

# Unit 4 Family Support Materials

## Expressions and More Equations

### Section A: Writing Equivalent Expressions

This week your student will be working with equivalent expressions (expressions that are always equal, for any value of the variable). For example,  $2x + 7 + 4x$  and  $6x + 10 - 3$  are equivalent expressions. We can see that these expressions are equal when we try different values for  $x$ .

|                | $2x + 7 + 4x$                                       | $6x + 10 - 3$                               |
|----------------|-----------------------------------------------------|---------------------------------------------|
| when $x$ is 5  | $2 \cdot 5 + 7 + 4 \cdot 5$<br>$10 + 7 + 20$<br>37  | $6 \cdot 5 + 10 - 3$<br>$30 + 10 - 3$<br>37 |
| when $x$ is -1 | $2 \cdot -1 + 7 + 4 \cdot -1$<br>$-2 + 7 + -4$<br>1 | $6 \cdot -1 + 10 - 3$<br>$-6 + 10 - 3$<br>1 |

We can also use properties of operations to see why these expressions have to be equivalent—they are each equivalent to the expression  $6x + 7$ .

**Here is a task to try with your student:**

Match each expression with an equivalent expression from the list below. One expression in the list will be left over.

1.  $5x + 8 - 2x + 1$
2.  $6(4x - 3)$
3.  $(5x + 8) - (2x + 1)$
4.  $-12x + 9$

List:

- $3x + 7$
- $3x + 9$
- $-3(4x - 3)$
- $24x + 3$
- $24x - 18$



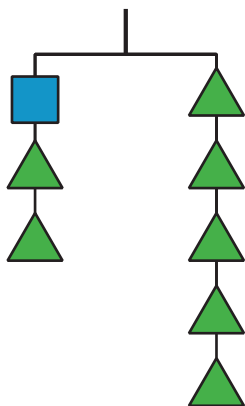
Solution:

1.  $3x + 9$  is equivalent to  $5x + 8 - 2x + 1$ , because  $5x + -2x = 3x$  and  $8 + 1 = 9$ .
2.  $24x - 18$  is equivalent to  $6(4x - 3)$ , because  $6 \cdot 4x = 24x$  and  $6 \cdot -3 = -18$ .
3.  $3x + 7$  is equivalent to  $(5x + 8) - (2x + 1)$ , because  $5x - 2x = 3x$  and  $8 - 1 = 7$ .
4.  $-3(4x - 3)$  is equivalent to  $-12x + 9$ , because  $-3 \cdot 4x = -12x$  and  $-3 \cdot -3 = 9$ .



## Section B: Equivalent Equations

This week your student will work on solving linear equations. We can think of a balanced hanger as a metaphor for an equation. An equation says that the expressions on either side have equal value, just like a balanced hanger has equal weights on either side.



If we have a balanced hanger and add or remove the same amount of weight from each side, the result will still be in balance. For example, we could remove 2 triangles from each side of this hanger and it would still balance. We could also add a square to each side and it would still balance.

We can do this with equations as well: Adding or subtracting the same amount from both sides of an equation keeps the sides equal to each other. For example, if  $4x + 20$  and  $-6x + 10$  have equal value, we can write an equation  $4x + 20 = -6x + 10$ . We could add  $-10$  to both sides of the equation or divide both sides of the equation by 2 and keep the sides equal to each other. Using these moves in systematic ways, we can find that  $x = -1$  is a solution to this equation.

**Here is a task to try with your student:**

Elena and Noah work on the equation  $\frac{1}{2}(x + 4) = -10 + 2x$  together. Elena's solution is  $x = 24$  and Noah's solution is  $x = -8$ . Here is their work:

Elena:

$$\begin{aligned}\frac{1}{2}(x + 4) &= -10 + 2x \\ x + 4 &= -20 + 2x \\ x + 24 &= 2x \\ 24 &= x \\ x &= 24\end{aligned}$$

Noah:

$$\begin{aligned}\frac{1}{2}(x + 4) &= -10 + 2x \\ x + 4 &= -20 + 4x \\ -3x + 4 &= -20 \\ -3x &= -24 \\ x &= -8\end{aligned}$$

Do you agree with their solutions? Explain or show your reasoning.

Solution:

No, they both have errors in their solutions.

Elena multiplied both sides of the equation by 2 in her first step, but forgot to multiply the  $2x$  by the 2. We can also check Elena's answer by replacing  $x$  with 24 in the original equation and seeing if the equation is true.



$$\begin{aligned}\frac{1}{2}(x + 4) &= -10 + 2x \\ \frac{1}{2}(24 + 4) &= -10 + 2(24) \\ \frac{1}{2}(28) &= -10 + 48 \\ 14 &= 38\end{aligned}$$

Because 14 is not equal to 38, Elena's answer is not correct.

Noah divided both sides by -3 in his last step, but wrote -8 instead of 8 for  $-24 \div -3$ . We can also check Noah's answer by replacing  $x$  with -8 in the original equation and seeing if the equation is true. Noah's answer is not correct.

