

Motivating the Reluctant Learner in the Math Classroom



Presenter:

Maryanne Douglass-French
Mathematics Teacher; Abraham Lincoln High School



⋮

Introduction

This workshop is intended to show teachers other strategies, techniques and materials used to motivate the reluctant or at risk learner. This workshop is especially appropriate for teachers of students in the self-contained classrooms although it is transferable to most classrooms.

This presentation will consist of a series of lessons that I have used in my classroom to motivate my students. Included in this presentation are introductory lessons, a reinforcing lesson, and a cooperative learning lesson.

Lesson 1:

Aim: How do we solve systems of linear equations?

Lesson 2: (two days)

Aim: How do we factor quadratic trinomials?

Lesson 3:

Aim: How do we find the product of two binomials using the FOIL method?

Lesson 4:

Aim: What are quadrilaterals?

Lesson 5:

Aim: How do we plot points on the X and Y-axis?

Lesson 1

Aim: How do we solve systems of linear equations?

Standard: M3f: Understand and use linear functions as a mathematical representation of proportional relationships

Objectives: Students will be able to:

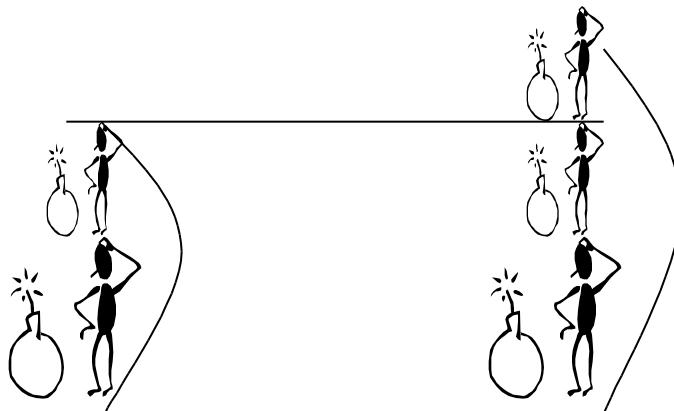
1. Explain what is meant by solving a system of linear equations.
2. Explain the procedure for solving a system of linear equations in two variable using the addition / multiplication method.
3. Solve systems of linear equations by the addition / multiplication method.
4. Check the solution to the system in both equations.

Written assignment:

Explain what is meant by solving a system of linear equations.

Do Now:

A man with one son standing on his head is 10 feet tall
A man with two sons standing on his head is 14 feet tall.
If both sons are the same height how tall is the man and how tall is each son. (Use the picture below to help find the solution)



Development:

1. Elicit from the class the height of the son (the son must be 4 feet tall). Using the height of the son as a guide go back to the first picture and determine the height of the father. (elicit from the class that the father must be 6 feet tall).

2. Write the following equations on the board

$$\begin{array}{r} m + 2s = 14 \\ -(m + s = 10) \\ \hline s = 4 \end{array}$$

tell the class we determined at this point that the son 4 feet tall. Show that we subtract the first equation

3. Going back to the second equation if the son is 4 feet tall how tall is the man

$$\begin{array}{r} m + 4 = 10 \\ -4 \quad -4 \\ \hline m = 6 \end{array}$$

4. Now lets check the problems to make sure the solution works in both equations.

Check

$$\begin{array}{l} m + s = 10 \\ 6 + 4 = 10 \\ 10 = 10 \end{array}$$

Check

$$\begin{array}{l} m + 2s = 14 \\ 6 + 2(4) = 14 \\ 6 + 8 = 14 \\ 14 = 14 \end{array}$$

