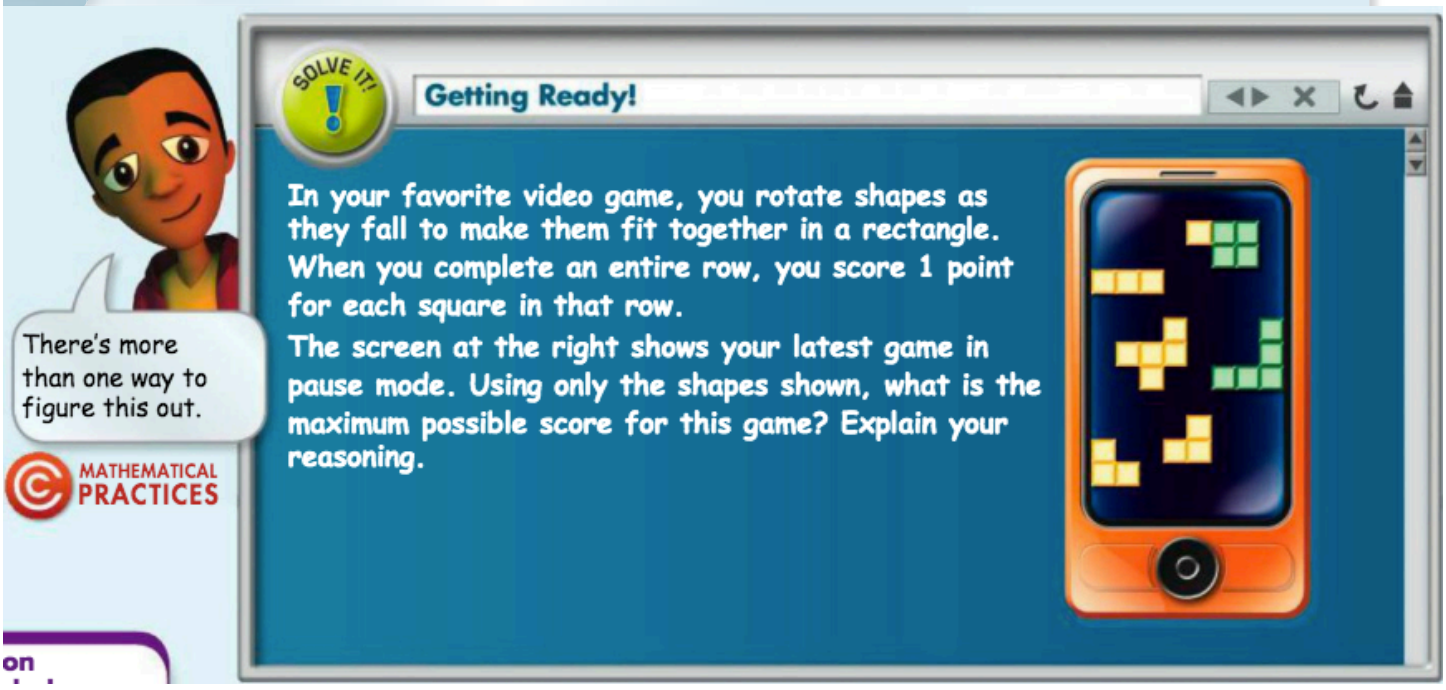
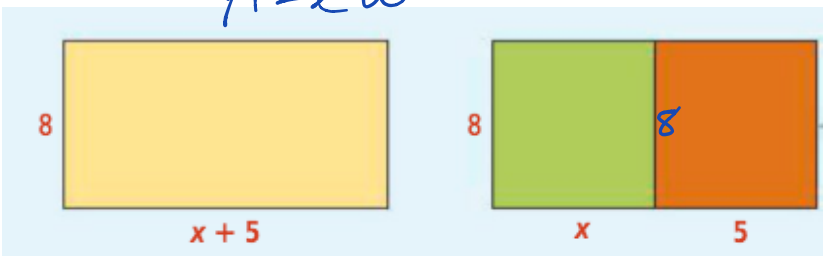
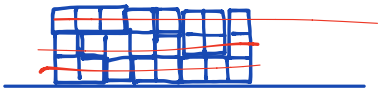
1-7 The Distributive Property



