Get Students Fired Up for Math with Collaborative Learning Activities

Session S074
Take the Poll

How Often do you incorporate Collaborative Learning in your Classes?

Often
Sometimes
Rarely

I have Never used Collaborative Learning .... Yet
Agenda

Collaborative Learning:

• What it is / is not
• Why teach with it
• Create it
• Facilitate it
• Tips for using it
Agenda

Collaborative Learning:

• What it is / is not
• Why teach with it
• Create it
• Facilitate activities
• Tips for using it
What is Collaborative Learning?

• To collaborate is to work together with others.

• Barkly, Cross, & Major define Collaborative Learning Activities as, “learning activities expressly designed for and carried out through pairs or small interactive groups.”

  1. Intentional Design
  2. Co-Laboring!
  3. Meaningful Learning takes place

Collaborative Learning Techniques: A Handbook for College Faculty
Barkley, Cross, and Major, Jossey-Bass, 2005
Agenda

Collaborative Learning:

• What it is / is not
• Why teach with it
• Create it
• Facilitate activities
• Tips for using it
Why teach with a Collaborative Learning Approach?

“Students who establish social relationships with faculty and other students in the community are:

→ more actively involved in learning,
→ report greater personal and academic growth,
→ and are better satisfied with their education than are students who are more isolated.”

Barkley, Cross, & Major, page 6 -- (Astin, 1993; Pascarella & Terenzini, 1991)
I FREAKING LOVE COLLABORATION
Why teach with a Collaborative Learning Approach?

Community College Center for Student Engagement

Five Benchmarks for Student Engagement:

→ Active & Collaborative Learning
→ Student Effort
→ Academic Challenge
→ Student-Faculty Interaction
→ Support for Learners

LINK 2 CCSSE: https://www.ccsse.org/survey/national3.cfm
Agenda

Collaborative Learning:

• What it is / is not
• Why teach with it
• Create it
• Facilitate activities
• Tips for using it
Collaborative Learning

What do you find to be the **challenge** with designing Collaborative Learning Activities for your Class?
Creating the Activity is as easy as 1, 2, 3!

Start with the problem set, then…

1. Provide Clear Directions, including how the activity will be graded.
2. Provide the possible answers.
3. Create an answer page that will be collected and graded.
Clear Directions

• How will you grade
• What should the group do
• “Each group member will write out the work for each problem on their own line paper”
• What to turn in
Clear Directions

“Possible Answers” Box

Answer Page to Collect

- Helps students continue to work while you are engaging with another group
- Gives the group confidence that they are on the right track
Directions

“Possible Answers” Box

Answer Page to Collect
Clear Directions

“Possible Answers” Box

Answer Page to Collect

- Keeps students working
- Keeps students accountable to have good answers
- Can be “checked as you go”
Sample Activity:  Available on App!

**MTH 210**
Section 2.6: Implicit Differentiation Class Activity

**Class Activity Instructions:** Work together to ensure that everyone in the group is following along and understanding every problem. Each student should show all work on their own line paper with the same guidelines as the written homework. Write the agreed-upon answers on the answer sheet to turn in.

**Implicit Differentiation:** Differentiate both sides of the equation with respect to x and then solve the resulting equation for y'.

Don't forget to apply the Chain Rule!

<table>
<thead>
<tr>
<th>The Function</th>
<th>Implicit Differentiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>dy/dx = y'</td>
</tr>
<tr>
<td>x</td>
<td>d dx = x = 1</td>
</tr>
<tr>
<td>3x²</td>
<td>d dx 3x² = 6x</td>
</tr>
<tr>
<td>3y²</td>
<td>d dy 3y² = 6y · dy/dx = 6y²</td>
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</table>

**Directions:** Find y' by implicit differentiation

1. 4x² + 3 = 2x³
2. s = 2x² - 2x³
3. 4 + 4x² + 4y² = x³
4. x = 2y³ + 4y³ = 3
5. 4x² = 4²y² - 2x³y³ + 2
6. (x² + 3)² = 4x²
7. sec(y²) = 5x² + 2
8. x² = 3 = cos(x²)

**Possible Answers**

<table>
<thead>
<tr>
<th>8x</th>
<th>3x²</th>
<th>2y³ + 3y² + 2</th>
<th>10y²</th>
<th>3y²sec(y²)tan(y²)</th>
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</thead>
<tbody>
<tr>
<td>-8y - 1</td>
<td>3y</td>
<td>-6y² - 3x²y²</td>
<td>-3x²y² + 2</td>
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<tr>
<td>12x²y³ - 3y - 10x</td>
<td>-5x</td>
<td>-4x</td>
<td>-2x³</td>
<td></td>
</tr>
<tr>
<td>5x²</td>
<td>-2x³</td>
<td>-1</td>
<td>10y² + 2y²</td>
<td></td>
</tr>
<tr>
<td>16y² = 12y</td>
<td></td>
<td></td>
<td>100y² + 100y</td>
<td></td>
</tr>
<tr>
<td>1/2</td>
<td>-2</td>
<td>1/10</td>
<td>1/100</td>
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**Group Answers:** Write the matching problem number in the correct box.

