



Mathematical Process Feature-Connections

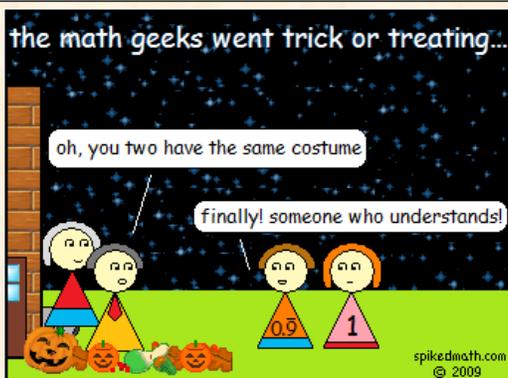
The only way we have to learn something new is to tie it to something we already know. This is how learning is built on prior experiences, and how neural networks form in the brain.

When we introduce a new topic, in any grade, we “tap and activate” prior knowledge. What outcomes last year led to the content of this year’s curriculum? There are many “tap and activate” activities! We can use an entrance slip, a self reflection formative assessment, a quick write, turn and talk, or preassessment based on prior outcomes.

Learning in all subjects is predicated on making connections between new concepts and existing ideas and schema; that is, mental images and ideas, or what the learner already knows. Powerful learning draws on the learners’ experiences and life context. Sandra Herbst calls this “getting the Velcro up”—creating conversations and experiences that new learning can “stick to”. As math educators we are very familiar with this, as we know that math concepts build on each other through the years.

Connecting ideas within mathematics. Mathematical themes are evident in the *strands* of the curriculum. Topics are grouped together so students can realize general principles at work and how they are related. Students will encounter these “big ideas” repeatedly and in many different contexts as they progress through grade levels. We need to highlight these related concepts to help students build on and expand their prior learning; otherwise, math is perceived as fragmented and compartmentalized. Learning is then through memorization which is low-level and not lasting. Our first job as educators is to become very familiar with the curriculum especially at our own level but also through the years (learning continuum of concepts) so that we can understand ideas that are nested within each other, and concepts that are threaded and integrated. Ideas must flow naturally from lesson to lesson and grade to grade.

Connections between math and life: All learning is achieved through anchoring new concepts to existing ideas and experiences. A teacher’s task is to illuminate the relations between the known and the new. When students are encouraged to contribute their own understandings into the learning, they are more engaged and have a sense of ownership of the learning. Math must be understood as intrinsic and enmeshed in the fabric of life, physics, and society, not an elite, unobtainable, isolated topic. We create memorable experiences to which concepts are linked by engaging senses, providing movement, application and experiences. Exploring mathematical topics through math labs, “explore” activities (MMS), manipulatives, collaborative discussions, presentations, debates, and multimedia create much more memorable learning events than pencil and paper seat work, though the actual content and topics may be the same.



Connections to other areas of learning: Our curriculum documents give suggestions for helping students transfer mathematical knowledge to other disciplines. Consider shapes and tessellations in art, data interpretation and probability in health and social, data and graphing in science education, fractions and music education, timing and statistics in phys ed, and graphs as models of behaviours in physics, logarithms as necessary to chemistry and physics, and calculating and measuring in PAA classes.

Connections between symbols and procedures in math. Math is a language of its own. Part of our work in establishing mathematically literate students is helping them gain an understanding of the representations of mathematical ideas. Students must be actively engaged in the work of mathematics to be immersed in the language of math. Word walls and front-loading vocabulary are strategies to assist with connecting to the language of mathematics, as are Frayer models, concept circles, carrol diagrams, mind maps and other concept attainment activities and graphical representations. One helpful approach is to use a “ We write” and “we say” explanation of new ideas. For example: We *write* $\sum_{n=1}^{12} 2n + 5$ and we *say* “Find the sum of all numbers generated by the function $2n+5$, starting at the first number, where n is one, and stopping at the twelfth number”. Number talk routines are excellent ways to promote mathematical literacy by arranging opportunities for students to compare, explore, reason with and talk about mathematical approaches and representations.

Saskatchewan Renewed Mathematics Curriculum

Glanfeild, F. (2007). Reflections on research in school mathematics. Toronto, Pearson.

