

Mathematics Improvement Network



World Class Mathematics for Parents:

What is it and what does it mean for my child?

Outline

- Standards: Why and what?
- Tackling a real problem
- Your priorities as parents
- Concepts and skills
- Concepts and Skills support Problem Solving
- Q & A

Key Questions

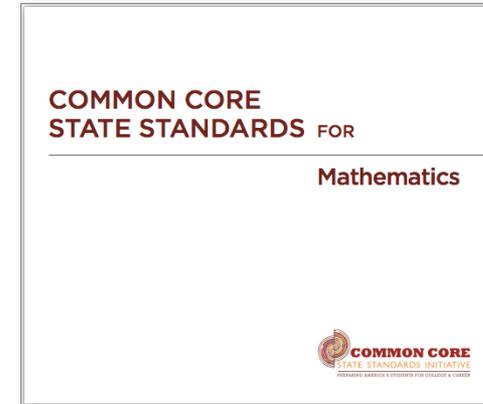
- What are standards?
Standards are learning expectations for students.
- Why do we need new standards?
- What do they mean for a district's mathematics program?

We will explore these questions in this session



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.

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.”

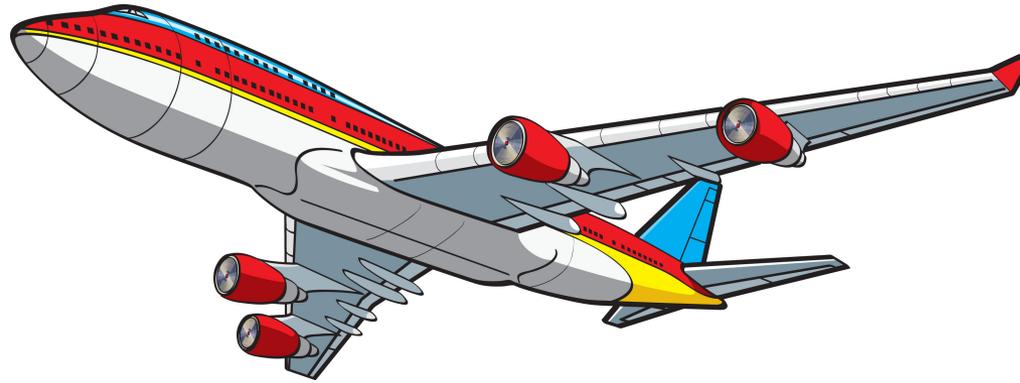
Mathematics Content Standards

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)

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 real problem

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



SNOWMASS

Population	714
Established	1967
Elevation	8624
Total	11,305

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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.

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)



Key capabilities

What are they?

Key Capabilities

- **What capabilities in general do you want your children to leave school with?**
- Let's look from a broader viewpoint, beyond just math.
- Talk with your neighbors, try to agree on your priorities, and write them down.

Key Capabilities

Key Capabilities

- How much did your school mathematics program contribute to building these key capabilities?
- How might these the “mathematical practices” in the Common Core Standards for Mathematics change that?

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

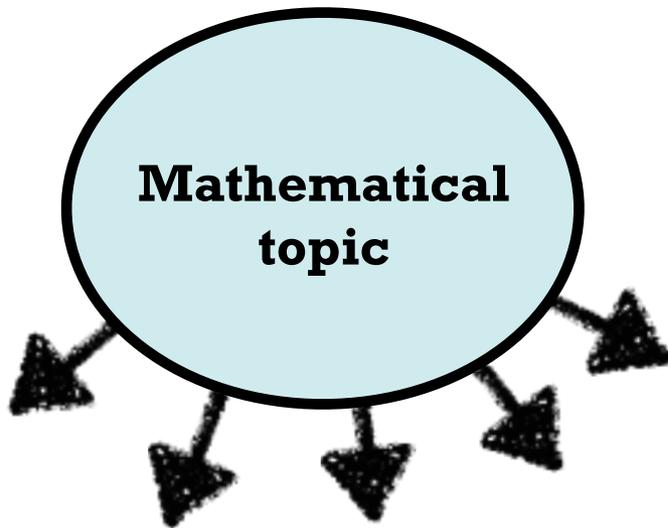
- Implementing the Standards for Mathematics has meant
 - Moving some curriculum
 - Broadening and refocusing instruction
 - A greater focus on content coherence
- It has also meant
 - Daily involvement by students with the practices
 - Assessments that assess concepts, procedures, reasoning and problem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



