Name _____ Date_____

Generating Equivalent Expressions

1. Write the expression in standard form.
   $(4f - 3 + 2g) - (-4g + 2)$

2. Find the result when $5m + 2$ is subtracted from $9m$.

3. Rewrite the expression in standard form.
   $27h \div 3h$

2. Write each expression in standard form. Verify that your expression is equivalent to the one given by evaluating each expression for the given value of the variable.

a. $4y - (3 + y);\ y = 2$	b. $(2b + 1) - b;\ b = -4$	c. $(6c - 4) - (c - 3);\ c = -7$
d. $(d + 3d) - (-d + 2);\ d = 3$	e. $(-5x - 4) - (-2 - 5x);\ x = 3$	f. $11f - (-2f + 2);\ f = \frac{1}{2}$
g. $-5g + (6g - 4);\ g = -2$	h. $(8h - 1) - (h + 3);\ h = -3$	i. $(7 + w) - (w + 7); w = -4$
j. $(2g + 9h - 5) - (6g - 4h + 2); g = -2$ and $h = 5$		

3. Write each expression in standard form. Verify that your expression is equivalent to the one given by evaluating both expressions for the given value of the variable.

a. $-3(8x);\ x = \frac{1}{4}$	b. $5 \cdot k \cdot (-7);\ k = \frac{3}{5}$	c. $2(-6x) \cdot 2;\ x = \frac{3}{4}$
d. $-3(8x) + 6(4x);\ x = 2$	e. $8(5m) + 2(3m);\ m = -2$	f. $-6(2v) + 3a(3);\ v = \frac{1}{3}; a = \frac{2}{3}$

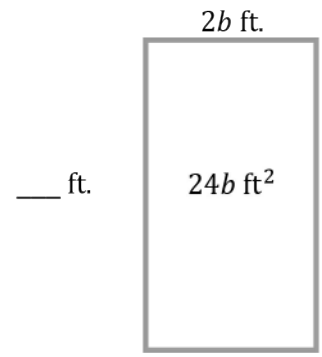
4. Write each expression in standard form. Verify that your expression is equivalent to the one given by evaluating both expressions for the given value of the variable.

a. $8x \div 2;\ x = -\frac{1}{4}$	b. $18w \div 6;\ w = 6$	c. $25r \div 5r;\ r = -2$
d. $33y \div 11y;\ y = -2$	e. $56k \div 2k;\ k = 3$	f. $24xy \div 6y;\ x = -2; y = 3$

5. For each problem (a)–(e), write an expression in standard form.
   a. Find the sum of $-3x$ and $8x$.
   b. Find the sum of $-7g$ and $4g + 2$.
   c. Find the difference when $6h$ is subtracted from $2h - 4$.
   d. Find the difference when $-3n - 7$ is subtracted from $n + 4$.
   e. Find the result when $13v + 2$ is subtracted from $11 + 5v$.
   f. Find the result when $-18m - 4$ is added to $4m - 14$.
   g. What is the result when $-2x + 9$ is taken away from $-7x + 2$?

6. Marty and Stewart are stuffing envelopes with index cards. They are putting x index cards in each envelope. When they are finished, Marty has 15 stuffed envelopes and 4 extra index cards, and Stewart has 12 stuffed envelopes and 6 extra index cards. Write an expression in standard form that represents the number of index cards the boys started with. Explain what your expression means.

7. The area of the pictured rectangle below is $24b$ ft^2. Its width is $2b$ ft. Find the height of the rectangle and name any properties used with the appropriate step.



