Expert Thinkers **ASK QUESTIONS**….

*What does questioning look like in math?*

When expert thinkers **read and process information** in math, they:

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| --- | --- |
| Question whether what they are reading and seeing make sense | Ask how the new information connects with previous information |
| Pause and wonder about something that confuses them | Think about how to use  the new information |

|  |  |
| --- | --- |
| Inquire about the nature  of the problem | Ask the purpose  of the problem |
| Wonder what the best strategies for solving the problem might be | Consider potential trouble spots in the problem solving process |

When expert thinkers **solve problems**, they ask questions in order to:

When expert thinkers ask questions to **think critically** about their own work and the work of others, they:

|  |
| --- |
| Wonder why a solution is accurate |
| Ask whether patterns can be generalized  from special cases |
| Think about alternative approaches to the  problem solving process |



Expert Thinkers **USE BACKGROUND KNOWLEDGE**….

*What does using background knowledge look like in math?*

When expert thinkers **read and process information** in math, they:

|  |  |
| --- | --- |
| Pay attention to when they DO or DO NOT have background knowledge about a concept | Assess the accuracy of their background knowledge, and build or revise knowledge as needed |
| Make connections between new ideas and things they already know | Consider how their background knowledge helps them to understand |

|  |  |
| --- | --- |
| Make meaning of vocabulary | Understand the type of math they are being asked to do |
| Develop problem solving plans to suit the situation | Use what they know about related problems to solve new problems efficiently and accurately |

When expert thinkers **solve problems**, they use background knowledge in order to:

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| --- |
| Consider whether a solution makes sense in the context |
| Make connections between  related problems and solutions |

When expert thinkers use background knowledge to **think critically** about their own work and the work of others, they:



Expert Thinkers **MAKE INFERENCES**….

*What does making inferences*

*look like in math?*

When expert thinkers **read and process information** in math, they:

|  |  |
| --- | --- |
| Draw conclusions that are not explicitly state in the text | Generalize from specific examples |

When expert thinkers **solve problems**, they make inferences in order to:

|  |  |
| --- | --- |
| Analyze data to identify patterns | Make predications based on information given |

When expert thinkers make inferences to **think critically** about their own work and the work of others, they:

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| --- |
| Try to determine the rationale behind a peer’s work |
| Analyze a solution in light of a general principle |



Expert Thinkers **MONITOR FOR MEANING**….

*What does monitoring for meaning*

*look like in math?*

When expert thinkers **read and process information** in math, they:

|  |  |
| --- | --- |
| Maintain an awareness of what they do and do not understand | Notice confusion and stop to address it |

When expert thinkers **solve problems**, they monitor for meaning in order to:

|  |  |
| --- | --- |
| Ensure they understand the context before beginning to  solve a problem | Stop to classify the type of work the problem is asking them to do |
| Estimate and then check  solutions against estimates | Ensure clear documentation  of solutions |

When expert thinkers monitor for meaning to **think critically** about their own work and the work of others, they:

|  |  |
| --- | --- |
| Explain thinking to others clearly | Determine whether the thinking makes sense |
| Inquire about the  thinking of others | Attend to precision |



Expert Thinkers **SYNTHESIZE**….

*What does synthesizing look like in math?*

When expert thinkers **read and process information** in math, they:

|  |  |
| --- | --- |
| Put together various pieces of information from different sources | Pay attention to how new ideas mesh with their  background knowledge |
| Integrate new information to grow their understanding | Notice their thinking change  over time |

When expert thinkers **solve problems**, they synthesize in order to:

|  |  |
| --- | --- |
| Generalize from patterns | Match a strategy to a problem |
| Apply concepts in new contexts | Develop situations that integrate more than one  mathematical strand |

When expert thinkers synthesize to **think critically** about their own work and the work of others, they:

|  |  |
| --- | --- |
| Compare their thinking and work to the work of others | Identify similarities between various solutions to a problem |
| Critique the reasoning behind a solution in light of known principles | Contextualize solutions to fit a real-world or “big picture” scenario |



Expert Thinkers **DETERMINE IMPORTANCE**….

*What does determining importance*

*look like in math?*

When expert thinkers **read and process information** in math, they determine importance by:

|  |  |
| --- | --- |
| Setting a purpose for their reading | Searching for the main ideas |
| Identifying important examples that help them understand | Finding special conditions or common misconceptions |

When expert thinkers **solve problems**, they determine importance in order to:

|  |  |
| --- | --- |
| Identify what the problem  is asking | Select relevant data |
| Identify potential pitfalls in the problem solving process | Consider special criteria that may be unique to each problem |

|  |
| --- |
| A solution that addresses the purpose of the problem |
| An answer that makes sense and is justified with mathematical reasoning |
| Arithmetic correctly completed |

When expert thinkers determine importance to **think critically** about their own work and the work of others, they look for:



Expert Thinkers **CREATE MENTAL MODELS**….

*What does creating a mental model look like in math?*

When expert thinkers **read and process information** in math, they:

|  |  |
| --- | --- |
| Model information in graphs, charts, drawings, diagrams, etc. | Create symbolic representations or pictures to help them remember and process information |

|  |  |
| --- | --- |
| Organize what they know | Represent abstract ideas concretely |
| Develop a system/plan for solving a problem | Represent their thinking and their solution |

When expert thinkers **solve problems**, they create mental models in order to:

When expert thinkers create mental models to **think critically** about their own work and the work of others, they:

|  |
| --- |
| Develop and refer to models when communicating with others |
| Understand the thinking of others by studying models |
| Evaluate the effectiveness of various models in a given situation |
| Revise and create new models as thinking changes over time |

