World Class Mathematics for Parents:
"What is it and what does it mean for my child?"

Leader's Guide

GOALS

This tool offers detailed support for a meeting to introduce parents, including "concerned parents", to the mathematics that is taught in high-performing countries, and described in the Common Core State Standards in Mathematics and related State Standards. It may also be useful with other stakeholders: employers, school boards, and school and district administrators.

In some areas the term "Common Core" has become politically toxic. It can fairly be replaced by "standards in high-performing countries", on which the Common Core is based. To make this easier we have used the word "Standards" in most of the slides and handouts

When more time is available, there are two associated extension activities that enable groups to look in more depth into two genres that are fundamental in learning mathematics:

- The connections between percents, decimal and fractions
- Multiple representations: stories, graphs and tables of numbers.

USERS

Mathematics leadership in schools and districts.

INTRODUCTION

In introducing any innovation it is important to have the support of all the groups of stakeholders who are affected. In education, parents are a key constituency to keep well informed. The broader, more robust international standards, set out in the Common Core, represent a vision for mathematics that some parents will find strange and worrying. The session is designed to give parents:

- a "feel" for learning math in the classroom, as described in the Standards
- an idea of how and why it differs from traditional "school math" , and
- the ways it advances the overall aims of education.

To this end, the session is activity-based, with parents being asked to participate and "get a feeling" for the students' experience, and how it differs from their memory of "school math".

The activities are designed to address both the content and the "Mathematical Practices" outlined in the Standards in a way that assuages parental concerns, while ensuring that:

- Parents are not made to feel inadequate (many may be insecure in their own mathematics),
- The Standards are recognized as more challenging than traditional math (It's *not* "fuzzy math"), but in a way that parents come to see is useful, interesting and achievable.

To this end the activities are selected to feature accessible problem solving experiences, while the core on concepts and skills is structured to avoid parents' public exposure.

SESSION OUTLINE

- Introduction (10 minutes)
- Tackling a problem: Airplane turn-round (15 minutes)
- Seeking parents' priorities (5 minutes)
- Concepts in the Standards for Mathematics (5 minutes)
    - Interpreting multiple representations: A graphs task (15 minutes)
    - Analyzing and testing generalizations (10 minutes)
- Concepts and Skills support Problem Solving (5 minutes)
- Summary (5 minutes)
- Questions (10 or more minutes)

MATERIALS REQUIRED

- This Users Guide, supported by the PowerPoint: 'Parents Meeting slides.pptx'
- Session Handouts: 1 copy per participant.

TIME NEEDED

This session, as described, should take about 90 minutes. It is important not to hurry the discussions. It can be shortened, for example by just talking through one of the concept activities but at a price – in participants' understanding and enjoyment.

PREPARATION

The workshop leader should carefully work through this Guide, referring to the Handouts. For the core Activity Sequence (below) it covers the same material as on the PowerPoint slides, including the notes below each slide.

Try to anticipate the common issues that participants will have and write down your responses to them prior to the meeting. The ones shown below are examples taken from trials. Some frequently asked questions (and some answers) about the Standards may be found here: http://www.corestandards.org/about-the-standards/frequently-asked-questions/#faq-2318

Common concern	**Suggested responses**
Will spending time on problem solving mean my child gets lower scores in state tests?	The new tests will assess both the mathematical content standards and the Mathematical Practices, which focus on reasoning and problem solving – so spending time on problem solving, reasoning and such is essential. Even with the old narrow tests, the large body of research shows that a more in-depth curriculum in the style of the Standards gives at least as good scores on narrow state tests – and much higher scores on tests that assess mathematics including problem solving and reasoning

I learned math just by practicing my skills. What's wrong with that?	The Standards are not saying that students don't practice skills and that these activities are to be eliminated in a curriculum and set of instructional materials that are aligned to the Standards. For this meeting, we haven't focused or shown examples of such activities because it is familiar to everyone. Practice alone works in the short term for some students but to retain skills we now know from research that one needs to understand why the rules and procedures work and working on understanding is usually the starting point when learning new content.
With this new math and new ways students are to do problems, I don't know how to help my child. When I try to show them how I would do it they say they can't do it that way.	This is an opportunity to emphasize the local initiatives going on in the district. Common strategies to help parents help their child include: --Grade level parent nights, --Chapter/unit newsletters that explain to parent how students are going to be introduced to a new topic and what they can do to help --Building/District websites that share information about leaning certain mathematics topics and strategies for how parents can help. Other suggestions include: --Ask your child to explain a problem s/he has been doing in. Ask him/her how they think they might start to solve it and try to pick up on their lead. --Contact your child's teacher and ask for suggestions on how you can help.

The suggestions for the activity sequence that follow are specific and detailed[1] in an effort to help users understand more deeply how the designers envisioned the materials being used, and the rational for why certain information and activities were incorporated.