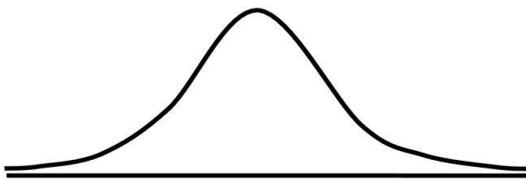
NCTM Web Site, <http://www.nctm.org/>

Ontario Association for Mathemamtics Education, <http://www.oame.on.ca/main/index1.php?lang=en&code=home>

New Jersey Mathematics Curriculum Framework (1996) Standard 3-Mathematical Connections

Manitoba Mathematics Curriculum Framework, Grade 8 Curriculum Support Document, http://www.edu.gov.mb.ca/k12/cur/math/support_gr8/full_doc.pdf

Happy Hallowe'en!! --statistically speaking...



Normal Curve



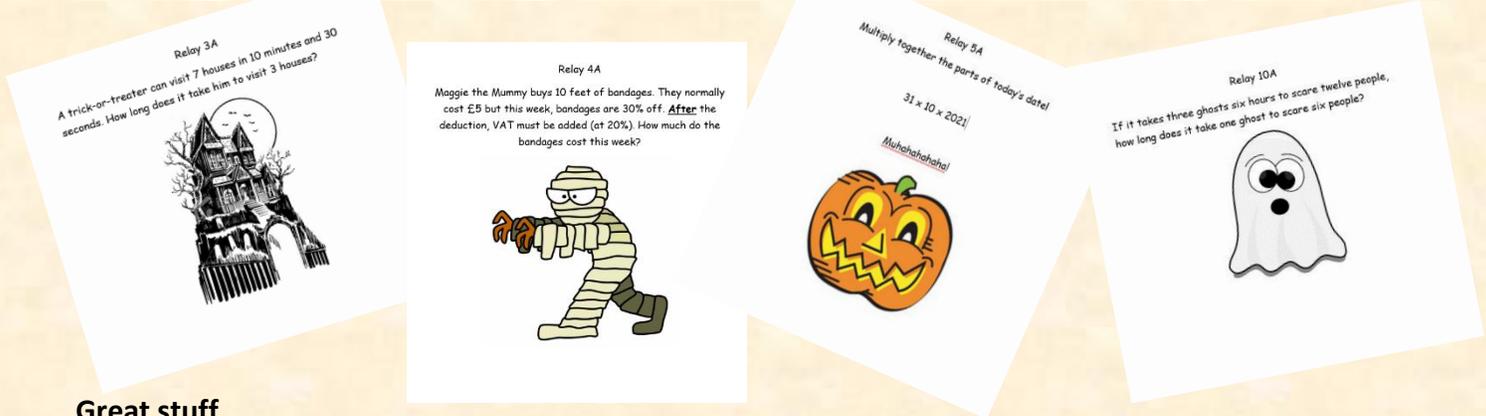
Paranormal Curve

CONNECTIONS:

As educators, we need to ensure that we highlight related math concepts to help students build on and expand their prior learning; otherwise, math is perceived as fragmented and compartmentalized. Learning is then through memorization

Halloween fun for your classroom! Check out Halloween relays at TES (it's a download, but cost will show £0.00 (It's made in UK but downloads in word so you can edit it to suit your grade level and change £ to \$)). Here's how the author suggests you use them: I give a pupil a question and they solve it. When they think they have the correct answer they will run out to me. If it is correct, they will get the next question. If it is incorrect, they go back to their station and continue to solve until they get it correct.

<https://www.tes.com/teaching-resource/halloween-relay-races-ks3-number-problems-6351742>