Concepts and Skills

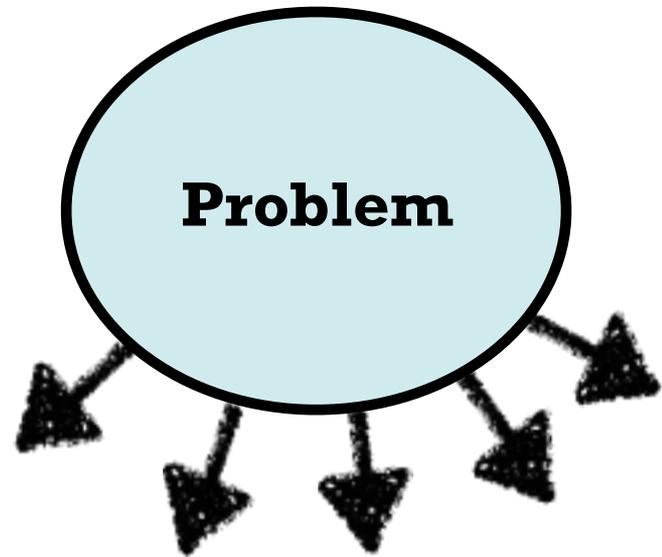
support each other

**Concept
focused math**



**Illustrative
Applications**

**Problem solving
focused math**



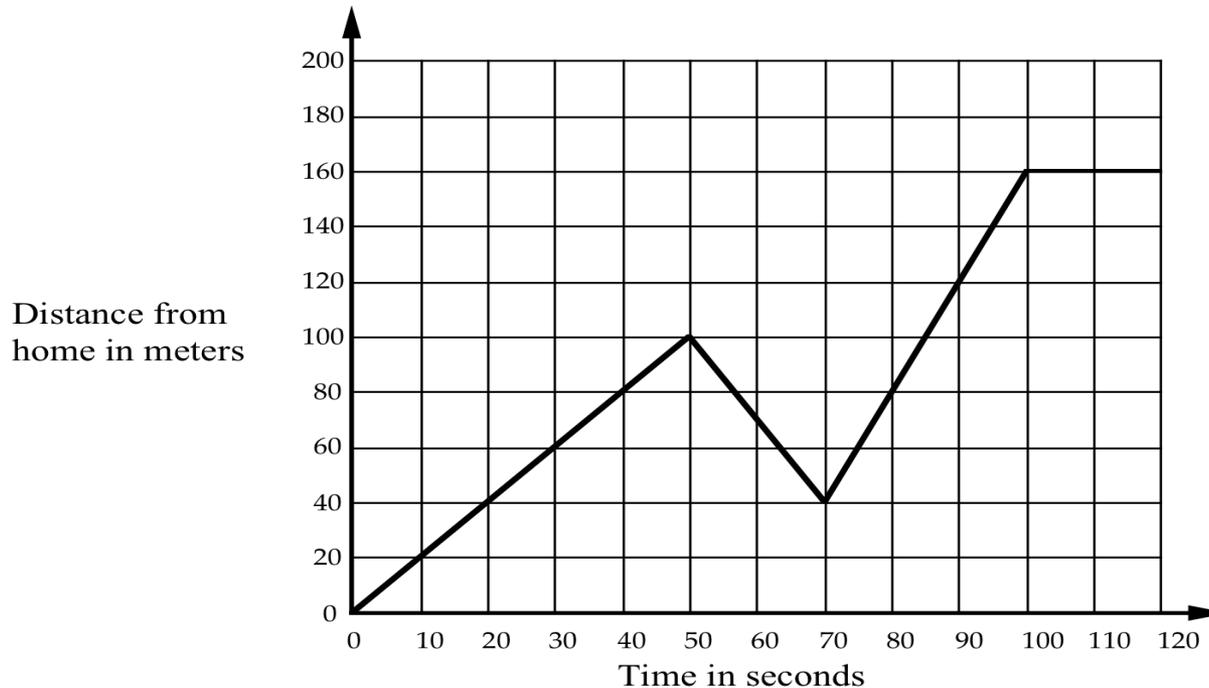
**Choose appropriate
mathematical tools**