5. Since our solution works in both equations we know our answer is correct.

6. Using the method obtained in the do now problem how do we solve the problem below

Class problems

1. $x + y = 12$
 $x - y = 4$

2. $a + b = 13$
 $a - b = 5$

3. $r + s = -6$
 $r - s = -10$

4. $3x + y = 16$
 $2x + y = 11$

5. $c - 2d = 14$
 $c + 3d = 9$

6. $x + y = 10$
 $x - y = 0$

7. $x + 2y = 8$
 $x - 2y = 4$

8. $8a + 5b = 9$
 $2a - 5b = -4$

9. $4x + 5y = 23$
 $4x - y = 5$

10. $-2m + 4n = 13$
 $6m + 4n = 9$

11. $3a - b = 3$
 $a + 3b = 11$

12. $3r + s = 6$
 $r + 3s = 10$

13. $4x - y = 10$
 $2x + 3y = 12$

14. $5m + 3n = 14$
 $2m + n = 6$

15. $x - y = -1$
 $3x - 2y = 3$

16. $5x - 2y = 20$
 $2x + 3y = 27$

17. $2x - y = 26$
 $3x - 2y = 42$

18. $2x + 3y = 6$
 $3x + 5y = 15$

Lesson 2 day 1

Aim: How do we play the find a number game?
(How do we factor quadratic trinomials)?
Day 1

Standard: M3h: Define, use and manipulate expressions

Objectives: Students will be able to:

- a. Recall procedure for multiplying two binomials
- b. Express quadratic trinomials in factored form as the product of two binomials.
- c. Factor quadratic trinomials where $a = 1$
- d. Check the factoring by multiplying

Do Now:

Today is game day. Take the Find a number sheet from the front desk. See how many you can find.

Development:

1. Make sure each student has a sheet.
2. Form two teams. Have each team answer as many questions as they can.
3. If time, have each team make up problems to try to stump the other team.

Find a number game.

Page 1 of 2

1. Find two numbers whose sum is +3 and whose product is +2.
2. Find two numbers whose sum is + 4 and whose product is +3.
3. Find two numbers whose sum is +6 and whose product is +5.
4. Find two numbers whose sum is +8 and whose product is +7.
5. Find two numbers whose sum is +10 and whose product is +9.
6. Find two numbers whose sum is +12 and whose product is +11.
7. Find two numbers whose sum is +5 and whose product is +4.
8. Find two numbers whose sum is +7 and whose product is +10.
9. Find two numbers whose sum is +9 and whose product is +18.
10. Find two numbers whose sum is +12 and whose product is +27.
11. Find two numbers whose sum is +8 and whose product is +15.
12. Find two numbers whose sum is +12 and whose product is +35.
13. Find two numbers whose sum is +11 and whose product is +24.
14. Find two numbers whose sum is +15 and whose product is +36.
15. Find two numbers whose sum is +13 and whose product is +40.
16. Find two numbers whose sum is +11 and whose product is +18.
17. Find two numbers whose sum is +13 and whose product is +30.
18. Find two numbers whose sum is +17 and whose product is +16.
19. Find two numbers whose sum is +2 and whose product is +1.
20. Find two numbers whose sum is +8 and whose product is +16.
21. Find two numbers whose sum is +10 and whose product is +25.
22. Find two numbers whose sum is -8 and whose product is +7.
23. Find two numbers whose sum is -12 and whose product is +11.
24. Find two numbers whose sum is -6 and whose product is +5.
25. Find two numbers whose sum is -5 and whose product is +6.
26. Find two numbers whose sum is -9 and whose product is +14.
27. Find two numbers whose sum is -11 and whose product is +10.
28. Find two numbers whose sum is -6 and whose product is +8.
29. Find two numbers whose sum is -10 and whose product is +21.
30. Find two numbers whose sum is -11 and whose product is +18.
31. Find two numbers whose sum is -9 and whose product is +8.
32. Find two numbers whose sum is -12 and whose product is +35.
33. Find two numbers whose sum is -8 and whose product is +15.
34. Find two numbers whose sum is -10 and whose product is +24.

Find a number game.