On the left of each slide in this Guide are:

Notes to the session leader in italics

Comments the leader may choose to use in normal text

Users will, of course, adapt as necessary – though we recommend sticking with this activity sequence the first time or two. (Trials having shown it works well for others like them.)

[1] People are often uneasy about giving such detailed "instructions", feeling it is demeaning to fellow professionals. Feedback from trials has shown this feeling in unfounded; the general reaction of users is to ask for *more* detail.

ACTIVITY SEQUENCE

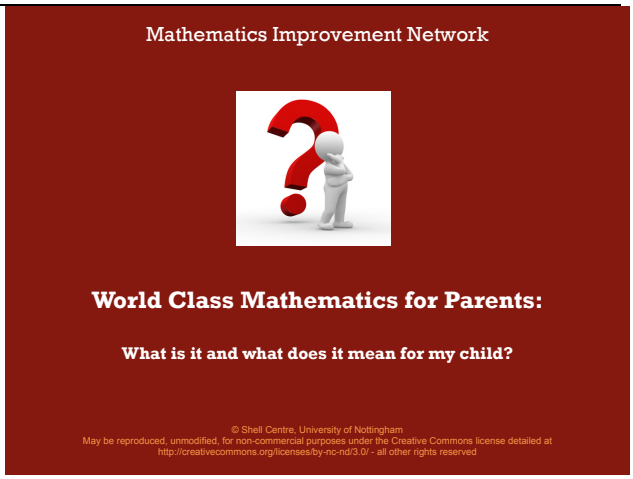
Title slide
(Revised version: Summer 2016)

You may like to customize this slide and/or the last one with your own institutional and contact details. Please leave the copyright attribution, however.

Possible comments below are in plain text. *Suggestions are in italics.*

Users will, of course, adapt as necessary – though we recommend sticking with this activity sequence the first time or two.

The purpose and goals for this session are to provide more information on the district's mathematics program and your child's learning experiences in math classrooms. I am sure there are questions you have in mind. We'll try to answer some of them in the next hour or so, with a Q&A at the end.

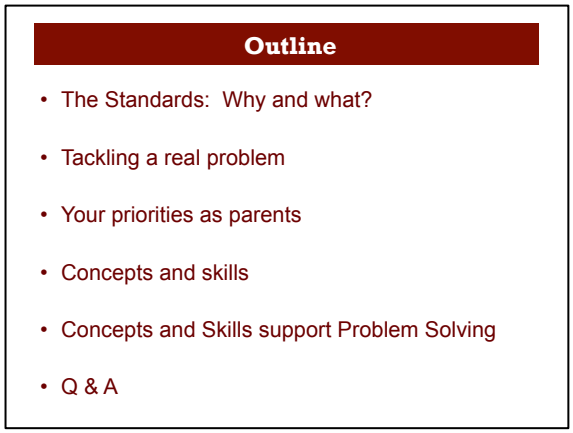


Slide 2

Move fairly quickly through Slides 1 to 7

This is how the workshop should go

Read the slide



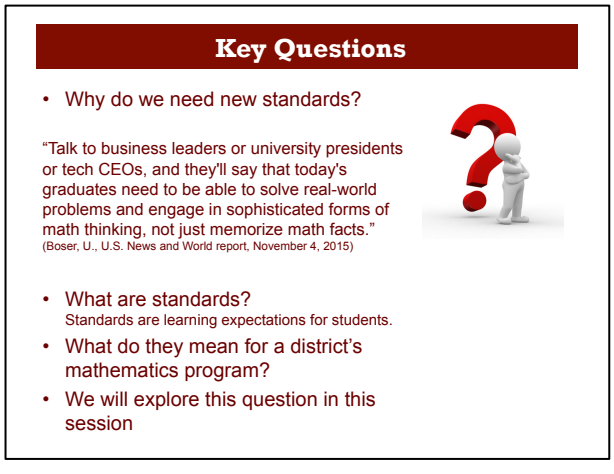
Slide 3

1. Introduction
(10 minutes)

Our aim in this session is to give you a picture of the State Standards for Mathematics, what they mean in terms of learning, and the important knowledge and skills your children will develop.

From some of the things you have heard, you may be surprised to know that, in the new Standards, students still learn the basic skills and concepts, such as arithmetic and algebra!
2 + 2 still makes 4!

But they also learn something more – how to think with mathematics.



Optional slide

First a word about the history.

The need for new, higher Standards grew from various things

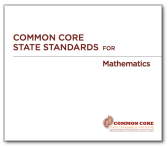
Read the slide

What we know from research and from employers is that people need to learn to be able to use their math - to construct chains of reasoning from a problem situation through to a solution.

Slide 4

Why have new Standards?

