

# Rubric: True or False?

## Key APS Mathematics Performance Standards:

### Target Performance Standards

#### Grade 8 Mathematics Standards:

1. **Interprets** data and **makes conclusions** from data.

#### Grade 7 Mathematics Standards:

2. **Determines** simple probability in experimental and theoretical situations.
3. **Determines** probability of dependent and independent events in experimental and theoretical situations.

- If the student does not attempt to solve the task or the work on the problem is completely unrelated to the task, the student's work for the task is considered "**Unscorable**" and should not be assigned a performance level of Novice, Apprentice, Practitioner, or Expert.

| Level         | Understanding  | Strategies, Reasoning, & Procedures   | Communication  |
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| <b>Novice</b> | <ul style="list-style-type: none"> <li>❖ The student understands that the task is a multiple step problem, but does not have the mathematical knowledge to complete the task and will only attempt to solve 1 or 2 aspects of the problem.</li> <li>❖ The student understands:               <ul style="list-style-type: none"> <li>• That s/he needs to determine the probability of scoring 0 out of 10 questions correct on a true/false quiz.</li> </ul> </li> <li>❖ The student will not understand enough about probability to use Pascal's Triangle or the concept of combinations to accurately solve the task.</li> </ul> | <ul style="list-style-type: none"> <li>❖ The student has started the task by using manipulatives and representations, but does not address all of the steps needed to solve the task.</li> <li>❖ The student does not use an effective strategy to solve the problem or makes errors in their calculations.</li> </ul> <p><b>Sample Strategy:</b><br/> <b>Step 1:</b> the student starts listing the answer combinations for a true/false quiz.<br/>           For Example:<br/>           Question 1: t/f, f/t, t/f, f/f 1 out of 4 chances<br/>           Question 2: t/f, f/t, t/f, f/f 1 out of 4 chances<br/>           Question 3: t/f, f/t, t/f, f/f 1 out of 4 chances<br/>           Question 4: t/f, f/t, t/f, f/f 1 out of 4 chances<br/>           Question 5: t/f, f/t, t/f, f/f 1 out of 4 chances<br/>           Question 6: t/f, f/t, t/f, f/f 1 out of 4 chances<br/>           Question 7: t/f, f/t, t/f, f/f 1 out of 4 chances<br/>           Question 8: t/f, f/t, t/f, f/f 1 out of 4 chances<br/>           Question 9: t/f, f/t, t/f, f/f 1 out of 4 chances<br/>           Question 10: t/f, f/t, t/f, f/f 1 out of 4 chances<br/> <b>Step 2:</b> Conclusion: Each question has 1 out of 4 chances for a solution for the two students, so they will have a <math>4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 = 1,048,576</math><br/>           1: 1,048,576 probability to answer 0 questions correctly.</p> | <ul style="list-style-type: none"> <li>❖ There is little or no communication, the student did not label the work, and/or their thinking is difficult to follow.</li> <li>❖ <b>Summary:</b> The student does not write his/her final answer, and/or uses little or no mathematical language and symbols to explain (in writing) how s/he calculated the probability of scoring 0 out of 10 correct on the true/false quiz using Pascal's Triangle.</li> <li>❖ <b>Representations:</b> The student has no system (charts/t-tables/graphs) to track the calculations for scoring 0 out of 10 correct on the true/false quiz using Pascal's Triangle.</li> </ul> |

Task Specific Rubric: True or False – Grade 8

APS/RDA/CHF: Performance-Based Mathematics Assessment 2001 - 02

\*Proficiency Levels are aligned to the APS Mathematics Content and Performance Standards – Final 2001

