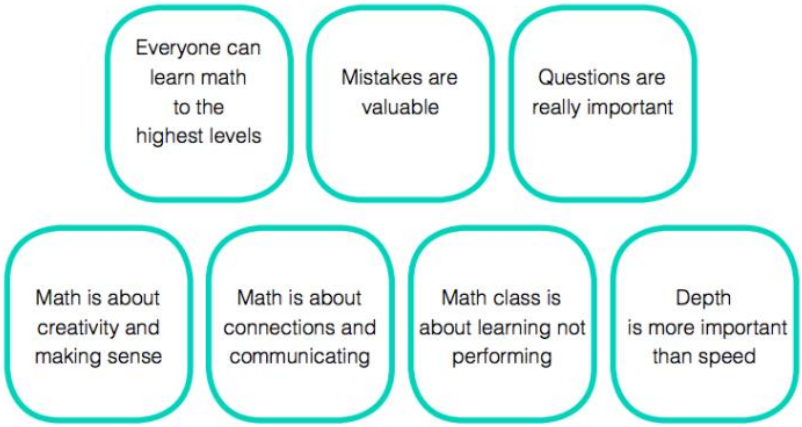
The person in the room doing the talking is the person doing the learning!!

Attend to **teacher talk time** vs **student talk time**.

What routines and activities are in place that allow students to communicate mathematically?

Number Talks or other Numeracy routines are "class starters" that foster class discussion. Students are given opportunities to explain their reasoning. The teacher role in this activity is to support mathematical dialog, and scribe student thinking. Problems that are chosen are "open middle" or "low floor, high ceiling" with many entry points. Often they are opinion tasks where there is no incorrect answer. Students on IIPs, students on adapted curriculum, and students in combined grades can all participate. (Would you Rather math, Which One Doesn't Belong" etc.



https://buildingmathematicians.wordpress.com/2016/08/19/how-to-set-up-positive-norms/

Communication

Do you see evidence of student dialog? Pair talk? Hands -free questioning? Small group discussion? Number talks? Gallery Walks? Accountable Talk routines?

Communication [C]

Students need opportunities to read about, represent, view, write about, listen to, and discuss mathematical ideas using both personal and mathematical language and symbols. These opportunities allow students to create links between their own language, ideas, and prior knowledge, the formal language and symbols of mathematics, and new learnings.

Communication is important in clarifying, reinforcing, and modifying ideas, attitudes, and beliefs about mathematics. Students should be encouraged to use a variety of forms of communication while learning mathematics. Students also need to communicate their learning using mathematical terminology, but only when they have had sufficient experience to develop an understanding for that terminology.

Concrete, pictorial, symbolic, physical, verbal, written, and mental representations of mathematical ideas should be encouraged and used to help students make connections and strengthen their understandings.

Communication works together with reflection to produce new relationships and connections. Students who reflect on what they do and communicate with others about it are in the best position to build useful connections in mathematics.
(Hiebert et al., 1997, p. 6)