- Concern with:
  - disparate standards across states
  - student mobility
  - global competition
  - today's jobs require different skills



- Governors and state superintendents pushed for the development of **common core standards** for grades K-12 in ELA and Mathematics
- Gates Foundation supported the development, involving wide consultation. They were released in 2010.

Slide 5

This article from U.S. News and World report summarises the need for new standards in a sentence

Read the slide

Now let's look at the Standards in a bit more detail

Why have new Standards?

"Talk to business leaders or university presidents or tech CEOs, and they'll say that

today's graduates need to be able to

- solve real-world problems and
- engage in sophisticated forms of math thinking,

not just memorize math facts."

Boser, U., U.S. News and World report, November 4, 2015

Slide 6

There are the Mathematics Contents Standards

These form the bulk of the Standards document and describe the concepts and skills that should be taught.

Much of what is here could be found in past individual state standards.

Mathematics Content Standards

Main focus:

- Students in K-5 develop a solid foundation in basic conceptual understandings and procedures (with a heavy focus on number and computation)
- In the middle grades, students build on this foundation through hands on learning in geometry, algebra, probability and statistics (with an focus on proportionality)
- High school students study advanced mathematics and apply mathematical ways of thinking to real world challenges (emphasizing mathematical modeling)

The Mathematical Practices are the main new feature of the standards. **Handout 1,** for reading later, expands on what they mean.

They describe what really doing mathematics involves – so they have always been there, implicitly, but have often been neglected.

The practices clarify the depth of understanding that students need to have. They emphasize that understanding a mathematical topic means students can use the concept to **make sense, reason, construct arguments, and solve non-routine problems.**

Slide 7

Mathematical Practice Standards

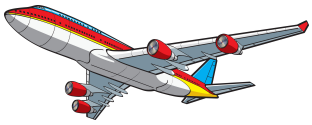
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Tackling a problem
(15 minutes starting at ~10 minutes)

Let's look at an example of a task that represents the broader goals of the Standards for your student's classroom experiences.

It's the problem in **Handout 2,** about the process of turning an airplane round efficiently between flights.

Slide 8



Tackling a real problem

.

Point to the table and read the bullet points

This problem relates to everyday life. Math can help solve it yet it involves more than just simple arithmetic.

Maybe you can guess what many students do? You're right –they just add the numbers. That's what one used to do in "school math" when given a bunch of numbers. As long as the computation was correct, all was fine. Who's worried about it having a sensible meaning?

Well the Standards are concerned about meaning!

Slide 9

Airplane Turn-round

- Between landing and taking off, the following jobs need to be done.
- How much time is needed to get all of the jobs done?

	Job	Time needed
A	Get passengers out of the cabin and off the plane	10 minutes
B	Clean the cabin	20 minutes
C	Refuel the plane	40 minutes
D	Unload the baggage from the cargo hold	25 minutes
E	Get new passengers on the plane	25 minutes
F	Load the baggage into the cargo hold	35 minutes
G	Do a final safety check before lift-off	5 minutes

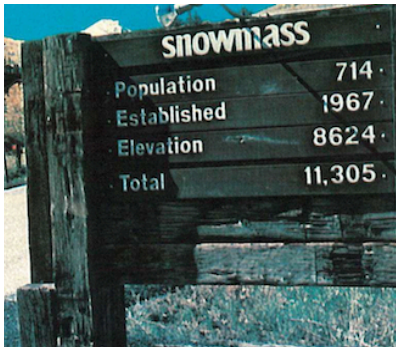
This photo, from a postcard, makes the point again nicely.

Pause for reading - and, perhaps, laughter

What does the Total mean? Absolutely nothing.
It's adding a number to a date to a height

Back to our problem.

Slide 10



In solving real problems the context of the problem is important.

If students start by just adding up the numbers, the teacher will need to get a discussion going, asking "Can you find a way to do it in a shorter time?" Please take a closer look and try and think of ways to shorten the time. Talk with your neighbor about how **you** might approach solving it.

Allow time (5-10 minutes) for discussion in pairs, circulate, then bring everyone together to discuss. Ask specific people an open question:

Is there a group here who would like to share how your group worked out a shorter time?

If they give a number, ask: Tell us how you got that? How about another group? What did you get?

So taking the context seriously pushes students to think about different ways to approach and represent the problem, and to compare alternative solutions.

Of course, they still have to add up correctly.

D+F+G is the longest sequence: 65 mins. Passenger changeover A+B+E+G is quicker: 60 mins. Refuelling can go at the same time.

Slide 11

Airplane Turn-round

- Between landing and taking off, the following jobs need to be done.
- How much time is needed to get all of the jobs done?

