



Activity

4A

Discover and apply the properties of equality.

It is best if students experiment with the tiles and a balance scale template (*SAB, Page 210*) to verify and/or discover the properties of equality. When experimenting, be sure to stress that the scale is mathematically balanced, but not necessarily physically balanced.

Tell students that they have worked with equations many times before, and that equations show two quantities that are equal: $-2 = -2$ or $+3 = +3$

Many times equations show quantities that are equal even though they look very different: $-2 + +3 = +1$ or $-4 + +5 = +2 + -1$

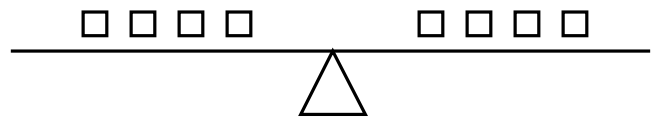
These equalities can be shown visually by using a balance scale to represent them. Unit squares and variables can be used to model equations. In all equations, the quantity on the left is mathematically equal to the quantity on the right, even if the physical model does not look balanced. Use unit squares and Transparency 22, the balance scale, to show several models using a dialogue similar to the one below.

For the following examples, \square = yellow and \blacksquare = red.

Example 1:

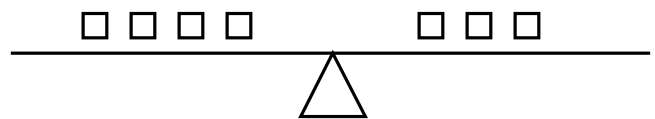
Place four yellow unit squares on each side of the balance scale.

“Is the scale balanced?” (Yes.) “Why?” (The mathematical value of the left side is equal to the mathematical value of the right side.)

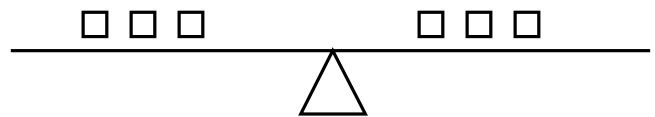


Remove a yellow unit square from the right side.

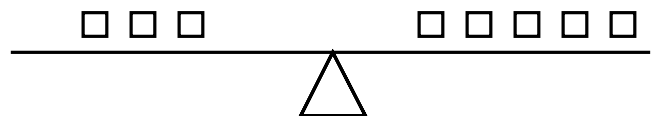
“What would happen if this were done to the scale?” (It would tip to the left.) “Why?” (The mathematical value of the left side is greater than the mathematical value of the right side.)



“If a yellow unit square were removed from the left side now, what would happen to the scale?” (It would balance.) “Why?” (The mathematical value of the left side is equal to the mathematical value of the right side.)

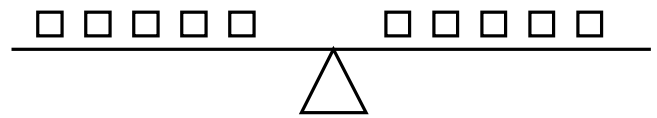


“If two yellow unit squares were added to the right side, what would happen to the scale?” (The scale would tip to the right.) “Why?” (The mathematical value of the right side would be greater than the mathematical value of the left side.)

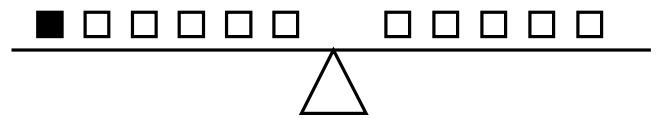


Example 2:

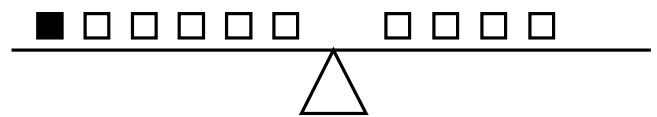
“What could be added to the left side of this scale to make the scale balance?” (Two yellow unit squares.)



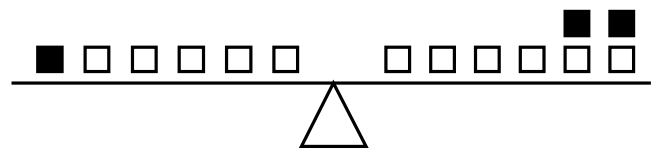
“What would happen if a red unit square were added to the left side of the scale?” (The scale would tip to the right.) “Why?” (The mathematical value of the right side of the scale would be greater than the mathematical value of the left side of the scale because one yellow and one red unit square, or one zero pair, have a combined value of 0.)



“What would happen to the scale if a yellow unit square were removed from the right side of the scale?” (The scale would balance.) “Why?” (The mathematical value of each side of the scale would be the same.)

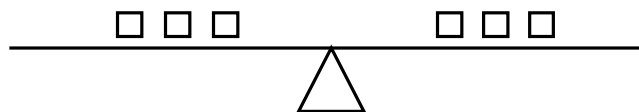


“What would happen if two red and two yellow unit squares were added to the right side of the scale?” (The scale would stay balanced.) “Why?” (Adding zero pairs does not affect the mathematical value.)



Draw a model of the scale below on the overhead. Have students use their Communicators® to tell what would happen to the balance scale if the actions that follow were taken.

(Note: These actions are not cumulative. The scale is reset after each action.)



1. What would happen if two yellow unit squares were added to the right side of the scale?
(The scale would tip to the right.)
2. What would happen if one yellow unit square were added to each side of the scale?
(The scale would stay balanced.)
3. What would happen if a yellow unit square and a red unit square were added to the right side of the scale?
(The scale would stay balanced.)
4. What would happen if a red square were added to the left side of the scale?
(The scale would tip to the right.)
5. What would happen if one red square were added to each side of the scale?
(The scale would stay balanced.)

6. What would happen if one yellow square were removed from the right side?
(The scale would tip to the left.)
7. What would happen if one yellow square were removed from each side of the scale?
(The scale would stay balanced.)
8. What would happen if two yellow and two red unit squares were placed on the left side of the scale?
(The scale would stay balanced.)

Assign "Actions with Balanced Scales I" (SAB, Page 71). Use models and a question-and-answer technique to validate answers. Have students summarize their activities by using Communicators[®] to indicate what actions can be taken that will keep a scale balanced and what actions can be taken that will make the scale tip.

Actions that keep the scale balanced:

1. Adding a zero pair to either the left or right side.
2. Subtracting or removing exactly the same thing from both sides at once.
3. Adding exactly the same thing to both sides at once.

Actions that make the scale tip:

1. Adding something to one side without adding it to the other.
2. Subtracting something from one side without subtracting it from the other.
3. Adding one thing to one side and subtracting the same thing from the other.

Assign "Actions with Balanced Scales II" (SAB, Page 72). Use models and a question-and-answer technique to validate answers.