Math 60, Sections 2.7-2.8 Notes and Practice Name: Solutions

Section 2.7 Introduction to Exponent Rules

1. Expand each expression to find the answer.

a. $x^3 \cdot x^4$ product of powers

$= x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$

$= x^7$

b. $(x^3)^4$ power of a power

$= x^3 \cdot x^3 \cdot x^3 \cdot x^3$

$x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$

$= x^{12}$

c. $(2xy^2)^3$

$= 2xy^2 \cdot 2xy^2 \cdot 2xy^2$

$= 2^3 x^3 y^6$

The Exponent Rules

$x^m \cdot x^n = x^{m+n}$ $\quad (x^m)^n = x^{m \cdot n}$ $\quad (xy)^m = x^m \cdot y^m$

2. Use the rules to simplify the expressions. You can always expand the exponents if that helps. It's ok to leave large numbers in exponential form.

a. $z^2 \cdot z^8 = z^{10}$

b. $(2t^5)^3 = 2^3 t^{15}$

$= 8t^{15}$

c. $(3^2)^6 = 3^{12}$

d. $w^2 \cdot w^3 \cdot w^4 = w^9$

$w^2(w^3)(w^4) = w^9$

e. $7^6 \cdot 7^5 = 7^{11}$

f. $x^1 \cdot x^{11} = x^{12}$

g. $(3xy)^4 = 3^4 x^4 y^4$
$= 81x^4y^4$

h. $5(y^3)^2 = 5y^6$

i. $(-2x^3)(-5x^3) = 10x^6$

j. $x^4 \cdot y^7 = x^4 y^7$

Section 2.8 Simplifying Expressions and Algebraic Properties

When does the order of two numbers in an operation matter?

commutative property

a. $7+6 \stackrel{?}{=} 6+7$ order doesn't matter

b. $2-18 \stackrel{?}{=} 18-2$ order matters

c. $8 \cdot 7 \stackrel{?}{=} 7 \cdot 8$ order doesn't matter

d. $15 \div 3 \stackrel{?}{=} 3 \div 15$ order matters

When does the placement of the parentheses matter?

a. $(7+3)+9 \stackrel{?}{=} 7+(3+9)$
$10+9 \stackrel{?}{=} 7+12$
$19 = 19$ ✓

b. $(4-6)-10 \stackrel{?}{=} 4-(6-10)$
$-2-10 \stackrel{?}{=} 4-(-4)$
$-12 \neq 8$

Associative property

c. $(6 \cdot 4) \cdot 2 \stackrel{?}{=} 6 \cdot (4 \cdot 2)$
$24 \cdot 2 \stackrel{?}{=} 6 \cdot 8$
$48 = 48$ ✓

d. $(100 \div 10) \div 5 \stackrel{?}{=} 100 \div (10 \div 5)$
$10 \div 5 \stackrel{?}{=} 100 \div 2$
$2 \neq 50$

The Commutative and Associative Properties

	Addition	Multiplication
Commutative Property switching places	$x+2=2+x$	$x\cdot 2=2\cdot x$
Associative Property changes the grouping	$(y+4)+1=y+(4+1)$	$(7z)\cdot 5=7(z\cdot 5)$ $=(7\cdot 5)z$ $35z$

3. Apply the properties listed. You do not need to simplify further.

a. Use the commutative property of multiplication to rewrite the expression $5z$. $z5$ or $z*5$

b. Use the associative property of multiplication to rewrite the expression $2(3b)$. $(2\cdot 3)b$

c. Use the commutative property of addition to rewrite the expression $4+6x$. $6x+4$

d. Use the associative property of addition to rewrite the expression $(p+7)+1$. $p+(7+1)$

The Distributive Property

Can you simplify this expression in two different ways? Do they give the same answer?

$3(6+2)=3(8)=24$

$3(6+2)=3\cdot 6+3\cdot 2=18+6=24$

$3(6-2)=3(4)=12$

$3(6-2)=3\cdot 6-3\cdot 2=18-6=12$

We need the distributive property when we have a variable in our expression.

$5(x+7)=5x+5\cdot 7=5x+35$

$5(x-7)=5x-35$

$-5(x-7)=-5x+35$

$-5x-5(-7)$

$-5x-(-35)$

4. Use the distributive property to rewrite the expressions.

a. $8(y+2)=8y+16$

b. $4(6-z)=24-4z$

c. $-\frac{1}{4}(x+8)=-\frac{1}{4}x-2$

d. $-9(t-3)=-9t+27$

$-\frac{1}{4}x-\frac{1}{4}\cdot\frac{8}{1}^{2}$

$-\frac{1}{4}x-2$

Like Terms and Simplifying Expressions

Cross out the items that cannot be combined. Circle the items that you can combine readily. Underline the items that could be combined with additional steps.

cats + dogs $8+9$ feet + pounds $x+y$ 3 apples − 2 apples $\frac{2}{7}+\frac{3}{7}$

$\frac{1}{4}+\frac{2}{11}$ miles ÷ hours $\frac{1}{2}\cdot\frac{3}{4}$ $2x+5x$ $1x^2+3x^2$ miles − feet

can divide any quantities

can multiply anything

$7x$

$4x^2$

Notice that we can only add and subtract like quantities. We can multiply and divide any quantities.