	Job	Time needed
A	Get passengers out of the cabin and off the plane	10 minutes
B	Clean the cabin	20 minutes
C	Refuel the plane	40 minutes
D	Unload the baggage from the cargo hold	25 minutes
E	Get new passengers on the plane	25 minutes
F	Load the baggage into the cargo hold	35 minutes
G	Do a final safety check before lift-off	5 minutes

It is the "shorter time" question that brings in a wider range of skills than one finds on a traditional 'adding' worksheet.

What students are doing here are the "mathematical practices". Notice that all those in red are important in what you have just done.

In addition to mathematics skills and procedures, students doing this task would engage in reasoning, modeling, sharing and supporting their ideas, constructing arguments and critiquing the reasoning of others.

[***Option***: *if the group is really engaged with the problem*

To further these practices, a classroom lesson would not end at this point. Instead, other questions might be posed, such as "If the airline wants to speed up turnaround, where are the bottlenecks? Where should they put more resources in to speed up the whole process?"

Allow a few minutes for pairs to discuss this - Put more resources into baggage turnaround.]

When curriculum and teachers increase the demand of a task in this way, it changes "regular" exercises into what some educators call "Expert Tasks". That is, substantial tasks in a form they might arise in the real world - or indeed within mathematics.

Slide 12

Mathematical Practices Standards

- Make sense of complex problems and persevere in solving them.
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning.

The point the last set of slides was making is nicely summarized in this slide - from a draft of the Standards.

Read this slide.

Discuss with your neighbor:

What things on this list align with what you want your student to be able to do?

Which of them were part of the math you got at school?

Slide 13

Doing Math - Overview

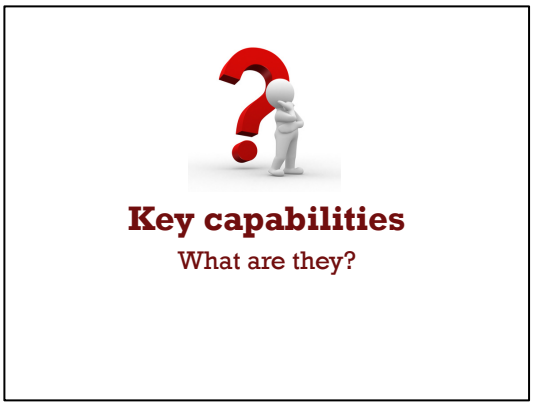
- Proficient students expect mathematics to make sense.
- They take an active stance in solving mathematical problems.
- When faced with a non-routine problem, they have the courage to plunge in and try something, and
- They have the procedural and conceptual tools to carry through.
- They are experimenters and inventors, and can adapt known strategies to new problems.
- They think strategically

(From a draft of CCSSM)

Seeking parents' priorities
(5 minutes starting at ~25 minutes)

Now let's look from a different viewpoint, broader than just math.

Slide 14



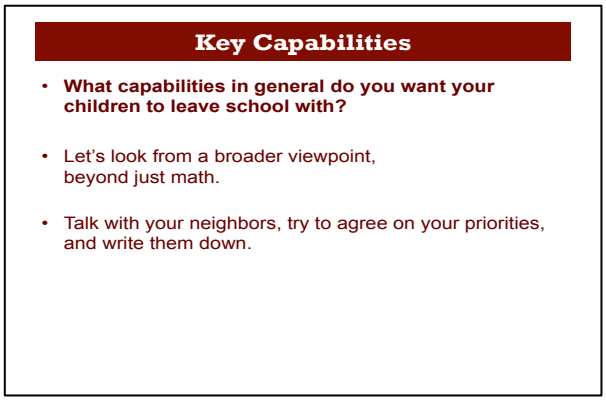
What capabilities in general do you want your children to leave school with?

Talk with you neighbors, try to agree on your priorities, and write them down.

Use **Handout 3.**

When the groups look to have finished, collect their top priorities from various groups.

Slide 15

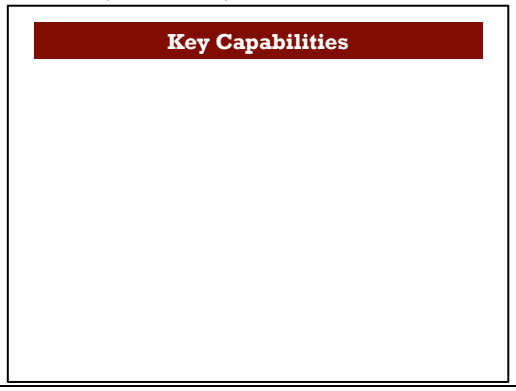


***Optional**: Escape from "slideshow" and list the responses on Slide 16 - or use a flipchart. Otherwise just collect and discuss their priorities. With most groups, the top priorities will be capabilities like:*

- *Co-operative, works well with others*
- *Self-confidence*
- *Tackles challenges sensibly*

It is rare for math skills to be near the top of the list. If that is what emerges, point it out.

