

IB Standard Level Mathematics: The Exploration Feedback to Student		STANDARD LEVEL		/20	
Name:			Date Collected:		
<b>A: Communication</b>				<b>/4</b>	
0: The exploration <b>does not</b> reach the standard described by the descriptor below.					
1: The exploration has <b>some</b> coherence.					
<ul style="list-style-type: none"> <li>Some coherence but not well organized, or some organization but not coherent.</li> <li>No aim or rationale.</li> </ul>		<ul style="list-style-type: none"> <li>Key explanations missing.</li> <li>Diagrams (if included) do not aid in the explanation.</li> </ul>			
2: The exploration has <b>some</b> coherence and shows <b>some</b> organisation.					
<ul style="list-style-type: none"> <li>Perhaps no (or weak) conclusion and/ or introduction.</li> <li>Some mathematical and/or non mathematical explanations are missing</li> <li>Coherent but not well organized, or well-organized but not coherent.</li> <li>May included aim or rationale.</li> </ul>		<ul style="list-style-type: none"> <li>Aim doesn't "fit" the rest of the paper.</li> <li>Some terms undefined</li> <li>Repetitive work and/or calculations.</li> <li>Tables, diagrams, graphs etc may not be explained.</li> <li>The diagrams may not aid the explanation very much.</li> <li>This is the highest achievement if a Q and A format is used.</li> </ul>			
3: The exploration is <b>coherent</b> and <b>well organised</b> .					
<ul style="list-style-type: none"> <li>Solid introduction and conclusion</li> <li>Most mathematical and/or non mathematical explanations are clear.</li> <li>Aim and rationale included</li> <li>Repetitive calculations.</li> <li>Diagrams, graphs, tables etc included, explained and aid in the exploration.</li> </ul>		<ul style="list-style-type: none"> <li>Aspects need clarification.</li> <li>Lacks conciseness (could be huge detracting tables that should be in an appendix.)</li> <li>Typing errors may detract from the flow.</li> <li>May include irrelevancies (hence lack of conciseness.)</li> <li>References included.</li> </ul>			
4: The exploration is <b>coherent, well organised, concise</b> and <b>complete</b> .					
<ul style="list-style-type: none"> <li>Strong introduction (which includes the context of the exploration) and conclusion</li> <li>Mathematical and/or non mathematical explanations are clear and concise.</li> <li>Includes rationale (why topic chosen) and aim which is clearly identifiable.</li> </ul>		<ul style="list-style-type: none"> <li>Exploration is logically developed. All appropriate avenues explored.</li> <li>Graphs and tables are appropriately placed within the exploration, extra large tables are summarized in paper and then added in an appendix</li> <li>Easy to follow (written for a peer audience)</li> <li>Proper citations and referencing where appropriate.</li> </ul>			
<b>B: Mathematical Presentation (includes mathematical vocabulary)</b>				<b>/3</b>	
0: The exploration <b>does not</b> reach the standard described by the descriptor below.					
1: There is <b>some</b> appropriate mathematical presentation.					
<ul style="list-style-type: none"> <li>Poor or minimal use of notation, terminology, and/or mathematical symbols.</li> <li>References to color, yet printed in black and white.</li> <li>Diagrams, tables, graphs etc may be unrelated.</li> </ul>		<ul style="list-style-type: none"> <li>Missed opportunities to show mathematical language.</li> <li>Paper is descriptive rather than mathematical</li> <li>Lack of appropriate ICT (information and communication technology) tools for the task.</li> </ul>			
2: The mathematical presentation is <b>mostly</b> appropriate.					
<ul style="list-style-type: none"> <li>Inconsistency of terminology and/or variables.</li> <li>Some key terms and variables defined</li> <li>Mostly correct use of mathematical language, terminology, symbols and notation (no *, or ^) use of approximate <math>\approx</math> instead of equal, appropriate use of subscripts etc.</li> </ul>		<ul style="list-style-type: none"> <li>Some appropriate use of ICT tools for the task.</li> <li>Some Graphs, diagrams etc are clear and appropriately scaled (zoomed in/out) and labelled for clear communication. (ie. Some wasted space on the graph by poor choice of domain and range)</li> </ul>			
3: The mathematical presentation is appropriate <b>throughout</b> .					
