FOOTHILL COLLEGE

# Using Writing Prompts In Algebra Classes


AMATYC 2018 – Orlando, Florida

Nicole Gray & Jeff Anderson


Foothill College, 12345 El Monte Road, Los Altos Hills, CA 94022 | foothill.edu

# Our Driving Question

What do I want my students to remember about Algebra five years after taking my course?

# Nicole's Algebra Teaching Goals

Five years after completing algebra, my students will remember…

- Mathematics is a language.
- Mathematical operations typically come in pairs (inverse operations).
- Math is a powerful tool for relating quantities.

# Nicole’s Algebra Teaching Goals

- Graphs are a powerful tool for displaying mathematical relationships.
- A “solution” in mathematics is a value for a variable that makes a statement true (It’s not just an “answer” for problem).
- $y = mx+b$.

# Jeff's Algebra Teaching Goals

Five years after completing algebra, I want my students to remember…

- I can learn and do mathematics.
- Math is easier to learn through discussion with other people.
- It is always OK to make mistakes as long as I learn from my experiences.

FOOTHILL COLLEGE

# Jeff's Algebra Teaching Goals

- I can use algebraic and graphical techniques to solve equations.
- Algebraic techniques use inverse operations to isolate variables.
- Graphical techniques use the points of intersection to solve equations.

# Using Writing Prompts

- Done in the first 10 minutes of class
- Basis for the opening discussion
- Help students remember concepts needed for the current lesson
- Enhance student understanding of concepts
- Help instructor gauge student understanding of those concepts

# Leverage Theories From Cognitive Science

- People learn better from BOTH pictures and words together versus words or pictures alone.

- New knowledge needs to be consciously organized and linked to prior knowledge.

From the Cognitive Theory of Multimedia Learning by Richard E. Mayer

# Example Prompt

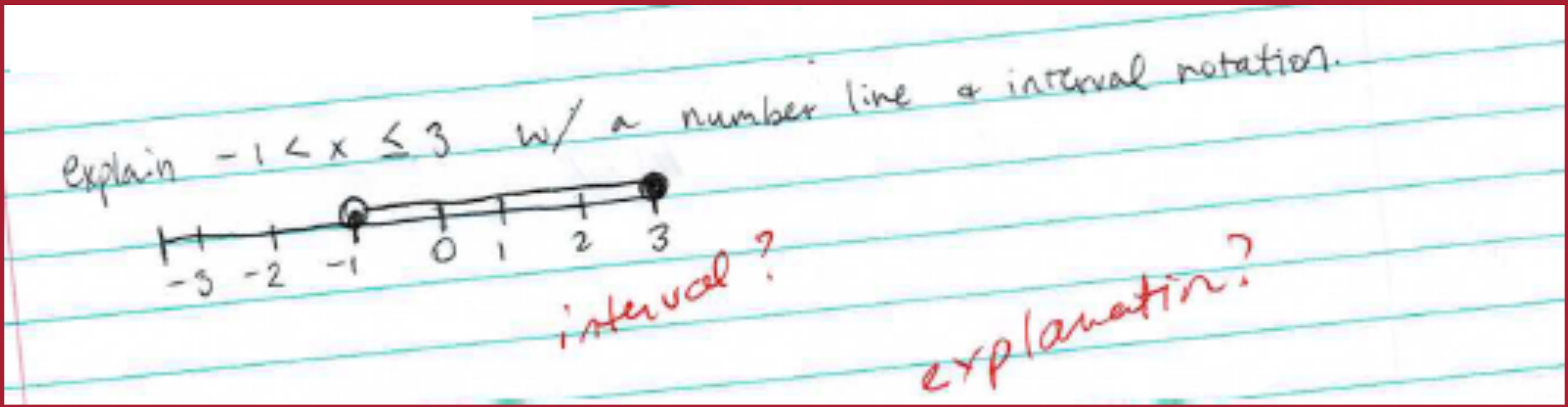
Explain to your friend how to represent

$$-1 < x \leq 3$$

using a number line and interval notation.

FOOTHILL COLLEGE

# Sample Student Response




FOOTHILL COLLEGE

# Sample Student Response

We can represent $-1 < x \leq 3$ on the number line like this


The parentheses means that the endpoint is not included, as x is bigger but not equal to -1. The brackets shows that the endpoint is included in the set, as x can be less or equal to 3.

