



UNIVERSITY OF  
**South Carolina**

# How a Math Student Gets "Unstuck" Using CircleIn's AI Tutor



National Science  
Foundation Grantee

Award #1951222 (SBIR Phase I, II and IIB)



Reviewed Samanatha's study pack  
and the link Brandon shared

Love ❤️ this study  
group!

So needed for Calc

12  
12 classmates thanked your reply  
to Juan's Chemistry question

☐ Read chapter 3

☒ Finish report

Can we go over  
the notes once  
more before  
the exam?

School: University of South Carolina, Summer 2025 Term

Student Name: Sean

Course: Intensive Basic College Math

Case for an AI Tutor: For commuter or online students with a tight schedule, who might juggle balancing work and family obligations, getting to campus for an appointment for academic help can be extremely difficult.

CircleIn's AI Tutor was designed to bridge this gap by providing personalized, on-demand, step by step academic assistance to all students. Our AI Tutor is "cheatproof", a responsible use of AI, which is unlike other AI applications that act as "answer engines" and they are fundamentally misaligned with the pedagogical goals of higher education tutoring.

See what Sean entered into the AI Tutor and follow his learning journey...

**Sean:** Solve  $-6x+6y=28$   $2y=2x+9$

**AI Tutor:** Awesome! Let's take a look at your system of equations:

1.  $-6x+6y=28$
2.  $2y=2x+9$

**Underlying Concepts and Principles:**

- These two equations can be solved using substitution or elimination.
- You want to find the values for  $x$  and  $y$  that make both equations true.

**Guiding Questions:**

1. Is one of the equations already set up so that you can easily solve for  $y$  or  $x$ ?
2. If you rearrange the second equation, can you express  $y$  in terms of  $x$  (or  $x$  in terms of  $y$ )? What would that look like?
3. How could you use substitution to plug that expression from the second equation into the first equation?

**Helpful Tip:**

When one equation is already solved for a variable (like  $2y=2x+9$ ), substitution is often the quickest method! Try rewriting the second equation to get  $y$  by itself, and see if you can substitute that into the first equation. Let me know what expression you get, and we'll go from there!

The Tutor gives Sean some guiding questions to help him get started with his equation...

**Sean:** Would you start by subtracting 9 from both sides?

**AI Tutor:** That's a really thoughtful question! If your goal is to isolate  $y$  in the second equation ( $2y=2x+9$ ), you might want to start by dividing both sides by 2.

Here's why: If you subtract 9 from both sides, you'd get  $2y-9=2x$ , but it's typically simpler to solve for  $y$  when you divide by the coefficient first, especially since both terms on the right are divisible by 2.

**Guiding Questions:**

1. What happens if you divide every term in the equation  $2y=2x+9$  by 2?
2. Once you've found  $y$  in terms of  $x$ , can you substitute that back into the first equation to solve for  $x$ ?

Why don't you try dividing both sides of the equation by 2 and write what you get for  $y$ ? Let's see what you come up with!

**Sean:**  $y=4.5$

**AI Tutor:** Nice effort! Let's check in on your work:

You started with:  $2y=2x+9$

If you divide every term by 2, you get:  $y=x+4.5$

It looks like you set  $y=4.5$ , but we actually get  $y$  in terms of  $x$ :  $y=x+4.5$ .

**Guiding Questions:**

1. Now that you have  $y$  in terms of  $x$ , what do you think is the next step? Where should you substitute  $y=x+4.5$ ?
2. What does the first equation look like if you replace every  $y$  with  $x+4.5$ ?

Try that substitution and let me know the new equation you get in only  $x$ ! If you need help writing it out, just let me know.

Sean makes a mistake and the tutor guides him to help him get back on track

**Sean:**  $-6x+6(x+4.5)=28$

**AI Tutor:** **Perfect!** You substituted  $y=x+4.5$  into the first equation:  $-6x+6(x+4.5)=28$

Now, let's think about the next steps!

