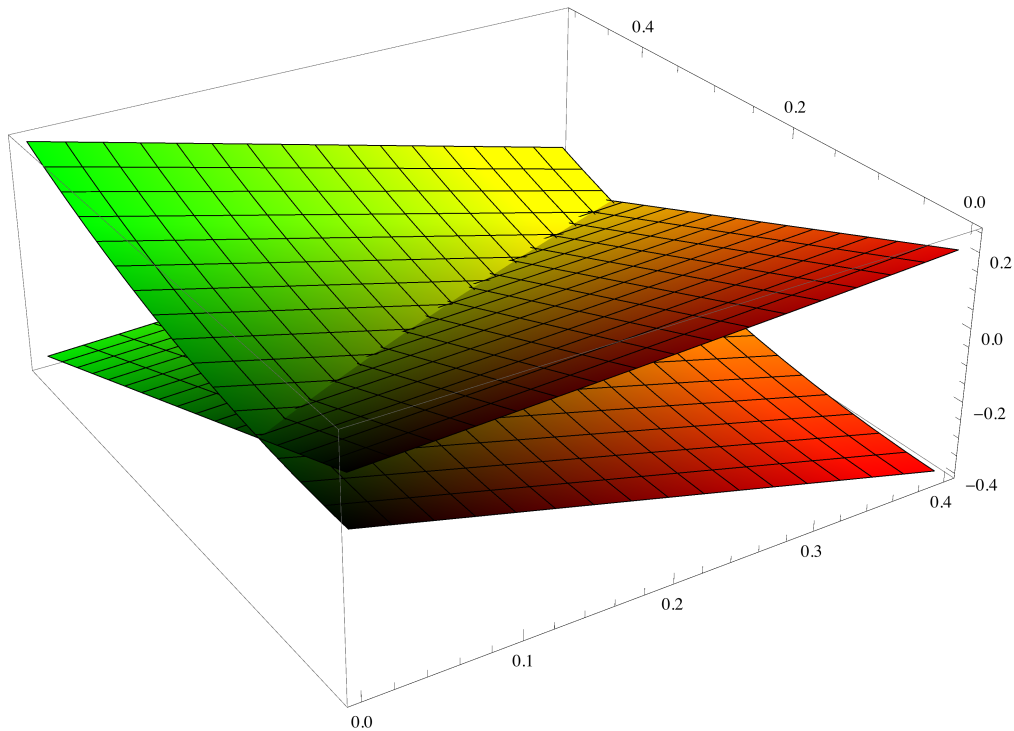
$$\left\{ \left\{ x \rightarrow \frac{1}{3} \left( -2 + \frac{7 \times 2^{2/3}}{(67 + 3i\sqrt{111})^{1/3}} + \frac{(67 + 3i\sqrt{111})^{1/3}}{2^{2/3}} \right) \right\}, \right.$$

$$\left\{ x \rightarrow -\frac{2}{3} - \frac{(1 + i\sqrt{3})(67 + 3i\sqrt{111})^{1/3}}{6 \times 2^{2/3}} - \frac{7(1 - i\sqrt{3})}{3(2(67 + 3i\sqrt{111}))^{1/3}} \right\},$$

$$\left. \left\{ x \rightarrow -\frac{2}{3} - \frac{(1 - i\sqrt{3})(67 + 3i\sqrt{111})^{1/3}}{6 \times 2^{2/3}} - \frac{7(1 + i\sqrt{3})}{3(2(67 + 3i\sqrt{111}))^{1/3}} \right\} \right\}$$

### ■ Primer 3

```
Plot3D[{Exp[x - 2] == y, y^2 == x}, {x, 0, 0.4}, {y, 0, 0.5},
  ColorFunction -> Function[{x, y, z}, RGBColor[x, y, 0.]]]
```



```
FindRoot[{Exp[x - 2] == y, y^2 == x}, {{x, 1}, {y, 1}}]
```

```
{x -> 0.019026, y -> 0.137935}
```

```
NSolve[{Exp[x - 2] == y, y^2 == x}, {x, y}]
```

```
NSolve::nsmet:
```

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

```
NSolve[{e-2+x == y, y2 == x}, {x, y}]
```

```
Solve[{Exp[x - 2] == y, y^2 == x}, {x, y}]
```