Page 2 of 2

35. Find two numbers whose sum is -13 and whose product is $+36$.
36. Find two numbers whose sum is -14 and whose product is $+40$.
37. Find two numbers whose sum is -18 and whose product is $+72$.
38. Find two numbers whose sum is -16 and whose product is $+60$.
39. Find two numbers whose sum is -16 and whose product is $+48$.
40. Find two numbers whose sum is -1 and whose product is -2 .
41. Find two numbers whose sum is -3 and whose product is -4 .
42. Find two numbers whose sum is -6 and whose product is -7 .
43. Find two numbers whose sum is $+4$ and whose product is -5 .
44. Find two numbers whose sum is -9 and whose product is $+8$.
45. Find two numbers whose sum is -12 and whose product is -13 .
46. Find two numbers whose sum is $+4$ and whose product is $+4$.
47. Find two numbers whose sum is $+8$ and whose product is -9 .
48. Find two numbers whose sum is -12 and whose product is -13 .
49. Find two numbers whose sum is -3 and whose product is -10 .
50. Find two numbers whose sum is -2 and whose product is -8 .
51. Find two numbers whose sum is -2 and whose product is -15 .
52. Find two numbers whose sum is $+6$ and whose product is -9 .
53. Find two numbers whose sum is -12 and whose product is -13 .
54. Find two numbers whose sum is -3 and whose product is -10 .
55. Find two numbers whose sum is -2 and whose product is -8 .
56. Find two numbers whose sum is -2 and whose product is -15 .
57. Find two numbers whose sum is $+2$ and whose product is -35 .
58. Find two numbers whose sum is $+4$ and whose product is -21 .
59. Find two numbers whose sum is $+1$ and whose product is -6 .
60. Find two numbers whose sum is -7 and whose product is -18 .
61. Find two numbers whose sum is -5 and whose product is -24 .
62. Find two numbers whose sum is $+9$ and whose product is -36 .
63. Find two numbers whose sum is -6 and whose product is -27 .
64. Find two numbers whose sum is -5 and whose product is -24 .
65. Find two numbers whose sum is -6 and whose product is -72 .
66. Find two numbers whose sum is $+11$ and whose product is -60 .
67. Find two numbers whose sum is -2 and whose product is -80 .
68. Find two numbers whose sum is -11 and whose product is $+28$.
69. Find two numbers whose sum is -1 and whose product is -72 .
70. Find two numbers whose sum is -1 and whose product is -12 .

Lesson 2 day 2

Aim: How do we factor quadratic trinomials?

Standard: M3h: Define, use and manipulate expressions

Objectives: Students will be able to:

- a. Recall procedure for multiplying two binomials
- b. Express quadratic trinomials in factored form as the product of two binomials.
- c. Factor quadratic trinomials where $a = 1$
- d. Check the factoring by multiplying

Material: Extra game sheets from yesterday

Writing Exercise:

Explain how to check the factors of quadratic equations.

Do Now: Ask student to find two numbers whose sum +3 is and whose product is +2. (remind students of the game sheet from yesterday).

Development:

1. Have the students pull out the sheets from the day before.
2. Tell the class that we are going to use the game to learn how to factor quadratics.
3. Put the following quadratic on the board.

$$x^2 + 3x + 2$$

Tell the class this is just like the first game problem we need to find two numbers whose sum is +3 and whose product is +2. Elicit the numbers +1 and +2.

4. Then to factor this quadratic we would write

$(x + 1)(x + 2)$ check using FOIL to show it is correct.