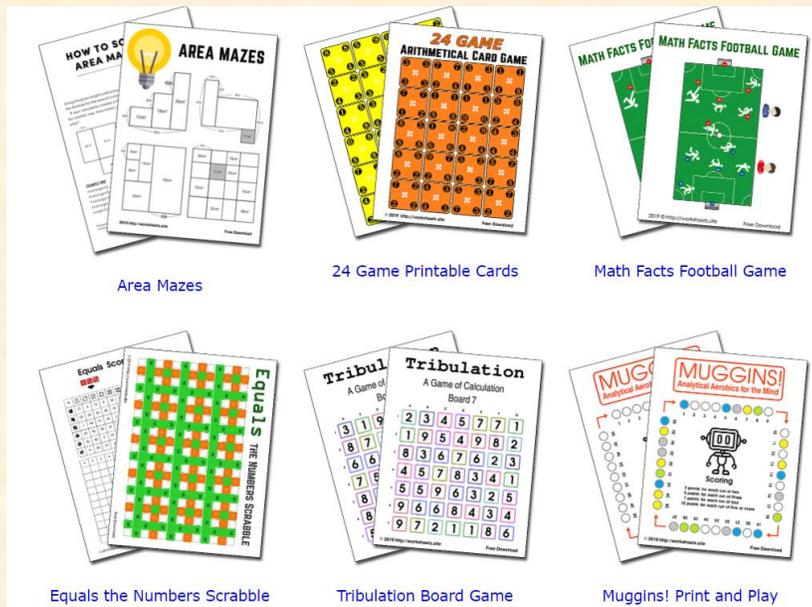
Great stuff

Looking for sources of games and activities to support math centres? Check out

<https://worksheets.site/> . I

cringe that this thing is called "worksheets"! That isn't what is cool about this site. There are lots of **games** here, from elementary to high school. Some activities make great enrichment, like exploring numbers in different bases, which is great for extending an understanding of place value, or Mayan number system to extend representing numbers.

More games: <https://iennialaib.wordpress.com/2019/05/28/the-simple-but-high-leverage-game-collection/>



Games
24 Game Printable Cards
99 Card Game
Avengers Dominoes
Destination Zero
Doubles Practice Game
Equals the Numbers Scrabble
Factor Captor Plus
Factors Color Board
Math Facts Football Game
Fractions Bingo
Fractions Dominoes
Free Print and Play Christmas Game
The Printable Game of the Goose
Math Games
Middleman Pen and Paper Money Handling Game
Printable Playing Card Sheets PDF
Muggins! Print and Play
Printable Multiplication Bingo Cards
Paper Color Dice
Parcheesi Rules
Printable Blokus
Printable Chess

Robert Kaplinski's "Open Middle" activities make naturally differentiated number tasks. There are many entry points, so students working on lower grade outcomes can participate, and students that are excelling can extend their thinking. These types of number activities work well in combined grade classrooms

AND include French resources.

<https://www.openmiddle.com/>

Directions: Using the digits 0-9 only once each, create as many true equations as possible.

$$\square \square = \square \square$$

0 1 2 3 4 5 6 7 8 9

Our STMS president, Chad Williams, has a great website, <https://www.beyondthealgorithm.ca/> This site is loaded with cool stuff, like information and links for parents, games that are well explained (Chad even includes videos to show you how to play them!), number sense routines, three-act tasks, and more. Watch the STMS site for PD events presented by Chad. They're always great, practical, and offer his first hand experience and sometimes photos and footage from his classroom.



Would you Rather math: These class starter/discussion prompts ask students to reason mathematically and justify their answer, using common or quirky real life examples. <https://www.wouldyourathermath.com/>

Work as a server at Restaurant A
OR
Work as a server at Restaurant B?

Restaurant A	Restaurant B
<p>\$18 per hour No tipping allowed</p> <p>(meals range from \$8 to \$25 each)</p>	<p>\$10.50 per hour Tipping encouraged</p> <p>(meals range from \$8 to \$25 each)</p>

You and two friends decide to each order a pizza for lunch.

Would You Rather...

Option A

Order your 3 pizzas on separate checks?

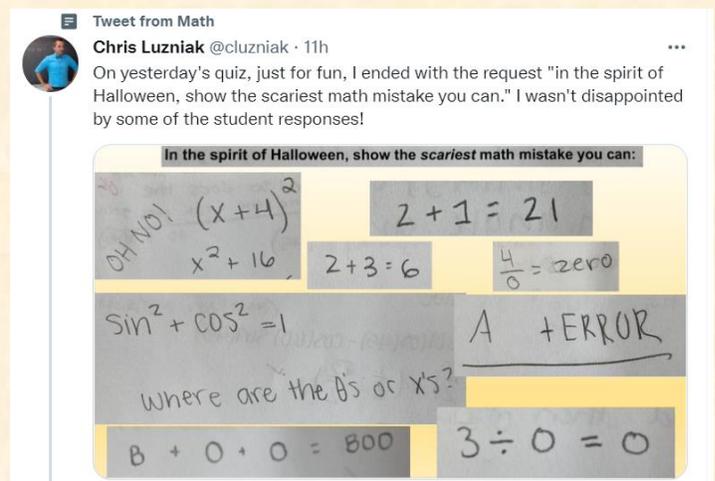
Option B

Order your 3 pizzas on the same check and split the cost?

