

Algebra Problems for Students

Instructions for the teacher

The major goal of this problem set is help students learn to interpret and translate mathematical expressions and equations. Often students struggle with algebra because they do not see the relevance to their lives. Working with problems in context (story problems) provides students the necessary relevance to be more successful. However, students struggle with contextual problems due their inability to translate/interpret from English to algebra and vice versus.

Some of your students may struggle with these problems for reasons other than motivation. In that case, our goal is to understand why the student struggled and to learn how to predict and circumvent these problems. The goal of this activity is to build student success in translating/interpreting by sequential exploration of translations and interpretation. The directions will be worded in such a way that responses are interpreted in a story format. Students will be given the opportunity to compare equations/expressions that are equivalent but are different forms. Students will start with the easiest processes in order to build on nature ability. The end goal would be translate story into algebraic expression or equations and the reverse. By seeing multiple incarnations of the same equation, it is our hope that students will understand that equations that look different can have the same meaning.

We want each teacher to urge all students to complete as much of the problem set as possible. If need be, the teacher should engage the struggling student with intermediate problems. lets take problem 1 of group 2 as an example. If the student is unable to come up with ' $a = 2b + 2$ and $b = 24$; therefore $a = 2 \cdot 24 + 2 = 50$ ', the teach might say, 'let's imagine that Bob has 10 marbles. Then Alice must have more than twice as many. How many is twice 10 plus 2.'

When the students have completed their work, you are to pick several interesting student responses and discuss those responses with that student. Take notes so that you can share the information with your fellow participants.

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Instructions for the student

Alice and Bob have sets of marbles. Suppose Alice starts with a marbles and Bob starts with b marbles. For each of the following events describe the marbles Bob has after the event. Note, these are seven independent problems.

Group 1 For each of the following events describe the marbles Bob has after the event. Note, these are seven independent problems.

1. Alice gives Bob 5 marbles.
2. Alice takes 2 marbles from Bob.
3. Alice gives Bob half her marbles.
4. Alice gives Bob twice as many marbles as Bob had.
5. Alice takes half of Bob's marbles and then gives him 10 marbles.
6. Alice gives Bob 10 marbles and then takes half of Bob's marbles.
7. Alice has five more than thirty percent of Bob's marbles. Write an equation that describes the situation.

Group 2 For each of the following events find the number requested. Note, these are seven independent problems.

1. Alice has twice as many marbles as Bob has, and two more besides. Bob has 24 marbles. How many marbles does Alice have?
2. Alice has twice as many marbles as Bob has, and two more besides. Alice has 50 marbles. How many marbles does Bob have?
3. Bob gave Alice 24 marbles, and then they both had 40 marbles. How many marbles did they each have originally?
4. Alice had 16 marbles and Bob had 64. Bob promised to give her some marbles so that they would have the same number. How many should he give me?
5. Bob gave Alice 24 marbles, and then they had the same number. I started with 16 marbles. How many marbles did Bob start with, and how! many marbles did they each have at the end?
6. Bob had four times as many marbles as Alice did. He gave her some marbles, and then they both had 40 marbles. How many marbles did Bob have originally?

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7. Bob had four times as many marbles as Alice had. He gave her some marbles, and then they both had 40 marbles. How many marbles did Alice have originally?
8. Bob had four times as many marbles as Alice had. He gave her 24 marbles, and then they both had the same number of marbles. How many marbles did Bob have originally?
9. Bob had four times as many marbles as Alice had. He gave 24 her marbles, and then they both had the same number of marbles. How many marbles did Alice have originally?
10. Bob had four times as many marbles as Alice had. He gave me some marbles, and then they both had 40 marbles. How many marbles did he give her?
11. Which equation(s) models the following scenario? Alice has five more than thirty percent of Bob's marbles.
(A) $a + 5 = .3b$ **(B)** $(b - 5) = a$ **(C)** $a = .3b + 5$
(D) $10(a - 5) = b$ **(E)** $.3a + 5 = b$
12. What would the equation $a = b + 7$ mean for Alice? Express your answer as a complete sentence.

Group 3

Translate each in the following equations into English as it relates to the number of marbles that Alice and Bob have. As before, Alice has a marbles and Bob has b marbles. Interpret each of the following English statements as an algebraic equation.

1. Alice has seven more marbles than Bob.
2. Alice and Bob together have 32 marbles.
3. Alice and Bob have the same number of marbles.
4. Alice has 3 marbles less than twice as many as Bob.

Is there a relationship between any of the above statements? Explain why or why not.

Group 4 Translate each in the following equations into English as it relates to the number of marbles that Alice and Bob have. Alice has a marbles and Bob has b marbles.

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1. $a - b = 5$
2. $a = b + 5$
3. $a - 5 = b$

Is there a relationship between any of the above statements? Explain why or why not.

Group 5 Advanced problems.

1. Bob and Alice have 32 marbles in total. If Bob gives Alice n marbles, then Alice will have n^2 marbles. But if Alice gives Bob k marbles, then Bob will have k^2 marbles. How many marbles did each start with?
2. If Bob gives Alice 3 marbles, she will have twice as many as Bob has. If she gives him 22 marbles, he will have three times as many as she has. How many marbles does Alice have to start?
3. Alice gives by one-fifth of her marbles after which Bob has the square of the number of marbles given to him. How many marbles did Bob have at the start?
4. The sum of the squares of a and b is 544. If Alice gives Bob 4 marbles, the new sum of squares is 512, how many marbles did Bob start with?