P30-34

September 10, 2018 1:13 PM

( ) or [ ] or { } HW P.30 Q5-9

5. Insert parentheses to make the expression true.

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a) $3+3\times4^2=96$

b) $4\times2\times3^2=576$

c) $6+2\times3^2=42$

d) $12\div4+2\times3-2=4$

e) $12\div4+2\times3-2=2$

f) $4\times2\times9-7-7=9$

g) $8-9-12+5=16$

h) $4\times2+3-7+4=0$

i) $12\div4+2\times3-2=5$

j) $4-2^3\times5\div24-4=2$

6. Insert parentheses in the expression $3+5\times4-6\div2$ to produce the following values:

a) 29

b) -2

Try

c) -8

d) 20

7. Insert any operation signs (parentheses, $+, -, \times, \div$) so that the given numbers make the statement true.

a) 2 3 5 6 = 23

b) 5 6 7 9 = 64

c) 7 5 4 2 = 2

d) 6 3 2 1 = 1

8. Bill enters $24\div2\times3$ into his calculator and expects to get 4. What mistake is he making?

9. Sue enters $8+4\div2$ into her calculator and expects to get 6. What mistake is she making?

1.6 Exponent Laws

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Multiplying with Exponents

Rule #1

We can simplify the expression $2^3\times2^4$ using the definition of exponents.

$$2^3\times2^4=\underbrace{(2\times2\times2)}_{\text{three 2's}}\underbrace{(2\times2\times2\times2)}_{\text{four 2's}}=\underbrace{2^7}_{\text{seven 2's}}$$

$b^m \times b^n = b^{m+n}$

Notice that the exponent 7 is the sum of the exponents 3 and 4. This is the basis for the product rule of exponents.

The Product Rule

If a is a real number, and m and n are integers, then:

$a^m\times a^n=a^{m+n}$ $(a\neq0)$

(When multiplying, if the bases are the same, keep the base, and add the exponents)

Common Mistakes:

ex) $3^7\times3^2=3^9$

1. $2^3\times2^4\neq4^{3+4}=4^7$
2. $2^3\times2^4\neq4^{3\times4}=4^{12}$
3. $2^3\times2^4\neq2^{3\times4}=2^{12}$

$3^7\times3^2$ = $3\times3\times3\times3\times3\times3\times3\times3\times3$ = 3^9

Example 1 Simplify.

a) $3^3\times3^4$

b) $2^3\times2^4\times2^5$

ex) $(-5)^5\times(5)^2=-5^{5+2}=-5^7$

► *Solution:* a) $3^3\times3^4=3^{3+4}=3^7$

b) $2^3\times2^4\times2^5=2^{3+4+5}=2^{12}$

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Dividing with Exponents

Rule #2 $b^m \div b^n = b^{m-n}$

Next we simplify a quotient.

$$\frac{3^6}{3^2} = \frac{3\times3\times3\times3\times3\times3}{3\times3} = \frac{\cancel{3}\times\cancel{3}}{\cancel{3}\times\cancel{3}}\times3\times3\times3\times3 = 3\times3\times3\times3 = 3^4$$

$\frac{4^5}{4\times4} = 4^2$

ex1) $4^5 \div 4^2 = 4^3$

ex2) $\frac{3^7}{3^3} = 3^{7-3} = 3^4$

Notice that the exponent 4 is the difference of the exponents 6 and 2. This is the basis for the quotient rule of exponents.

The Quotient Rule

If a is a real number, and m and n are integers, then:

$\frac{a^m}{a^n} = a^{m-n}$, $(a \neq 0)$

(When dividing, if the bases are the same, keep the base, and subtract the exponents)

8^2

Common Mistakes:

1. $\frac{3^4}{3^2} \neq 3^4$
2. $\frac{3^4}{3^2} \neq 1^{4-2} = 1^4 = 1$
3. $\frac{3^4}{3^2} \neq 1^4$

Example 2 Simplify.

a) $\frac{5^8}{5^4}$ b) $\frac{3^4\times3^3}{3^5}$

►*Solution:* a) $\frac{5^8}{5^4} = 5^{8-4} = 5^4$

b) $\frac{3^4\times3^3}{3^5} = 3^{4+3-5} = 3^3$

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Zero Exponent

Suppose the numerator and denominator have the same base, both raised to the same power. We know that any expression divided by itself is equal to one. For example $\frac{5\times5\times5}{5\times5\times5} = 1$. But $\frac{5\times5\times5}{5\times5\times5} = \frac{5^3}{5^3}$, if we apply the quotient rule then $\frac{5^3}{5^3} = 5^{3-3} = 5^0$. Therefore $5^0 = 1$.