5. Put the following quadratics on the board.

- | | | |
|----------------------|----------------------|----------------------|
| 2. $x^2 + 4x + 3$ | 3. $x^2 + 6x + 5$ | 4. $x^2 + 8x + 7$ |
| 5. $x^2 + 10x + 9$ | 6. $x^2 + 12x + 11$ | 7. $x^2 + 5x + 4$ |
| 8. $x^2 + 7x + 10$ | 9. $x^2 + 9x + 18$ | 10. $x^2 + 12x + 27$ |
| 11. $x^2 + 8x + 15$ | 12. $x^2 + 12 + 35$ | 13. $x^2 + 11x + 24$ |
| 14. $x^2 + 15x + 36$ | 15. $x^2 + 13x + 40$ | 16. $x^2 + 11x + 18$ |
| 17. $x^2 + 13x + 30$ | 18. $x^2 + 17x + 16$ | 19. $x^2 + 2x + 1$ |
| 20. $x^2 + 8x + 16$ | 21. $x^2 + 10x + 25$ | 22. $x^2 - 8x + 7$ |
| 23. $x^2 - 12x + 11$ | 24. $x^2 - 6x + 5$ | 25. $x^2 - 5x + 6$ |
| 26. $x^2 - 9x + 14$ | 27. $x^2 - 11x + 10$ | 28. $x^2 - 6x + 8$ |
| 29. $x^2 - 10x + 21$ | 30. $x^2 - 11x + 18$ | 31. $x^2 - 9x + 8$ |
| 32. $x^2 - 12x + 35$ | 33. $x^2 - 8x + 15$ | 34. $x^2 - 10x + 24$ |
| 35. $x^2 - 13 + 36$ | 36. $x^2 - 14x + 40$ | 37. $x^2 - 18x + 72$ |
| 38. $x^2 - 16x + 60$ | 39. $x^2 - 16x + 48$ | 40. $x^2 - x - 2$ |
| 41. $x^2 - 3x - 4$ | 42. $x^2 - 6x - 7$ | 43. $x^2 + 4x - 5$ |
| 44. $x^2 - 9x + 8$ | 45. $x^2 - 12x - 13$ | 46. $x^2 + 4x + 4$ |
| 47. $x^2 + 3x + 2$ | 48. $x^2 + 8x - 9$ | 49. $x^2 - 12x - 13$ |
| 50. $x^2 - 3x - 10$ | 51. $x^2 - 2x - 8$ | 52. $x^2 + 6x - 9$ |
| 53. $x^2 - 12x - 13$ | 54. $x^2 - 3x - 10$ | 55. $x^2 - 2x - 8$ |
| 56. $x^2 - 2x - 15$ | 57. $x^2 + 2x - 35$ | 58. $x^2 + 4x - 21$ |
| 59. $x^2 + x - 6$ | 60. $x^2 - 7x - 18$ | 61. $x^2 - 5x - 24$ |
| 62. $x^2 + 9x - 36$ | 63. $x^2 - 6x - 27$ | 64. $x^2 - 5x - 24$ |
| 65. $x^2 - 6x - 72$ | 66. $x^2 + 11x - 60$ | 67. $x^2 - 2x - 80$ |
| 68. $x^2 - 11x - 28$ | 69. $x^2 - x - 72$ | 70. $x^2 - x - 12$ |

Lesson 3

Aim: How do we find the product of polynomials using the foil method?

Standard: M6a: Carry out numerical calculations and symbol manipulations effectively.

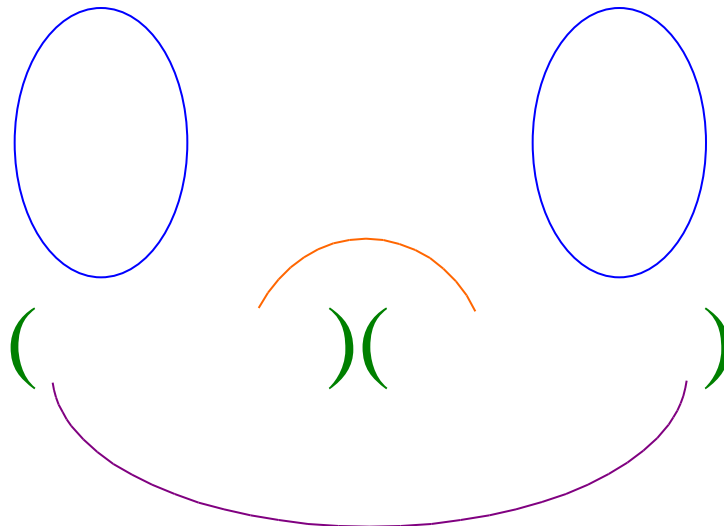
Objectives: Students will be able to:

1. State what each letter in FOIL represents
2. Explain when the FOIL method is used.
3. Multiply two binomials using the FOIL method.