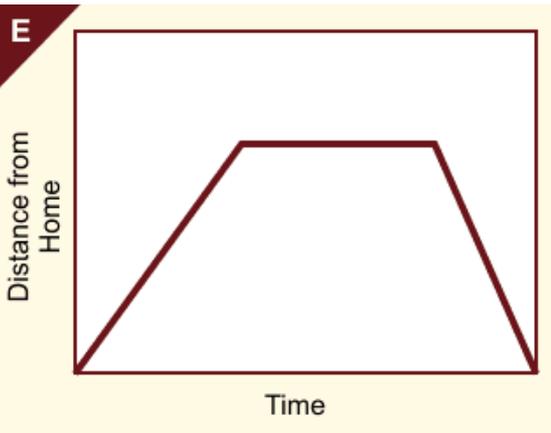
Tasks for Concept Development and Reinforcement

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

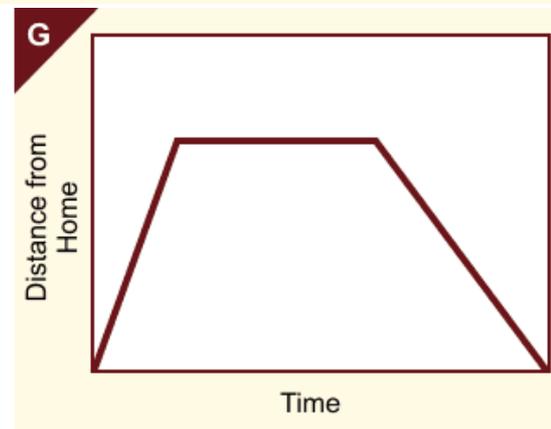
Multiple representations: Distance-time graphs

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?

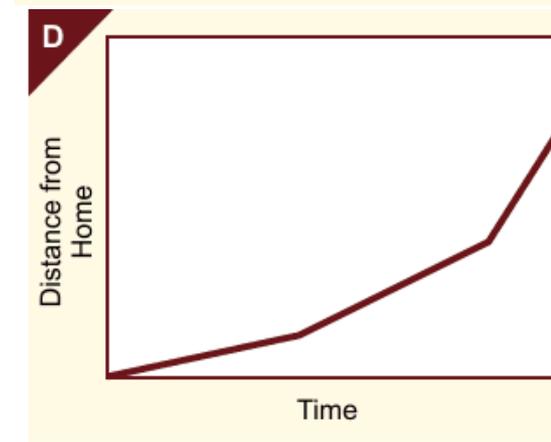




2 Opposite Tom's home is a hill. Tom climbed slowly up the hill, walked across the top, and then ran quickly down the other side.



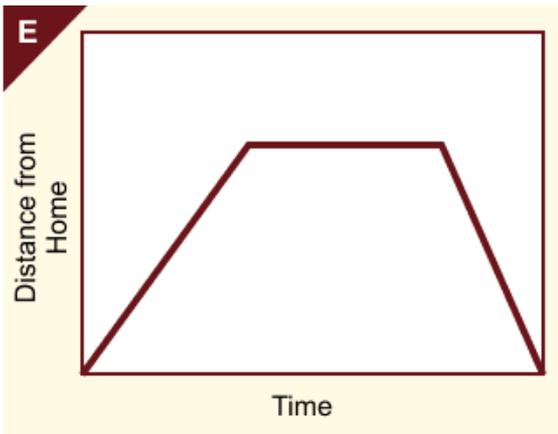
1 Tom ran from his home to the bus stop and waited. He realized that he had missed the bus so he walked home.



6 Tom walked to the store at the end of his street, bought a newspaper, and then ran all the way back.

Ambiguity promotes discussion.

