

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

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

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.
[Link to PDF File: Washburn](#)