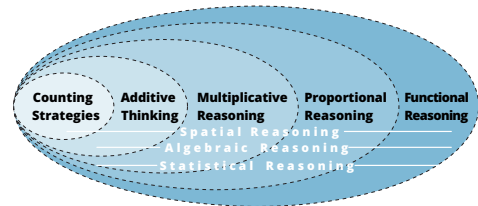


# Development of Mathematical Reasoning

## What is Developing Mathematical Reasoning?

Developing Mathematical Reasoning is a process of constructing mental relationships and connections in increasingly sophisticated ways. This does not mean simply getting answers to these types of questions. It means allowing learners to grapple with more and more simultaneity, so that the brain creates a dense network of connections. The graphic purposefully has dotted lines because students will revert back and forth a bit as they transition to the next level as the rigor is increased. Each domain of reasoning builds on the previous and is necessary for a learner to build to the next domain.



The Development of Mathematical Reasoning

## What does Developing Mathematical Reasoning look like?

Counting Strategies may be exemplified by counting by 1s.



Additive Thinking may be exemplified by adding in bigger jumps than 1 by 1.

(Select the image above to view more information.)

Multiplicative Reasoning may be exemplified by multiplying in bigger chunks than one group at a time.

(Select the image above to view more information.)

Proportional Reasoning may be exemplified by using multiplication to reason about 2 quantities that are linked and vary together.

(Select the image above to view more information.)

Functional Reasoning may be exemplified by considering simultaneously the effect of the rate (which is a ratio - proportional reasoning) on the parent function, which is (often) a set of infinite points that follow a rule (often containing both multiplicative and additive components).

(Select the image above to view more information.)

## Spatial, Algebraic, and Statistical Reasoning

Statistical, spacial, and algebraic reasoning are less nested domains building on each other and more longitudinal in nature. Students can begin to develop each of these domains as young learners and then get increasingly more sophisticated with each.