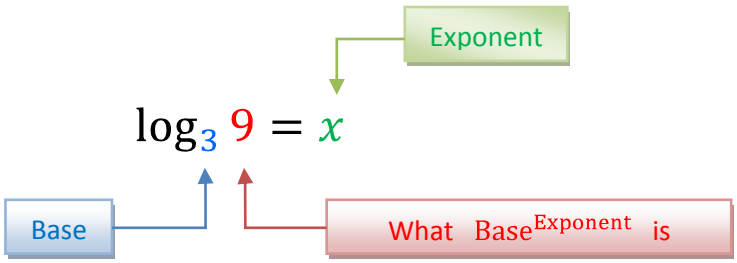
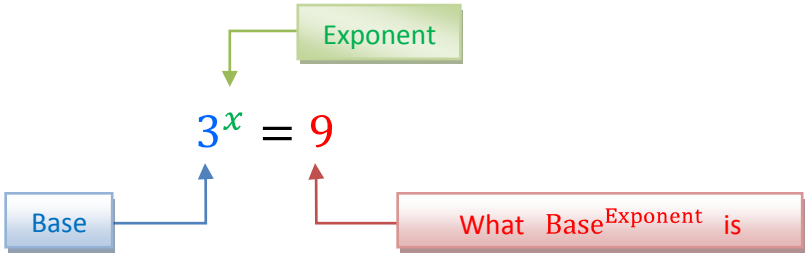
Simplify $\log_3 9$

Step 1 – Let's set this $=$ to *x*.

$$\log_3 9 = x$$

Step 2 – Rewrite the logarithmic equation as an exponential equation.





Step 3 – Solve for x. You might be able to figure it out in your head. Otherwise, let's get the same bases and set the exponents equal to each other.

$$3^x = 3^2$$
$$x = 2$$

Step 4 – We've found the answer! But we don't need to write the *x* because there really wasn't any *x* to start with – we are the ones who put it in there (we could have used *y* or *m* or ?)

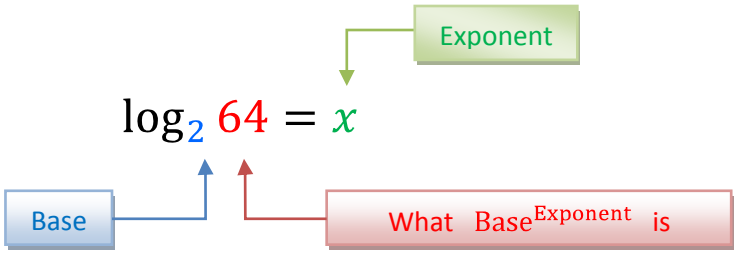
$$\log_3 9 = \mathbf{2}$$

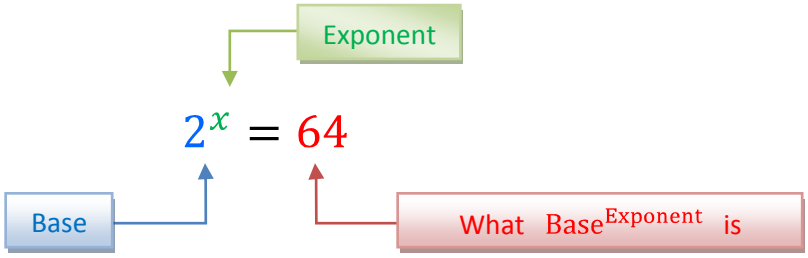
Simplify $\log_2 64$

Step 1 – Let's set this $=$ to *x*.

$$\log_2 64 = x$$

Step 2 – Rewrite the logarithmic equation as an exponential equation.





Step 3 – Solve for x. You might be able to figure it out in your head. Otherwise, let's get the same bases and set the exponents equal to each other.

$$2^x = 2^6$$
$$x = 6$$

Step 4 – We've found the answer!