h/t @MrsJennCarr
Photo Cred: @nannotwo

Cool stuff for secondary classrooms—check out Jo Morgan’s website. I can’t believe all the resources on here...from generating debates about misconceptions, games, challenges, visuals, and great ideas for creative math and enrichment. <https://www.resourceaholic.com/p/maths-gem.html>

The game Garbage Math, <https://youtu.be/l3vfCsRXDM>, a game for k-8 is on Dr. David Costello’s site. He has other games, and is the author of the book “Using What Works”. His web site is costellomath.com, and on uses #makingmathstick on Twitter.





Mathshko has interesting tasks, puzzles, and challenges for upper middle years and **high school**
<https://mathshko.com/>

If you haven't checked out Mathigon/Polypad yet, it's time to take a look! This interactive software for math is developing very quickly—there's new stuff all the time and people are loving it! Even the front page of the site is 3D cool. <https://mathigon.org/>

Be sure to take the virtual tour to see all the possibilities! Mathigon describes itself as a virtual math playground and "Text Book of the Future". Really it's got a bit of everything, including virtual manipulatives, math illustrations, interactives, and activities. Here's a 1.5 minute intro to "Polypad", the interactive manipulatives feature. <https://youtu.be/jZp4G-8EHhE>. This powerful tool can be used to demonstrate on SMARTboard/Viewboard, to teach virtually, or you can even assign tasks. The video demonstrations of nets, translations, rotations, 3D solids, number patterns, geometry relationships etc. are amazing! Check it out!

The Mathematical Playground
 Online learning has never been so interactive and engaging!
 ▶ Watch Overview

Are monsters good at math?

$\frac{18}{6} \sqrt{108}$ π \neq $2 + 2 = 4$ $E=mc^2$
 $\frac{3}{5}$

Not unless you *Count Dracula*.

<p>Polypad</p> <p>The ultimate collection of virtual manipulatives: polygons, number and algebra tiles, fraction bars, Tangram, pentominoes, and much more.</p> <p>New Polypad Tasks</p>	<p>Timeline of Mathematics</p> <p>Travel through time and explore the greatest mathematicians and biggest mathematical discoveries in history.</p> <p>Open</p>	<p>Factris</p> <p>A classic risk reward high score game, that teaches about factors and basic numeracy while rearranging rectangular blocks to fill a grid.</p> <p>Play</p>
<p>Multiplication by Heart</p> <p>These beautiful flash cards use spaced repetition to teach multiplication facts. Achieve fluency with just five minutes of practice per day!</p> <p>Play Shuffle Mode</p>	<p>Problems and Puzzles</p> <p>A selection of our favourite mathematical puzzles and problems. Most are simple to understand, but the solutions require clever and unconventional thinking.</p> <p>Open</p>	<p>Almanac of Interesting Numbers</p> <p>Scroll along the number line, and explore hundreds of interesting curious properties and facts. Then zoom in and out to discover even more!</p> <p>Open</p>
<p>Mathematical Origami</p> <p>Explore the beautiful world of Origami and mathematics. Be amazed by stunning photographs, try our folding instructions, or learn about the mathematical background.</p> <p>Open</p>	<p>Exploding Dots</p> <p>This is an astounding mathematical story developed for Global Math Week. Join millions of students and teachers in learning about place value, infinity and p-adic numbers.</p> <p>Open</p>	<p>Tangram Builder</p> <p>There are countless different shapes that can be created using the seven simple Tangram tiles. What can you come up with?</p> <p>Open</p>

Rich and Safe Math Environment: Tackling Math Anxiety

A prerequisite to students learning math is a safe environment, where kids feel they can take risks, speak out loud, share their ideas and reasoning, feel comfortable with their level of ability, and view mistakes as learning opportunities. Even though we *think* our classrooms operate like this, research shows the fear of mathematics is alive and well, and many students suffer through math classes with significant anxiety. Chris Hogbin puts it this way: **“For many students, mathematics is more than just a chore. It’s a source of gut-wrenching stress and constant dread that’s to be avoided at all costs. That’s**

because *mathematics anxiety* is a legitimate condition. It has long-term consequences for learning, and it doesn’t disappear with age”. Conversations with parents sometimes reveal the truth in this statement, as they harbor a fear of math left over from their school days. This can manifest as a distrust of curriculum, a dislike or even hatred of mathematics, and communication of a “fixed mindset”—giving their children a false message that some people are just not good at math. Classroom teachers continually battle this mindset that comes into the classroom with our students. We hear it at student-led conferences, we hear the message repeated by our students who tell us their “no good” or even “dumb at” math, and we hear it repeated in society.