Slide 16 (blank slide)

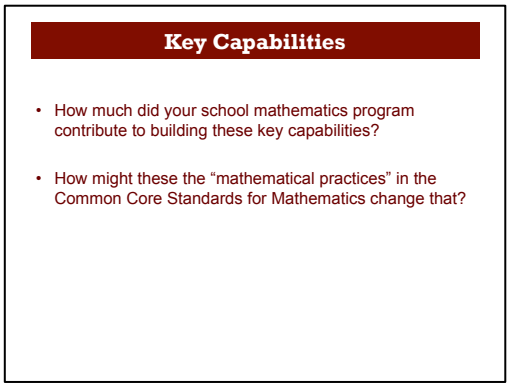


How much did your school math contribute to building these capabilities?

Probably not much!

Improving on this is a key goal of the Standards.

Slide 17



Read the slide

So what does this mean for your district's math program?

- **Coherence.** A program of curriculum, instruction and assessment that is **focused, logical, with a clearly articulated set of concepts** that develop over time in which understanding the ideas is central to knowing the mathematics. (*CCSS*, 2010; *PSSM*, 2000)
- **Balance.** A program where both conceptual understanding and procedural fluency are developed and the development of both are closely linked to the practices involved in "doing mathematics, notably constructing and critiquing reasoning and solving non-routine problems.

Slide 18

What do the Standards mean for a District's Program?

- Implementing the Standards for Mathematics has meant
  - Moving some curriculum
  - Broadening and refocusing instruction
  - A greater focus on content coherence
- It has also meant
  - Daily involvement by students with the practices
  - Assessments that assess concepts, procedures, reasoning and problem solving

Concepts in the Math Standards
(5 minutes starting at 30 minutes)

We've looked at an example of a student task aligned with the Standards and that engages students in problem solving. Now we want to engage you in an experience that involves developing students' concepts and skills.

The tasks that follow not only represent the learning expectations of the Standards but also research on effective teaching and learning.

Slide 19

Concepts and Skills

support each other

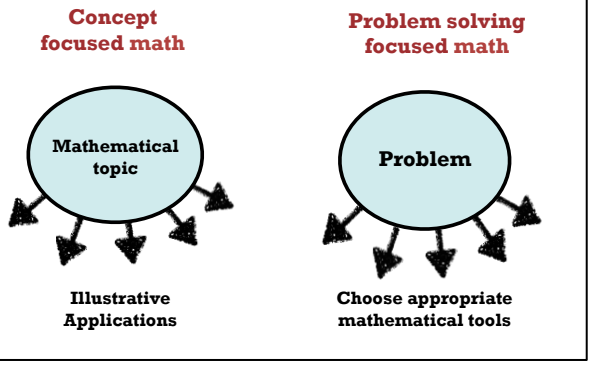
There are two different kinds of mathematical activity that children need to be involved in when studying mathematics.

Concept and Skill focused: Building a mathematical toolkit consisting of computational math skills and understanding of math concepts

Problem-solving focused: Learning to use your mathematical toolkit

Students need both.

Slide 20



In developing students understanding of mathematical concepts, it is important that they engage in a variety of **genres** – types of learning activity.

Read the genres

Just as in Language Arts it is important that students read and study multiple genres - narratives, arguments, poems etc - so is it in mathematics.

Multiple math genres contribute to students' understanding of mathematical ideas. We only have time to look briefly at two. The first involves graphs, but takes it to a different and more rigorous level then some of you might remember or have experienced.

Slide 21

Tasks for Concept Development and Reinforcement

- Classifying, naming and defining objects
- Interpreting multiple representations
  - what is another way of showing this?
- Analyzing and testing generalizations
- Exploring structure and connections

Interpreting multiple representations: A Graphs task

(15 minutes starting at 35 minutes)

Graphs play a big role in presenting information about the world. They are a powerful mathematical representation with all kinds of uses. It is important to understand what story a graph tells. Let's take a look at a lesson that is designed to help students understand graphs.

Think a moment about what this graph represents. Notice the axes are **time** and **distance from home**.

What do you think Jane might be doing?

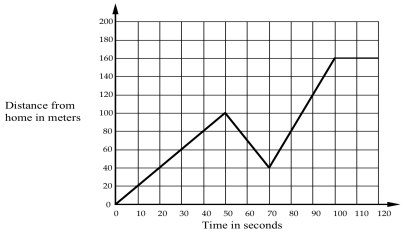
Read the text slowly. Be sensitive to those who may misinterpret the graph.

Students often confuse graphs with pictures. In the beginning of studying graphs it is not uncommon for students to say things like: "Jane goes uphill, then downhill, then uphill again".
Or they say: Jane speeds up, slows down, then speeds up again" thinking that the graph is about speed instead of distance. It takes time, discussions and multiple experiences to help students understand what 'story' graphs like this are telling.

