P35-39

September 10, 2018 1:17 PM

4. Simplify.

a) 3^0 _____ b) -3^0 _____

c) $(-3)^0$ _____ d) 2×3^0 _____

e) $(2\times 3)^0$ _____ f) $-(2\times 3)^0$ _____

g) $(-2\times 3)^0$ _____ h) $(2+3)^0$ _____

i) 2^0+3^0 _____ j) -2^0-3^0 _____

k) $(-2)^0+(-3)^0$ _____ l) $(-2)^0-(-3)^0$ _____

m) $\frac{-2^0}{-3^0}$ _____ n) $-\left(\frac{2}{3}\right)^0$ _____

o) $\frac{0^2}{2^0}$ _____ p) $\left(\frac{0}{2}\right)^2$ _____

5. Multiply and simplify. Leave answer in exponential form.

a) $2^5\times 2^4$ _____ b) $3^5\times 3^3$ _____

c) $(-2)^4(-2)^5$ _____ d) $5^0\times 5^0\times 5^0$ _____

e) $(-3)^4(-3)^2(-3)^3$ _____ f) $4^3\times 4^0\times 4$ _____

g) $7\times 7^2\times 7^4$ _____ h) $(-4)^0(-4)^2(-4)^3$ _____

i) $2^3\times 2^4\times 3\times 3^2$ _____ j) $(-3)(-3)^3(-5)^2(-5)^4$ _____

6. Divide and simplify. Leave answer in exponential form.

a) $\frac{2^6}{2^3}$ _____ b) $\frac{3^8}{3^4}$ _____

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$-2 = -1$

c) $\frac{(-3)^5}{(-3)^2}$ _____ d) $\frac{(-1)^8}{(-1)^3}$ _____

$(-2)^0 = 1$

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e) $\frac{4^9 \times 3^6}{4^5 \times 3^2}$ _____ f) $\frac{(-2)^8 \times 7^4}{(-2)^5 \times 7}$ $\frac{(-2)^0}{1} \times (7)^3$ 7^3

g) $\frac{8^{12}}{(-8)^9}$ _____ h) $\frac{(-2)^8}{2^3}$ _____

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i) $\frac{3^5 \times 5^6}{(-3)^2 \times 5^3} = 3^3 \times 5^3 =$ $3^3 \times 5^3$

$\frac{3\times3\times3\times3\times3 \times 5\times5\times5\times5\times5\times5}{3\times3 \times 5\times5\times5}$

j) $\frac{(-5)^7 \times 7^4}{5^3 \times (-7)^2}$ $-\frac{5^7}{5^3} \times \frac{7^4}{7^2}$ $-5^4 \times 7^2$

7. Simplify. Leave answer in exponential form.

a) $\frac{2^7 \times 2^5}{2^8}$ _____ b) $\frac{(-3)^4(-3)^3}{(-3)^5}$ _____

c) $\frac{5^7}{5^3 \times 5^4}$ _____ d) $\frac{(-7)^4(-7)^5}{(-7)^3(-7)^2}$ _____

e) $\frac{10 \times 10^7 \times 10^4}{10^6 \times 10^5}$ _____ f) $\frac{(-11)^3(-11)^5(-11)^0}{(-11)(-11)^2} = \frac{(-11)^8}{(-11)^3}$ $(-11)^5$ odd

$(-11)^0 = 1$

if $(-11)^4$ even $= 11^4$

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7 g) $\frac{(-2)^5 \times 2^3 \times (-2)^4}{2 \times (-2)^2 \times 2^2} = \frac{-2^{12}}{+2^5}$ overall

$12 - 5 = 7$

-2^7

$2 \times 2^2 \times 2^2 = 2 \times 2 \times 2 \times 2 \times 2$

h) $\frac{5^4 \times (-5)^5 \times 5^5}{-5 \times 5^3}$ _____

i) $\frac{(-7)^0 \times 7^9}{(-7)^2(-7)^3(-7)}$ _____ j) $\frac{(-3)^{10}}{3^3 \times (-3)^5 \times 3}$ _____

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8. Simplify, then evaluate. → get final answer in plain form.

Right

a) $2^3 \times 2^4 - 2^2 \times 2^3$ _____ b) $2^5 \div 2 + 2^5 \times 2^2$ _____

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8 c) $(-3)^1 + (-3)^6 \div (-3)^5 - (-3)^2$ $6 - 5$ -69

d) $3^7 \div (3^6 \div 3^3) \div 3^2$ _____

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8 c) $(-3)^4 + (-3)^6 \div (-3)^5 - (-3)^2$ 6 − 5 — 69

$= 3^4 + (-3)^1 - (+9)$

$= 81 - 3 - 9 = 69$

d) $3^7 \div (3^6 \div 3^3) \div 3^2$ _____

e) $5^9 \div 5^5 \times 5 \div 5^3$ _____

f) $5^9 \div (5^5 \times 5) \div 5^3$ _____

g) $(-2)^2 \times 2^4 + (-2)^3 \times 2$ _____ 8

h) $(-3)^6 \div 3^4 + (-3)^3 \div 3^1$ 6−4, 3−1 — $+3^2 + -3^2$ — $9 - 9$ — ∅

i) $(-5)^3 \div 5^2 + (-3)^3 \div 3^2$ _____

j) $(-8)^2 \times 8 + (-8)^5 \div 8^2$ _____

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k) $\dfrac{(-2)^5 + (-2)^2}{(-2)^4}$ _____ 8

l) $\dfrac{(-3)^4 - 3^2}{(-3)^3}$ _____

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9. Simplify.