Effect Size Class Discussion: 0.88 Questioning: 0.48

Saskatchewan Curriculum Guide

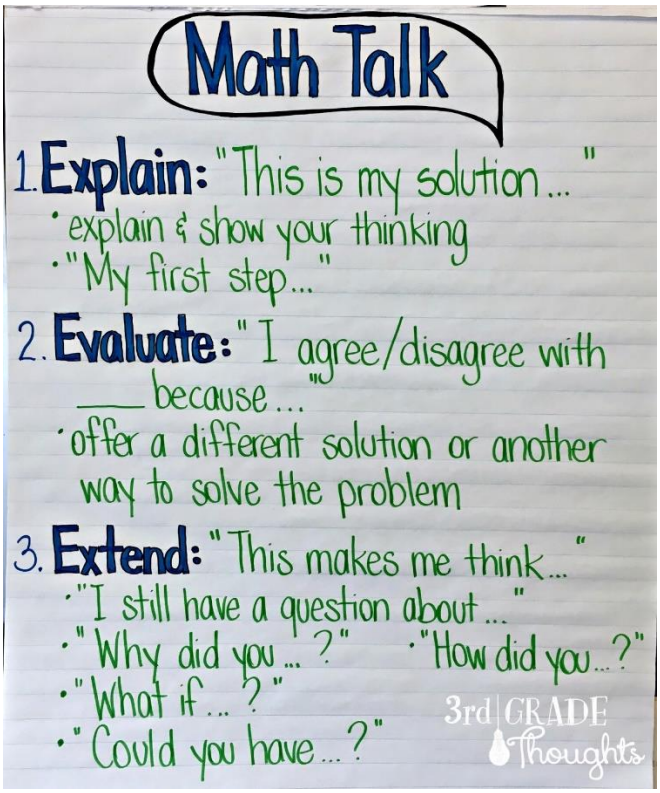
Grade Eight Number Strand Rubric

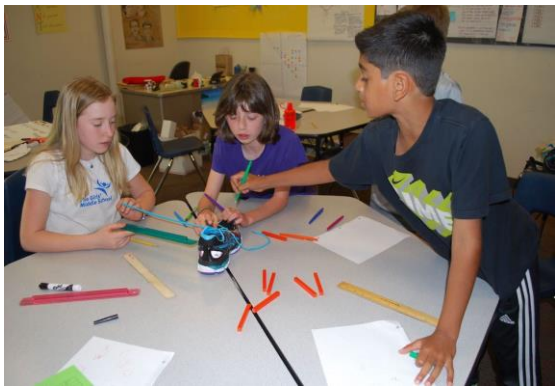
	4	3 (At Grade Level)	2	1
Strategies	The student can independently use prior knowledge to choose, create, and apply multiple efficient strategies to engage in varied and rich mathematical problems.	**The student can independently use prior knowledge to choose and apply strategies to engage in mathematical problems.**	The student is developing the ability to select and use strategies to engage in mathematical problems.	The student is not yet able to select and use strategies to engage in mathematical problems.
Application	The student demonstrates exemplary accuracy, flexibility, and efficiency while engaging in new contexts and complex math problems.	**The student demonstrates accuracy, flexibility, and efficiency when solving math problems.**	The student is developing the ability to demonstrate accuracy, flexibility, and efficiency when solving math problems.	The student is not yet accurate, flexible nor efficient when solving math problems.
Expression of Understanding	The student can independently and efficiently justify thinking with multiple representations using precise mathematical language. Logical connections are being made to synthesize mathematical concepts.	**The student is able to justify thinking through multiple representations using mathematical language. Logical connections are being made across mathematical concepts.**	The student is able to justify thinking with a single representation while using inconsistent mathematical language. Logical connections are being made across some mathematical concepts.	The student is not yet able to justify thinking or show representations and is not yet able to use mathematical language. Logical connections are not yet being made across mathematical concepts.
	*In **grade eight**, the above criteria apply to: squares and principal square roots of whole numbers; multiplying and dividing (fractions and mixed numbers, integers); percents greater than or equal to zero; and rates, ratios, and proportional reasoning, as defined by the curricular document.*			

https://www.edonline.sk.ca/webapps/blackboard/content/listContent.jsp?course_id=_2869_1&content_id=_355613_1

Notice the necessity of helping our students communicate their mathematical reasoning to be at least a level "2" on the Provincial Rubric

Communication





https://saskmath.ca/fostering-a-mathematically-rich-classroom/
https://youtu.be/7lladzWG-bw
https://www.edutopia.org/article/4-ways-encourage-math-talks

"The way human beings learn has nothing to do with being kept quiet." - Ralph Peterson

Students consolidate their thinking by verbalizing their reasoning.

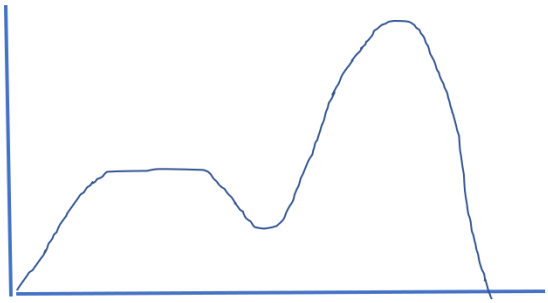
Strategies for "Communicating in Mathematics"

1. **Taking regular practice and making it more collaborative**
   a. Making debates instead of doing independent practice problems—Here's an example using multiple choice questions from text. They are simply copied to cards and students are asked to collaboratively solve.
   https://drive.google.com/file/d/1gX71o8el6YsZkaMMhloCX1diFTJU9d-K/view?usp=sharing

   b. Practicing a new skill from examples on the board? After students have tried your practice questions, put them on the board. Write student initials by each question. Choose 2 students that are not in close proximity. Rule is they have to confer with each other and agree on an answer, then one or both students contributes their solution (with work shown!) on the board.

   c. Flip the assignment to make it more collaborative and require deeper thinking:
   For example, instead of Draw a graph of this situation, present a graph and have groups of students write the "story" that goes with the graph. Groups take turns presenting their graph under document camera and explaining the situation they came up with .