We can represent this as interval notation like this: (-1, 3]. Meaning that X is more than -1, and can be equal or less than 3.

For cases where we have infinite numbers, we always use parentheses. Ex [3, ∞).

# Example Prompt

Explain to your friend what a system of equations is and what a solution is for a system of equations.

FOOTHILL COLLEGE

# Sample Student Response

A system of equations is a set, or a collection of equations that have the same variables and we work with them together, at the same time.

A solution for a system of equations is the value for the variables that make both equations true.

When we graph both equations, the solution will be where the point where the lines (from both equations) meet.

There are three possibilities:

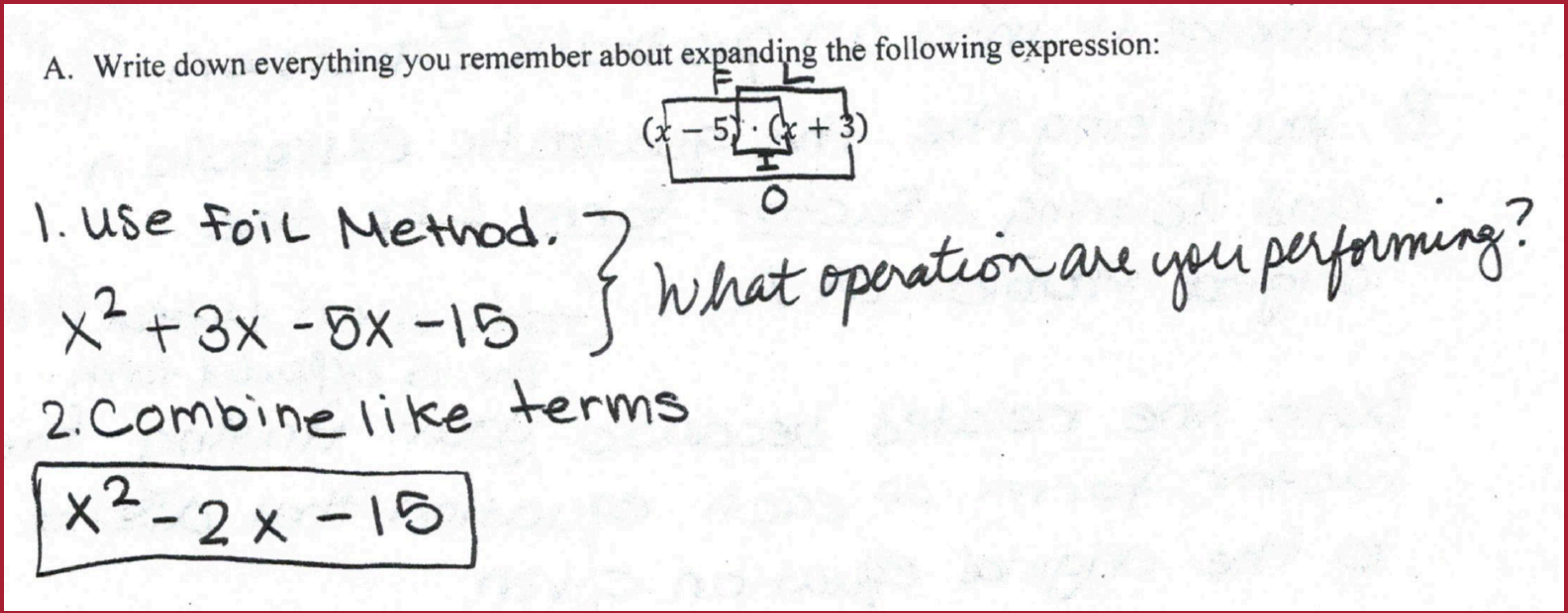
① Independent equations: when there is only one solution for both equations

② Dependent equations: when there is infinite solutions for both equations

③ Inconsistent equations: when both equations have no solution, because they are parallel to each other, therefore they never meet

FOOTHILL COLLEGE

# Jeff Prompt and Student Response



A. Write down everything you remember about expanding the following expression:

$$(x-5)\cdot(x+3)$$

F L I O

1. use Foil Method.