Slide 22

Multiple representations: Distance-time graphs

Every morning Jane walks along a straight road to a bus stop 160 meters from her home, where she catches a bus to college.
The graph shows her journey on one particular day. Describe what may have happened. Is the graph realistic? Why?



A reasonable story?

"Jane leaves home, walking to the bus stop. After about a minute, she sees her friend behind her and walks back to meet her. They then realize they might miss the bus so run together and reach the stop with time to spare."

*(*or *realises she has dropped something)*

Numbers optional in a story like that.
Faster speed on the third steeper part of the graph is important

To help students develop the depth of understanding of graphs, in the full lesson students are then given ten graphs and verbal descriptions to match.

Handout 5. has just three of them.

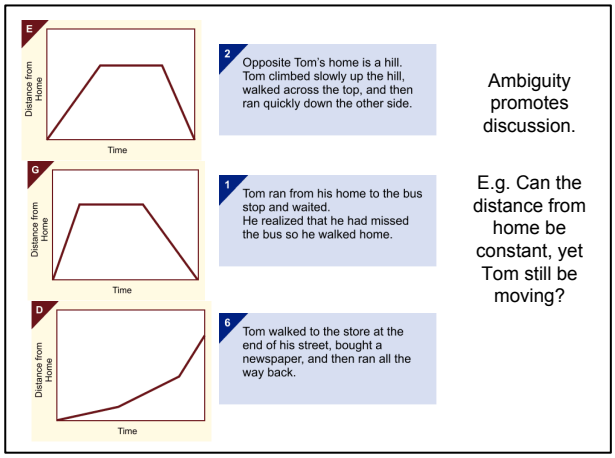
Talk with your neighbors to work out how to match each of these graphs to one of the stories.

Give participants time to discuss this in pairs.

Ask but don't expect an answer; instead talk about how this is done to make students think about the graph representation and what it means.

Notice that horizontal lines do not always mean that he's stopped. Why not?

Slide 23



This activity is more challenging mathematically. Judge whether the group are confident enough to tackle it. Otherwise just read below and move on.

After students have matched graphs and stories, they are given tables, containing data for each situation, to match up, as in **Handout 6.**

You need to match all three: Graph to word, words to table, table to graph.

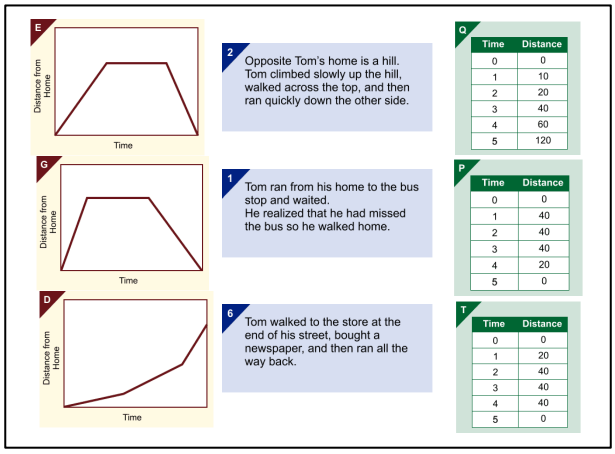
- How does the table show running? Walking?
- How does the graph show this?

Tables provoke a different way of seeing things – a different representation.

Teachers notice how adding the tables pushes students' thinking and that they often see students changing matches for the graphs and stories because of the tables.

This task exemplifies the genre "Interpreting Multiple Representations". It addresses conceptual understanding and procedural fluency, as well as reasoning and making connections within mathematics.

Slide 24



Optional break out

If you have time and a group that wants more engagement with the mathematics, use one or both of the following MIN tools:

- *Parents meeting: Graphs extension*
- *Parents meeting: Percents extension*

These are exceptionally rich, and normally engaging, learning activities. Each takes at least 40 minutes

Broadening and deepening the mathematics curriculum by including tasks like that just presented, is what knowing and learning mathematics is about. And, although this may seem like a new idea, this broader vision of mathematics has been articulated by leading educators for some time.

This quote underlines the difference between learning facts and procedures and learning for understanding.

It is rather like the difference between using a GPS and using a map.

The Standards are about learning for understanding, which develops facts and procedures.

Slide 25

Building connections is crucial

- "Knowledge, learning, understanding are not linear. They are not little bits of facts lined up in rows or piled up one on top of the other. A field of knowledge (such as mathematics) is a territory, and knowing it is not just a matter of knowing all the items in the territory, but of knowing how they relate to, compare with, and fit in with each other.
- It is the difference between knowing the names of all the streets in a city and being able to get from any place, by any desired route, to any other place."

