

## Math Seminar Study

The following is a study on students' understanding of proof. Please take the next 15 minutes and answer the following questions.

1. **Gender:** (please circle)            Male                      Female
2. **Current Grade Level:** (please circle)    Freshman                      Sophomore                      Junior                      Senior
3. **Minors or Coordinates:** \_\_\_\_\_
4. **GPA:** (please circle)    Below 2.0                      2.01-2.50                      2.51-3.00                      3.01-3.50                      3.51-4.00

**5. Check off the upper level math classes you have taken:**

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| <input type="checkbox"/> Linear Algebra<br><input type="checkbox"/> Modern Algebra I<br><input type="checkbox"/> Ordinary Differential Equations<br><input type="checkbox"/> Intro to Real Analysis I<br><input type="checkbox"/> Intro to Real Analysis II<br><input type="checkbox"/> Intro to Probability & Statistics I<br><input type="checkbox"/> College Geometry<br><input type="checkbox"/> Intro to Complex Analysis | <input type="checkbox"/> Modern Algebra II<br><input type="checkbox"/> Intro to Topology<br><input type="checkbox"/> Numerical Analysis<br><input type="checkbox"/> Intro to Probability & Statistics II<br><input type="checkbox"/> Applications of Math<br><input type="checkbox"/> Intro to Partial Differential Equations<br><input type="checkbox"/> Theory of Numbers<br><input type="checkbox"/> History of Math |
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**6. In the remainder of the study you will be asked questions specifically about proof. Before you start, write down your definition of proof.**

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**7. Look at the following example and answer the questions that follow<sup>1</sup>:**

Arthur, Bonnie, Ceri, Duncan, Eric, and Yvonne were trying to prove whether the following statement is true or false:

**When you add any 2 even numbers, your answer is always even.**

<p style="text-align: center;">Arthur's answer</p> <p>a is any whole number          b is any whole number          2a and 2b are any two even numbers  <math>2a + 2b = 2(a + b)</math></p> <p style="text-align: center;">So Arthur says it's true.</p>	<p style="text-align: center;">Bonnie's answer</p> <p><math>2+2=4</math>   <math>4+2=6</math>  <math>2+4=6</math>   <math>4+4=8</math>  <math>2+6=8</math>   <math>4+6=10</math></p> <p style="text-align: center;">So Bonnie says it's true.</p>	<p style="text-align: center;">Ceri's answer</p> <p>Even numbers are numbers that can be divided by 2. When you add numbers with a common factor, 2 in this case, the answer will have the same common factor.</p> <p style="text-align: center;">So Ceri says it's true.</p>
<p style="text-align: center;">Eric's answer</p> <p>Let <math>x =</math> any whole number  <math>y =</math> any whole number  <math>x + y = z</math>  <math>z - x = y</math>  <math>z - y = x</math>  <math>z + z - (x+y) = x + y = 2z</math></p> <p style="text-align: center;">So Eric says it's true.</p>	<p style="text-align: center;">Duncan's answer</p> <p>Even numbers end in 0, 2, 4, 6, or 8. When you add any two of these, the answer will still end in 0, 2, 4, 6, or 8.</p> <p style="text-align: center;">So Duncan says it's true.</p>	<p style="text-align: center;">Yvonne's answer</p> <div style="text-align: center;"> </div> <p style="text-align: center;">So Yvonne says it's true.</p>

**7a. From the above answers, choose one that would be the closest to what you would do if you were asked to answer this question. (please circle)**

Arthur                  Bonnie                  Ceri                  Duncan                  Eric                  Yvonne

**7b. Give a brief reason why you choose this answer.**

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**7c. From the above answers, choose the one to which your teacher would give the best grade. (please circle)**

Arthur                  Bonnie                  Ceri                  Duncan                  Eric                  Yvonne

**7d. From the above answers, choose the one(s) that are valid. (please circle)**

Arthur                  Bonnie                  Ceri                  Duncan                  Eric                  Yvonne

**8. Prove that when you add any 2 odd numbers, your answer is always even. (Write down your answer in the manner that would receive the best grade you can.)**

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<sup>i</sup> This question table was taken from L. Healy and C. Hoyles, *A Study of Proof Conceptions in Algebra*, Journal for Research in Mathematics Education **31** (2000), No. 4, pp. 396-428.