1. **Write the expression in standard form.**

$(4f - 3 + 2g) - (-4g + 2)$

$4f + (-3) + 2g + \big(-(-4g + 2)\big)$	*Subtraction as adding the opposite*
$4f + (-3) + 2g + 4g + (-2)$	*Opposite of a sum is the sum of its opposites*
$4f + 2g + 4g + (-3) + (-2)$	*Any order, any grouping*
$4f + 6g + (-5)$	*Combined like terms*
$4f + 6g - 5$	*Subtraction as adding the opposite*

2. **Find the result when $5m + 2$ is subtracted from $9m$.**

$9m - (5m + 2)$	*Original expression*
$9m + \big(-(5m + 2)\big)$	*Subtraction as adding the opposite*
$9m + (-5m) + (-2)$	*Opposite of a sum is the sum of its opposites*
$4m + (-2)$	*Combined like terms*
$4m - 2$	*Subtraction as adding the opposite*

3. **Rewrite the expression in standard form.**

$27h \div 3h$

$27h \cdot \frac{1}{3h}$	*Multiplying by the reciprocal*
$\frac{27h}{3h}$	*Multiplication*
$\frac{27}{3} \cdot \frac{h}{h}$	*Any order, any grouping*
$9 \cdot 1$	
9	

1. Write each expression in standard form. Verify that your expression is equivalent to the one given by evaluating each expression using $x = 5$.

a. $3x + (2 - 4x)$ $-x + 2$ $-5 + 2 = -3$ $3(5) + (2 - 4(5))$ $15 + (2 + (-20))$ $15 + (-18) = -3$	b. $3x + (-2 + 4x)$ $7x - 2$ $7(5) - 2$ $35 - 2 = 33$ $3(5) + (-2 + 4(5))$ $15 + (-2 + 20)$ $15 + 18 = 33$	c. $-3x + (2 + 4x)$ $x + 2$ $5 + 2 = 7$ $-3(5) + (2 + 4(5))$ $-15 + (2 + 20)$ $-15 + 22 = 7$
d. $3x + (-2 - 4x)$ $-x - 2$ $-5 - 2 = -7$ $3(5) + (-2 - 4(5))$ $15 + (-2 + (-4(5)))$ $15 + (-2 + (-20))$ $15 + (-22) = -7$	e. $3x - (2 + 4x)$ $-x - 2$ $-5 - 2 = -7$ $3(5) - (2 + 4(5))$ $15 - (2 + 20)$ $15 - 22$ $15 + (-22) = -7$	f. $3x - (-2 + 4x)$ $-x + 2$ $-5 + 2 = -3$ $3(5) - (-2 + 4(5))$ $15 - (-2 + 20)$ $15 - (18)$ $15 + (-18) = -3$
g. $3x - (-2 - 4x)$ $7x + 2$ $7(5) + 2$ $35 + 2 = 37$ $3(5) - (-2 - 4(5))$ $15 - (-2 + (-4(5)))$ $15 - (-2 + (-20))$ $15 - (-22)$ $15 + 22 = 37$	h. $3x - (2 - 4x)$ $7x - 2$ $7(5) - 2$ $35 - 2 = 33$ $3(5) - (2 - 4(5))$ $15 - (2 + (-4(5)))$ $15 - (2 + (-20))$ $15 - (-18)$ $15 + 18 = 33$	i. $-3x - (-2 - 4x)$ $x + 2$ $5 + 2 = 7$ $-3(5) - (-2 - 4(5))$ $-15 - (-2 + (-4(5)))$ $-15 - (-2 + (-20))$ $-15 - (-22)$ $-15 + 22 = 7$

j. In problems (a)–(d) above, what effect does addition have on the terms in parentheses when you removed the parentheses?

By the any grouping property, the terms remained the same with or without the parentheses.

k. In problems (e)–(i), what effect does subtraction have on the terms in parentheses when you removed the parentheses?

The opposite of a sum is the sum of the opposites; each term within the parentheses is changed to its opposite.

