

Name Michael Myers

This Project is due by Test Day, whenever you take your test, either Wednesday, 4/24 or Thursday, 4/25. Neatness, Completeness and Margins count. Show all work.

Early Birds: Friday BEFORE the test. 10% bonus for doing so, with the added benefit of getting feedback BEFORE the test.

**Face-to-Face Students:** This Writing Project is due by the end of class, Wednesday, 4/24.

**Online Students:** If you can do a quality scan to a single, multi-page PDF, you may submit your work by e-mail in the *Course Shell*. Use the *Classlist* link in the Main Navbar, and attach it to a message to Harry Mills. I'm not accepting submissions to my [stevemills@aims.edu](mailto:stevemills@aims.edu) account.

1 Solve the system of linear equations  $3x - 2y = 12$  in 3 ways:  
 $5x + y = 10$

$$\begin{array}{r} 66 + 7 \\ \hline 70 \end{array}$$

a. (10 pts) Find the general vicinity of the solution by graphing the system. This should give you a general idea. Don't worry about it being super-accurate, although the more care you take, the better the estimate will be. Just graph the two lines by the intercept method. Supply the exact answer after you work parts b and c, below. I care much more about OPLs than tickmarks. OPLs are required. Tickmarks are not.

b. (10 pts) Use the Substitution Method

c. (10 pts) Use the Elimination Method.

2. (10 pts) Use Elimination to solve the independent system of linear equations:  $x + 2y + 2z = 7$ ,  $-2x + y + 4z = 0$ ,  $2y + 3z = 6$

3. Consider the dependent system of linear equations:  $x + 2y + 2z = 3$ ,  $2x - y + 7z = 4$ ,  $-x + 3y - 5z = -1$

a. (10 pts) Give the general solution. Be kind to your teacher and let  $z$  be free! That means, find an expression for  $x$  and  $y$  in terms of the variable  $z$ .

b. (10 pts) Give the particular solutions corresponding to  $z = 0$ ,  $z = 1$  and  $z = -1$ .

4. **The Underlying Assumption:** All of the techniques we learn for solving systems of linear equations are based on the *assumption* that the systems *have* solutions. So when we arrive at a false (*absurd!*) statement after a few elimination steps, the only explanation is that there was no solution in the first place\*. Our incorrect assumption\* led to something absurd, like  $0 = 10$  or  $0 = -5$ .

\*... or you made a mechanical error and should check your work, just to make sure. Stay organized and always check your work.

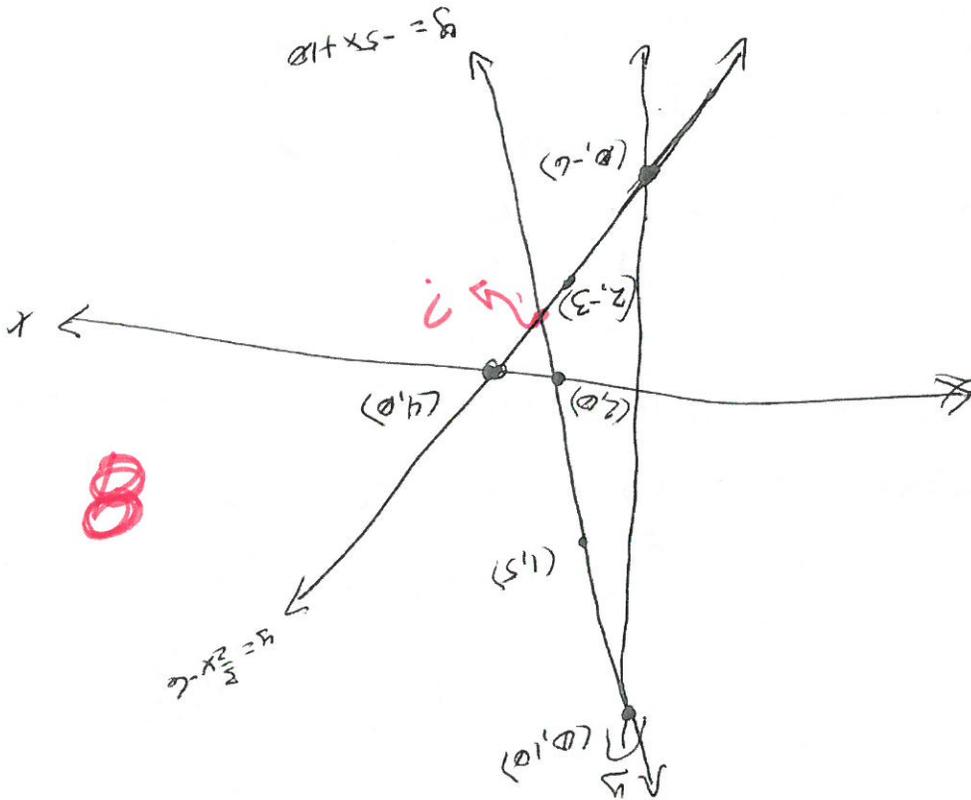
**Higher Learning:** In higher mathematics, this is the most basic method of proving something is false: "Assume it's true and conclude something absurd (like  $0 = 1$ ).". It's important that you realize what's happening when you arrive at those absurdities at the end of a perfectly logical and legal sequence of moves. That said, let me *finally* get to the question:

(10 pts) **Your Task:** Show that the dependent system of linear equations  $2x - y + 7z = 4$   
 $x + 2y + 2z = 3$   
 $-x + 3y - 5z = 0$

has no solution. I expect to see the word "absurd" in your discussion.

