2.4 Multiplying and Dividing Powers

Key Ideas

Powers with the same base can be simplified using various Exponent Laws

Multiplication Law Add exponents	$a^m \times a^n = a^{m+n}$	$10^7 \times 10^2 = 10^{7+2} = 10^9$
Division Law Subtract exponents	$a^m \div a^n = a^{m-n}$	$\frac{2^7}{2^3} = 2^{7-3} = 2^4$
Power Law multiply exponents	$(a^m)^n = a^{m \times n}$	$(5^4)^3 = 5^{4\times 3} = 5^{12}$

$2^3 \times 2^2 = (2\times 2\times 2) \times (2\times 2) = 2^{3+2} = 2^5$

$\frac{2\times 2\times 2\times 2\times 2\times 2\times 2}{2\times 2\times 2} = 2^4$

$(5^4)^3 = (5^4)(5^4)(5^4)$

Note: The Exponent Laws only work when the bases are the same.

For example: $2^5 \times 3^4$ can't be simplified using the Exponent Laws $\neq 6^9$

Simplify the following in exponent form.

1. $(-3)^4(-3)^7$ $(-3)^{4+7} = (-3)^{11}$

2. $\left(\frac{1}{2}\right)^8 \div \left(\frac{1}{2}\right)^2$ $\left(\frac{1}{2}\right)^{8-2} = \left(\frac{1}{2}\right)^6$

3. $(6^3)^7$ $(6)^{3\times 7} = 6^{21}$

4. $(x^5)^4 \div (x^2)^7$ $= x^{5\times 4} \div x^{2\times 7} = x^{20} \div x^{14} = x^{20-14} = x^6$

5. $(a^5)^3 \times (a^2)^2 \div (a^3)^3$ $= a^{5\times 3} \times a^{2\times 2} \div a^{3\times 3} = a^{15} \times a^4 \div a^9 = a^{15+4-9} = a^{10}$

Replace the $\square$ so that the statement is true

6. $8^2 = 2^{\square}$

$8 = 2^3$ $\therefore 8^2 = (2^3)^2 = 2^{3\times 2} = 2^6$

4 → 2 2

replace '8' with 2^3

7. $9^2 = \square^4$

3 3

$9 = 3^2 \rightarrow 9^2 = (3^2)^2 = 3^{2\times 2} = 3^4$

Math 9 2.4 Multiplying and Dividing Powers Part 2 Name: _____

Notes

Review Exponent Laws

$x^4 \times x^3 = x^{4+3} = x^7$ $a^8 \div a^2 = a^{8-2} = a^6$ $(x^5)^4 = x^{5\times4} = x^{20}$ $a^0 = 1$

Practice: Simplify as powers

1) $2^3 \times 2^7 \div 2^6$

$= 2^{10} \div 2^6$

$= 2^4$

2) $(10^4)^5 \div (10^2)^8$

$= 10^{20} \div 10^{16}$

$= 10^4$

3) $\dfrac{(-3)^6 \times (-3)^1}{(-3)^4}$

$= \dfrac{(-3)^7}{(-3)^4} = (-3)^3$

4) $\dfrac{(5^7)(5^5)}{(5^4)^2}$

$= \dfrac{(5)^{12}}{5^8} = 5^4$

5) $(7^4)^2(7)$

$= 7^8(7)^1$

$= 7^9$

6) $6^{11} \div (6^3)^3$

$= 6^{11} \div 6^9$

$= 6^2$

Simplify as a power, then evaluate.

1) $(2^3)^4 \div 2^9$

$= 2^{12} \div 2^9$

$= 2^3$

$= 8$

2) $(5^2)^3 \times 5 \div 5^4$

$= 5^6 \times 5 \div 5^4$

$= 5^7 \div 5^4$

$= 5^3$

$= 125$

3) $(-2)^7 \div (-2)^3$

$= (-2)^4$

$= 16$

4) -5^2

$= -25$

5) $(-5)^2$

$= 25$

6) $-(-5)^2$

$= -25$

7) $(-5)^3$

$= -125$

8) 5×10^0

$= 5 \times 1$

$= 5$

9) -10^0

$= 1$

10) $-(-10)^0$

$= -1$

Writing powers with the lowest base.

Many numbers can be written with base 2.
For example: $4 = 2\times2 = 2^2$, $8 = 2\times2\times2 = 2^3$, $16 = 2\times2\times2\times2 = 2^4$
$25 = 5\times5 = 5^2$, $125 = 5\times5\times5 = 5^3$

Knowing how to show some numbers in lower bases can help simplify powers

Examples:

$2^{\boxed{3}} = 8$ $\quad$ $3^{\boxed{3}} = 27$ $\quad$ $6^{\boxed{2}} = 36$

$2^{\boxed{6}} = 4^3$ $\quad$ $(2^2)^3$

$2^{\boxed{12}} = 8^4$ $\quad$ $(2^3)^4$

$2^{\boxed{8}} = 16^2$ $\quad$ $(2^4)^2$

$5^{\boxed{4}} = 25^2$ $\quad$ $(5^2)^2$

$5^{\boxed{6}} = 25^3$ $\quad$ $(5^2)^3$

$3^{\boxed{6}} = 27^2$ $\quad$ $(3^3)^2$

Now try these.

---

1) $2^{12} = 4^{\boxed{6}}$

$(2^2)^{\square}$

$=(2^2)^6$

$=2^{12}$

2) $9^{\boxed{3}} = 27^2$

$(3^2)^{\square} = (3^3)^2$

$(3^2)^3 = (3^3)^2$

$3^6 = 3^6$

3) $5^6 = 125^{\boxed{2}}$

$5^6 = (5^3)^2$

$5^6 = 5^6$