# Making Connections: Stacking Cups (part 2)

How many cups does it take stack A to match the height of stack B?

## Student Methods

### Arithmetic - Estimations

### Table

| Red | | White | |
|---|---|---|---|
| Cups (Rim) A | Height ¼" | Cups (Rim) B | Height ½" |
| 0 | 4.625 | 0 | 3.375 |
| 1 | 4.875 | 1 | 3.875 |
| 2 | 5.125 | 2 | 4.375 |
| 3 | 5.375 | 3 | 4.875 |
| 4 | 5.625 | 4 | 5.375 |
| 5 | 5.875 | 5 | 5.875 |
| 6 | 6.125 | 6 | 6.375 |
| 7 | 6.375 | 7 | 6.875 |
| 8 | 6.625 | 8 | 7.375 |
| 9 | 6.875 | 9 | 7.875 |
| 10 | 7.125 | 10 | 8.375 |

### Equation

A $y = 0.25x + 4.625$

B $y = 0.5x + 3.375$

**Slope-Intercept Form:**

m= rim size

b= height of cup without rim

x= number of cups

y= total height of cups

**Solve: Transitive Property**

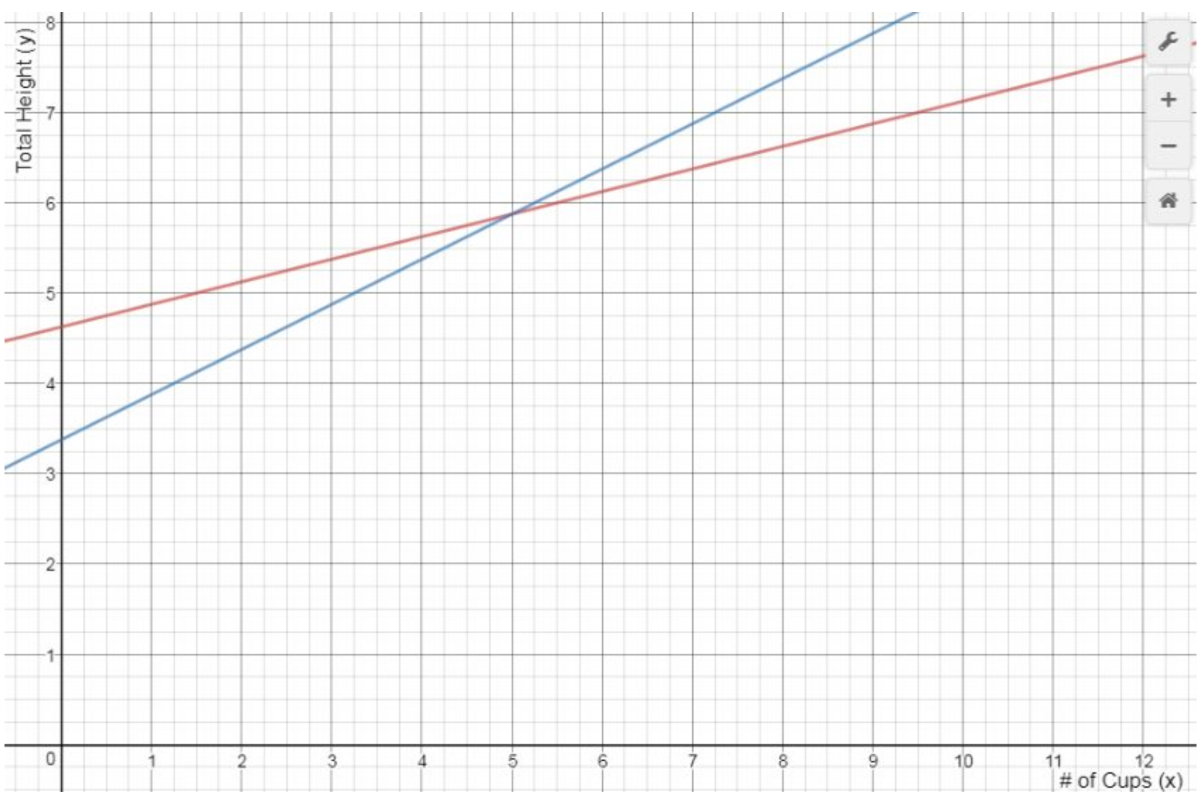
$0.5x + 3.375 = 0.25x + 4.625$

$0.5x = 0.25x + 1.25$

$0.25x = 1.25$

$x = 5$ cups

The ***PURPOSE*** for this activity... ***Linear Systems***.