While elementary children tend to enjoy and engage in mathematics as they learn counting, quantity, and number representations, as we move through middle years some children withdraw and disengage, and by high school some are so disengaged they drop math, or have extreme emotional reactions in math class. There is a legitimate fear and even shame associated with difficulty in math.

Professor Daniel Ansari, Canada Research Chair in Developmental Cognitive Neuroscience, noted that 60% of Grade 8 students worry about struggling in mathematics, and 30% of students are anxious when completing math homework. A study in Ontario by the Education Quality and Accountability Office noted that the problem is worse for female students, and the difference between males’ and females’ self perception regarding math ability increases in older grades. Brain research has shown that math anxiety is not just a social problem. It also affects brain function, using up the brain’s working memory, and making it even more difficult for anxious students to think and learn.

How can teachers create an environment that helps student overcome the stigma of mathematics, and feel comfortable in our classrooms?

“Brain scans in highly math-anxious kids also revealed that parts in the brain involved in mathematical processing, dorsolateral prefrontal cortex and intraparietal—were less active”

Ramirez et al. *Journal of Cognition and Development*



SEVEN WAYS TO AVOID FEEDING THE MATH ANXIETY MONSTER

1. **Stop timing tests—even “mad minutes”!** Jo Boaler says that it’s critical to address the ways in which the timing of tests and tasks “transforms children’s brains, leading to an inevitable path of math anxiety and low math achievement”. We need to reinforce for students that *speed does not equal greater math ability*, and some students who take longer think more deeply about the problem. Some of the best mathematicians in the world are not speedy processors!
2. While we work towards fluency, we need to de-emphasize memorization, and discuss understanding and flexibility as important. **Fluency ≠ memorization!** PISA results in 2012 found that the school systems with poorest performance were ones that emphasized memorization. (This does not mean we don’t practice, and it does not mean we don’t work toward fluency.)
3. Use a “game” approach when you can and when it’s feasible. There are many, many educators who have collected quality, **meaningful games** that reinforce skills. (See “Cool Stuff, above)
4. Practice and model a **growth mindset**, embracing mistakes as necessary for learning to happen. Focus on *learning*, and de-emphasize *grades*. Capitalize on mistakes as teaching points and thank students for pointing out a misconception as a learning opportunity. Reassure students that understanding happens at different points in time, and all people have unique brains and unique ways of thinking and learning. Just because you don’t get it “today” doesn’t mean you never will! Highlight for students how much they *have* grown.
5. Interestingly, research shows that **mixed-ability groups** help students more than like-ability grouping. Struggling students benefit from learning about the thinking of higher-level ability students, and those higher ability students think about math more deeply by helping their peers.
6. Communicate to **parents** the impact that their communication about math -positive or negative- has on their children.
7. Reading **math stories to preschool** children was shown to improve their confidence and readiness to learn math in school. Lots of sites with ideas: <https://bedtimemath.org/>, <https://www.education.com/stories/math/>

Boaler, J. (2015). Mathematical mindsets. Jossey Bass Wiley.

<https://globalnews.ca/news/3909083/anxiety-in-ontario-students-teachers-parents/>

