### Example 1

Rewrite each as a power in base 3.

a) \(27 = 3^3\) 

\[ (3^3)^2 = 3^4 \]

b) \(9^2 = \left(3^2\right)^2 \)

\[ (3^3)^{1/3} \left(3\sqrt[3]{81}\right)^2 \]

c) \(27^{1/3} \left(3\sqrt[3]{81}\right)^2 \)

\[ (3)^{1/3} \left(3\sqrt[3]{3^4}\right)^2 \]

You do this:

Change to a power with base 2.

a) \(4^3 = 2^6 \)

\[ \left(2^2\right)^3 = 2^6 \]

b) \(\frac{1}{8} = 2^{-3} \)

\[ 2^{2/3} \cdot \left(\sqrt[3]{16}\right)^3 \]

c) \(8^{2/3} = 2^6 \)

\[ 2^{2/3} \cdot \left(2^{4/3}\right)^3 \]

Note: 4 and 64 are both powers of 4.

- Rewrite both sides of the equation as powers with the same base.
- Ignore the base and set the exponents equal to each other.

### Try These

a) \(4^x = 4^{x+3} \)

b) \(9^{4x} = 27^{x-1} \)
a) \[
\frac{4x}{2} = \frac{4}{2} \quad 2(x+3) = 2
\]
\[
4x = 2x + 6
2x = 6
x = 3
\]

Application: Compound Interest Formula.

\[ A = P \left(1 + \frac{r}{n}\right)^{nt} \]

How long will it take $5000 to grow to $5900 in a term deposit that pays 6.12% per year, compounded quarterly.

\[
A = 5900
P = 5000
r = 6.12\% = 0.0612
n = 4 \text{ times per year}
\]
\[
t = ?
\]

\[
\frac{5900}{5000} = \left(1 + \frac{0.0612}{4}\right)^{4t}
\]
\[
1.18 = \left(1 + \frac{0.0612}{4}\right)^{4t}
\]
\[
1.18 = 1.0153
\]

\[
\log 1.18 = \log 1.0153
\]

\[
t \approx 4
\]

guess: check.
use logs.
\[
\frac{\log 1.18}{\log 1.0153} = 4 = \frac{\log 1.0153}{\log 1.0153}
\]

2.73 years

on your calculator:
\[
\frac{\log 1.18}{\log 1.0153} = \frac{4}{4} = 4
\]

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