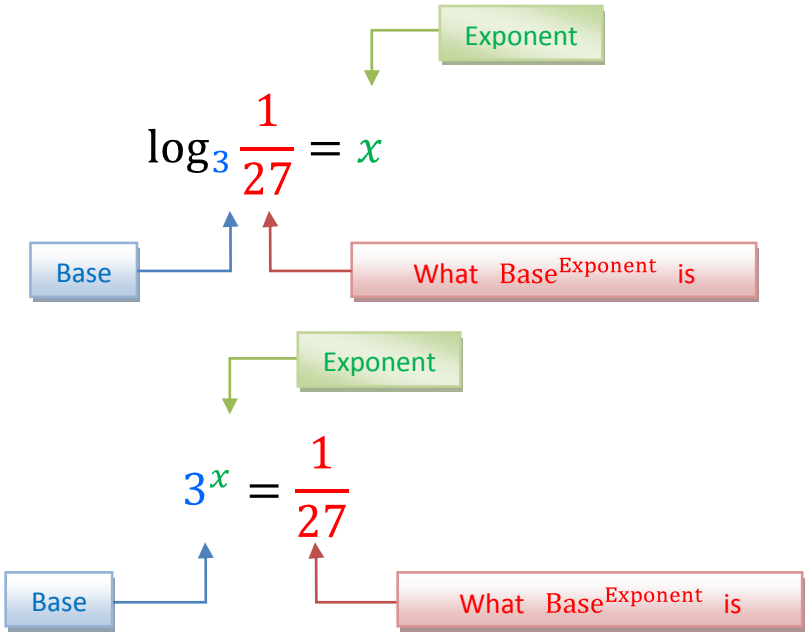
$$\log_2 64 = \mathbf{6}$$

Simplify $\log_3 \frac{1}{27}$

Step 1 – Let's set this = to *x*.

$$\log_3 \frac{1}{27} = x$$

Step 2 – Rewrite the logarithmic equation as an exponential equation.



Step 3 – Solve for x. You might be able to figure it out in your head. Otherwise, let's get the same bases and set the exponents equal to each other. We can "flip" the $\frac{1}{27}$ into 27^{-1} so we can use a base of 3 on both sides.

$$3^x = (27)^{-1} \qquad 3^x = 3^{-3}$$
$$3^x = (3^3)^{-1} \qquad x = -3$$

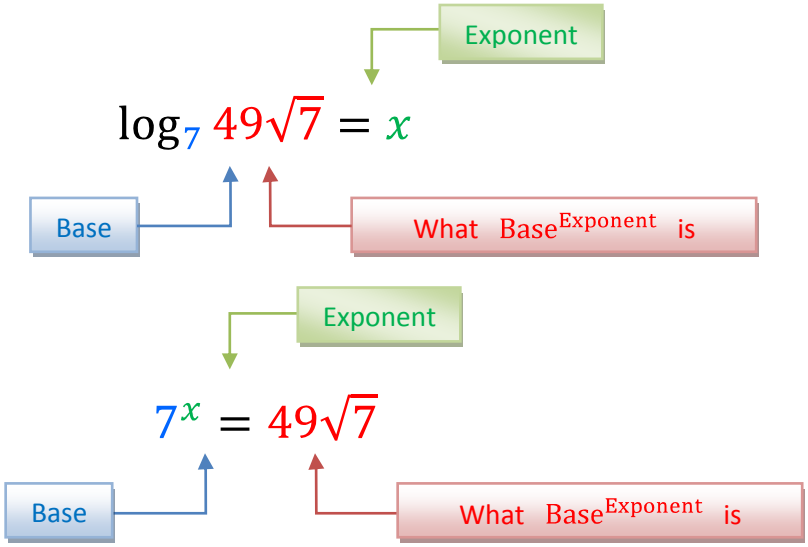
Step 4 – We've found the answer! $\log_3 \frac{1}{27} = \mathbf{-3}$

Simplify $\log_7 49\sqrt{7}$

Step 1 – Let's set this = to *x*.

$$\log_7 49\sqrt{7} = x$$

Step 2 – Rewrite the logarithmic equation as an exponential equation.



Step 3 – Solve for x. Let's get the same bases and set the exponents equal to each other. We will use a fractional exponent instead of the $\sqrt{7}$.

$$7^x = 7^2 7^{1/2}$$
$$7^x = 7^{2+1/2}$$
$$7^x = 7^{4/2+1/2}$$

$$7^x = 7^{5/2}$$
$$x = \frac{5}{2}$$

Step 4 – We've found the answer!

