

Precalculus

Trickier logarithmic equations involving quadratics

Todor Milev

2019

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

- Recall $\lg = \log_{10}$.

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

$$\lg((x + 2)(x - 1)) = 1$$

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

$$\lg((x + 2)(x - 1)) = 1$$

$$(x + 2)(x - 1) = 10^1$$

| Exp. base 10

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

$$\lg((x + 2)(x - 1)) = 1$$

$$(x + 2)(x - 1) = 10^1$$

Exp. base 10

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

$$\lg((x + 2)(x - 1)) = 1$$

$$(\textcolor{red}{x} + 2)(\textcolor{red}{x} - 1) = 10^1$$

$$\textcolor{red}{x}^2 + x - 2 = 10$$

| Exp. base 10

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

$$\lg((x + 2)(x - 1)) = 1$$

| Exp. base 10

$$(\textcolor{red}{x} + 2)(x - \textcolor{red}{1}) = 10^1$$

$$x^2 + \textcolor{red}{x} - 2 = 10$$

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

$$\lg((x + 2)(x - 1)) = 1$$

| Exp. base 10

$$(x + 2)(x - 1) = 10^1$$

$$x^2 + x - 2 = 10$$

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

$$\lg((x + 2)(x - 1)) = 1$$

$$(x + 2)(x - 1) = 10^1$$

$$x^2 + x - 2 = 10$$

| Exp. base 10

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

$$\lg((x + 2)(x - 1)) = 1$$

$$(x + 2)(x - 1) = 10^1$$

$$x^2 + x - 2 = 10$$

| Exp. base 10

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

$$\lg((x + 2)(x - 1)) = 1$$

| Exp. base 10

$$(x + 2)(x - 1) = 10^1$$

$$x^2 + x - 2 = 10$$

$$x^2 + x - 12 = 0$$

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

$$\lg((x + 2)(x - 1)) = 1$$

| Exp. base 10

$$(x + 2)(x - 1) = 10^1$$

$$x^2 + x - 2 = 10$$

$$x^2 + x - 12 = 0$$

$$(?) (?) = 0$$

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

$$\lg((x + 2)(x - 1)) = 1$$

| Exp. base 10

$$(x + 2)(x - 1) = 10^1$$

$$x^2 + x - 2 = 10$$

$$x^2 + x - 12 = 0$$

$$(x - 3)(x + 4) = 0$$

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

$$\lg((x + 2)(x - 1)) = 1$$

| Exp. base 10

$$(x + 2)(x - 1) = 10^1$$

$$x^2 + x - 2 = 10$$

$$x^2 + x - 12 = 0$$

$$(x - 3)(x + 4) = 0$$

$$x = 3 \text{ or } x = -4$$

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

$$\lg((x + 2)(x - 1)) = 1$$

| Exp. base 10

$$(x + 2)(x - 1) = 10^1$$

$$x^2 + x - 2 = 10$$

$$x^2 + x - 12 = 0$$

$$(x - 3)(x + 4) = 0$$

$$x = 3 \quad \text{or} \quad x = -4$$

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$

Example

Solve the equation.

$$\lg(x+2) + \lg(x-1) = 1$$

$$\lg((x+2)(x-1)) = 1$$

| Exp. base 10

$$(x+2)(x-1) = 10^1$$

$$x^2 + x - 2 = 10$$

$$x^2 + x - 12 = 0$$

$$(x-3)(x+4) = 0$$

$$x = 3 \quad \text{or} \quad x = -4$$

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$
- Check whether answers are in domain of original expression:

Example

Solve the equation.

$$\lg(x+2) + \lg(x-1) = 1$$

Domain: $x > 1$

$$\lg((x+2)(x-1)) = 1$$

Exp. base 10

$$(x+2)(x-1) = 10^1$$

$$x^2 + x - 2 = 10$$

$$x^2 + x - 12 = 0$$

$$(x-3)(x+4) = 0$$

$$x = 3 \quad \text{or} \quad x = -4 \quad \text{not in domain}$$

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$
- Check whether answers are in domain of original expression:
 $\lg(t)$ is not a real number for $t < 0$.

Example

Solve the equation.

$$\lg(x + 2) + \lg(x - 1) = 1$$

Domain: $x > 1$

$$\lg((x + 2)(x - 1)) = 1$$

Exp. base 10

$$(x + 2)(x - 1) = 10^1$$

$$x^2 + x - 2 = 10$$

$$x^2 + x - 12 = 0$$

$$(x - 3)(x + 4) = 0$$

$$x = 3 \quad \text{or} \quad \cancel{x = -4} \quad \text{not in domain}$$

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$
- Check whether answers are in domain of original expression:
 $\lg(t)$ is not a real number for $t < 0$.

Example

Solve the equation.

$$\lg(x+2) + \lg(x-1) = 1$$

Domain: $x > 1$

$$\lg((x+2)(x-1)) = 1$$

Exp. base 10

$$(x+2)(x-1) = 10^1$$

$$x^2 + x - 2 = 10$$

$$x^2 + x - 12 = 0$$

$$(x-3)(x+4) = 0$$

$$x = 3 \quad \text{or} \quad \cancel{x = -4} \quad \text{not in domain}$$

- Recall $\lg = \log_{10}$.
- $\log_a(st) = \log_a(s) + \log_a(t)$, rule does not hold for negative s, t .
- Check whether answers are in domain of original expression:
 $\lg(t)$ is not a real number for $t < 0$.