2. Write each expression in standard form. Verify that your expression is equivalent to the one given by evaluating each expression for the given value of the variable.

a. $4y-(3+y);\ y=2$

$3y-3$

$3(2)-3$

$6-3=3$

$4(2)-(3+2)$

$8-5$

$8+(-5)=3$

b. $(2b+1)-b;\ b=-4$

$b+1$

$-4+1=-3$

$(2(-4)+1)-(-4)$

$(-8+1)+4$

$(-7)+4=-3$

c. $(6c-4)-(c-3);\ c=-7$

$5c-1$

$5(-7)-1$

$-35-1=-36$

$(6(-7)-4)-(-7-3)$

$(-42-4)-(-10)$

$-42+(-4)+(10)$

$-46+10=-36$

d. $(d+3d)-(-d+2);\ d=3$

$5d-2$

$5(3)-2$

$15-2=13$

$\big(3+3(3)\big)-(-3+2)$

$(3+9)-(-1)$

$12+1=13$

e. $(-5x-4)-(-2-5x);\ x=3$

-2

$(-5(3)-4)-\big(-2-5(3)\big)$

$(-15-4)-(-2-15)$

$(-19)-(-17)$

$(-19)+17=-2$

f. $11f-(-2f+2);\ f=\frac{1}{2}$

$13f-2$

$13\left(\frac{1}{2}\right)-2$

$\frac{13}{2}-2$

$6\frac{1}{2}-2=4\frac{1}{2}$

$11\left(\frac{1}{2}\right)-\left(-2\left(\frac{1}{2}\right)+2\right)$

$\frac{11}{2}-(-1+2)$

$\frac{11}{2}-1$

$\frac{11}{2}+\left(-\frac{2}{2}\right)=\frac{9}{2}=4\frac{1}{2}$

g. $-5g+(6g-4);\ g=-2$

$g-4$

$-2-4=-6$

$-5(-2)+(6(-2)-4)$

$10+(-12-4)$

$10+\big(-12+(-4)\big)$

$10+(-16)=-6$

h. $(8h-1)-(h+3);\ h=-3$

$7h-4$

$7(-3)-4$

$-21-4=-25$

$(8(-3)-1)-(-3+3)$

$(-24-1)-(0)$

$(-25)-0=-25$

i. $(7+w)-(w+7);\ w=-4$

0

$\big(7+(-4)\big)-(-4+7)$

$3-3$

$3+(-3)=0$

j. $(2g+9h-5)-(6g-4h+2);\ g=-2$ and $h=5$

$-4g+13h-7$

$-4(-2)+13(5)-7$

$8+65+(-7)$

$73+(-7)=66$

$(2(-2)+9(5)-5)-(6(-2)-4(5)+2)$

$(-4+45-5)-\big(-12+\big(-4(5)\big)+2\big)$

$(41-5)-(-12+(-20)+2)$

$\big(41+(-5)\big)-(-32+2)$

$36-(-30)$

$36+30=66$

3. Write each expression in standard form. Verify that your expression is equivalent to the one given by evaluating both expressions for the given value of the variable.

a. $-3(8x);\ x=\frac{1}{4}$ $-24x$ $-24\left(\frac{1}{4}\right)$ $-\frac{24}{4}=-6$ $-3\left(8\left(\frac{1}{4}\right)\right)$ $-3(2)=-6$	b. $5\cdot k\cdot(-7);\ k=\frac{3}{5}$ $-35k$ $-35\left(\frac{3}{5}\right)$ $-\frac{105}{5}=-21$ $5\left(\frac{3}{5}\right)(-7)$ $3(-7)=-21$	c. $2(-6x)\cdot 2;\ x=\frac{3}{4}$ $-24x$ $-24\left(\frac{3}{4}\right)$ $-\frac{72}{4}=-18$ $2\left(-6\left(\frac{3}{4}\right)\right)\cdot 2$ $2\left(-3\left(\frac{3}{2}\right)\right)\cdot 2$ $2(-3)\left(\frac{3}{2}\right)(2)$ $-6(3)=-18$
d. $-3(8x)+6(4x);\ x=2$ 0 $-3(8(2))+6(4(2))$ $-3(16)+6(8)$ $-48+48=0$	e. $8(5m)+2(3m);\ m=-2$ $46m$ $46(-2)=-92$ $8(5(-2))+2(3(-2))$ $8(-10)+2(-6)$ $-80+(-12)=-92$	f. $-6(2v)+3a(3);\ v=\frac{1}{3};$ $a=\frac{2}{3}$ $-12v+9a$ $-12\left(\frac{1}{3}\right)+9\left(\frac{2}{3}\right)$ $-\frac{12}{3}+\frac{18}{3}$ $-4+6=2$ $-6\left(2\left(\frac{1}{3}\right)\right)+3\left(\frac{2}{3}\right)(3)$ $-6\left(\frac{2}{3}\right)+2(3)$ $-4+6=2$