<ul style="list-style-type: none"> <li>Key terms and variables explicitly defined.</li> <li>Correct use of mathematical language, terminology, symbols and notation (no *, or ^) use of approximate <math>\approx</math> instead of equal, appropriate use of subscripts etc.</li> <li>Appropriate and varied forms of mathematical representation used (formulae, diagrams, tables, charts, graphs, models)</li> <li>Appropriate ICT tools are used for the task (ie, spreadsheet, GDC, Geogebra, pencil and ruler, etc.)</li> </ul>		<ul style="list-style-type: none"> <li>Appropriate degrees of accuracy for situation.</li> <li>Discrete versus continuous data clearly articulated if applicable.</li> <li>Graphs and diagrams appropriately labelled and scaled (zoomed in/out) for clear communication.</li> </ul> <p>ACCEPT THE GERMAN NOTATION: <math>n \in \mathbb{R} \setminus \{0\}</math> which means <math>n \in \mathbb{R}</math> but <math>n \neq 0</math>.</p>			
<b>C: Personal Engagement</b>				<b>/4</b>	
0: The exploration <b>does not</b> reach the standard described by the descriptor below.					
1: There is evidence of <b>limited</b> or <b>superficial</b> personal engagement.					
<ul style="list-style-type: none"> <li>Student created examples may exist.</li> <li>Unfamiliar math is quoted and not explained.</li> <li>Unsupported mathematics.</li> </ul>		<ul style="list-style-type: none"> <li>Missed opportunities to explore.</li> <li>Minimal independent thinking.</li> <li>Minimal personal interest.</li> </ul>			
2: There is evidence of <b>some</b> personal engagement.					
<ul style="list-style-type: none"> <li>Student created examples but may not have been followed through.</li> <li>Student applies some unfamiliar mathematics and some research into it has taken place.</li> </ul>		<ul style="list-style-type: none"> <li>Some independent thinking has occurred but limited</li> <li>Some personal interest shown but limited</li> </ul>			
3: There is evidence of <b>significant</b> personal engagement.					
<ul style="list-style-type: none"> <li>Student created examples exist.</li> <li>Student explores and applies math.</li> <li>Some evidence of personal interest</li> </ul>		<ul style="list-style-type: none"> <li>Some personal involvement.</li> <li>Student shows independent thinking.</li> <li>Some research has been undertaken.</li> </ul>			
4. There is <b>abundant</b> evidence of <b>outstanding</b> personal engagement.					

<ul style="list-style-type: none"> <li>• Works independently.</li> <li>• Creates strong personal examples</li> <li>• Thinks creatively.</li> <li>• Demonstrates personal interest</li> <li>• Present mathematical ideas in your own way.</li> <li>• Looks for and creates mathematical models for real-world situations (if applicable)</li> <li>• Asks questions, makes conjectures, investigates mathematical ideas.</li> <li>• Researches the area of interest.</li> </ul>	<ul style="list-style-type: none"> <li>• Considers different perspectives (historical or global or local)</li> <li>• Actively explores, learns, applies and describes unfamiliar (yet appropriately challenging) mathematics.</li> <li>• Shows independent thinking.</li> <li>• Highly original work.</li> <li>• Shows personal ownership of the work.</li> <li>• Asks questions to explore and explores them.</li> <li>• Passion and interest is abundant in the overall read of the paper.</li> </ul>	
<b>D: Reflection</b>		<b>/3</b>
0: The exploration <b>does not</b> reach the standard described by the descriptor below.		
1: There is evidence of <b>limited</b> or <b>superficial</b> reflection.		
<ul style="list-style-type: none"> <li>• Very limited, simple and superficial reflection.</li> <li>• Opportunities for reflection were not taken.</li> </ul>	<ul style="list-style-type: none"> <li>• Some questions raised.</li> </ul>	
2: There is evidence of <b>meaningful</b> reflection.		
<ul style="list-style-type: none"> <li>• Student makes connections and links to other mathematical ideas.</li> <li>• Some questions raised.</li> <li>• Implications of the results are considered.</li> <li>• Reflection on results and findings</li> <li>• Accuracy and reasonableness considered.</li> </ul>	<ul style="list-style-type: none"> <li>• Reflection is meaningful (but not critical)</li> <li>• A limited discussion on possible limitations (and/or extensions, improvements)</li> <li>• Not enough questions are raised. What if I did....</li> </ul>	
3: There is <b>substantial</b> evidence of <b>critical</b> reflection.		
