

11.2

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Objective: I can simplify and solve using exponent rules.

A. Basic Properties of Exponents

1.	$b^0 = 1$	Zero Property	1) $11^0 = 1$
2.	$b^{-n} = \frac{1}{b^n}$ or $\frac{1}{b^{-n}} = b^n$ <i>Handwritten: $\frac{1 \cdot b^{-n}}{1} = \frac{1}{1 \cdot b^n}$</i>	Negative Exponent Property	1) $5^{-3} = \frac{1}{5^3} = \frac{1}{125}$ 2) $\frac{1}{2^{-3}} = 2^3 = 8$ 3) $\left(\frac{1}{6}\right)^2 = \frac{1^2}{6^2} = \frac{1}{36}$ 4) $9 = 3^2 = \left(\frac{1}{3}\right)^{-2}$ <i>Handwritten: $\frac{3}{2a^4} = \frac{3a^4}{2}$</i>
3.	$(b^m)(b^n) = b^{m+n}$	Product Rule	1) $x^6 x^8 = x^{14}$ 2) $(3x^4)(-4x) = -12x^5$
4.	$\frac{b^m}{b^n} = b^{m-n}$	Quotient Rule	1) $\frac{x^4}{x^2} = x^2$ 2) $\frac{x^6}{x^7} = x^{-1} = \frac{1}{x}$ 3) $\frac{4x^3}{6x^1} = \frac{2x^2}{3}$
5.	$(b^m)^n = b^{m \cdot n}$	Power to a Power Rule	1) $(4x)^2 = \frac{4^2 x^2}{16x^2}$ 2) $4x^2 = 4x^2$ 3) $(-2x^3)^3 = -8x^9$
6.	$a^{m/n} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$ <i>Handwritten: a^m-exp, a^n-root</i>	Positive Rational Exponents	1) $16^{2/3} = \sqrt[3]{16^2} = \sqrt[3]{64}$ 2) $\frac{1}{8^{-4/3}} = 8^{4/3} = \sqrt[3]{8^4} = 8$ <i>Handwritten: $2^4 = 16$</i>

B. Write numbers as exponents.

Example: $9 = 3^2$ Hint: They all have more than one answer.	1. $4 = 2^2$ 4^1 $\frac{1}{2^{-2}}$ $\frac{1}{4^1}$	2. $16 = 4^2$ 16^1 2^4	3. $32 = 2^5$	4. $27 = 3^3$	5. $243 = 3^5$
	6. $\frac{1}{25} = 25^{-1}$ 5^{-2}	7. $\frac{1}{2} = 2^{-1}$	8. $\frac{1}{6^x} = 6^{-x}$	9. $81 = 9^2$ 81^1 3^4	10. $\frac{1}{7} = 7^{-1}$

C. Same base

- In the expression, 5^2 : **5** is the _____ and **2** is the _____.
- If the *bases* of both sides of an exponential equation are the **same**:

$$B^m = B^n$$

then

the exponents are equal: $m = n$

D. Steps to Solve by changing the base

$5^{3x} = \frac{1}{125}$ $5^{3x} = \frac{1}{5^3}$ $5^{3x} = 5^{-3}$ $3x = -3$ $\frac{3x}{3} = \frac{-3}{3}$ $x = -1$	<p>Given</p> <p>Express the denominator of the right side with a base of 5. We have $125 = 5^3$.</p> <p>Apply the Negative Exponent Property.</p> <p>At this point, the bases are the same. Set the exponents equal to each other.</p> <p>Solve for x.</p> <p>To solve x, divide both sides by 3. That's it.</p>
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E. Examples

<p>1. $4^5 = 4^x$</p> <p>$5 = x$</p>	<p>2. $7^{-3x-5} = 7^{2x}$</p> <p>$-3x-5 = 2x$</p> <p>$-5 = 5x$</p> <p>$x = -1$</p>	<p>3. $3^{-3n} = 243$</p> <p>$3^{-3n} = 3^5$</p> <p>$-3n = 5$</p> <p>$n = -\frac{5}{3}$</p>
<p>4. $5^{-3x-3} = \frac{1}{625}$</p> <p>$5^{-3x-3} = 625^{-1}$</p> <p>$5^{-3x-3} = (5^4)^{-1}$</p> <p>$5^{-3x-3} = 5^{-4}$</p> <p>$-3x-3 = -4$</p> <p>$-3x = -1$</p> <p>$x = \frac{1}{3}$</p>	<p>5. $16^{m+1} = 64$</p> <p>$(4^2)^{m+1} = 4^3$</p> <p>$4^{2m+2} = 4^3$</p> <p>$2m+2 = 3$</p> <p>$2m = 1$</p> <p>$m = \frac{1}{2}$</p>	<p>6. $81^{m+2} = \frac{1}{9}$</p> <p>$(9^2)^{m+2} = 9^{-1}$</p> <p>$2m+4 = -1$</p> <p>$2m = -5$</p> <p>$m = -\frac{5}{2}$</p>
<p>7. $\left(\frac{1}{9}\right)^{-3r-2} = 27^r$</p> <p>$(3^{-2})^{-3r-2} = (3^3)^r$</p> <p>$6r+4 = 3r$</p> <p>$4 = -3r$</p> <p>$r = \frac{4}{-3}$</p>	<p>8. $\frac{4^{-x}}{4^{5x-2}} = 32$</p> <p>.....</p>	<p>9. $\frac{16}{2^{2n+1}} = 8$</p> <p>.....</p>