To solve problems in mathematics, it is often useful to rewrite expressions in simpler forms. The ***Distributive Property*** *simplifies the product of a number and a sum or difference.*

$A = \ell w$





$A = 8(x+5) \Rightarrow A = 8(x) + 8(5)$

$= 8x + 40$

PROPERTY: THE DISTRIBUTIVE PROPERTY OF MULTIPLICATION

$3(4x^2 - 3x + 5)$

Let *a*, *b*, and *c* be real numbers, then:

$a(b + c) = ab + ac,$	$(b + c)a = ba + ca,$	$a(b - c) = ab - ac$	$(b - c)a = ba - ca$

Examples:

$4(25 + 6) = 4(25) + 4(6)$	$(25 + 6)4 = 25(4) + 6(4)$	$7(30 - 2) = 7(30) - 7(2)$	$(30 - 2)7 = 30(7) - 2(7)$

PROBLEM 1: SIMPLIFYING EXPRESSIONS

Simplify.

a) $3(2x+5)$

$3(2x)+3(5)$

$6x+15$

b) $(5b-4)(-7)$

$(5b+(-4))(-7)$

$-35b+28$

$-7(5b)-(-7)(4)$

$-35b+(+28)$

$-35b+28$

c) $4\left(\frac{1}{2}x-\frac{5}{6}\right)$

$\frac{2}{1}\cdot\frac{1}{2}x-\frac{2}{1}\cdot\frac{5}{6}$

$2x-\frac{10}{3}$

d) $-5(-7x+2)$

$35x-10$

e) $5(x-11)$

$5x-55$

f) $12\left(3-\frac{1}{6}t\right)$

$12(3)-\frac{2}{1}\cdot\frac{1}{6}t$

$36-2t$

g) $(0.4+1.1c)3$

$1.2+3.3c$

$\times\frac{4}{3}$

1.2

$\times\frac{4}{3}$

3.3

h) $-y(2y-1)$

$-2y^2+y$

Recall that a fraction bar may act as a grouping symbol. A fraction bar indicates division. Any fraction $\frac{a}{b}$ can also be written as $a\cdot\frac{1}{b}$. You can use this fact and the Distributive Property to rewrite some fractions as sums or differences.

$a\div b_1$

$a\cdot\frac{1}{b}$

PROBLEM 2: REWRITING FRACTION EXPRESSIONS

Simplify.

a) $\frac{7x+2}{5}$

$\frac{1}{5}(7x+2)$

b) $\frac{14-3x}{2}$

$\frac{7}{1}\cdot\frac{14}{2}-\frac{3x}{2}$

$7-\frac{3}{2}x$

c) $\frac{9-6x}{3}$

$\frac{3}{1}\cdot\frac{9}{3}-\frac{2}{1}\cdot\frac{6x}{3}$

$3-2x$

d) $\frac{6-14x}{-4}$

$-\frac{3}{2}\cdot\frac{6}{4}+\frac{7}{2}\cdot\frac{14x}{4}$

$-\frac{3}{2}+\frac{7}{2}x$

e) $\frac{4x-16}{3}$

$\frac{4x}{3}-\frac{16}{3}$

$\frac{4}{3}x-\frac{16}{3}$

f) $\frac{11+3x}{6}$

$\frac{11}{6}+\frac{1}{2}\cdot\frac{3x}{2}$

$\frac{11}{6}+\frac{1}{2}x$

g) $\frac{15+6x}{12}$

$\frac{5}{4}\cdot\frac{15}{12}+\frac{1}{2}\cdot\frac{6x}{12}$

$\frac{5}{4}+\frac{1}{2}x$

h) $\frac{4-2x}{8}$

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

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

The Multiplication Property of -1 states that $-1 \cdot x = -x$. To simplify an expression such as $-(x + 6)$, you can rewrite the expression as $-1 \cdot (x + 6)$.