<ul style="list-style-type: none"> <li>• Discusses the implications of results.</li> <li>• Accuracy and reasonableness considered and discussed.</li> <li>• Considers the significance of the findings and results.</li> <li>• Possible limitations (and/or extensions, improvements)</li> <li>• Connections or links to other fields and mathematical areas.</li> <li>• Choices of approach are considered and evaluated along the process.</li> </ul>	<ul style="list-style-type: none"> <li>• Critical reflection demonstrated throughout (if applicable) and in conclusion.</li> <li>• Considers personal examples and work.</li> <li>• Mathematical difficulties, problems and contradictions discussed.</li> <li>• Critical reflection on what has been learned.</li> <li>• Insightful questions raised. What if I ....</li> </ul>	
<b>E: Use of Mathematics</b>		<b>/6</b>
0: The exploration <b>does not</b> reach the standard described by the descriptor below.		
<ul style="list-style-type: none"> <li>• There is no use of mathematics.</li> <li>• No mathematical strategy used.</li> </ul>	<ul style="list-style-type: none"> <li>• Descriptive not mathematical in nature.</li> </ul>	
1: <b>Some</b> relevant mathematics is used.		
<ul style="list-style-type: none"> <li>• Mathematics is not at SL level</li> <li>• Elementary mathematical strategies used.</li> </ul>	<ul style="list-style-type: none"> <li>• Largely descriptive with some mathematics.</li> </ul>	
2: Some relevant mathematics is used. <b>Limited understanding</b> is demonstrated.		
<ul style="list-style-type: none"> <li>• Mathematics is not at SL level</li> <li>• Limited demonstration of understanding.</li> </ul>	<ul style="list-style-type: none"> <li>• Can apply the methods without elaboration.</li> <li>• There is some correct mathematics.</li> </ul>	
3: Relevant mathematics <b>commensurate with the level of the course</b> is used. <b>Limited understanding</b> is demonstrated.		
<ul style="list-style-type: none"> <li>• Mathematics is in the syllabus, at a similar level or beyond.</li> <li>• Limited demonstration of understanding.</li> </ul>	<ul style="list-style-type: none"> <li>• Can apply the methods without elaboration.</li> <li>• There is some correct mathematics.</li> </ul>	
4: Relevant mathematics commensurate with the level of the course is used. The mathematics explored is <b>partially</b> correct. <b>Some</b> knowledge and understanding are demonstrated.		
<ul style="list-style-type: none"> <li>• Some demonstration of understanding of "why"</li> <li>• Can apply the method but not the deeper why.</li> </ul>	<ul style="list-style-type: none"> <li>• The mathematics is partially correct.</li> <li>• Some connections or links made to other areas of mathematics.</li> </ul>	
5: Relevant mathematics commensurate with the level of the course is used. The mathematics explored is <b>mostly</b> correct. <b>Good</b> knowledge and understanding are demonstrated.		
<ul style="list-style-type: none"> <li>• Mathematics is understood.</li> <li>• Correctly explores the mathematics from various perspective or angles.</li> <li>• Applies some problem solving techniques</li> <li>• Where appropriate patterns are recognized and explained.</li> </ul>	<ul style="list-style-type: none"> <li>• Applies mathematics in different contexts.</li> <li>• A sophistication of mathematics is shown.</li> <li>• Identifying links to different areas of mathematics.</li> <li>• Contains mathematical rigor.</li> <li>• Mathematics is mostly error-free and uses appropriate level of accuracy most of the time.</li> </ul>	
6: Relevant mathematics commensurate with the level of the course is used. The mathematics explored <b>is correct</b> . <b>Thorough</b> knowledge and understanding are demonstrated.		
<ul style="list-style-type: none"> <li>• Mathematics is fully understood.</li> <li>• Applies problem solving techniques</li> <li>• Is mathematically rigorous.</li> </ul>	<ul style="list-style-type: none"> <li>• Clarity of mathematical language and logic when making mathematical arguments and calculations.</li> <li>• Precise mathematics is error-free and uses appropriate level of accuracy at all times.</li> </ul>	

Compiled by Munich International School Mathematics Department  
 Buchanan, Laurie et al. Mathematics Standard Level. Oxford, U.K.: Oxford University Press, 2012.  
 "Examples of Explorations." IBO.org. International Baccalaureate Organization. n.d. Web. 25 March 2013.  
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