$x^2 + 3x - 5x - 15$

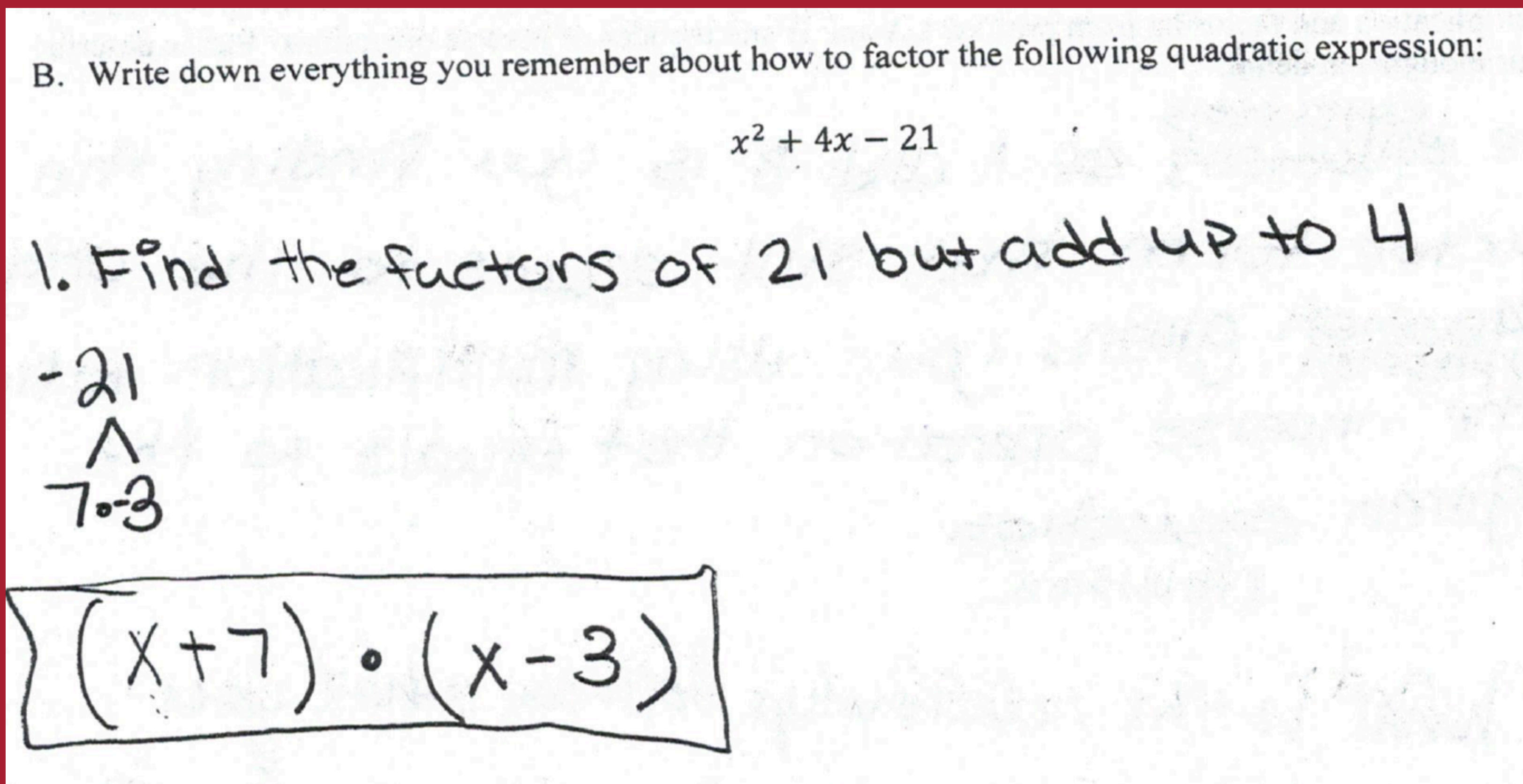
What operation are you performing?