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| <p><b>Apprentice</b></p> | <ul style="list-style-type: none"> <li>❖ The student understands that the task is a multiple step problem, but cannot use the information at each of the steps to progress the problem.</li> <li>❖ The student understands: <ul style="list-style-type: none"> <li>• That s/he needs to determine the probability of scoring 0 out of 10 questions correct on a true/false quiz.</li> <li>• The probability of independent events.</li> <li>• Theoretical probability.</li> </ul> </li> <li>❖ The student will not understand how to use Pascal's Triangle to the application of probability in determining 0 out of 10 correct answers on a true/false quiz.</li> </ul> | <ul style="list-style-type: none"> <li>❖ The student has started the task using manipulatives or representations, has chosen a strategy to solve the task, but does not achieve a correct solution.</li> <li>❖ Task calculations include: <ul style="list-style-type: none"> <li>• Determining the probability of 1:2 for answering true/false for each question.</li> <li>• Accurately computing the numbers of Pascal's Triangle to Row 10, but cannot use the information accurately to solve the task.</li> </ul> </li> </ul> <p><b>Sample Strategy:</b></p> <p><b>Step 1: Initial Analysis</b></p> <ul style="list-style-type: none"> <li>• The student determines that answering True/False questions are a 1:2 probability (correct/incorrect).</li> </ul> <p><b>Step 2: Pascal's Triangle</b></p> <ul style="list-style-type: none"> <li>• The student draws Pascal's Triangle to row 10, but cannot use the information to determine the probability.</li> </ul> <p><b>For Example:</b></p> <p>Row 10: 1 10 45 120 210 252 210 120 45 10 1</p> <ul style="list-style-type: none"> <li>• The student compares the results of scoring 10 out of 10 answers correct, 9:10 correct, etc. to 0:10 correct.</li> </ul> <p style="margin-left: 40px;">1:1 if 10:10 correct<br/> 1:10 if 9:10 correct<br/> 1:45 if 8:10 correct<br/> 1:120 if 7:10 correct<br/> 1:210 if 6:10 correct<br/> 1:252 if 5:10 correct<br/> 1:210 if 4:10 correct<br/> 1:120 if 3:10 correct<br/> 1:45 if 2:10 correct<br/> 1:10 if 1:10 correct<br/> 1:1 if 0:10 correct</p> <p><b>Step 4: Conclusion</b> - The student determines that the probability of getting 0 out of 10 correct on the quiz is 1:1 and basis his/her decision about Mr. Hall's suspicions on inaccurate data.</p> | <ul style="list-style-type: none"> <li>❖ The student has communicated his/her understanding of the task by labeling their work, but the task is not clearly organized and the student's thinking is hard to follow.</li> <li>❖ <b>Summary:</b> The student states his/her final answer. The student uses some mathematical language and symbols to explain (in writing) how s/he calculated the probability of scoring 0 out of 10 correct on the true/false quiz using Pascal's Triangle.</li> <li>❖ <b>Representations:</b> The student has not established an accurate system (charts/t-tables/graphs) to track the calculations for scoring 0 out of 10 correct on the true/false quiz using Pascal's Triangle.</li> </ul> |
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| <p><b>Practitioner</b></p> | <p><b>Proficiency</b></p> <ul style="list-style-type: none"> <li>❖ The student understands that the task is a multiple step problem and that the answer at each step, progresses the problem.</li> <li>❖ The student understands: <ul style="list-style-type: none"> <li>• That s/he needs to determine the probability of scoring 0 out of 10 questions correct on a true/false quiz.</li> <li>• The probability of independent events.</li> <li>• Theoretical probability.</li> <li>• Pascal's Triangle.</li> <li>• The application of Pascal's Triangle to combinations and independent probability events.</li> </ul> </li> </ul> | <p><b>Proficiency</b></p> <ul style="list-style-type: none"> <li>❖ The student uses one effective strategy to correctly solve all of the steps of the task.</li> <li>❖ Task calculations include: <ul style="list-style-type: none"> <li>• Determining the probability of 1:2 for answering true/false for each question.</li> <li>• Accurately computing the numbers of Pascal's Triangle to Row 10.</li> <li>• Interpreting row 10 of Pascal's Triangle.</li> <li>• Analyzing Pascal's Triangle to determine the probability of guessing 10 out of 10 true/false questions incorrectly.</li> <li>• Explaining their results.</li> </ul> </li> </ul> <p><b>Sample Strategy:</b></p> <p><b>Step 1:</b> Initial Analysis</p> <ul style="list-style-type: none"> <li>• The student determines that answering True/False questions are a 1:2 probability (correct/incorrect).