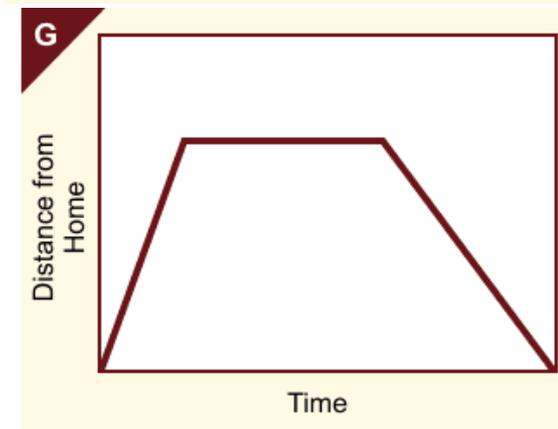
E.g. Can the distance from home be constant, yet Tom still be moving?



2 Opposite Tom's home is a hill. Tom climbed slowly up the hill, walked across the top, and then ran quickly down the other side.

Q

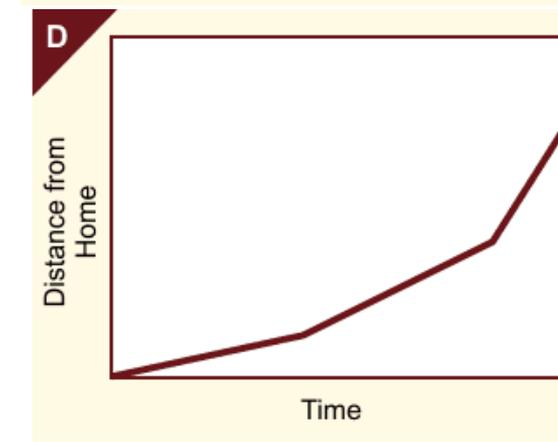
Time	Distance
0	0
1	10
2	20
3	40
4	60
5	120



1 Tom ran from his home to the bus stop and waited. He realized that he had missed the bus so he walked home.

P

Time	Distance
0	0
1	40
2	40
3	40
4	20
5	0



6 Tom walked to the store at the end of his street, bought a newspaper, and then ran all the way back.

T

Time	Distance
0	0
1	20
2	40
3	40
4	40
5	0

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

Tasks for Concept Development and Reinforcement

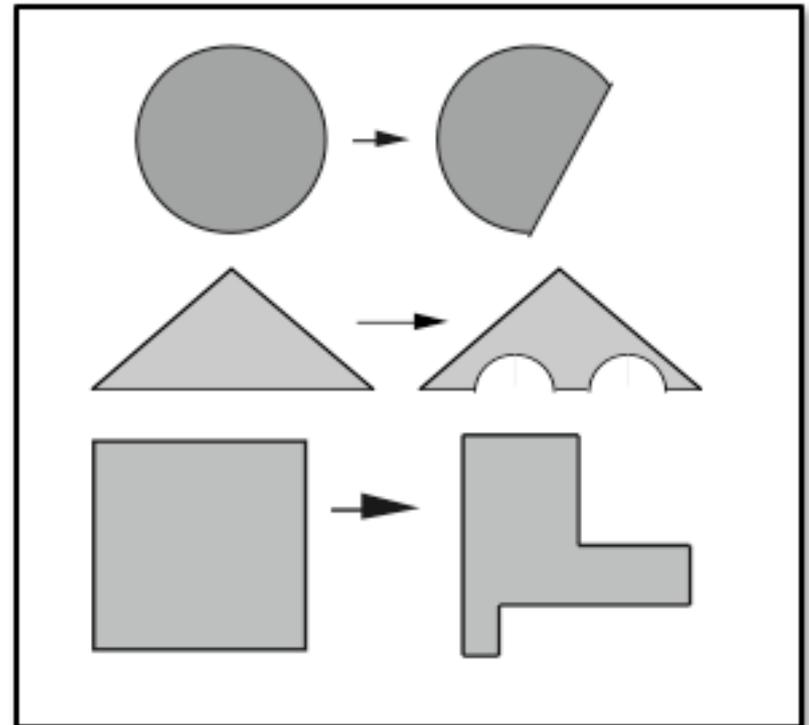
- Classifying, naming and defining objects
- Interpreting multiple representations
- Analyzing and testing generalizations
 - “always, sometimes or never true?”
- Exploring structure and connections

