

Name: \_\_\_\_\_

### Simplifying Monomial Exponents (Part 2)

On the last worksheet, we established the rule  $x^a x^b = x^{a+b}$ , meaning that all you have to do when you multiply bases that are the same is add the exponents (or, if you expanded, count how many times you multiply by each part). But what happens if you raise an exponent to another exponent  $((x^a)^b)$ ?

**For each monomial, expand using the exponents inside the parentheses first, then expand using the outside exponent.**

Monomial	(Expand inside)	Expand outside ()	Result
1. $(x^5)^3 =$			$(x^5)^3 =$
2. $(x^3)^5 =$			$(x^3)^5 =$
3. $(3^4)^{-2} =$			$(3^4)^{-2} =$
4. $(3^{-2})^4 =$			$(3^{-2})^4 =$
5. $((-2)^6)^2 =$			$((-2)^6)^2 =$
6. $((-2)^2)^6 =$			$((-2)^2)^6 =$
7. $((ab)^{-3})^4 =$			$((ab)^{-3})^4 =$
8. $((ab)^4)^{-3} =$			$((ab)^4)^{-3} =$
9. $((-5b)^5)^2 =$			$((-5b)^5)^2 =$
10. $((-5b)^2)^5 =$			$((-5b)^2)^5 =$

What happens to the exponent when you raise it to another exponent?

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Rule:  $(x^a)^b = x^{\text{---}}$

**Use the rule you discovered to simplify each monomial.**

11. $(7^1)^4$	12. $(m^6)^7$	13. $(x^{-4})^5$
14. $((-4)^{-8})^{-5}$	15. $(x^7)^0$	16. $((2a)^3)^{-5}$
17. $((gh)^2)^3$	18. $((4x)^{-6})^{-8}$	19. $(b^4)^8$
20. $((-5)^5)^4$	21. $((-x)^6)^2$	22. $(r^7)^5$

We are going to continue practicing our exponent operations, but we're going to add to the difficulty level, by including fractional exponents, so let's have a quick look at fraction operations.

### Multiplying Fractions

When you multiply fractions, it does not matter if the denominators are the same. All you have to do to multiply fractions is to multiply across the top and multiply across the bottom, then simplify the result, if needed.

Example 3:  $(x^{\frac{1}{3}})^{\frac{1}{6}} = x^{\frac{1}{3} \cdot \frac{1}{6}}$

We need to know what  $(\frac{1}{3})(\frac{1}{6})$  equals.

$$\left(\frac{1}{3}\right)\left(\frac{1}{6}\right) = \frac{1}{3} \cdot \frac{1}{6} = \frac{1 \cdot 1}{3 \cdot 6} = \frac{1}{18}$$

$$\left(x^{\frac{1}{3}}\right)^{\frac{1}{6}} = x^{\left(\frac{1}{3}\right)\left(\frac{1}{6}\right)} = \boxed{x^{\frac{1}{18}}}$$

Example 4:  $(x^{10})^{\frac{3}{4}} = x^{(10)\left(\frac{3}{4}\right)}$

$$(10)\left(\frac{3}{4}\right) = \left(\frac{10}{1}\right)\left(\frac{3}{4}\right) = \frac{10 \cdot 3}{1 \cdot 4} = \frac{30}{4} \leftarrow \frac{15 \cancel{-2}}{2 \cancel{-2}} = \frac{15}{2}$$

$$(x^{10})^{\frac{3}{4}} = x^{(10)\left(\frac{3}{4}\right)} = \boxed{x^{\frac{15}{2}}}$$

23. $(x^{\frac{1}{2}})^{10}$	24. $(a^{\frac{2}{3}})^{\frac{3}{2}}$	25. $(r^{\frac{2}{3}})^{\frac{1}{2}}$	26. $((2p)^{\frac{1}{5}})^{\frac{1}{4}}$
27. $(y^{\frac{1}{4}})^3$	28. $((km)^{\frac{6}{5}})^{\frac{5}{3}}$	29. $(7^{\frac{5}{8}})^2$	30. $(4^{\frac{3}{7}})^{\frac{7}{3}}$
31. $((-5)^3)^{\frac{1}{12}}$	32. $(x^3)^2(y^4)^{\frac{1}{2}}$	33. $(g^5)^{\frac{2}{5}}(h^3)^5$	34. $(m^7)^{\frac{1}{14}}(n^3)^{\frac{1}{3}}$
35. $(3^2)^{\frac{5}{2}}(2^4)^{\frac{3}{4}}$	36. $(a^3)^{\frac{1}{3}}a^5$	37. $r^8(r^{\frac{2}{3}})^6$	38. $(5^{\frac{1}{3}})^6(5^3)$

### Answers

1 & 2. $x^{15}$	3 & 4. $3^{-8} = \frac{1}{3^8}$	5 & 6. $(-2)^{12}$	7 & 8. $a^{-12}b^{-12} = \frac{1}{a^{12}b^{12}}$	9 & 10. $(-5)^{10}b^{10}$
Rule: $x^{ab}$	11. $7^4$	12. $m^{42}$	13. $x^{-20} = \frac{1}{x^{20}}$	14. $(-4)^{40}$
15. $x^0 = 1$	16. $2^{-15}a^{-15} = \frac{1}{2^{15}a^{15}}$	17. $g^6h^6$	18. $4^{48}x^{48}$	19. $b^{32}$
20. $(-5)^{20}$	21. $(-x)^8$	22. $r^{35}$	23. $x^5$	24. $a^1 = a$
25. $r^{\frac{1}{3}}$	26. $2^{\frac{1}{20}}p^{\frac{1}{20}}$	27. $y^{\frac{3}{4}}$	28. $k^2m^2$	29. $7^{\frac{5}{4}}$
30. $4^1 = 4$	31. $-5^{\frac{1}{4}}$	32. $x^6y^2$	33. $g^2h^{15}$	34. $m^{\frac{1}{2}}n^1 = m^{\frac{1}{2}}n$
35. $5^25^3 = 5^5$	36. $a^1a^5 = a^6$	37. $r^8r^4 = r^{12}$	38. $5^25^3 = 5^5$	