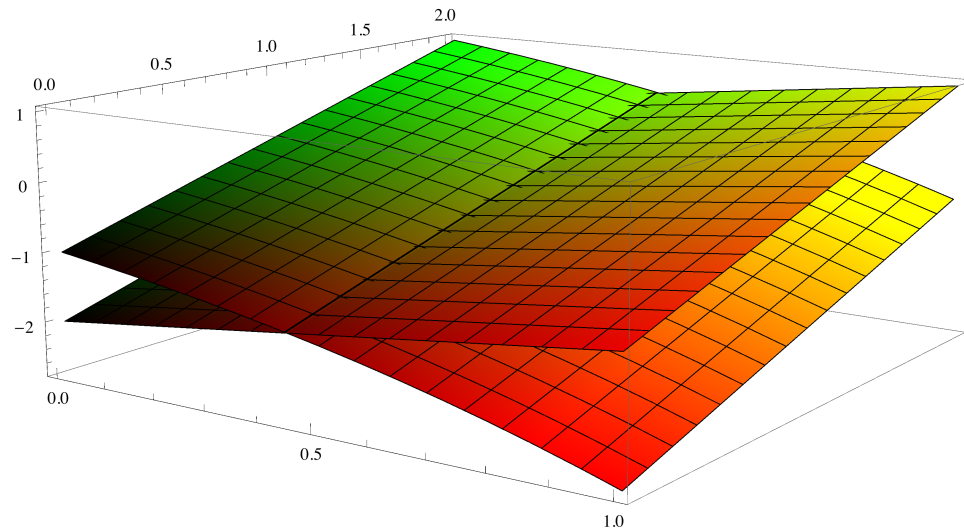
```
Solve::nsmet:
```

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

```
Solve[{e-2+x == y, y2 == x}, {x, y}]
```

■ **Primer 4**

```
Plot3D[{y == Exp[x], x + y == 2}, {x, 0, 1}, {y, 0, 2},
  ColorFunction -> Function[{x, y, z}, RGBColor[x, y, 0.]]]
```



```
FindRoot[{y == Exp[x], x + y == 2}, {{x, 1}, {y, 1}}]
```

```
{x -> 0.442854, y -> 1.55715}
```

```
NSolve[{y == Exp[x], x + y == 2}, {x, y}]
```

NSolve::ifun :

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

```
{{x -> 0.442854, y -> 1.55715}}
```

```
NSolve[Reduce[{y == Exp[x], x + y == 2}, {x, y}], {x, y}]
```

```
{{x -> ConditionalExpression[2. - 1. ProductLog[C[1], e^2],
  C[1] ∈ Integers], y -> ConditionalExpression[
  2.71828^2. - 1. ProductLog[C[1], e^2], C[1] ∈ Integers]}}
```

```
NSolve[Reduce[{y == Exp[x], x + y == 2}, {x, y}, Reals], {x, y}]
```

```
{{x -> 0.442854, y -> 1.55715}}
```

```
Solve[Reduce[{y == Exp[x], x + y == 2}, {x, y}, Reals], {x, y}]
```

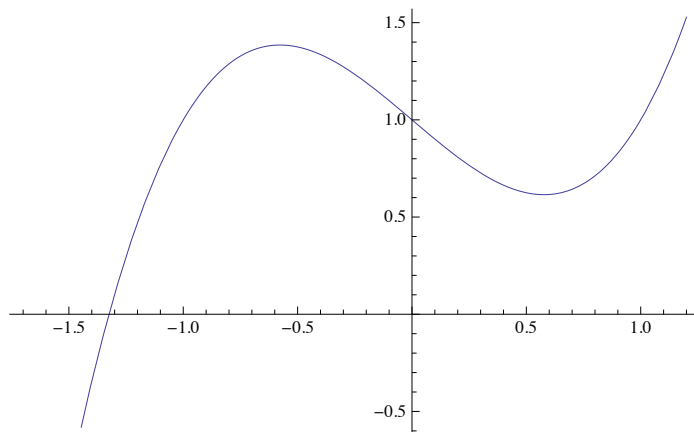
```
{{x -> 2 - ProductLog[e^2], y -> ProductLog[e^2]}}
```

```
N[ProductLog[e^2]]
```

```
1.55715
```

### ■ Primer 5

```
Plot[x^3 - x + 1, {x, -1.7, 1.2}]
```



```
FindRoot[x^3 - x + 1, {x, -1}]
```

```
{x → -1.32472}
```

```
FindRoot[x^3 - x + 1, {x, 1}]
```

