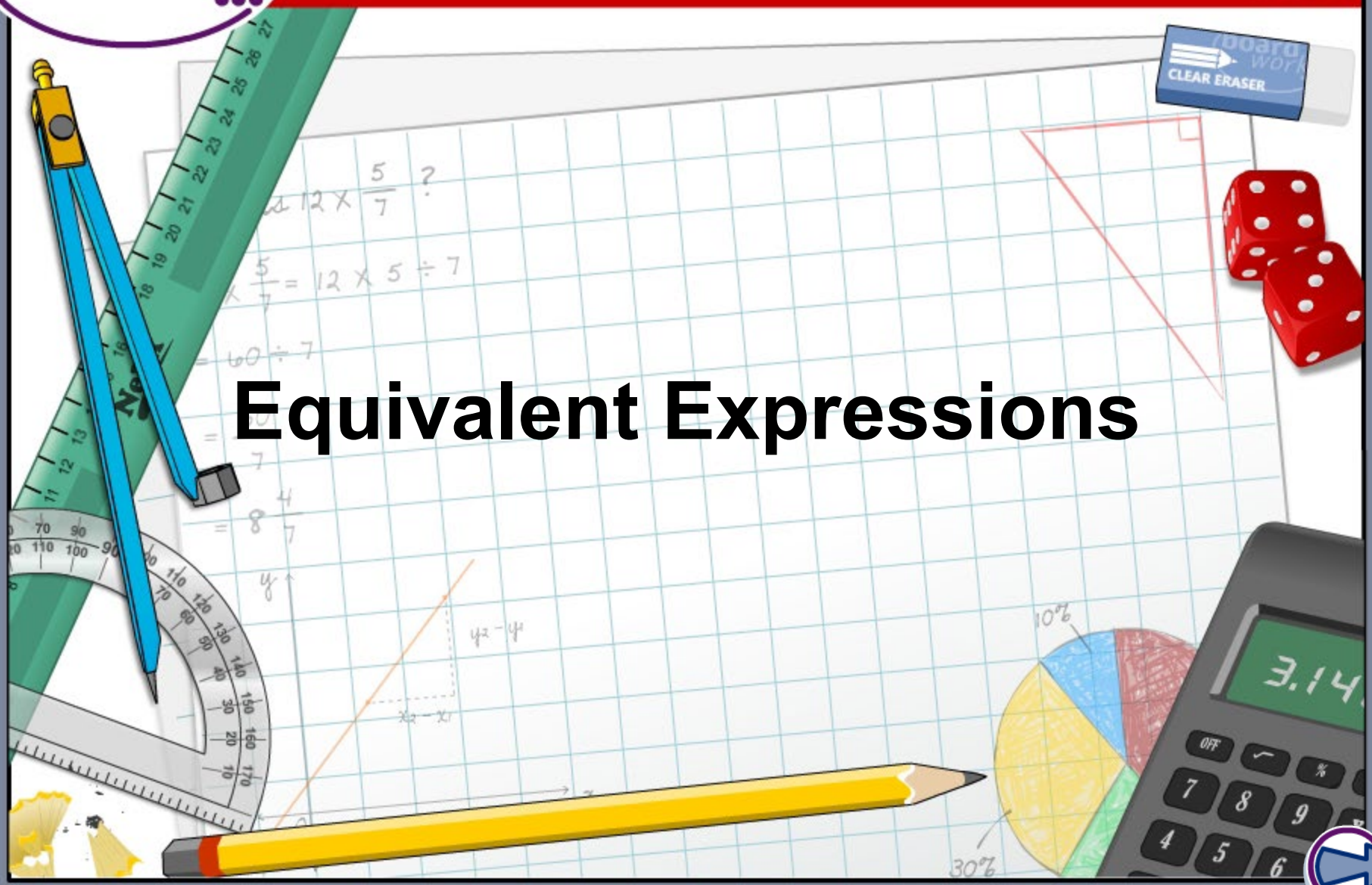


Equivalent Expressions

Information

Common core icons

This icon indicates a slide where the Standards for Mathematical Practice are being developed. Details of these are given in the Notes field.

Slides containing examples of mathematical modeling are marked with this stamp.

This icon indicates an opportunity for discussion or group work.

The **Standards for Mathematical Practice** outlined in the Common Core State Standards for Mathematics describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

They are:

1) Make sense of problems and persevere in solving them.

2) Reason abstractly and quantitatively.

3) Construct viable arguments and critique the reasoning of others.

4) Model with mathematics.

5) Use appropriate tools strategically.

6) Attend to precision.

7) Look for and make use of structure.

8) Look for and express regularity in repeated reasoning.

This icon indicates that the slide contains activities created in Flash. These activities are not editable.

This icon indicates teacher's notes in the Notes field.

Properties of operations

Properties of Operations

Commutative | Associative | Distributive

Press the properties of operations
to find out more about each property.

Properties practice

Commutative

$5 \times -3 = -15$ $\quad -3 \times 5 = -15$

$8 + -2 = 6$ $\quad -2 + 8 = 6$

The sign sticks to the number behind it.

Associative

$3 \times (5 \times -3) = (3 \times 5) \times -3$

$-7 + (9 + 15) = (-7 + 9) + 15$

Distributive

$-4(2 + 5) = (-4 \times 2) + (-4 \times 5)$

$= (-8) + (-20)$

$= -28$

$2(3 - 9) = (2 \times 3) - (2 \times 9)$

$= (6) - (18)$

$= -12$

Identity and zero properties

The **identity property** means that the answer is always equal to the original number:

- when 0 is added to a number

$$5 + 0 = 5 \qquad c + 0 = c$$

- when 1 is multiplied with a number.

$$8 \cdot 1 = 8 \qquad a \cdot 1 = a$$

The **zero property** means that multiplying any number by 0 will equal 0.

$$2 \cdot 0 = 0 \qquad c \cdot 0 = 0$$

Like terms

What is a like term?