4. Write each expression in standard form. Verify that your expression is equivalent to the one given by evaluating both expressions for the given value of the variable.

a. $8x\div 2;\ x=-\frac{1}{4}$ $4x$ $4\left(-\frac{1}{4}\right)=-1$ $8\left(-\frac{1}{4}\right)\div 2$ $-2\div 2=-1$	b. $18w\div 6;\ w=6$ $3w$ $3(6)=18$ $18(6)\div 6$ $108\div 6=18$	c. $25r\div 5r;\ r=-2$ 5 $25(-2)\div(5(-2))$ $-50\div(-10)=5$
d. $33y\div 11y;\ y=-2$ 3 $33(-2)\div(11(-2))$ $(-66)\div(-22)=3$	e. $56k\div 2k;\ k=3$ 28 $56(3)\div(2(3))$ $168\div 6=28$	f. $24xy\div 6y;\ x=-2;y=3$ $4x$ $4(-2)=-8$ $24(-2)(3)\div(6(3))$ $-48(3)\div 18$ $-144\div 18=-8$

5. For each problem (a)–(e), write an expression in standard form.

   a. Find the sum of $-3x$ and $8x$.

   $-3x + 8x = 5x$

   b. Find the sum of $-7g$ and $4g + 2$.

   $-7g + (4g + 2) = -3g + 2$

   c. Find the difference when $6h$ is subtracted from $2h - 4$.

   $(2h - 4) - 6h = -4h - 4$

   d. Find the difference when $-3n - 7$ is subtracted from $n + 4$.

   $(n + 4) - (-3n - 7) = 4n + 11$

   e. Find the result when $13v + 2$ is subtracted from $11 + 5v$.

   $(11 + 5v) - (13v + 2) = -8v + 9$

   f. Find the result when $-18m - 4$ is added to $4m - 14$.

   $(4m - 14) + (-18m - 4) = -14m - 18$

   g. What is the result when $-2x + 9$ is taken away from $-7x + 2$?

   $(-7x + 2) - (-2x + 9) = -5x - 7$

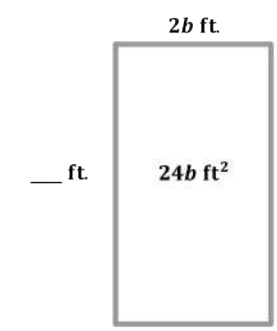
6. Marty and Stewart are stuffing envelopes with index cards. They are putting x index cards in each envelope. When they are finished, Marty has 15 stuffed envelopes and 4 extra index cards, and Stewart has 12 stuffed envelopes and 6 extra index cards. Write an expression in standard form that represents the number of index cards the boys started with. Explain what your expression means.

   They inserted the same number of index cards in each envelope, but that number is unknown x. An expression that represents Marty's index cards is $15x + 4$ because he had 15 envelopes and 4 cards left over. An expression that represents Stewart's index cards is $12x + 6$ because he had 12 envelopes and 6 left over cards. Their total number of cards together would be:

$$15x + 4 + 12x + 6$$
$$15x + 12x + 4 + 6$$
$$27x + 10$$

   This means that all together, they have 27 envelopes with x index cards in each, plus another 10 left over index cards.

7. The area of the pictured rectangle below is $24b$ ft^2. Its width is $2b$ ft. Find the height of the rectangle and name any properties used with the appropriate step.



$24b \div 2b$	
$24b \cdot \frac{1}{2b}$	*Multiplying the reciprocal*
$\frac{24b}{2b}$	*Multiplication*
$\frac{24}{2} \cdot \frac{b}{b}$	*Any order, any grouping in multiplication*
$12 \cdot 1$	
12	

   The height of the rectangle is 12 ft.