2. Combine like terms

$x^2 - 2x - 15$

FOOTHILL COLLEGE

# Jeff Prompt and Student Response


B. Write down everything you remember about how to factor the following quadratic expression:

$$x^2 + 4x - 21$$

1. Find the factors of 21 but add up to 4

-21

7·-3

$(x+7)\cdot(x-3)$

# Jeff Prompt and Student Response

C. How might problem A be related to problem B? To answer this question, you might look at the start and end of each problem. What similarities do you notice? What differences do you notice?

A. your Expanding the equation using Foil method to make it into an quadratic expression. To write in expan for

B. you taking the the quadratic expression and forming a factor form Like the Original Problem of A

Good. One is factored form, One is expanded form.

Both Are related because your finding the factor form of each equation that also = to the original equation given.

FOOTHILL COLLEGE

# Jeff prompt and student response

D. Remember that the major theme of this Math 105 class is to develop algebraic and graphical techniques to solve algebraic equations. With this in mind, what connection do you see between the processes of multiplication and factoring from problems A and B and the idea of inverse operations? Please describe your thoughts in detail.

The ~~equations~~ expressions of A and B is you finding the factor form that still equals to the original ~~equation~~ expression given. your using multiplication to find the inverse operation that equals to the given ~~equation~~ expression

What is the relationship between what you are doing in going from Form A → Form B and Form B → Form A ?

# Evolution in Student Work I

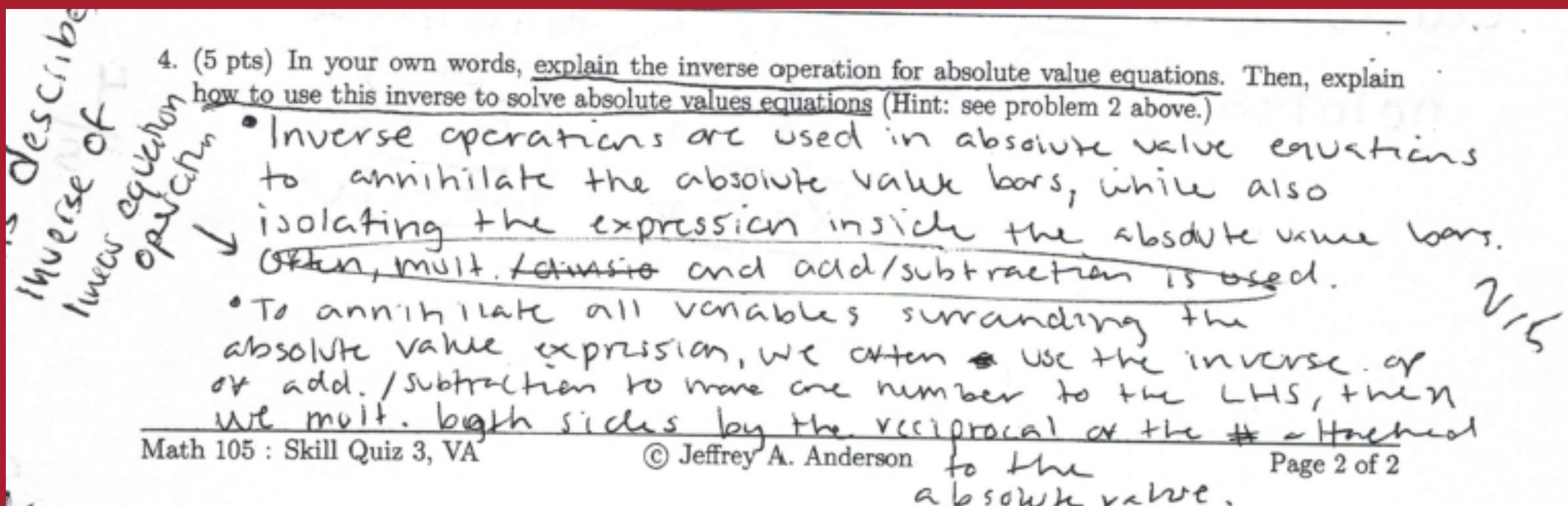
4. (5 pts) In your own words, explain the zero product property. Then, explain how to use the zero product property as an inverse operation to solve quadratic equations (Hint: see problem 2 above.)

The zero product property occurs when all variables of an equation are set equal to zero. When solving quadratic equations, it ~~helps us~~ gives us an opportunity to ~~factor~~ the equation and find the solutions in a less complicated process.

1/5

↑ tell me more...