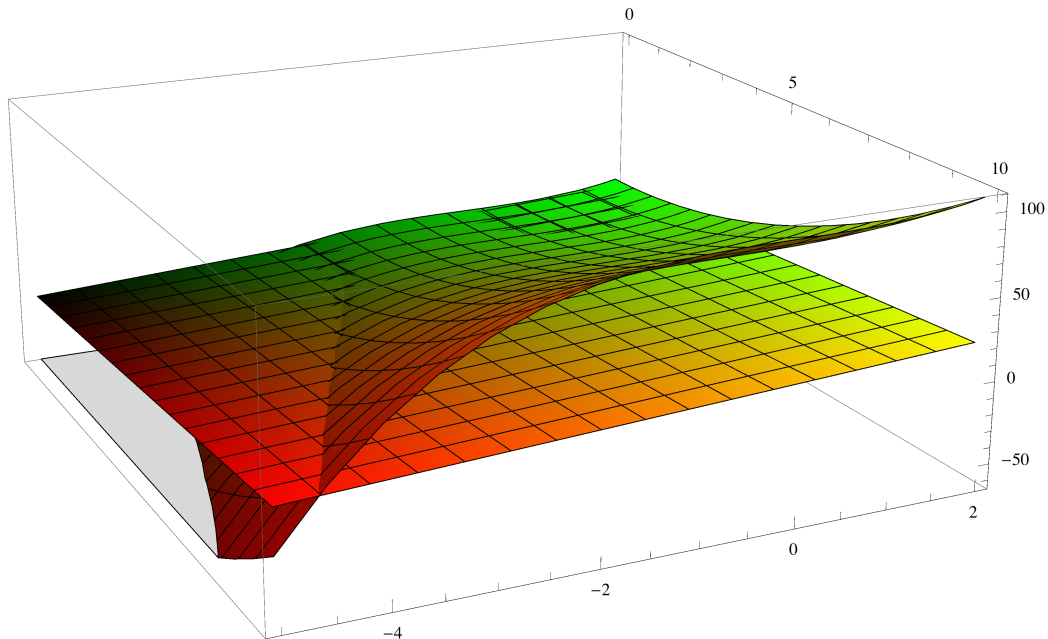
FindRoot::lstol:

The line search decreased the step size to within tolerance specified by AccuracyGoal and PrecisionGoal but was unable to find a sufficient decrease in the merit function. You may need more than MachinePrecision digits of working precision to meet these tolerances. >>

```
{x → 0.57735}
```

### ■ Primer 6

```
Plot3D[{x^2 + y^3 == 1, 2 x + 3 y == 4}, {x, 0, 10}, {y, -5, 2},
  ColorFunction -> Function[{x, y, z}, RGBColor[x, y, 0.]]]
```



```
FindRoot[{x^2 + y^3 == 1, 2 x + 3 y == 4}, {{x, 1}, {y, 1}}]
```

FindRoot::lstol:

The line search decreased the step size to within tolerance specified by AccuracyGoal and PrecisionGoal but was unable to find a sufficient decrease in the merit function. You may need more than MachinePrecision digits of working precision to meet these tolerances. >>

```
{x -> 0.723829, y -> 0.850781}
```

```
FindRoot[{x^2 + y^3 == 1, 2 x + 3 y == 4}, {{x, 7}, {y, -4}}]
```

```
{x -> 7.93641, y -> -3.95761}
```

```
NSolve[{x^2 + y^3 == 1, 2 x + 3 y == 4}, {x, y}]
```

```
{{x -> 7.93641, y -> -3.95761},
 {x -> 0.719295 + 0.255679 i, y -> 0.853803 - 0.170453 i},
 {x -> 0.719295 - 0.255679 i, y -> 0.853803 + 0.170453 i}}
```

```
NSolve[{x^2 + y^3 == 1, 2 x + 3 y == 4}, {x, y}, Reals]
```

```
{{x -> 7.93641, y -> -3.95761}}
```

```
Solve[{x^2 + y^3 == 1, 2 x + 3 y == 4}, {x, y}, Reals]
```

$$\left\{ \left\{ x \rightarrow \frac{1}{2} \left( 4 - \frac{3}{4} \left( -3 - \frac{41}{(267 - 8\sqrt{37})^{1/3}} - (267 - 8\sqrt{37})^{1/3} \right) \right), \right. \right.$$

$$\left. \left. y \rightarrow \frac{1}{4} \left( -3 - \frac{41}{(267 - 8\sqrt{37})^{1/3}} - (267 - 8\sqrt{37})^{1/3} \right) \right\} \right\}$$