a) $2^{a+3} \times 2^{a-1}$ _____

b) $\dfrac{3^{2m}}{3^{m-1}}$ _____

Quiz : Friday on Sec 1.5–1.6

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c) $\dfrac{5^{4a-3} \times 5^{3-a}}{5^{2a+1}}$ _____

d) $\dfrac{7^{6-2a}}{7^{a+3} \times 7^{2-3a}} = \dfrac{7^{(6-2a)}}{7^{(-2a+5)}} = 7^1 = 7$

$a+3+(2-3a)$

$a-3a+3+2$

$(6-2a) - (-2a+5)$

$6-2a+2a-5$

$6-5$

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$a^4 = a \times a \times a \times a$

1.7 Power Rules

Ex $[3^2]^4 = [3\times3] \times [3\times3] \times [3\times3] \times [3\times3] = 3^8$

3×3 — $2\times4=8$

Consider an expression like $(5^3)^2$.

We know that to square a number means to multiply it by itself.

$(5^3)^2 = 5^3 \times 5^3$

$= (5\times5\times5)(5\times5\times5)$

Power Rule A) $(a^n)^m = a^{n\times m}$

Power Rule A) $(a^m)^n = a^{m \times n}$

$= (5 \times 5 \times 5)(5 \times 5 \times 5)$

$= 5 \times 5 \times 5 \times 5 \times 5 \times 5$

$= 5^6$

Ex1) $((4^2)^3)^6 = 4^{2 \times 3 \times 6} = 4^{36}$

Notice that the exponent 6 is the product of the exponents 3 and 2. This is the basis for the power rule of exponents.

The Power Rule

For any real number a, and any integers m and n:

$(a^m)^n = a^{m \times n}$

(To raise a power to a power, multiply the exponents)

Ex3) $[2^2 \cdot 2^4]^7 = [2^6]^7 = 2^{42}$ (not: 2^8)

$2 \times 2 \cdot 2 \times 2 \times 2 \times 2$; 6×7

Common Mistakes:

1. $(3+5)^2 \neq 3^2 + 5^2 = 34$. The correct answer is $(3+5)^2 = 8^2 = 64$. An exponent can belong to more than one base within a set of parentheses **only** when the bases are related by multiplication or division, **not** addition or subtraction.

2. $2^4 \times 2^3 = 2^{4+3} = 2^7$ but $(2^4)^3 = 2^{4 \times 3} = 2^{12}$. Be careful not to mix up the product rule and exponent rule.

Power Rule B) $(a \cdot b)^n = a^n \cdot b^n$

Example 1 Simplify.

a) $(2^3)^4$

b) $(3^2)^5$

Ex4) $(2^2 \cdot 5^3)^4 = 2^8 \cdot 5^{12}$

Ex5) $[2^2 + 3^3]^2 \neq [2^4 + 3^6]$ ✗

$4 + 27$

$= [31]^2$ ✓

▶ *Solution:*

a) $(2^3)^4 = 2^{3 \times 4} = 2^{12}$

b) $(3^2)^5 = 3^{2 \times 5} = 3^{10}$

Raising a Product or Quotient to a Power

The power rule can be applied to both products and quotients.

$(3 \times 4)^2 = (3 \times 4)(3 \times 4)$

$= (3 \times 3)(4 \times 4)$

$= 3^2 \times 4^2$

$\left(\frac{2}{5}\right)^3 = \left(\frac{2}{5}\right)\left(\frac{2}{5}\right)\left(\frac{2}{5}\right)$

$= \frac{2 \times 2 \times 2}{5 \times 5 \times 5}$

$= \frac{2^3}{5^3}$

Rule for Raising a Product to a Power

For any integer n, and any real numbers a and b:

$(ab)^n = a^n b^n$

(To raise a product to a power, raise each factor to that power)

$(ab)^n = a^n b^n$

(To raise a product to a power, raise each factor to that power)

Power Rule C: $\left[\frac{a \cdot b}{c}\right]^n = \frac{a^n \cdot b^n}{c^n}$

Example 2 Remove brackets and simplify; evaluate if possible.

a) $(2\times 3)^4$ **b)** $(a^2b^3)^n$

Ex1) $\left[\frac{16}{2}\right]^5 = 8^5$

▶ *Solution:* **a)** $(2\times 3)^4 = 2^4\times 3^4 = 16\times 81 = 1296$

b) $(a^2b^3)^n = a^{2n}b^{3n}$

Ex2) $\left(\frac{5^2}{2^3}\right)^4 = \frac{5^8}{2^{12}}$

Rule for Raising a Quotient to a Power

For any integer n, and any real numbers a and b, $b \neq 0$:

$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

(To raise a quotient to a power, raise the numerator and the denominator to that power)

Ex3) $\left(\frac{-3^2}{7^0}\right)^5 = \frac{-3^{10}}{1^5} = -3^{10}$ ($7^0 = 1$)

$(13^1)^3$

Try) $\left[\frac{2^2+3^2}{7^3}\right]^3 = \left[\frac{13}{7^3}\right]^3 = \frac{13^3}{7^9}$ ($4+9$)

Example 3 Remove brackets and simplify; evaluate if possible.

a) $\left(\frac{2}{5}\right)^3$ **b)** $\left(\frac{a^3}{b^2}\right)^n$

▶ *Solution:* **a)** $\left(\frac{2}{5}\right)^3 = \frac{2^3}{5^3} = \frac{8}{125}$

b) $\left(\frac{a^3}{b^2}\right)^n = \frac{a^{3n}}{b^{2n}}$