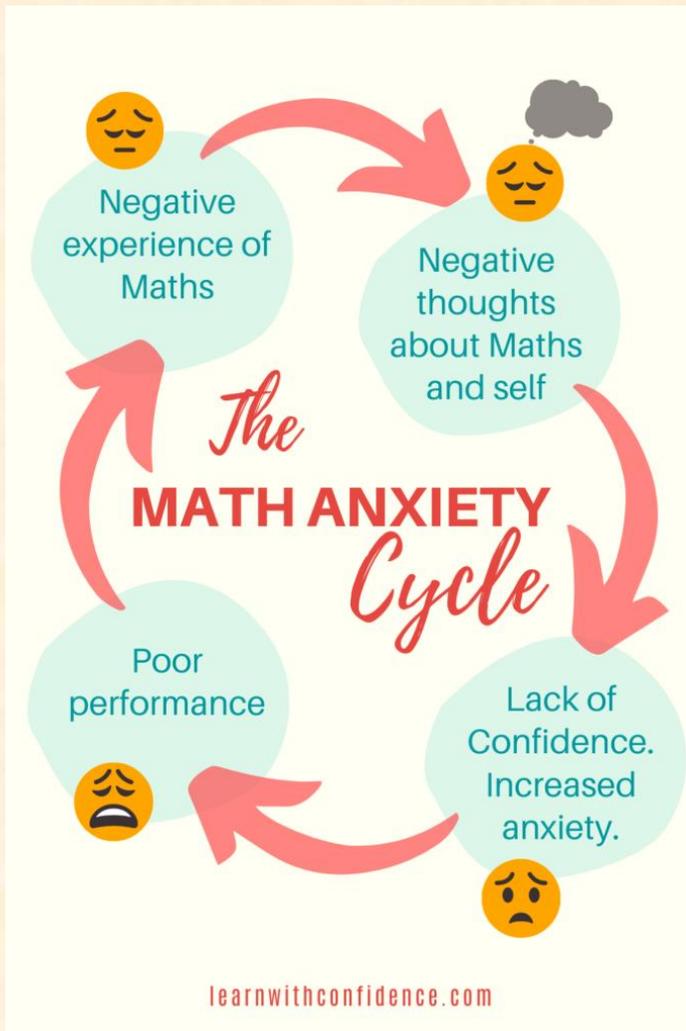
<https://www.edu.uwo.ca/news-events/2020/math-anxiety.html>

<https://www.prodigygame.com/main-en/blog/math-anxiety/>

See SaskMath: Establishing a Rich and Safe Math Environment

<https://saskmath.ca/establishing-a-mathematically-rich-and-safe-environment/>





Let's move math out of the classroom into the wider school community! Some teachers are hanging challenges in hallways, or on bulletin boards outside their classrooms to let kids and staff on break stop and think about math.

Challenges can be easy or difficult, as long as they are rich. Here's one teacher's task--

<https://mathequalslove.net/simple-sums-puzzle/>

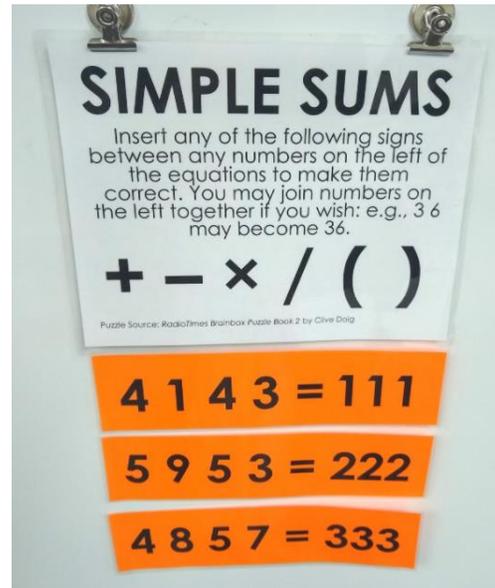


Image from <https://learnwithconfidence.com/help-your-child-overcome-math-anxiety/>

Did you know? On our Sask Curriculum site there are Sample Outcome Assessments. These are newer, deeper, and richer than the Sask Common Math Assessments.

Also added this year are Parent Pamphlets! These are designed to help parents understand the math their children are learning.

Want to chat more about Math in your Classroom? Call Me! Cindy Smith 306-783-8787 306-621-2248

PreK & K Grade 1 Grade 2 Grade 3 Grade 4 Grade 5 Grade 6 Grade 7 Grade 8 Grade 9 Levels 10, 20, 30

Search for Resources

Mathematics 8

Curriculum Document	Outcomes & Indicators	Resources
PDF The full Mathematics 8 curriculum, available in a print-friendly PDF format. Also includes the complete list of outcomes and indicators.	Online Format CSV Treaty Education Outcomes & Indicators	All Resources for This Curriculum Core and Additional resources and Other Useful Materials recommended for Mathematics 8. Assessment Resources Sample Math Outcome Questions : An Assessment Resource for teachers Parent Supports Building Math Success : Parent Pamphlets

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Saskatchewan

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<https://christtheteacher.ca/ctt/cttcsmathhub/>