**Guiding Questions:**

1. What should you do with the  $6(x+4.5)$  part of the equation? How can you simplify it?
2. After expanding, what does the equation look like?
3. Once you have all like terms combined, can you solve for  $x$ ?

Go ahead and expand out that expression, combine like terms, and see what you get! Let me know your next step or your result. If you get stuck, I can help you through the details!

**Sean:**  $-6x+6x+27=28$

**AI Tutor:** Nice work expanding! You've applied the distributive property correctly:  $-6x+6x+27=28$

Now, notice something interesting about the equation:

**Guiding Questions:**

1. What happens when you combine the  $-6x$  and  $+6x$  terms?
2. After combining them, what does your equation become?
3. Is this a special situation with the variables? What does it mean for the solutions to this system?

Give it a try combining those like terms and let me know what you discover! If you notice a pattern from your earlier problems, you might see something familiar here.

**Sean:**  $X+27=28$

**AI Tutor:** It looks like you combined incorrectly—let's double-check that last step.

You have:  $-6x+6x+27=28$

When you combine  $-6x$  and  $+6x$ , they actually cancel each other out:  $0x+27=28 \Rightarrow 27=28$

There's no more  $x$  left in the equation!

Guiding Questions:

1. Is the statement  $27=28$  true?
2. What do you think this tells you about the solutions to this system? Does it remind you of any previous problems we worked on?

Remember, an equation like this can give you a clue about whether the system has one solution, no solution, or infinitely many. Let me know what you think!

After Sean gets confused again, the tutor helps him arrive to the correct answer and solve the equation!

**Sean:** **There's no solution**

**AI Tutor:** Exactly right! When you end up with a statement like  $27=28$ , which is never true, it means the system has no solution.

What this means:

- The two equations represent parallel lines that will never intersect.
- This is just like the earlier problem where we ended up with a false statement.
- The system is called inconsistent.

**You did a great job catching on to the pattern and thinking through each step!**

Do you want to try a system with one solution, infinite solutions, or another math topic altogether? I'm here to help however you need! Just let me know what you'd like to do next.



**Sean:** lets do  $2x+5y=15$   $-5x+y=30$

**AI Tutor:** No problem at all! Let's work with your new system:

1.  $2x+5y=15$
2.  $-5x+y=30$

Sean and the AI Tutor  
move on the next equation

### **Underlying Concepts and Principles:**

- You have two variables and two equations—so we're still in a good position to use substitution or elimination.
- Looking at the coefficients, elimination might work well if you try to align the x or y terms.

### **Guiding Questions:**

1. Would you like to eliminate x or y first? Which is easier based on the coefficients?
2. If you want to eliminate x, is there a way to multiply one or both equations so that the coefficients for x become opposites (the same number but with different signs)?
3. After you adjust the equations, can you add or subtract them to eliminate a variable?

### **Tip:**

- If you'd rather do substitution, which equation is easier to solve for one variable (like isolating y or x)?

Let me know how you'd like to proceed—choose elimination or substitution, and which variable you want to eliminate or solve for first! If you need a little nudge on where to start, just ask.

**Sean:** I multiplied the 2nd equation by 5 and got  $-25x+5y+150$

**AI Tutor:** Great job spotting that multiplying the second equation by 5 will align the coefficients of  $y$ !

Let's check your multiplication step:

The second equation is:  $-5x+y=30$

If you multiply every term by 5, you get:

$$5 \times (-5x+y) = 5 \times 30 \Rightarrow$$

$$-25x+5y=150$$

You wrote  $-25x+5y+150$  just a small mistake—the correct equation should be  $-25x+5y=150$ .

### Guiding Questions:

1. Now you have two equations:

- $2x+5y=15$
- $-25x+5y=150$

What variable can you eliminate by subtracting one equation from the other?

2. Try setting the equations up, one over the other, and subtract (or add—depending on the signs) to eliminate  $y$ . What equation are you left with, and how will you solve for  $x$ ?