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$$\begin{aligned} 1) \quad 2y &= 3x - 12 \\ y &= \frac{3}{2}x - 6 \\ y &= -5x + 10 \end{aligned}$$



$$3x - 2y = 12$$

4	0	0	0
x	y	z	w
0	-6	0	0

Quicker

$$\left\{ \left( \frac{32}{13}, -\frac{30}{13} \right) \right\}$$

$$y = -\frac{30}{13}$$

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$$\begin{aligned} 3x - 2y &= 12 \\ 10x + 2y &= 20 \end{aligned}$$

$$\begin{aligned} 15x &= 32 \\ x &= \frac{32}{15} \end{aligned}$$

$$3\left(\frac{32}{15}\right) - 2y = 12$$

$$\frac{96}{15} - 2y = 12$$

$$-\frac{2y}{15} = 12 - \frac{96}{15}$$

$$-\frac{2y}{15} = \frac{180}{15} - \frac{96}{15}$$

$$-\frac{2y}{15} = \frac{84}{15}$$

$$-2y = 84$$

$$y = -42$$

$$\begin{aligned} 13x &= 32 \\ x &= \frac{32}{13} \end{aligned}$$

$$\begin{aligned} 3x - 2y &= 12 \\ 10x + 2y &= 20 \end{aligned}$$

(c)

$$\left\{ \left( \frac{32}{13}, -\frac{30}{13} \right) \right\}$$

$$y = -\frac{30}{13}$$

$$\begin{aligned} 3x - 2y &= 12 \\ 10x + 2y &= 20 \end{aligned}$$

$$15x = 32$$

$$x = \frac{32}{15}$$

$$\begin{aligned} 13x &= 32 \\ x &= \frac{32}{13} \end{aligned}$$

$$\begin{aligned} 2\left(\frac{32}{13}\right) - 2y &= 12 \\ \frac{64}{13} - 2y &= 12 \\ -2y &= 12 - \frac{64}{13} \\ -2y &= \frac{156}{13} - \frac{64}{13} \\ -2y &= \frac{92}{13} \\ y &= -\frac{46}{13} \end{aligned}$$

16)  $y = \frac{2}{3}x - 6$

or  $\frac{2}{3}x$  but NOT  $\frac{3}{2}x$

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→

$$\boxed{\{1, -1, 6, -2\}}$$

$$\boxed{x = -8}$$

$$\frac{x + 8 = -8}{x = -16}$$

$$E1) x + 2(6) + 2(-2) = 8$$

$$\boxed{y = 6}$$

$$2y = 12$$

$$2y - 6 = 6$$

$$E3) 2y + 3(-2) = 6$$

$$\boxed{z = -2}$$

$$-5 = E3) - 6y - 15z = -30$$

$$10y + 16z = 28$$

$$2(5y + 8z = 14)$$

$$-7x + y + 4z = 0 \quad E2$$

$$2. 2x + 4y + 4z = 14 \quad E1 \cdot 2$$

q's

for some races having -off as you do. See my more systems the way. Learn broader numbers

Vague. Un-systematic. Can hunt you when you make a small error. You're gonna

MATIZ

difference in how we write this.

Subtle, but CRUCIAL  $z \in \mathbb{R}$

My  $z$  can do a  $0 \times 1 \times 1 \times 1 \times 1$  op

See the difference

$z$ 's are real numbers

$\left( \frac{-16}{5}z + \frac{11}{3}z + \frac{5}{2}z \right)$

$$\begin{aligned} 5y &= 3z + 2 \\ y &= \frac{3}{5}z + \frac{2}{5} \end{aligned}$$

$$5y - 3z = 2$$

$$\begin{array}{r} 2 \cdot E3 \quad 2x + 6y - 10z = -2 \\ E2 \quad 2x - y + 2z = 4 \\ \hline \end{array}$$

$$\begin{aligned} 5x &= -16z + 11 \\ x &= -\frac{16}{5}z + \frac{11}{5} \end{aligned}$$

$$E5) 5x + 16z = 11$$

$$E3) -x + 3y - 5z = -1$$

$$3 \cdot E2) 6x - 3y + 21z = 12$$

3a)

but poorly documented. Tell the story rather than focusing to the ending. See how I document for my steps. That's your goal for math.

particular system is bogus

This dependent system of linear equations does not have a solution. After using logical elimination methods, I found the observed result that  $0 = 11$ . Since that isn't true, it shows this

$$\begin{array}{r}
 \boxed{0 = 11} \\
 \hline
 E4) \quad -5z + 3z = 7 \\
 E3) \quad 5z - 3z = 4 \\
 \hline
 2 \cdot E3) \quad 2x - 5z + 7z = 4 \\
 E4) \quad -5z + 3z = 7 \\
 \hline
 2 \cdot E3) \quad 2x + 6z - 10z = 0 \\
 \hline
 E2) \quad 2x - 5z + 7z = 4 \\
 \hline
 E4) \quad -5z + 3z = 7 \\
 \hline
 E2) \quad 2x - 5z + 7z = 4 \\
 \hline
 4) \quad -2 \cdot E1) - 2x - 4z - 4z = 3
 \end{array}$$

4.5

$$z = -1 \left\{ \left( \frac{2}{5}, -\frac{1}{5}, -1 \right) \right\}$$

$$z = 1 \left\{ (-1, 1, 1) \right\}$$

$$z = 0 \left\{ \left( \frac{11}{2}, \frac{5}{2}, 0 \right) \right\}$$

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