



Routines for Reasoning Kelemanik, Lucenta, and Janssen Creighton (p.3)

Avenues of Thinking: A Framework for Making Sense of Several CCSS Standards for Mathematical Practice

Reason Abstractly and Quantitatively (MP2)	Look for and Make Use of Structure (MP7)	Look for and Express Regularity in Repeated Reasoning (MP8)
<p><i>Attend to ...</i> Quantities and relationships</p>	<p><i>Attend to ...</i> The organization or behavior of number and space</p>	<p><i>Attend to ...</i> Repetition in processes or calculations</p>
<p><i>Ask Yourself</i></p> <ul style="list-style-type: none"> • What can I count or measure? • What quantity or relationship does this number describe? • How do the quantities relate to each other? • How much bigger/smaller (how many times bigger/smaller) is one quantity than another? • How can I represent this situation so that I can see the quantities and relationships? • How can I show how much bigger/smaller (how many times bigger/smaller) one quantity is in my diagram? • What quantities or relationships do I see in the diagram? • Is there a “hidden” quantity or relationship that I can now see in the representation? • What does this (expression, variable, number, shaded region, etc.) represent in the problem context? 	<p><i>Ask Yourself</i></p> <ul style="list-style-type: none"> • What type of problem is this? • Does this remind me of another problem situation? • How is this (situation, object, process, etc.) behaving? Can I connect it to something else I know? • What are the parts (chunks) of the process? • How can I get the answer without doing all the calculations? • How can I use properties to uncover structure? • How can I change the form of this (number, expression, shape) to surface the underlying structure? 	<p><i>Ask Yourself</i></p> <ul style="list-style-type: none"> • Is there something in this problem context that repeats or suggests some regularity? • How can I create or use a repeated process to help me figure out what’s going on in this problem? • What was my process? Was it the same every time? • Am I counting/drawing/building/calculating in the same way each time? • What about this process is repeating? • How can I describe the repetition in words/variables, etc.? • What operations can I use to model this process? • How can I use the repetition to make my rule?
<p><i>Take Action</i></p> <ul style="list-style-type: none"> • Determine which quantities/relationships are important. • Identify quantities explicitly mentioned in the problem situation. • Identify implied quantities. • Use representations to see quantities and relationships. • De-contextualize the problem situation. • Contextualize the problem. 	<p><i>Take Action</i></p> <ul style="list-style-type: none"> • Chunk complicated mathematical objects (expressions, shapes, etc.). • Connect representations. • Change the form of the number, expression, space, e.g., create equivalent expressions. • Recall and use properties, rules of operations, and geometric relationships. 	<p><i>Take Action</i></p> <ul style="list-style-type: none"> • Try several numbers and observe the process. • Draw or build the next several figures in the series. • Record and track calculations. • Generalize the repetition.

Routines for Reasoning Kelemanik, Lucenta, and Janssen Creighton (p.179)