The Zero Exponent Rule

For any non-zero real number a:

$a^0 = 1$, $(a \neq 0)$

(Any non-zero number real number raised to the zero power is one, 0^0 is undefined)

Examples: $3^0 = 1$, $\left(\frac{2}{3}\right)^0 = 1$

Combined Operations

Example 3 Simplify

a) $(-2)^3\times2^3$

b) $\frac{(-3)^4}{3^4}$

c) $2^7 - 2^2\times2^3$

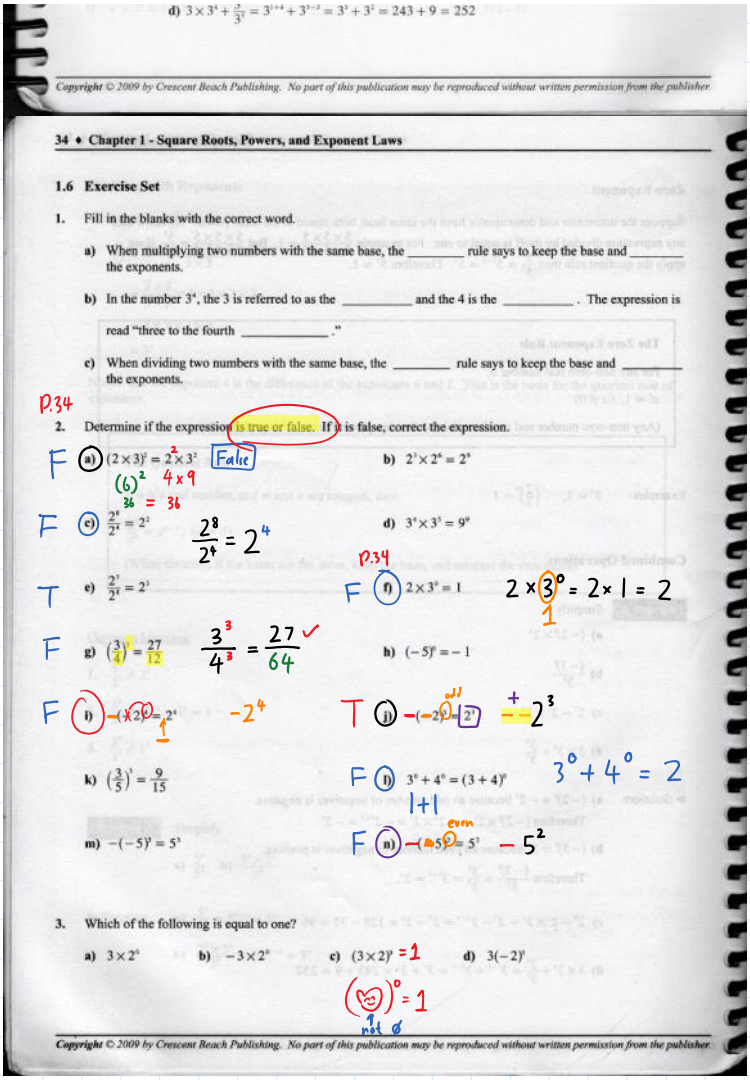
d) $3\times3^4 + \frac{3^5}{3^2}$

►*Solution:* a) $(-2)^3 = -2^3$ because an odd number of negatives is negative.
Therefore $(-2)^3\times2^3 = -2^3\times2^3 = -2^{3+3} = -2^6$

b) $(-3)^4 = 3^4$ because an even number of negatives is positive.
Therefore $\frac{(-3)^4}{3^4} = \frac{3^4}{3^4} = 3^{4-4} = 3^0$.

c) $2^7 - 2^2\times2^3 = 2^7 - 2^{2+3} = 2^7 - 2^5 = 128 - 32 = 96$

d) $3\times3^4 + \frac{3^5}{3^2} = 3^{1+4} + 3^{5-2} = 3^5 + 3^3 = 243 + 9 = 252$



d) $3\times3^4+\frac{2}{3^{-1}}=3^{1+4}+3^{2-(-1)}=3^5+3^3=243+9=252$

1.6 Exercise Set

1. Fill in the blanks with the correct word.

a) When multiplying two numbers with the same base, the _____ rule says to keep the base and _____ the exponents.

b) In the number 3^4, the 3 is referred to as the _____ and the 4 is the _____. The expression is read "three to the fourth _____."

c) When dividing two numbers with the same base, the _____ rule says to keep the base and _____ the exponents.

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2. Determine if the expression is true or false. If it is false, correct the expression.

F a) $(2\times3)^2=2^2\times3^2$ False — $(6)^2$ 4×9 $36=36$

b) $2^3\times2^4=2^8$ — $\frac{2^8}{2^4}=2^4$

F c) $\frac{2^4}{2^4}=2^2$

d) $3^4\times3^5=9^9$

T e) $\frac{2^7}{2^5}=2^2$

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F f) $2\times3^0=1$ — $2\times3^0=2\times1=2$, $3^0=1$

F g) $\left(\frac{3}{4}\right)^3=\frac{27}{12}$ — $\frac{3^3}{4^3}=\frac{27}{64}$ ✓

h) $(-5)^0=-1$

F i) $-(\times2)^4=2^4$ — -2^4

T j) $-(-2)^{odd}=2^3$ — $+2^3$

k) $\left(\frac{3}{5}\right)^3=\frac{9}{15}$

F l) $3^0+4^0=(3+4)^0$ — $3^0+4^0=2$, $1+1$

m) $-(-5)^3=5^3$

F n) $-(-5)^{even}=5^2$ — -5^2

3. Which of the following is equal to one?

a) 3×2^0 b) -3×2^0 c) $(3\times2)^0=1$ d) $3(-2)^0$

$(\ )^0=1$, not $\emptyset$

P34 Q2-8 (left)

Quiz 1.5-1.6 on Friday !!