

• **Concepts:**

Logarithm

Exponential equation

Base

Exponent

Negative exponent

Fraction

In evaluating $\log_4\left(\frac{1}{16}\right)$ we are looking for the exponent on 4 that will evaluate to $\frac{1}{16}$.

So the value we are looking for is a solution to

$$4^x = \frac{1}{16}.$$

We might note that $4^2 = 16$ so that $4^{-2} = \frac{1}{16}$.

• **Conclusions:**

We have found that $\log_4\left(\frac{1}{16}\right) = -2$.

We can check our answer by evaluating 4^{-2} . Since this is $\frac{1}{16}$ our answer is correct.

19.3 Problems (6 pt Problems)

1. Evaluate 2^x at 0, 2, 4 and 8. What do you notice?
2. Evaluate $\log_3 9$.
3. If we invest \$100 at an annual rate of 2% compounded quarterly, how much will we have after 5 years?

19.4 Exercises

1. Evaluate $3^x - 4^{2x}$ at $x = -1$ and at $x = 1$.
2. If we invest \$150 at an annual rate of 3% compounded quarterly, how much will we have after 10 years?
3. Using trial and error, how long would we have to invest \$150 at an annual rate of 3% compounded annually to have \$300? Can you write your answer as a logarithm?
4. Where else might you find applications of exponential expressions and logarithms. Give two examples.