"How Children Fail" John Holt Pelican Books 1984

Analyzing and testing generalizations
(10 minutes after ~50 minutes)

We'll now look at one more genre of activity:

"Analyzing and testing generalizations"

Slide 26

Tasks for Concept Development and Reinforcement

- Classifying, naming and defining objects
- Interpreting multiple representations
- Analyzing and testing generalizations
  - "always, sometimes or never true?"
- Exploring structure and connections

These tasks involve students evaluating a set of mathematical statements and deciding if and when they are true (or not). Tasks of this nature deepen students understanding of mathematical concepts.

The statements used are ones often made by students. Here's an example.

Read the statement slowly

What do you think?

Is it always, sometimes or never true?

If it is sometimes true, can you say when it is true?

Slide 27

Always, Sometimes or Never true?

When you cut a piece off a shape you reduce its area and perimeter.

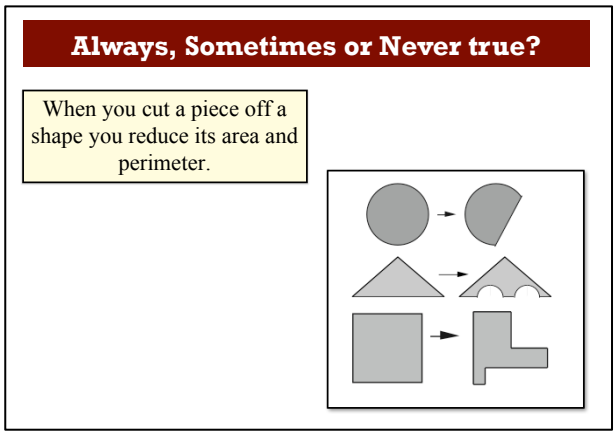
Working with this genre can be challenging for students. Sometimes, when students are struggling to make sense of such statements, a task may offer students a few examples to consider, to push their ideas and thinking of the statement and the mathematics. **Handout 7** gives some more examples you might like to think about later.

Note the set of drawings that accompany this statement.

How do the drawings help you think about the task and the mathematics? Did you change your answer after looking at the drawings? Why?

Ask - but it is not needed that you have participants answer these questions in a whole group discussion. You may suggest they talk to somewhat near them about how the drawings affected their thinking.

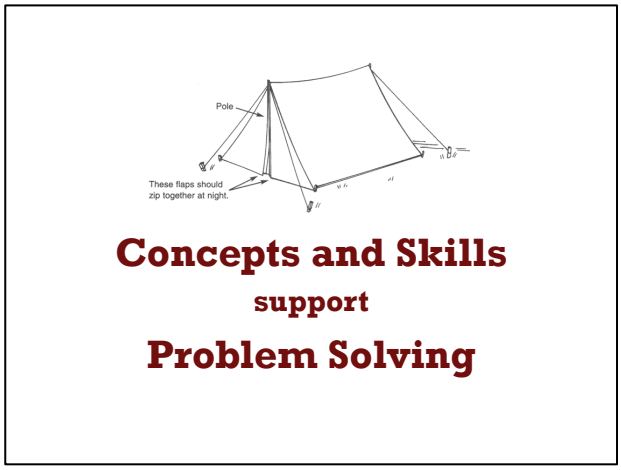
Slide 28



Concepts and skills support problem solving (5 minutes after 60 minutes)

Let's see how concepts and skills support problem solving in another example.

Slide 29



The Standards mean we need to include real-world problems that involve students in making *decisions* about the mathematics they use.

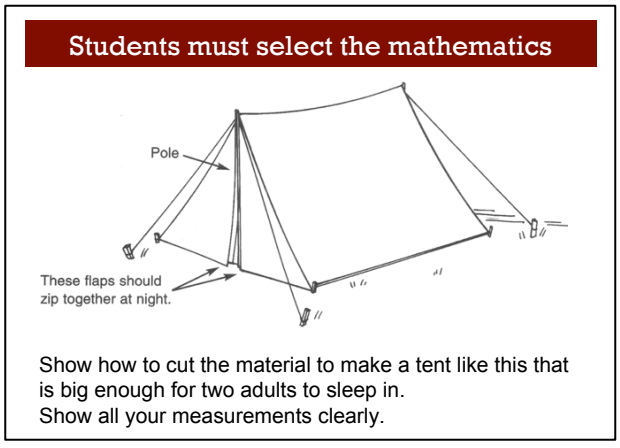
We usually call these modeling problems. They are often poorly defined, just like most real world problems are, and require the student to make assumptions.

Here is just one example. *(Read the task on the slide.)*

Students need to estimate the size of an adult, then sketch the shape of the material for the tent. They must then estimate and calculate measurements so they can cut the material.