Materials: Colored chalk

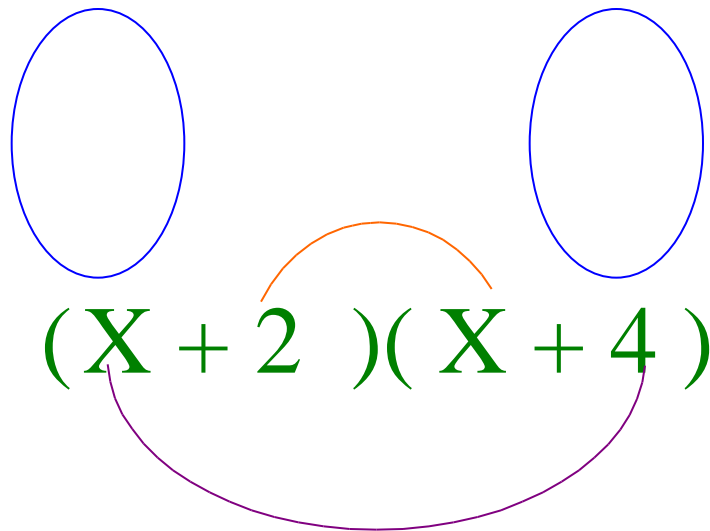
Do now:

Describe the figure below:



Development:

1. Elicit responses from the do now.
2. Tell the students this is the method we will use to multiply two binomials.
3. Start: insert into the face of the figure $(x + 2)(x + 4)$
Multiply the first two pieces (identify them as such by placing a “F” on top of each x). Place this value in the left eye.
Multiply the last two pieces (identify them as such by placing a “L” on top of each number). Place this value in the right eye.
Multiply the inside two pieces (identify them as such by placing an “I” below of the 2 and X). Place this value on the nose of the figure.
Multiply the outside two pieces (identify them as such by placing an “O” below of the x and 4). Place this value on the smile.
Tell the students to add the monomial in the smile and the monomial in the nose together.



Class problems: Practice Set:

1. $(x + 1)(x + 4)$
2. $(y + 6)(y + 2)$
3. $(t + 3)(t + 5)$
4. $(n + 2)(n + 3)$
5. $(p + 8)(p + 2)$
6. $(k + 7)(k + 5)$
7. $(w - 1)(w + 6)$
8. $(x + 1)(x - 7)$
9. $(y + 2)(y - 4)$
10. $(p - 3)(p - 5)$
11. $(t - 6)(t - 2)$
12. $(r - 6)(r - 3)$
13. $(z - 8)(z + 3)$
14. $(m + 1)(m - 10)$
15. $(c - 4)(c + 5)$
16. $(q + 2)(q - 4)$
17. $(f + 6)(f - 5)$
18. $(p - 7)(p - 3)$
19. $(x - 4)(x - 6)$
20. $(v - 3)(v + 9)$
21. $(r - 8)(r + 11)$
22. $(s - 10)(s + 5)$
23. $(d + 9)(d + 12)$
24. $(j - 5)(j + 2)$
25. $(g - 8)(g - 9)$
26. $(n - 12)(n + 3)$
27. $(y + 4)(y - 8)$

Lesson 4

Aim: What are quadrilaterals?

Standard: M2b: Work with two and three-dimensional figures and their properties.

Objectives: Students will be able to:

1. Define a quadrilateral
2. State that the sum of the measures of the angles of a quadrilateral is 360 degrees.
3. Solve numerical and algebraic problems involving the measures of the angles of a quadrilateral.

Materials: Quadrilateral sheet Appendix 1, rulers and compasses for each group.

Do Now: Give the students the quadrilateral sheet, rulers and compasses. Have them work in-groups of three. Tell the class to make as many observations as they can about the figures on the sheet.

Development:

1. Give the students in the group the following goal as part of this team:
 - Observer: It is the task of this student to observe and report the activities of the group.
 - Note taker: It is the task of this student to take notes and keep a record of the groups progress.
 - Reporter: It is the task of this student to report to the class the findings of the team.

