

## Precalculus

Basic exponent equation of type  $c^{px+q} = Ad^{rx+s}$

Todor Milev

2019

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

Common base

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

Common base

$$a = b^{\log_b a}$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

Common base

$$a = b^{\log_b a}$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

Common base

$$a = b^{\log_b a}$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

$$2^{(\log_2 3)(2x+5) - (-x+1)} = 5$$

Common base

$$a = b^{\log_b a}$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

$$2^{(\log_2 3)(2x+5) - (-x+1)} = 5$$

Common base

$$a = b^{\log_b a}$$



## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

Common base

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$a = b^{\log_b a}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

$$2^{(\log_2 3)(2x+5) - (-x+1)} = 5$$

Apply  $\log_2$

$$(\log_2 3)(2x + 5) + x - 1 = \log_2 5$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

Common base

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$a = b^{\log_b a}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

$$2^{(\log_2 3)(2x+5)-(-x+1)} = 5$$

Apply  $\log_2$

$$(\log_2 3)(2x + 5) + x - 1 = \log_2 5$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

Common base

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$a = b^{\log_b a}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

$$2^{(\log_2 3)(2x+5)-(-x+1)} = 5$$

Apply  $\log_2$

$$(\log_2 3)(2x + 5) + x - 1 = \log_2 5$$

$$x( \quad + \quad ) + \quad = \log_2 5$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

Common base

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$a = b^{\log_b a}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

$$2^{(\log_2 3)(2x+5)-(-x+1)} = 5$$

Apply  $\log_2$

$$(\log_2 3)(2x + 5) + x - 1 = \log_2 5$$

$$x(2\log_2 3 + 1) + 5\log_2 3 - 1 = \log_2 5$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

Common base

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$a = b^{\log_b a}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

$$2^{(\log_2 3)(2x+5)-(-x+1)} = 5$$

Apply  $\log_2$

$$(\log_2 3)(2x + 5) + x - 1 = \log_2 5$$

$$x(2 \log_2 3 + 1) +$$

$$= \log_2 5$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

Common base

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$a = b^{\log_b a}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

$$2^{(\log_2 3)(2x+5)-(-x+1)} = 5$$

Apply  $\log_2$

$$(\log_2 3)(2x + 5) + x - 1 = \log_2 5$$

$$x(2 \log_2 3 + 1) + 5 \log_2 3 = \log_2 5$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

Common base

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$a = b^{\log_b a}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

$$2^{(\log_2 3)(2x+5)-(-x+1)} = 5$$

Apply  $\log_2$

$$(\log_2 3)(2x + 5) + x - 1 = \log_2 5$$

$$x(2 \log_2 3 + 1) + 5 \log_2 3 = \log_2 5 + 1$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

Common base

$$(2^{\log_2 3})^{2x+5} = 5 \cdot 2^{-x+1}$$

$$a = b^{\log_b a}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

$$2^{(\log_2 3)(2x+5)-(-x+1)} = 5$$

Apply  $\log_2$

$$(\log_2 3)(2x + 5) + x - 1 = \log_2 5$$

$$x(2 \log_2 3 + 1) + 5 \log_2 3 = \log_2 5 + 1$$

$$x = \frac{\log_2 5 + 1}{2 \log_2 3 + 1}$$



## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

Common base

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$a = b^{\log_b a}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

$$2^{(\log_2 3)(2x+5)-(-x+1)} = 5$$

Apply  $\log_2$

$$(\log_2 3)(2x + 5) + x - 1 = \log_2 5$$

$$x(2 \log_2 3 + 1) + 5 \log_2 3 = \log_2 5 + 1$$

$$x = \frac{\log_2 5 + 1 - 5 \log_2 3}{2 \log_2 3 + 1}$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

Common base

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$a = b^{\log_b a}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

$$2^{(\log_2 3)(2x+5)-(-x+1)} = 5$$

Apply  $\log_2$

$$(\log_2 3)(2x + 5) + x - 1 = \log_2 5$$

$$x(2\log_2 3 + 1) + 5\log_2 3 = \log_2 5 + 1$$

$$x = \frac{\log_2 5 + 1 - 5\log_2 3}{2\log_2 3 + 1}$$

## Example

Solve.

$$3^{2x+5} = 5 \cdot 2^{-x+1}$$

Common base

$$\left(2^{\log_2 3}\right)^{2x+5} = 5 \cdot 2^{-x+1}$$

$$a = b^{\log_b a}$$

$$2^{(\log_2 3)(2x+5)} = 5 \cdot 2^{-x+1}$$

$$\frac{2^{(\log_2 3)(2x+5)}}{2^{-x+1}} = 5$$

$$2^{(\log_2 3)(2x+5)-(-x+1)} = 5$$

Apply  $\log_2$

$$(\log_2 3)(2x + 5) + x - 1 = \log_2 5$$

$$x(2 \log_2 3 + 1) + 5 \log_2 3 = \log_2 5 + 1$$

$$x = \frac{\log_2 5 + 1 - 5 \log_2 3}{2 \log_2 3 + 1}$$

$$x \approx -1.1038$$

Calculator