Lets look at one student's solution:

Slide 30



Notice this student's assumptions, that:

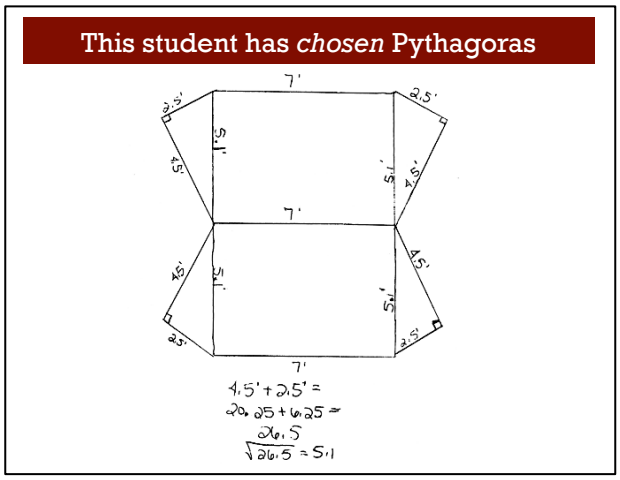
- 4.5 feet high enough for the tent,
- 5 feet is wide enough
- 7 feet is long enough.

She has then had to visualize the shape of the material for cutting. This is quite difficult!

The student has also chosen to use the Pythagorean theorem to calculate the slanted edge of the tent. (5.1 feet). This is a measurement needed for cutting it.

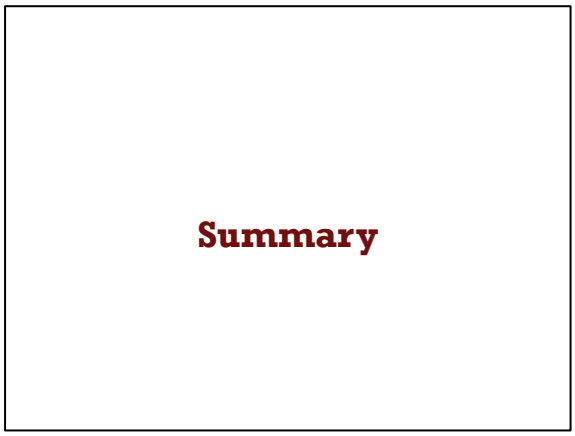
In most math lessons students are **told** the math to use. It is rare to see them choosing it! But this is what is needed if they are to use math powerfully to tackle problems in the real world.

Slide 31



Summary (5 minutes after 65 minutes)

Slide 32

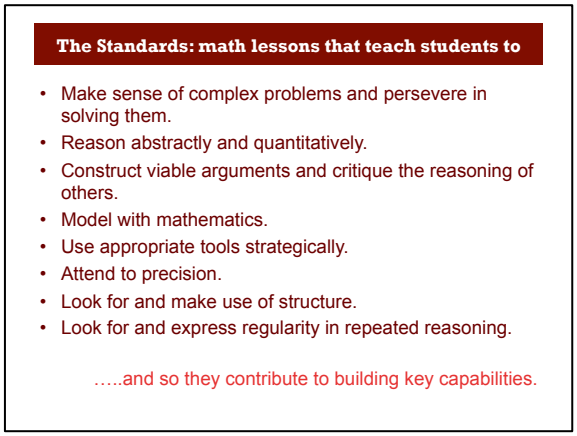


This slide summarizes the objectives of the Standards.

We have tried to illustrate most of these points in this workshop.

Of course, there is more.

Slide 33



Good instruction practices are, of course, critical to implementation of the Standards.

Good teaching depends on knowing where your students are and responding appropriately.

In math classrooms, teachers should encourage students to discuss their ideas - as you have been doing. This may involve:

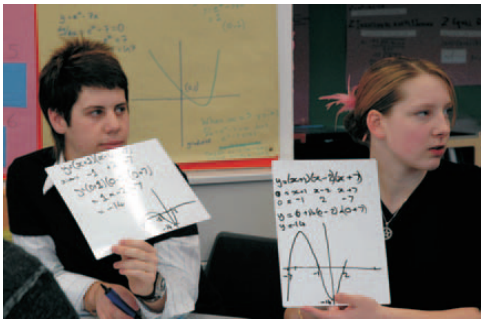
• students recording their ideas on mini-whiteboards for sharing with each other and the teacher, who can quickly see where students are in their thinking

• students work together to produce posters that display their reasoning. Then the teacher can walk around the room, listen and take note of student thinking, without interrupting student discussions.

Research shows us that by articulating their ideas openly, in words, pictures, and symbols students develop a much better understanding of mathematics.

Slide 34

Improving the flow of information



Time for Questions

(10 or more minutes after 65 minutes)

Allow plenty of time for this.

Now is the chance to use the responses you have prepared.

Slide 35

Now for your Questions

Thank you

Customize the final slide with your own contact details.

Slide 36

Mathematics Improvement Network

Thank you

<your contact email>

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