[1-6A] Use Properties of Integer Exponents Name: 3rd p.

Multiplication Property of Exponents

Complete the table below and answer the questions that follow.

Product	Expanded Form	Exponential Form
$3^2 \cdot 3^3$	$(3 \cdot 3) \cdot (3 \cdot 3 \cdot 3)$	3^5
$2^3 \cdot 2^3$	$(2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2)$	2^6
$2^5 \cdot 2^4$	$(2 \cdot 2 \cdot 2 \cdot 2 \cdot 2) \cdot (2 \cdot 2 \cdot 2 \cdot 2)$	2^9
$4^7 \cdot 4^1$	$(4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4)(4)$	4^8
$x^4 \cdot x^2$	$(x \cdot x \cdot x \cdot x)(x \cdot x)$	x^6

Compare the original product in the first column to the exponential form you found in the third column. What pattern do you see? The base stays the same, and add the exponents.

Use the pattern to create a general rule for the multiplication property of exponents.

$$x^a \cdot x^b = \underline{\quad x^{a+b} \quad}$$

Test your rule on the following expressions to check that it works:

a) $4^3 \cdot 4^2 = 4^5$

b) $5^2 \cdot 5^4 = 5^6$

Division Property of Exponents (Quotient)

$\frac{3}{3} = 1$

Complete the table below and answer the questions that follow.

Division	Expanded Form	Exponential Form
$\frac{3^5}{3^2}$	$\frac{3\cdot3\cdot3\cdot3\cdot3}{3\cdot3} = 3\cdot3\cdot3$	3^3
$\frac{2^4}{2^1}$	$\frac{2\cdot2\cdot2\cdot2}{2} = 2\cdot2\cdot2$	2^3
$\frac{5^{12}}{5^8}$	$\frac{5\cdot5\cdot5\cdot5\cdot5\cdot5\cdot5\cdot5\cdot5\cdot5\cdot5\cdot5}{5\cdot5\cdot5\cdot5\cdot5\cdot5\cdot5\cdot5}$	5^4
$\frac{4^7}{4^5}$	$\frac{4\cdot4\cdot4\cdot4\cdot4\cdot4\cdot4}{4\cdot4\cdot4\cdot4\cdot4}$	4^2
$\frac{x^3}{x^1}$	$\frac{x\cdot x\cdot x}{x}$	x^2

Compare the original division in the first column to the exponential form you found in the third column. What patterns do you see? The base stays the same, Subtract the exponents

Use the pattern to create a general rule for the power properties of exponents.

$$\frac{x^a}{x^b} = x^{a-b}$$

Test your rule on the following expressions to check that it works:

a) $\frac{x^6}{x^3} = x^3$

b) $\frac{2^9}{2^7} = 2^2$

Find each product or quotient. Express your answer using exponents.

1. $4^7 \cdot 4^6$ 4^{13}
2. $v^5 \cdot v^4$ v^9
3. $(f^3)(f^9)$ f^{12}
4. $22^5 \cdot 22^5$ 22^{10}
5. $7h(5h^3)$ $35h^4$
6. $-10x^2(7x^3)$ $-70x^5$
7. $\frac{7^5}{7^2}$ 7^3
8. $\frac{1^8}{1^6}$ 1^2
9. $\frac{(-12)^3}{(-12)^3}$ $(-12)^0 = 1$
10. $3^8 \cdot 3^3$ 3^{11}
11. $\frac{c^{30}}{c^{13}}$ c^7
12. $\frac{(-p)^{18}}{(-p)^{12}}$
13. $-7u^6(-6u^5)$
14. $\frac{2w^3}{2w}$
15. $-5m^3(4m^6)$
16. the product of two cubed and two squared
17. the quotient of six to the eighth power and six squared

If you can't read the exponents….look at the PDF under the button of "Properties of Exponents Packet."

Multiplying and Dividing Monomials

Find each product or quotient. Express your answer using exponents.

1. $2^3 \cdot 2^5$
2. $10^2 \cdot 10^7$
3. $1^4 \cdot 1$
4. $6^3 \cdot 6^3$
5. $(-3)^2(-3)^3$
6. $(-9)^2(-9)^2$
7. $a^2 \cdot a^3$
8. $n^8 \cdot n^3$
9. $(p^4)(p^4)$
10. $(z^6)(z^7)$
11. $(6b^3)(3b^4)$
12. $(-v)^3(-v)^7$
13. $11a^2 \cdot 3a^6$
14. $10t^2 \cdot 4t^{10}$
15. $(8c^2)(9c)$
16. $(4f^8)(5f^6)$
17. $\frac{5^{10}}{5^2}$
18. $\frac{10^6}{10^2}$
19. $\frac{7^9}{7^6}$
20. $\frac{12^8}{12^3}$
21. $\frac{100^9}{100^8}$
22. $\frac{(-2)^3}{-2}$
23. $\frac{r^8}{r^7}$
24. $\frac{z^{10}}{z^8}$
25. $\frac{q^8}{q^4}$
26. $\frac{g^{12}}{g^8}$
27. $\frac{(-y)^7}{(-y)^2}$
28. $\frac{(-z)^{12}}{(-z)^5}$

For #29-32, write the numerical or variable expression, and then simplify.

29. the product of two squared and two to the sixth power — 29. _____ = _____
30. the quotient of ten to the seventh power and ten cubed — 30. _____ = _____
31. the product of y squared and y cubed — 31. _____ = _____
32. the quotient of a to the twentieth power and a to the tenth power — 32. _____ = _____