Solving a System of Three Equations

Balance Challenge

Goals

- Identify weights of blocks from relationships shown by level pan balances.
- Replace variables or a group of variables with their values.
- Understand that substituting for one or more variables with others of equal weight will not affect the balance.

Questions to Ask

1. What is in the left pan of pan balance A? (1 cylinder and 2 cubes) How much do they weigh? (11 pounds)
2. What is in the right pan of B? (2 cylinders and 2 cubes) How much do they weigh? (14 pounds)
3. What do the left pan of A and the right pan of B have in common? (both have 1 cylinder and 2 cubes) What is different? (B has an extra cylinder.)
4. How can you use that information to figure out the weight of the extra cylinder? (Replace the 1 cylinder and 2 cubes with 11 pounds, then remove 11 pounds from both pans. The extra cylinder is 14 - 11, or 3 pounds.)
5. What will you do after you know the weight of the cylinder? (Replace the cylinder in A with its weight in order to figure out the weight of the cube.)

Solutions

1. 6
2. 4
3. 3

4. Possible solution: All of the blocks in the left pan of A are contained in the right pan of B. Replace the cylinder and 2 cubes in B with 11 pounds. Remove 11 pounds from each pan. Then the extra cylinder in B is 14 - 11, or 3 pounds. In B, replace each cylinder with 3 pounds. Remove 6 pounds from each pan. That leaves 2 cubes weighing 14 - 6, or 8 pounds. Each cube is 8 ÷ 2, or 4 pounds. Replace the cylinder in C with 3 pounds and the cube with 4 pounds. Then remove 7 pounds from each pan. The sphere weighs 13 - 7, or 6 pounds.

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Once students have identified the group of blocks that are the same in two pans of two different balances, have them draw a circle around them. In this way, they can more easily see what is "extra" in one of the pans.

Some students may notice that in B there are two pairs of blocks with a cylinder and cube in each. Thus the weight of each pair is 14 ÷ 2, or 7 pounds. The same pair of blocks in A can be replaced with 7 pounds. The weight of the "extra" cube in A can then be determined.
Balance Challenge

1. \( \bigcirc = \) ________ pounds
2. \( \square = \) ________ pounds
3. \( \bigotimes = \) ________ pounds

4. How did you figure out the weights?

[Blank lines for writing answer]