Acc7.4 Family Support Material

This unit covers three big topics. Read about each topic and find a task or activity to complete with your student below.

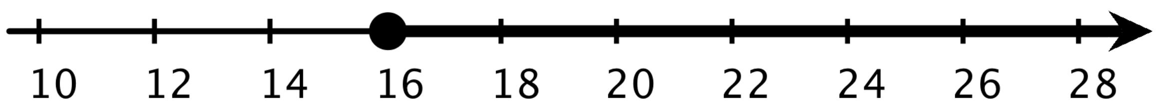
Inequalities

Writing Equivalent Expressions

Equations in One Variable

Inequalities

This week your student will be working with inequalities (expressions with $>$ or $<$ instead of $=$). We use inequalities to describe a range of numbers. For example, in many places you need to be at least 16 years old to be allowed to drive. We can represent this situation with the inequality $a \geq 16$. We can show all the solutions to this inequality on the number line.



The diagram shows 16 and all numbers to the right of 16 (so all values greater than or equal to 16) being possible values of a.

We call any value of a that makes an inequality true a **solution to the inequality**.

Here is a task to try with your student:

Noah already has \$10.50, and he earns \$3 each time he runs an errand for his neighbor. Noah wants to know how many errands he needs to run to have at least \$30, so he writes this inequality:

$$3e + 10.50 \geq 30$$

We can test this inequality for different values of e. For example, 4 errands is not enough for Noah to reach his goal, because $3 \cdot 4 + 10.50 = 22.5$, and \$22.50 is less than \$30.

1. Will Noah reach his goal if he runs:
    a. 8 errands?
    b. 9 errands?
2. What value of e makes the equation $3e + 10.50 = 30$ true?
3. What does this tell you about all the solutions to the inequality $3e + 10.50 \geq 30$?
4. What does this mean for Noah's situation?

Solution

1. a. Yes, if Noah runs 8 errands, he will have $3 \cdot 8 + 10.50$, or \$34.50.
    b. Yes, since 9 is more than 8, and 8 errands was enough, so 9 will also be enough.
2. The equation is true when $e = 6.5$. We can rewrite the equation as $3e = 30 - 10.50$, or $3e = 19.50$. Then we can rewrite this as $e = 19.50 \div 3$, or $e = 6.5$.
3. This means that when $e \geq 6.5$ then Noah's inequality is true.
4. Noah can't really run 6.5 errands, but he could run 7 or more errands, and then he would have more than \$30.

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	$2 \cdot 5 + 7 + 4 \cdot 5$ $10 + 7 + 20$ 37	$6 \cdot 5 + 10 - 3$ $30 + 10 - 3$ 37
when x is -1	$2 \cdot \text{-}1 + 7 + 4 \cdot \text{-}1$ $\text{-}2 + 7 + \text{-}4$ 1	$6 \cdot \text{-}1 + 10 - 3$ $\text{-}6 + 10 - 3$ 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. $\text{-}12x + 9$

List:

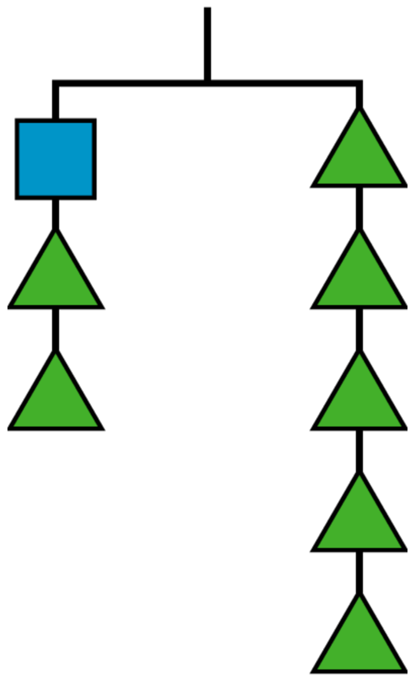
- $3x + 7$
- $3x + 9$
- $-3(4x - 3)$
- $24x + 3$
- $24x - 18$

Solution

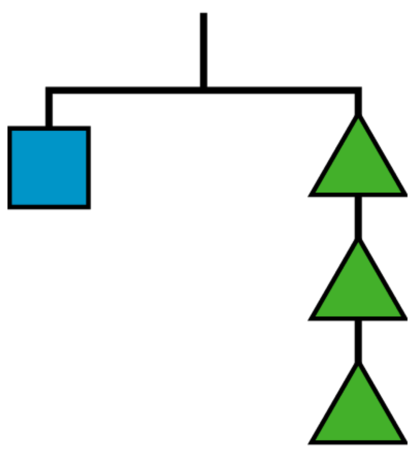
1. $3x + 9$ is equivalent to $5x + 8 - 2x + 1$, because $5x + -2x = 3x$ and $8 + 1 = 9$.
2. $24x - 18$ is equivalent to $6(4x - 3)$, because $6 \cdot 4x = 24x$ and $6 \cdot -3 = -18$.
3. $3x + 7$ is equivalent to $(5x + 8) - (2x + 1)$, because $5x - 2x = 3x$ and $8 - 1 = 7$.
4. $-3(4x - 3)$ is equivalent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

Equations in One Variable

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.



$$a + 2b = 5b$$



$$a = 3b$$

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.

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. $\frac{1}{2}(x+4) = -10 + 2x$ $\frac{1}{2}(24+4) = -10 + 2(24)$ $\frac{1}{2}(28) = -10 + 48$ $14 = 38$ Since 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.