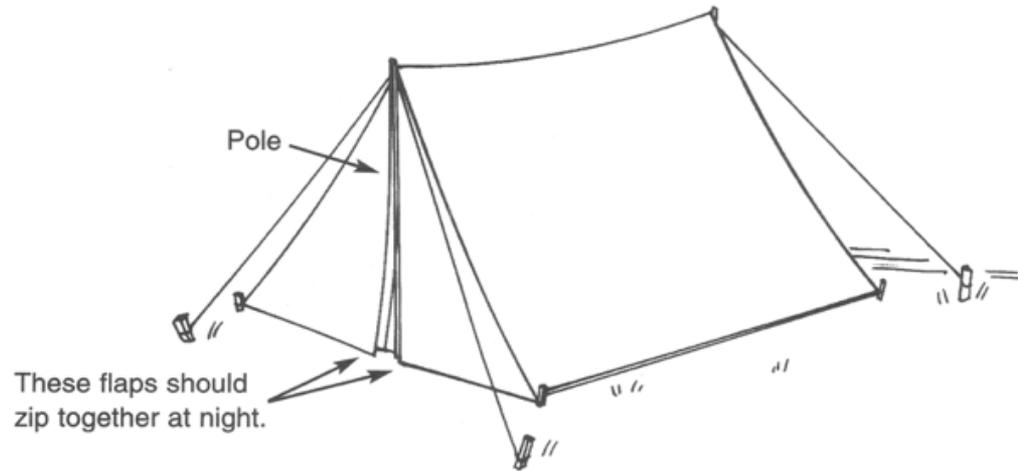
Always, Sometimes or Never true?

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

Always, Sometimes or Never true?

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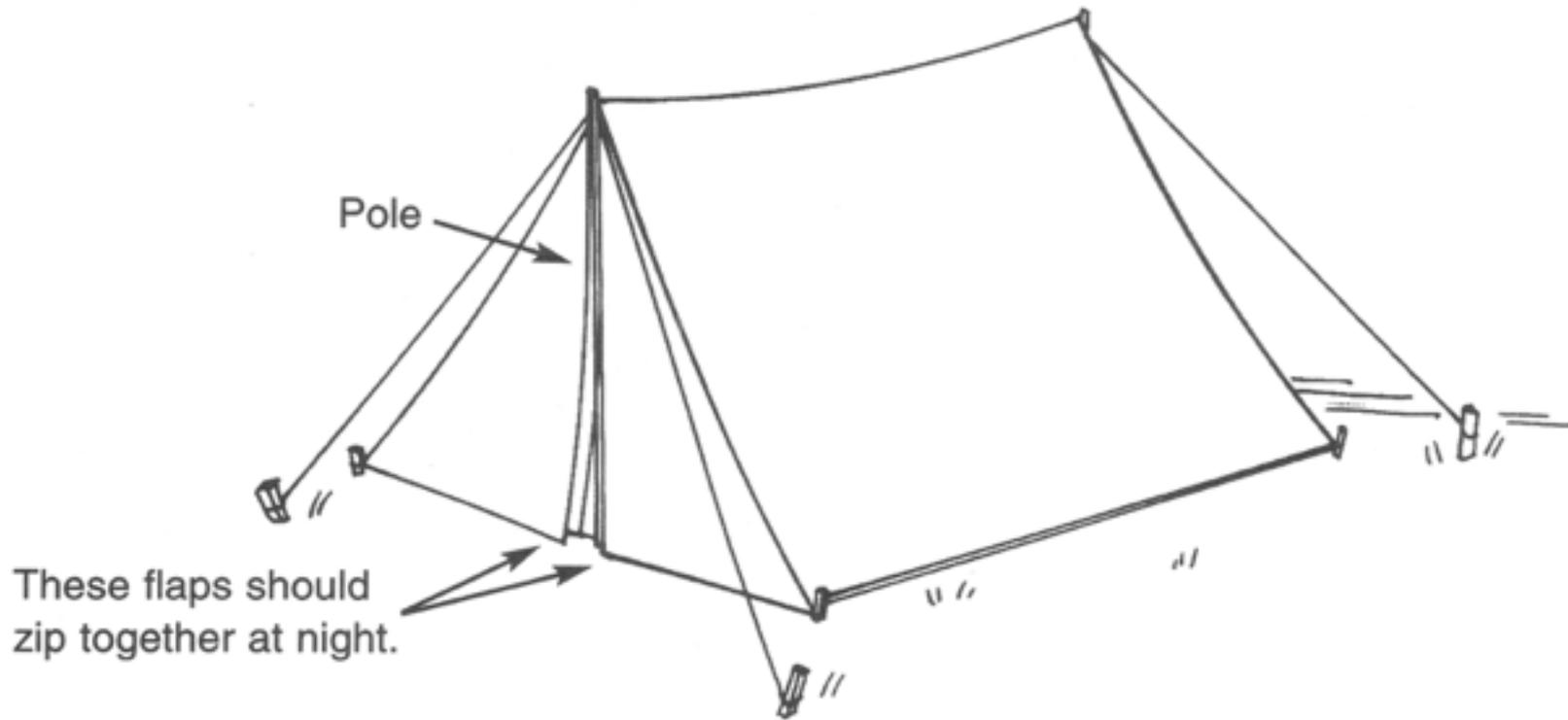