Write a "story" situation that would correlate with this graph. Be sure to label your axes, and explain what is happening at each change of direction/slope on the graph



For example, I've had this graph explained as your ice cream craving over time in the summer, your hair length over time, the money in your bank account, snowfall, and once even how many boyfriends you've had (which made for great discussion since obviously the person in the graph is dating many guys at once! Haha! Maybe the max point of the graph is where all

these guys find out they're dating the same girl and they all dump her).
Many times groups have talked about this as a mountain climber, or mountain biker, which tells me they don't understand the idea of relationships in a graph. This is formative assessment evidence you would never get from kids just doing the assignment.

There are lots of text book assignment questions that can be flipped in this way.

2. Formative assessment ideas that generate math talk

a) Commit and toss
http://web.wnlsd.ca/enrichment/FormativeassessmentResources/Commit_and_Toss.pdf

Commit and Toss

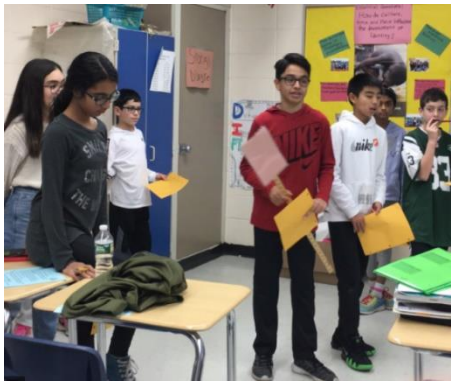
Agree or disagree with this statement:
" Two negatives make a positive"

☐ Agree

☐ Disagree

Justify your answer:

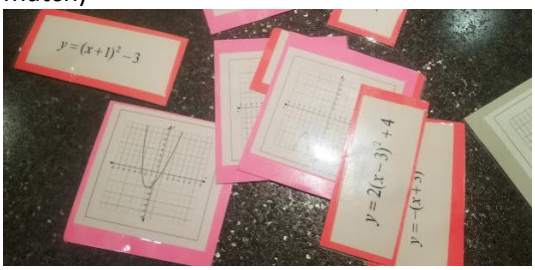
b) Four corners: "In this strategy, students individually choose a response to a question or prompt and move to an area in the room where they join others who share their ideas and responses. This strategy is flexible and can be used for many topics, questions, and problems in mathematics."
https://oame.on.ca/main/files/thinklit/FourCorners2.pdf

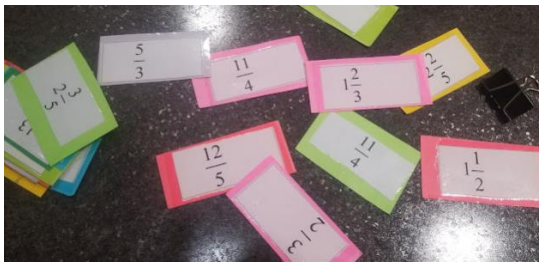


c) Gallery Walk https://www.sfusdmath.org/gallery-walk.html

When time is short you can modify this activity to "group hosting" where instead of everyone seeing every group's posted work, pairs of groups "host" each other over at their posters and explain their reasoning.

d) Card matching. Need to create partners for a day? Meet kids at the door, and everyone gets a card (or a quickly cut up hand drawn piece of paper, whatever!)
You can have graphs to match with equations, graphs to match with slope, slope to match with equation, equations in 2 different forms, polynomials simplified and expanded, fractions as mixed and improper, fractions as models and as numbers, numbers as fraction or decimal, or fraction/decimal/percent for a group of 3, any equation with the solution, etc…so that kids find their partner. They need to be able to justify why that person is their partner (why their cards match)





3. Peer coaching ideas
   a) Math Speed dating
   https://ispeakmath.org/tag/speed-dating/

   Each student is an "expert" at one problem. Works well for multistep problems, solving equations, order of operations, etc. With each new partner the student guides their partner through solving their problem, then the two switch roles (student vs coach) and solve the other person's problem. When everyone is done one side of the long table all move down a seat. Now each person has a new problem or equation to solve, but they still coach their new partner on their own equation, which they got to be an expert at.

   b) Rally Coach (from Cooperative Learning, Dina Kushner)
Student A completes a problem while doing a "think aloud"—telling what they're doing. The partner B listens, and coaches. If A gets stuck, B is only allowed to ask prompting questions. Then roles reverse.

   c) Scripted peer coaching—is like Rally Coach but the "coach" (B) has a worked solution to the problem to guide them. Only the coach can see the work and answer. They can ask prompting questions to A who is solving the problem.

There are many more communication strategies that work well! Row problems, Graffiti activities, inside-outside circle, hot-seat questioning, and others. Have fun exploring these!