Remind the class that each student must have all of the information on their sheet

2. After 10 to 15 minutes have each group report their findings. This should be recorded on the blackboard and should include the following:

Quadrilaterals:

- a. 4 sided figure
- b. the sum of the measures of the angles is 360
- c. brief introduction of the family of quadrilaterals
 1. parallelogram
 2. rectangle
 3. square
 4. rhombus
 5. trapezoid

5. Review with the properties of the figures listed above

Parallelogram

- a. opposite sides are parallel
- b. the sum of the measures of the four angles is 360
- c. consecutive angles are supplementary
- d. opposite angles have the same degree measure
- e. opposite sides are congruent

Rectangle

- a. all the properties of a parallelogram
- b. four right angles

Rhombus

- a. all the properties of a parallelogram
- b. four equal sides

Square

- a. all the properties of a rhombus

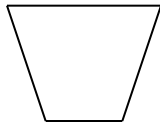
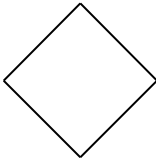
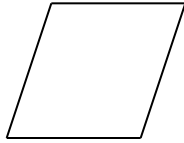
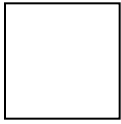
Trapezoid

- a. exactly one pair of parallel sides called bases
- b. non parallel sides call legs

Class Problems:

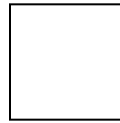
1. In rhombus ABCD, $AB = 6x - 3$ and $BC = 4x - 7$. Find x .
2. In rectangle PQRS, $PQ = 4x - 10$ and $SR = 7x - 40$. Find x .
3. In rectangle ABCD, diagonal AC is drawn. If $m \angle DCA = 30$, find $m \angle CAD$.
4. The measure of two opposite angles of a parallelogram are represented by $5x + 40$ and $3x + 50$. Find x .
5. In parallelogram ABCD, $m \angle A = 3x + 40$ and $m \angle C = 7x - 100$. Find the measure of $\angle D$.
6. In parallelogram ABDC, diagonal AC is drawn. If $m \angle D = 110$ and $m \angle CAD = 50$, find $m \angle CAB$.
7. In parallelogram ABDC, $m \angle B = 60$. Find $m \angle C$.
8. In parallelogram MATH, $MA = 5x - 6$ and $HT = 3x + 8$. Find the value of x .
9. In parallelogram WXYZ, $m \angle Z = 6x + 40$ and $m \angle X = 4x + 70$. Find $m \angle X$.
10. In parallelogram EFGH, $m \angle E = 2x$, and $m \angle F = 3x + 5$. Find $m \angle E$ and $m \angle F$.

These are quadrilaterals

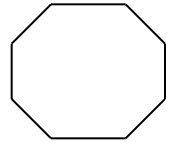


Which of these are quadrilaterals?

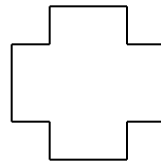
1.



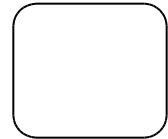
2.



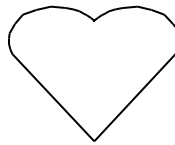
3.



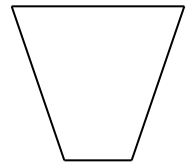
4.



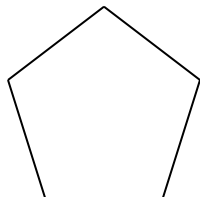
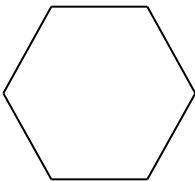
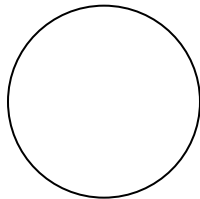
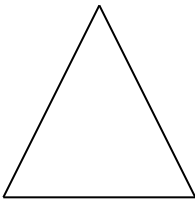
5.



6.



These are not quadrilaterals



What are quadrilaterals?

Lesson 5

Aim: Game Day (Battleship)

How do we graph points on a coordinate plane?

Standard: M6f: Use the number line and Cartesian coordinates in the plane and in space.

Objectives: Students will be able to:

- a. Draw and label axes and quadrants of a coordinate plane.
- b. Graph an ordered pair.
- c. Find the coordinates of a point in the plane.
- d. Name the abscissa and ordinate of a point in the plane.

Material: 1 game sheet for each student in an envelope (number the game sheet only).

Do Now: Take an envelope from the desk and choose an opponent for today's game.

Development:

1. Have each student use his or her notebooks as a dividing line.
2. Review with the class the rules for playing.
3. Review and label the x and y axes for the students.
4. Review how we graph and ordered pair.
5. Play game.