PROBLEM 3: USING THE MULTIPLICATION PROPERTY OF -1

Simplify.

a) $-1(2y - 3x)$

$-1(2y) - (-1)(3x)$

$-2y + (+3x)$

$-2y + 3x$

b) $-(-5x + 2)$

$5x - 2$

c) $-(.3x - 2.9)$

$-.3x + 2.9$

d) $-(8r - 3t)$

$-8r + 3t$

e) $-(a + 5)$

$-a - 5$

f) $-(-x + 31)$

$x - 31$

g) $-(4x - 12)$

$-4x + 12$

h) $-(6m - 9n)$

$-6m + 9n$

$5m - 2n - (6m - 9n)$

$5m - 2n - 6m + 9n$

You can use the Distributive Property to make calculations easier to do with mental math. Some numbers can be thought of as simple sums or differences.

PROBLEM 4: USING THE DISTRIBUTIVE PROPERTY FOR MENTAL MATH

Simplify using mental math.

a) $4(52)$

$4(50 + 2)$

$200 + 8$

208

b) $4(47)$

$4(50 - 3)$

$200 - 12$

188

c) $8(4.95)$

$8(5 - 0.05)$

$40 - .4$

39.6

d) $8(7.75)$

$8(8 - .25)$

$64 - 2$

62

e) $6(71)$

$6(70 + 1)$

$420 + 6$

426

f) $9(39)$

$9(40 - 1)$

$360 - 9$

351

g) $8(302)$

$8(300 + 2)$

$2400 + 16$

2416

h) $4(398)$

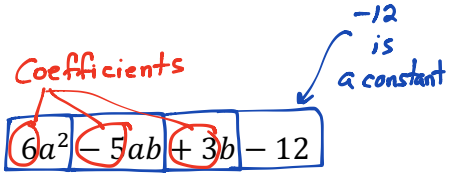
$4(400 - 2)$

$1600 - 8$

1592

$(17)(37)$

In an algebraic expression a ***term*** *is a number, a variable, or the product of a number and one or more variables.* A ***constant*** *is a term that has no variable.* A ***coefficient*** *is a numerical factor of a term.*



4 terms

EXACTLY (same variables with the same exponents)

Like terms *have the same variable factors.* To identify like terms, compare the variable factors of the terms.

Terms:	$7a$ and $-3a$	$4x^2$ and $12x^2$	$6ab$ and $-2a$	$1xy^2$ and $1x^2y$
Variable Factors:	a, a	x^2, x^2	ab, a	xy^2, x^2y
Like Terms?	yes	yes	no	no

An algebraic expression in simplest form has no like terms or parentheses. You can use the Distributive Property to help combine like terms. Think of $ba + ca = (b + c)a$.

NOT SIMPLIFIED: $2(3x - 5 + 4x)$ SIMPLIFIED:

$6x - 10 + 8x$

$14x - 10$

$6x + 8x$

$(6+8)x$

$14x$

$(2+3)x^2$ ← $2x^2 + 3x^2$

$5x^2$

PROBLEM 5: COMBINING LIKE TERMS

Simplify.

a) $8x^2 + 2x^2$

$10x^2$

b) $5x - 3 - 3x + 6y + 4$

$2x + 6y + 1$

c) $-2r^3t^2 - 5r^2t^3 + 2r^3t^2$

$-5r^2t^3$

d) $3y - 1y$

$2y$

e) $-7mn^4 - 5mn^4$

$-12mn^4$

g) $7y^3z - 6yz^3 + 1y^3z$

$8y^3z - 6yz^3$

h) Can you simplify $8x^2 - 2x^4 - 2x + 2 + xy$ any further? Explain.

NO; no like terms and no parentheses

HW

Evens only