Concepts and Skills

support

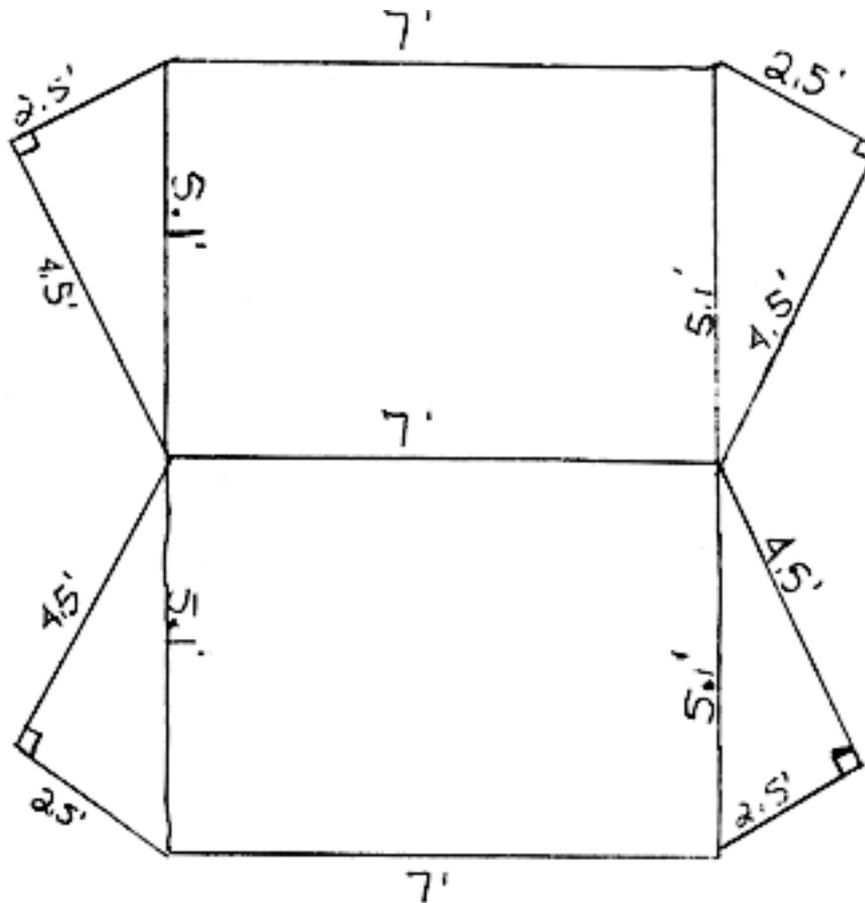
Problem Solving

Students must select the mathematics



Show how to cut the material to make a tent like this that is big enough for two adults to sleep in.
Show all your measurements clearly.

This student has *chosen* Pythagoras



$$\begin{aligned} 4.5' + 2.5' &= \\ 20.25 + 6.25 &= \\ 26.5 & \\ \sqrt{26.5} &= 5.1 \end{aligned}$$

Summary

The Standards: math lessons that teach students to

- 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.

.....and so they contribute to building key capabilities

Improving the flow of information





**Now for your
Questions**

Mathematics Improvement Network

Thank you

<your contact email>