Give subtraction a try and tell me what you get for your new equation! If you need help with the details, just ask.



**Sean:**  $27x = -135$

**AI Tutor:** Awesome! You've subtracted the two equations and simplified to:  
 $27x = -135$

**Guiding Questions:**

1. What operation would you perform next to solve for  $x$  in  $27x = -135$
2. After finding the value of  $x$ , what should you do to find  $y$ ?

Go ahead and solve for  $x$ , then try plugging that value back into one of the original equations to find  $y$ . Let me know what you get, or share your steps if you'd like to double-check together! Keep going—you're almost done! Great! You're making awesome progress.

Now that you have  $27x = -135$ :

**Guiding Questions:**

1. What do you get for  $x$  when you divide both sides by 27?
2. Once you have  $x$ , which of the original equations would you like to use to substitute back and solve for  $y$ ?
3. What happens when you plug your value for  $x$  into that equation?

Give these steps a try! Let me know what value you find for  $x$ , and then we'll work on  $y$  together. You're almost there!

**Sean:** I got  $x=-5$

**AI Tutor:** Excellent job! You correctly solved for  $x$  and found  $x=-5$ .

Now, let's find  $y$ :

**Guiding Questions:**

1. Which of the original equations do you want to substitute  $x=-5$  into? (You can use either  $2x+5y=15$  or  $-5x+y=30$ .)
2. After substituting  $x=-5$ , what does your new equation look like?
3. Can you solve for  $y$  once you substitute and simplify?

Go ahead and pick an equation, plug in  $x=-5$ , and let me know what you get for  $y$ ! If you'd like me to check your work, just write it out step by step. You're doing fantastic!

**Sean:**  $2(-5)+5y=15$

**AI Tutor:** Great! You chose to substitute  $x=-5$  into the equation  $2x+5y=15$

$$2(-5)+5y=15$$

**Guiding Questions:**

1. What is  $2 \times (-5)$ ?
2. After you substitute that value, what does your equation look like?
3. Can you isolate  $y$  from there?

Try working through those steps and let me know what you get for  $y$ . You're almost finished with this system!

**Sean:**  $-10+5y=15$ , subtract both sides by 10, get  $5y=5$ , divide both sides by 5, get  $y=0$

**AI Tutor:** Fantastic work! You did a great job solving for  $y$ :

$$-10 + 5y = 15 \quad \parallel$$

$$5y = 15 + 10 \quad \parallel$$

$$5y = 25 \quad \parallel \text{ \texttt{\textbackslash text}}$$

{(Be careful here—should it be  $5y = 25$  or  $5y = 5$  ? Let's check your arithmetic!)}

**Let's double-check:**

You subtracted  $-10$  from both sides, but remember, you need to add 10 to both sides (since  $-10$  is subtracted from the left):

$$-10+5y=15$$

$$5y=15+10$$

$$5y=25$$

Now, divide both sides by 5:

$$y=25/5 =5$$

So, your slight arithmetic mistake was in the subtraction step! Your thought process is correct—just a small error in calculation.

**Summary:**

- $x=-5x=-5$

- $y=5y=5$

**Encouragement:**

You're thinking through the steps perfectly and almost nailed it—just a tiny calculation slip! It's common and absolutely normal; double-checking your arithmetic can help. Would you like to try another system, or do you have any questions or want to confirm your answer by plugging it back into one of the originals? Let me know how I can help next!

In his final answer, Sean makes a small mistake, and the tutor helps him correct it by explaining everything step-by-step so he doesn't get confused again.

The AI Tutor is encouraging and congratulates Sean for his efforts!

# How Sean, a Math Student, Gets “Unstuck” Using CircleIn’s AI Tutor

Let’s schedule the “AI Tutor Challenge” for your professors, so they can experience the power of how our AI Tutor can help their students the moment they need assistance.