What is a Solution of a Linear System? The intersection of the two lines (the point that satisfies both equations)

How many cups does it take to make the two stacks the same height? __5 cups__ What is that height? __5.875"__

**What it might look like on a test:**

**A campground offers canoe rentals for $5.50 per hour with a deposit of $20.00 and bicycle rentals for $7.00 per hour with a deposit of $15.00. Write and graph each equation to represent the total cost *y* of renting an item for any number of hours *x*. Which item would cost less to rent for 5 hours? For what hour ranges would each activity be the better deal?**

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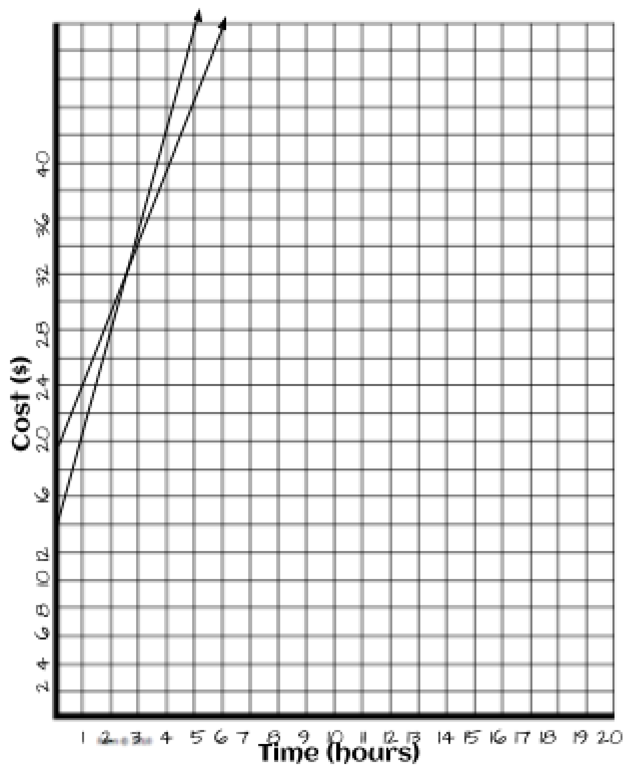


What would represent the rate of change (slope) in this situation?
canoe m = **$5.50**
bicycle m = **$7.00**

What would represent the constant (y-intercept) in this situation?
canoe b = **$20.00**
bicycle b = **$15.00**

Write equations in slope-intercept form? Then graph and <u>label</u>.
**$y = 5.5x + 20$**
**$y = 7x + 15$**

Would this represent a linear system? Explain why or why not.
**Yes; there are two linear equations representing rental types on the same graph**.
Does it have a solution? Explain why or why not.
**Yes; the lines do intersect at approximately 1.5 hours and $27.**
What is the question asking? What is your final answer?
**Canoeing is cheaper for 5 hours (over 1.5 hours). The graph shows that bicycling is cheaper under 1.5 hrs, canoeing and bicycling are about the same price for 1.5 hrs, and canoeing is cheaper for over 1.5 hrs.**

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## Big Ideas

- **Linear equations have a constant rate of change and a beginning value**
  - Example from cup challenge: **The red cup rim increases height ¼” with each cup added and starts at 4.625” without the rim. The white cup rim increases height ½” with each cup added and starts at 3.375” without the rim.**
- **Linear functions can be represented in multiple ways**
  - Example from cup challenge: **Tables, equations, graphs.**
- **Linear systems have multiple related situations represented together**
  - Example from cup challenge: **The heights of two different styles of cups.**
- **Linear systems have solutions that can be seen on the graph and in the equations**
  - Example from cup challenge: **(5, 5.875) At 5 cups each, both stacks are 5.875” in height.**
  - How are the solutions seen and checked? **The solution can be seen at the intersection on the graph and checked by plugging into each equation to see that it makes them both true.**