# Evolution in Student Work I



4. (5 pts) In your own words, explain the inverse operation for absolute value equations. Then, explain how to use this inverse to solve absolute values equations (Hint: see problem 2 above.)

- Inverse operations are used in absolute value equations to annihilate the absolute value bars, while also isolating the expression inside the absolute value bars. ~~Often, mult.~~ ~~/divisio~~ and add/subtraction is ~~used~~ used.
- To annihilate all variables surrounding the absolute value expression, we often use the inverse. or add./subtraction to move one number to the LHS, then we mult. both sides by the reciprocal or the # attached to the absolute value.

describe inverse of linear equation operation

2/5

Math 105 : Skill Quiz 3, VA © Jeffrey A. Anderson Page 2 of 2

# Evolution in Student Work I

4. (5 pts) In your own words, explain the inverse operation for rational equations. Then, explain how to use this inverse to rational equations (Hint: see problem 3 above.)

The purpose of inverse operations is to annihilate their opposing operations. The inverse operation for rational equations is mult. because we need to annihilate the ratio, which is a term of division. When solving rational equations, our goal, as mentioned previously, is to annihilate the ratio so we first mult. each side by the reciprocal of one denominator. After, we distribute appropriatly. Next, we mult. both sides by the reciprocal of the remaining denominator, ~~which~~ and distribute accordingly. ~~By~~ By doing this inverse operation, the denominators are annihillated and we can solve the equation as a linear equation.

# Evolution in Student Work II

4. (5 pts) In your own words, explain the zero product property. Then, explain how to use the zero product property as an inverse operation to solve quadratic equations (Hint: see problem 2 above.)

Nice

ZPP is when $a \cdot b = c$, Then a or b $= 0$

Use ZPP as an inverse operation when multiply factor of two products of one side from equation equal to zero ✓

5/5

# Evolution in Student Work II

4. (5 pts) In your own words, explain the inverse operation for absolute value equations. Then, explain how to use this inverse to solve absolute values equations (Hint: see problem 2 above.)

Use the inverse operation to add / subtract and multiply / divide for absolute values equtions. Then you will get a pure absolute on left hand side of equation equal to a non negative constant. Solve again till you get the solutions. Then check, If both side are equal.

Thus; $x = c$ , $x = -c$

4/5

# Evolution in Student Work II

4. (5 pts) In your own words, explain the inverse operation for rational equations. Then, explain how to use this inverse to rational equations (Hint: see problem 3 above.)

When rational equations involve with the different variables in denominator, you will use inverse operationt by making both side equal fraction with the same denominator, then take DM out. If $\frac{A}{D} = \frac{B}{D}$, then $A = B$. From problem 3, to solve

Step 1: Find common denominator by factoring, you will get

$x(x+2)$ is the common denominator.

Step 2: After both side have the same DM, then the DM will be disappeared

Step 3: You will get a quandrartic equation, then using the ZPP to solve this equation. To do

- Set up the LHS $= 0$
- Factor by grouping on the LHS to get into 2 products
- Using inverse operation for this algebraic equation. If $a \cdot b = c$, then $a = 0$ or $b = 0$
- At lats, check the solutions by making sure that the DM is not a zero

# Launching: Student On-Boarding

- Starts on the first day of class
- Explain why these writing quizzes are a part of the course
- Grade and provide feedback in week 1
  - Give full credit to all students
  - Write feedback on assignments
  - Sample and discuss work in class

# Grading

- 5 – 10% of overall grade
- Grading Rubric (out of 10)
  - 10 – well-written, clear verbal explanation plus extra info
  - 9 – well-written, ideas are clearly discussed & supported
  - 8 – ideas seem to be correct but statements are unclear
  - 7 – correct example with no or sparse verbal description
  - 6 – answer is not correct
  - 5 – incomplete or question not addressed

# Student Reactions

"The writing quizzes really helped me to solidify what I was learning."
–student SH

"The writing quizzes forced me to study for every class and keep up with the work."
–student LM

# Questions?

# Thank you!

**Nicole Gray** GrayNicole@Foothill.edu
**Jeff Anderson** (650) 949 – 7116

Supporting materials available at https://wp.me/p7esKf-5j

FOOTHILL COLLEGE