</li> <li>• The student determines that each answer is an independent event and can use Pascal's Triangle to determine the probability of choosing 10 incorrect answers out of 10 questions.</li> </ul> <p><b>Step 2:</b> The student represents Pascal's Triangle.</p> <ul style="list-style-type: none"> <li>➤ See 'Teacher Instructions' of the task <i>Pascal's Triangle</i> for the complete chart.</li> </ul> <p>Row 10: 1 10 45 120 210 252 210 120 45 10 1</p> <p><b>Step 3:</b> Analysis of Pascal's Triangle</p> <ul style="list-style-type: none"> <li>• The student adds the sum of row 10. The sum is 1024</li> <li>• The student compares the results of scoring 10 out of 10 answers correct, 9:10 correct, etc. to 0:10 correct. <ul style="list-style-type: none"> <li>1:1024 if 10:10 correct</li> <li>10:1024 if 9:10 correct</li> <li>45:1024 if 8:10 correct</li> <li>120:1024 if 7:10 correct</li> <li>210:1024 if 6:10 correct</li> <li>252:1024 if 5:10 correct</li> <li>210:1024 if 4:10 correct</li> <li>20:1024 if 3:10 correct</li> <li>45:1024 if 2:10 correct</li> <li>10:1024 if 1:10 correct</li> <li>1:1024 if 0:10 correct</li> </ul> </li> </ul> <p><b>Step 4:</b> Conclusion - The student determines that the probability of getting 0 correct on the quiz is 1:1024 and concludes that Mr. Hall should be suspicious of the students for cheating.</p> | <p><b>Proficiency</b></p> <ul style="list-style-type: none"> <li>❖ The student can represent his/her work in a clear, organized manner.</li> <li>❖ <b>Summary:</b> The student states his/her final answer. The student uses appropriate mathematical language and symbols to explain (in writing) how s/he calculated the probability of scoring 0 out of 10 correct on the true/false quiz using Pascal's Triangle.</li> <li>❖ <b>Representations:</b> The student has created an efficient system (charts/t-tables/graphs) to track the calculations for scoring 0 out of 10 correct on the true/false quiz using Pascal's Triangle.</li> </ul> |
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| <p><b>Expert</b></p> | <ul style="list-style-type: none"> <li>❖ The student understands that the task is a multiple step problem and that the answer at each step, progresses the problem.</li> <li>❖ The student understands that s/he needs to: <ul style="list-style-type: none"> <li>• That s/he needs to determine the probability of scoring 0 out of 10 questions correct on a true/false quiz.</li> <li>• The probability of independent events.</li> <li>• Theoretical probability.</li> <li>• Pascal's Triangle.</li> <li>• The application of Pascal's Triangle to combinations and independent probability events.</li> <li>• The powers of <math>\frac{1}{2}</math>.</li> </ul> </li> <li>❖ <b>Task Extension:</b> The student includes a written rule, equation, generalization, and/or observation about their mathematical insights for probability, combinations, and/or Pascal's Triangle.</li> </ul> | <ul style="list-style-type: none"> <li>❖ The student uses more than one accurate and appropriate strategy to solve all of the steps of the task.</li> <li>❖ Task calculations include: <ul style="list-style-type: none"> <li>• Accurately computing the numbers of Pascal's Triangle to Row 10.</li> <li>• Interpreting row 10 of Pascal's Triangle.</li> <li>• Analyzing Pascal's Triangle to determine the probability of guessing 10 out of 10 true/false questions incorrectly.</li> <li>• Explaining their results.</li> </ul> </li> <li><b>Sample Strategy:</b> See the 'Practitioner' strategy.</li> <li>❖ <b>Task Extension:</b> The student uses the powers of <math>\frac{1}{2}</math> or 2 to the <math>n</math> power to multiply the probabilities for each event together.</li> <li><b>Question 1:</b> <math>2^1 = 2</math></li> <li><b>Question 2:</b> <math>2^2 = 4</math></li> <li><b>Question 3:</b> <math>2^3 = 8</math></li> <li><b>Etc....</b></li> </ul> | <ul style="list-style-type: none"> <li>❖ The student can represent his/her work in a clear, organized manner.</li> <li>❖ <b>Summary:</b> The student states his/her final answer. The student uses appropriate mathematical language and symbols to explain (in writing) how s/he calculated the probability of scoring 0 out of 10 correct on the true/false quiz using Pascal's Triangle.</li> <li>❖ <b>Representations:</b> The student has created an efficient system (charts/t-tables/graphs) to track the calculations for scoring 0 out of 10 correct on the true/false quiz using Pascal's Triangle.</li> <li>❖ <b>Task Extension:</b> The student includes a written rule, equation, generalization, and/or observation about their mathematical insights for probability, combinations, and/or Pascal's Triangle.</li> </ul> |
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