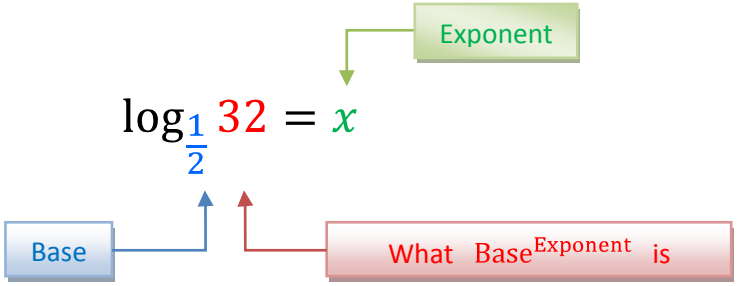
$$\log_7 49\sqrt{7} = \mathbf{\frac{5}{2}}$$

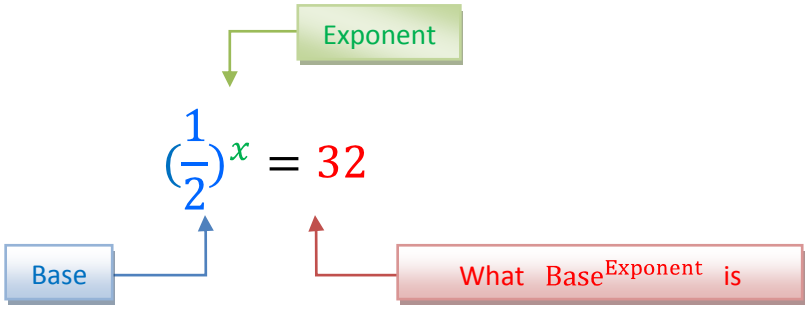
Simplify $\log_{\frac{1}{2}} 32$

Step 1 – Let's set this = to *x*.

$$\log_{\frac{1}{2}} 32 = x$$

Step 2 – Rewrite the logarithmic equation as an exponential equation.





Step 3 – Solve for x. Let's get the same bases and set the exponents equal to each other. We can "flip" the $\frac{1}{2}$ into 2^{-1} so we can use a base of 2 on both sides.

$$(2^{-1})^x = 32$$
$$2^{-x} = 2^5$$
$$-x = 5$$
$$x = -5$$

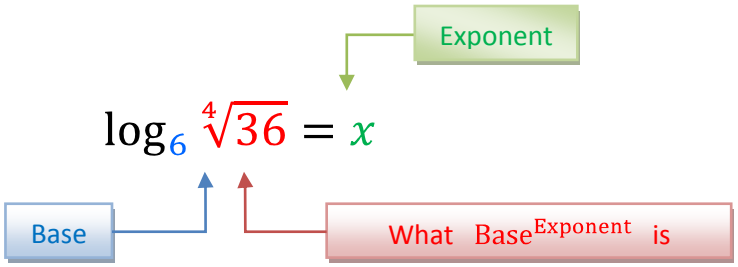
Step 4 – We've found the answer! $\log_{\frac{1}{2}} 32 = \mathbf{-5}$

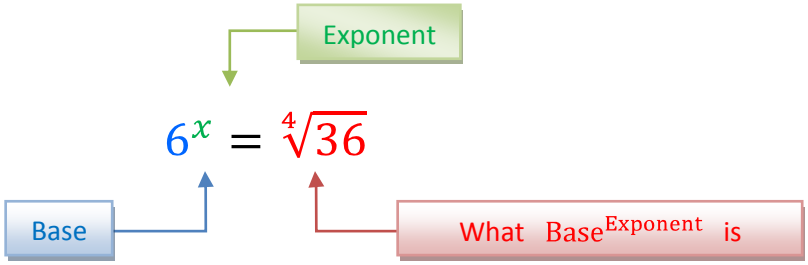
Simplify $\log_6 \sqrt[4]{36}$

Step 1 – Let's set this = to *x*.

$$\log_6 \sqrt[4]{36} = x$$

Step 2 – Rewrite the logarithmic equation as an exponential equation.





Step 3 – Solve for x. Let's get the same bases and set the exponents equal to each other. We will use a fractional exponent instead of $\sqrt[4]{36}$.

$$6^x = 36^{1/4}$$
$$6^x = (6^2)^{1/4}$$
$$6^x = 6^{2/4}$$

$$6^x = 6^{1/2}$$
$$x = \frac{1}{2}$$

Step 4 – We've found the answer! $\log_6 \sqrt[4]{36} = \mathbf{\frac{1}{2}}$