Like terms

5. Simplify the following expressions by combining like terms, if possible.

a. $12x+8x$ $= 20x$

b. $8x-8y$ $= 8x-8y$

c. $2t-5t$ $= -3t$

d. $3x^2+x^1$ $= 3x^2+x$ $3x^2(x)=3x^3$

6. Use all the properties to simplify the following expressions.

drop the parentheses after distributing

a. $5+4(x-3)$

$= 5+4x-12$

$= 4x-7$ or $-7+4x$

b. $2(3x-1)+4(2x+9)$

$= 6x-2+8x+36$

$= 14x+34$

c. $3\left(7-2y+\frac{5}{3}x\right)$

$= 21-6y+\frac{1}{1}\cdot\frac{5}{3_1}x$

$= 21-6y+5x$

d. $10-(-9x+6)$

$= 10-1(-9x+6)$

$= 10+9x-6$

$= 4+9x$

e. $\frac{1}{2}(12t-10)-2(6t+5)$

$6t-5-12t-10$

$-6t-15$

f. $(7x-3)-3(8x-2)$

$7x-3-24x+6$

$-17x+3$

Simplifying Expressions with Exponents

$x(x+4)$

$= x \cdot x + x \cdot 4$

$= x^2 + 4x$

$2x^2 \cdot x - x^2 \cdot 8$

$x^2(2x-8)$

$= 2x^3 - 8x^2$

$x + x = 2x$

$x \cdot x = x^2$

7. Find the product of the monomial and the binomial.

a. $\frac{1}{2}x(x+4)$ (one term; two terms)

$= \frac{1}{2}x^2 + 2x$

b. $3x(-2x-9)$

$= -6x^2 - 27x$

c. $9t^2(t-11)$

$9t^3 - 99t^2$

d. $5p^2\left(-2p^2 - \frac{1}{4}p\right)$

$-10p^4 - \frac{5}{4}p^3$

8. Simplify completely.

a. $6a^3 - 9a^3(2-a^4)$

$6a^3 - 18a^3 + 9a^7$

$-12a^3 + 9a^7$

b. $7(-2x+9) - 9(-2x+8)$

$-14x + 63 + 18x - 72$

$4x - 9$

More Practice

9. Simplify the following expressions if possible. If already simplified, then enter the same expression in Webwork.

a. $x^4 + x^4 = 2x^4$

b. $x^4 \cdot x^4 = x^8$

c. $x + x^4 = x + x^4$

not like terms

d. $x \cdot x^4 = x^5$

10. The number of students enrolled in math courses at PCC has grown over the years. The formulas $M = 0.4x + 3.1$ and $W = 0.36x + 4.8$ describe the number of people who identify as men and women (in thousands) enrolled in math courses at PCC, x years after 2005. Give a simplified formula for the total, T, which is the total of the students who identify as men and women. Nonbinary students need to be added to this problem.

$T = m + w = 0.4x + 3.1 + .36x + 4.8$

$T = .4x + 7.9$

11. Simplify the following expressions, if possible. If already simplified, then enter the same expression in Webwork.

a. $-3p^5 - 2p^5 = -5p^5$

b. $-2p^5 \cdot p^2 = -2p^7$

c. $-5p^4 + p^5 = -5p^4 + p^5$ not like terms

d. $5p^4 \cdot p^4 = 5p^8$

12. Find the product of the monomial and the binomial.

a. $-2x^2(6x+1)$

$= -12x^3 - 2x^2$

b. $\frac{3}{5}x(x+4)$

$= \frac{3}{5}x^2 + \frac{3}{5} \cdot \frac{4}{1}$

$= \frac{3}{5}x^2 + \frac{12}{5}$

c. $-4z^2(z-6)$

$= -4z^3 + 24z^2$

d. $11r^2(-4r^2 + r)$

$= -44r^4 + 11r^3$

13. Simplify completely.

a. $3y - 7y(-7 - y^4)$

$= 3y + 49y + 7y^5$

$= 52y + 7y^5$

b. $-5(-8x+1) - 7(-4x-3)$

$= 40x - 5 + 28x + 21$

$= 68x + 16$