Profile of a Mathematics Graduate

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Graduates in Mathematics are:

Thinkers	They are reflective explorers of ideas for the purpose of discovery, understanding, and validation of mathematical thought
As <i>thinkers</i> , they	
Interpret meaning	Seek to understand individual concepts before linking them to other concepts so they understand the bigger picture
Make new connections	See the link between pieces of knowledge (existing or newly constructed) and how they are related
Use multiple approaches	Can hold alternative and multiple perspectives, whether representations, structures, verbal descriptions, or logical approaches
Visualize	See and use images including drawing pictures, diagrams, schematic, etc., as a way to explore and understand mathematical ideas
Are precise	Appreciate exactness and strive to be error-free in thought, word usage, details, and notation
Are metacognitive	Are aware of their own thinking about mathematics
Are comfortable with abstraction	Move nimbly from the concrete to symbolic, using advanced objects, expanded statement structures, and increasing complexity of notation

Communicators They clearly convey mathematics to a variety of audiences through various mediums

As *communicators*, they...

Translate	Translate between symbolic mathematical language and mathematical English, especially with respect to quantifiers and modifiers
Write clearly	Articulate mathematical ideas in clear and precise writing
Converse mathematically	Successfully articulate mathematical ideas in interactive discussions
Teach	Help others learn through intelligibly explaining mathematical concepts
Think on their feet	Facilely and adeptly deal with unexpected questions and lines of inquiry
Listen actively	Comprehend and understand what another says, effectively checking perceptions

Problem Solve	They state problems clearly, and identify issues and assumptions, transfer- ing mathematical knowledge and models to produce validated solutions
As <i>problem solvers</i> , they	
Identify assumptions	<i>Identify critical assumptions that solutions or processes depend on and test to ensure that assumptions are valid</i>
Identify and define problems	See the gap between what is known and what needs to be known and precisely state the criteria of a the desired problem solution
Persevere	Display commitment to solving problems despite obstacles, frustrations, & setbacks
Accept failure	Use failure as a pathway to success by analyzing, assessing, and tracking errors
Are tenacious	Aggressively attack problems with purpose, intensity, focus, and patience
Identify key issues	Identify, using inquiry, significant aspects of complex situations or ill-posed problems
Learners	They effectively read, critically think and speak, contextualize, generalize and look for new ways of putting this knowledge into practice
As <i>learners</i> , they	
Read mathematically	Have a set of practical methods for analyzing a mathematical textbook or paper by using the models, inquiry, summaries, and a glossary to increase understanding
Take risks	Are willing to expose their performance in learning, thinking, and problem solving by working in front of and with others
Inquire	Ask effective and enriching questions for in a given context to facilitate understanding
Think analytically	Can see the details and reasons for the similarities and the differences in mathematical structures, ideas, and language
Are self-directed	Are willing to struggle alone to challenge their own abilities in producing a level of learning that often is assisted by others
Generalize	Can take a specific piece of mathematical knowledge, identify the range of pertinent issues, and then create and solve a complex problem key to that mathematical

Reasoners	They appreciate the beauty of and enjoy the ability to construct mathematical arguments
As <i>reasoners</i> , they	
Make conjectures	<i>Use inductive reasoning through predictions, pattern recognition, and hypothesizing</i>
Find counter examples	Know how to find examples that allow for the refutation of conjecture and when they are salient
Create and use proofs and derivations	Use proofs to extend mathematical knowledge and understanding

knowledge, thus ensuring transfer of learning across contexts

Reasoners (con't)	They appreciate the beauty of and enjoy the ability to construct mathematical arguments
As <i>reasoners</i> , they also	
Proceed logically	Can justify why an idea, proof or construction is true, valid, or applicable; can determine implication and entailment for and of information
Identify dead ends	Identify boundaries to process and logic so that time is not spent ineffectively
Reuse previous mathematics knowledge	Are aware of the existing content of mathematical theory and pratice so that time is not spent "reinventing the wheel"

Modelers	They can size up real-life situations, simplify them, translate them to mathematical models, analyze the results and apply for benefit of others
As <i>modelers</i> , they	
Build models	Translate real world phenomena into mathematics
Analyze models	Describe important relationships mathematically
Use creativity	Innovate when existing patterns or schema don't work
Gain and transfer knowledge	Recognize in context both what needs to be learned before proceeding (knowledge to be gained) as well as what is already known (knowledge to be transfered)
Collaborate	Know that helping others is a successful strategy for increasing one's own learning
Simplify	<i>Identify what is important in a complex context and reframe problems, solutions, and information, accordingly</i>
Integrate and reuse	See in past experiences a variety of items such as sub-models, tools, and results that can be effectively integrated into new modeling challenges

Experts	They convince others about their passion, comprehensiveness, depth, experience and continual learning.
As <i>experts</i> , they	
Know the big ideas	Can teach others the foundational base of mathematics: key theorems, number systems, set theory, operations, etc.
See the connections of the big ideas	Appreciate how the major topics of mathematics are related and can see these connections in context
Love mathematics	Are interested in, seek out, like to use, and are playful with new areas of mathematics, research, and life applications
Consult	Can connect and transfer mathematics to other disciplines, using mathematical thinking to illuminate real-world contexts
Use mathematical language	Proficiently use the vocabulary, symbols, notation, structures, & conventions of mathematics to produce and understand mathematical statements

Tool Users	They are capable of integrating the appropriate selection and use of tools to improve mathematical performance
As <i>tool users</i> , they	
Analyze tools	Clearly identify the functions, features, and critical limitations of tools
Select tools	Identify the most appropriate tools for a given situation based upon clear criteria
Understand tools	Ensure that the mathematics of the tool are performed correctly
Use tools effectively	Represent the mathematics accurately within the designed structure and limitations of the tool
Validate results	Examine results where the probability of correctness approaches 100%

Professionals	They consciously and consistently use the methods and values of mathematics
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As <i>professionals</i> , they	
Claim an identity	Think, act, and self-identify as mathematicians
Employ conventions	Use the standards, conventions, and values for doing mathematics
Are self-confident	Believe in themselves and are eager to take on new challenges
Engage in self- assessment	Want to continually to improve their abilities in mathematics and do so by self- assessing in all areas in order to grow professional performance
Show respect for others	Appreciate that mathematical skill is one of many skills and that regardless of an individual's selected discipline, others always have something to teach us
Are accountable	Commit to and follow through on formal and informal obligations in a timely manner