**Problem Number:** __________  Problem Number: __________  Problem Number: __________  Problem Number: __________  Problem Number: __________

Problem Number: __________  Problem Number: __________  Problem Number: __________  Problem Number: __________  Problem Number: __________

Problem Number: __________  Problem Number: __________  Problem Number: __________  Problem Number: __________  Problem Number: __________

**Bonus #1:** __________  **Bonus #2:** __________
Agenda

Collaborative Learning:

- What it is / is not
- Why teach with it
- Create it
- Facilitate it
- Tips for using it
Facilitate it

• Embedded Tutors are a great fit!
• Productive Struggle
• Active Learning Teaching
• Pull everyone in
• Just in Time Mini Lectures are Powerful
Half Answer Sheet

Unit 2 Quiz Review Activity

Group Members: __________ __________

1.

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Unit 2 Quiz Review Activity

Group Members: __________ __________

1. __________ __________

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1. __________ __________
**Tips for Creating Engagement**

- The magic word... "Quiz"
- The half/half answer sheet
- Post-activity Assessment
- Bonus: Write the name and an interesting fact about a classmate
Get Students Fired Up for Math with Collaborative Learning Activities

Session S074
**MTH 210**

Section 2.6: Implicit Differentiation Class Activity

**Class Activity Instructions:** Work together to ensure that everyone in the group is following along and understanding every problem. Each student should show all work on their own line paper with the same guidelines as the written homework. Write the agreed-upon answers on the answer sheet to turn in.

**Implicit Differentiation:**
Differentiate both sides of the equation with respect to \( x \) and then solve the resulting equation for \( y' \).

Don't forget to apply the **Chain Rule**!

### The Function | Implicit Differentiation
---|---
\( y \) | \( \frac{d}{dx} y = y' \)
\( x \) | \( \frac{d}{dx} x = 1 \)
\( 3x^2 \) | \( \frac{d}{dx} 3x^2 = 6x \)
\( 3y^2 \) | \( \frac{d}{dx} 3y^2 = 6y \cdot \frac{d}{dx} y = 6yy' \)

### Directions: Find \( y' \) by implicit differentiation

1. \( 4y^2 + 3 = 2x^3 \)
2. \( 5 = 2x^2 + 2y^3 \)
3. \( 4 = 4x^2 + 4y^3 + y^2 \)
4. \( x + 5y^2 + 4y^3 = 3 \)
5. \( 4x = -4xy^3 - 2x^3y^3 + 2 \)
6. \( (4y^2 + 3)^2 = 4x^3 \)
7. \( \sec(y^9) = 5x^6 + 2 \)
8. \( -3y^2 + 5 = 5x^2 \)
9. \( 4 = x^2 + y^2 \)
10. \( x + y^2 = -3y + 4 \)
11. \( -4y^2 - y + 3 = 4x^2 \)
12. \( 5x^2 = -4x^3y^3 - 3xy + 2 \)
13. \( x^3 = (5y^2 + 5)^2 \)
14. \( x^6 + 3 = \cos (3y^3) \)

### Possible Answers

<table>
<thead>
<tr>
<th>( \frac{8x}{-8y - 1} )</th>
<th>( \frac{3x^2}{4y} )</th>
<th>( \frac{2y^3 + 3x^2y^3 + 2}{-6xy^2 - 3x^3y^2} )</th>
<th>( \frac{10x^5}{3y^8 \sec (y^9) \tan (y^9)} )</th>
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<tr>
<td>( \frac{-12x^2y^3 - 3y - 10x}{12x^3y^2 + 3x} )</td>
<td>( \frac{-5x}{3y} )</td>
<td>( \frac{-4x}{6y^2 + y} )</td>
<td>( \frac{-2x^5}{3y^2 \sin (3y^3)} )</td>
</tr>
<tr>
<td>( \frac{3x^2}{16y^3 + 12y} )</td>
<td>( \frac{-2x}{3y^2} )</td>
<td>( \frac{-1}{10y + 12y^2} )</td>
<td>( \frac{3x^2}{100y^3 + 100y} )</td>
</tr>
<tr>
<td>( -\frac{1}{2y + 3} )</td>
<td>( -\frac{x}{y} )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MTH 210  
Section 2.6: Implicit Differentiation Class Activity

Group Participants:  
____________________________________  
____________________________________  
____________________________________  
____________________________________  

Class Activity Instructions: Work together to ensure that everyone in the group is following along and understanding every problem. Each student should show all work on their own line paper with the same guidelines as the written homework. Write the agreed-upon answers on the answer sheet to turn in.

**Group Answers:** Write the matching problem number in the correct box.

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<th>Problem</th>
<th>Solution</th>
<th>Problem Number</th>
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<tr>
<td>( \frac{8x}{-8y - 1} )</td>
<td>( \frac{3x^2}{4y} )</td>
<td>( \frac{2y^3 + 3x^2y^3 + 2}{-6xy^2 - 3x^2y^2} )</td>
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<tr>
<td>( \frac{3x^2}{16y^3 + 12y} )</td>
<td>( \frac{-2x}{3y^2} )</td>
<td>( \frac{-1}{10y + 12y^2} )</td>
</tr>
<tr>
<td>( \frac{-1}{2y + 3} )</td>
<td>( \frac{-x}{y} )</td>
<td></td>
</tr>
</tbody>
</table>

**Bonus #1:**  

**Bonus #2:**