We have two apples and two pears.

We can write this:

apple + pear + apple + pear

In symbols, we could say:

$a + p + a + p$

Like terms contain the same symbol.
They represent the same variable and have the same ending.

Combining like terms

When we add or subtract **like terms** in an **expression** we say we are **simplifying an expression**, by **combining like terms**.

$$a + a + a + a = 4 \cdot a$$

$$= 4a$$

$$3a + 2b + 4a + 6b = 3a + 4a + 2b + 6b$$

$$= 7a + 8b$$

This expression cannot be simplified any further. There are no more like terms.

How would you simplify $3a - 2a$?

Combining practice

Simplify these expressions by combining like terms.

1) $a + a + a + a + a = 5a$

2) $5b - 4b = b$

3) $4c + 3d + 3 - 2c + 6 - d = 4c - 2c + 3d - d + 3 + 6$

$= 2c + 2d + 9$

4) $4n + n^2 - 3n = 4n - 3n + n^2 = n + n^2$

5) $4r + 6s - t =$ **Cannot be simplified**

Multiplying terms

Earlier we saw how to simplify terms that have been added:

$$a + a + a + a = 4 \times a$$

$$= 4a$$

How would you simplify terms that have been multiplied?

$$a \cdot a \cdot a \cdot a = a^4$$

When several like terms are multiplied, we can use **exponent laws** to simplify the expression.

Dividing terms

We can often simplify expressions by **cancelling**.

For example:

$$n^3 \div n^2 = \frac{n^3}{n^2}$$

$$= \frac{\cancel{n}^{1} \cdot \cancel{n}^{1} \cdot n}{\cancel{n}_{1} \cdot \cancel{n}_{1}}$$

$$= n$$

$$6p^2 \div 3p = \frac{6p^2}{3p}$$

$$= \frac{\cancel{6}^{2} \cdot \cancel{p}^{1} \cdot p}{\cancel{3}_{1} \cdot \cancel{p}_{1}}$$

$$= 2p$$

Where have you seen cancelling used in this way before?

Parentheses

Look at this algebraic expression: $4(a + b)$

What does it mean? How could you simplify it?

This expression means: $4 \cdot (a + b)$

or $(a + b) + (a + b) + (a + b) + (a + b)$

$= a + b + a + b + a + b + a + b$	associative
$= a + a + a + a + b + b + b + b$	commutative
$= (a + a + a + a) + (b + b + b + b)$	associative
$= 4a + 4b$	combine like terms

In one step, this is the **distributive** property.

Parentheses practice

Simplify these expressions.

1.	$2(4 - a) + 5$	? W
2.	$3x + 2(5 - x)$	? W
3.	$4 - (5n - 3)$	? W
4.	$2(3n - 4) + 3(3n + 5)$	? W
5.	$5(3a + 2b) - 2(2a + 5b)$	? W

Using the grid method

Expand this expression: $7(7a+5b)$

×	$7a$	$+5b$	=
7			

1
2
3

positives only

More simplifying

Do you think $5x + 10$ can be simplified?

The terms $5x$ and 10 have a common factor, 5.

Some expressions can be simplified by dividing each term by a common factor.

We can divide $5x + 10$ by 5:

$$(5x + 10) \div 5 = \frac{5x}{5} + \frac{10}{5} = x + 2$$

We are applying the **distributive** property.

We must write the 5 **outside** of a set of parentheses around the new, divided expression:

$$5(x + 2)$$

Factoring expressions

Writing $5x + 10$ as $5(x + 2)$ is called **factoring the expression**.

Factor $6a + 8$

The greatest common factor of $6a$ and 8 is 2.

$(6a + 8) \div 2 = 3a + 4$

$6a + 8 = 2(3a + 4)$

Factor $12 - 9n$

The greatest common factor of 12 and $9n$ is 3.

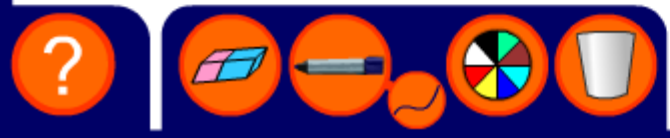
$(12 - 9n) \div 3 = 4 - 3n$

$12 - 9n = 3(4 - 3n)$

Algebraic multiplication square

Use factoring to find the values of the missing terms.
Press on the empty spaces to reveal the answers.

×			
	$5ab+25b^2$	$9a+45b$	$-2ab-10b^2$
	$-15ab-15b^2$	$-27a-27b$	$6ab+6b^2$
	$5ab+20b^2$	$9a+36b$	$-2ab-8b^2$
	$15ab+30b$	$27a+54$	$-6ab-12b$
	$30ab+15b^2$	$54a+27b$	$-12ab-6b^2$



Matching equivalent expressions

$6a+12b$	$5(3a-4b)$	$3(2a+b)$	$6a+3b$	$6a-12b$
$8a+12b$	$14a+7b$	$15a-20b$	$6(a+2b)$	$4a+6b$
$2(2a+3b)$	$6(a-2b)$	$3a+6b$	$3(a+2b)$	$4(2a+3b)$
$4(a-b)$	$7(2a+b)$	$12a-4b$	$4(3a-b)$	$4a-4b$

Press to match the equivalent expressions.