STANDARDS FOR MATHEMATICAL PRACTICE

part of the Common Core State Standards for Grades K-12

HABITS TO DEVELOP
CRITICAL ***THINKERS*** &
CONFIDENT ***PROBLEM-SOLVERS***

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"The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students."

http://www.corestandards.org/Math/Practice/

The information contained in this booklet and the accompanying workshops will increase your knowledge and confidence about the kinds of habits, thinking processes, and skills your child will need to be successful in math. You will see the connection between these 8 Math Practices and the kinds of habits and skills your child will need as an adult, whether they are thriving at a university or pursuing excellence in a career.

The learning process is a bumpy one, often unpaved, and filled with challenge. Knowing this, possessing the right ATTITUDE can increase our willingness to strive forward with passion, even after a setback. It is our shared hope that our children persevere and overcome any challenge set before them.

The Standards for Mathematical Practice and the Common Core Content Standards for Mathematics, together, make up the California Common Core State Standards for Mathematics (CCSS-M). These standards, practices, and a positive math attitude will prepare students for success in college and careers.

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Encourage a Positive Math Attitude

You are your children's first teacher and their best cheerleader. To combat any math negativity in your home, be aware of your own math attitude. Getting help from books, friends, relatives, and the Internet are ways we **PERSEVERE**.

Say:

- "I know you are struggling now, but I believe that your hard work will pay off."
- "I can see that this is challenging, but I think you're getting it."
- "I know you tried your best because _____." (eg., I saw you reviewing your class notes all week)
- "I am so proud of the way you _____." (eg., have been focused on finishing your homework right after school)
- "Remember how this used to be so challenging for you? Now you're a pro!"
- _____

Do:

- Tell a short motivational story about your own experience that illustrates how perseverance pays off.
- Offer to work WITH your children, but do not do the work FOR them.
- Brainstorm who your children might get help from—a homework buddy from class, www.khanacademy.com, or a textbook.
- Model healthy strategies for coping with stress—take a short break, deep breaths, or do 10 jumping-jacks.
- Teach your child the benefits of being well-prepared—taking good notes, writing down assignments and important dates, having good attendance, studying a little each day, and keeping schoolwork organized.
- _____

Sources:

1 From "The Journey Through Middle School Math" by Karen Mayfield-Ingram with Alma Ramirez. From the EQUALS program at the Lawrence Hall of Science, at the University of California, Berkeley. ©2005 The Regents of the University of California.
2 From "Parent Involvement and Awareness: Helping at Home with Mathematics Homework" by Paul Giganti Jr., CMC Math Festival Program
3 From "Tips for Families – Homework Help", http://www.nctm.org/resources/content.aspx?id=2876
4 From "Suggestions for Homework Help", http://connectedmath.msu.edu/parents/tips.shtml

Make sense of problems and PERSEVERE in solving them.

I will **determine** the **MEANING** of this problem and **WHY** I am being asked to **solve** it.

I will RECOGNIZE and ANALYZE the given information.

I --- will --- plan --- my --- solution --- pathway---.

I will make CONNECTIONS between this problem and others like it.

I will **CHANGE** my **strategy** if I am stuck.

I will **APPLY** known methods & **TRY** new ones.

I will CHECK my answer using a DIFFERENT method.

I will PERSEVERE!

CCSS.MP1

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MP1 – Make sense of problems and PERSEVERE in solving them.

Questions you can ask during homework time to encourage MP1

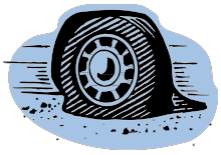
- What do you know about this math problem right now? [1] What do the symbols and/or the vocabulary mean?
- What steps did you take to solve this problem? [1]
- Can we work through one of the problems that you *did* understand? [1]

Other questions:

- _____
- _____

Ways you can connect everyday experiences to MP1

- Unexpected life circumstances: As adults, the kinds of challenges we face require that we attempt to make sense of a difficult life situation (job/career changes, moving to a new home, car repairs, etc.) and then persevere through it. Consider sharing with your child how you make major decisions in difficult situations. What are the factors you consider? How do you solve problems when overwhelmed?



- School/Career Training: If you have decided to go back to school or to learn a new skill, there is a good chance that you have experienced having to make sense of assignments, study for exams, and re-prioritize your habits for success. Talk to your child about how you persevered.

Other Suggestions:

- _____

REASON

abstractly & quantitatively.

I will **p a u s e**,

when necessary, to reflect on the **REASONABLENESS** of my work.

I will represent problems that I read and see in different ways—including **numerically** & **symbolically**.

I will carefully consider which UNITS are involved in the problem and which UNITS to use in my solution.

I will **t h i n k flexibly** about *properties* of a d d i t i o n, subtraction, multiplication, & division.

I will take problems using **numbers** and **symbols** and apply real-life meaning to them.

I will **REASON** abstractly.

I will **REASON** quantitatively.

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CCSS.MP2

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MP 2 – REASON abstractly and quantitatively.

Questions you can ask during homework time to encourage MP2

- Explain how you worked this problem out. [1]
- Explain the steps or the strategy you used to solve the problem.[2]
- Explain how you arrived at this solution in another way.[4]

Other questions:

- _____
- _____
- _____
- _____

Ways you can connect everyday experiences to MP2

- Planning an event: A lot of work goes into planning a party or similar event. Thinking abstractly, you envision how you want your guests to feel when they come to your party. Then, thinking quantitatively, you make a list and assign a dollar amount for each item you will purchase to establish the best environment for the party. How does thinking in these two ways help you to plan the party in a more complete way? Talk to your child about the benefits of reasoning abstractly and quantitatively.

Other Suggestions:

- _____

_____

CONSTRUCT

viable arguments and

CRITIQUE

the reasoning of others.

I will make:

a) conjectures
b) estimations
c) speculations
d) all of the above

I will use what I have ALREADY LEARNED about mathematics when I CONSTRUCT mathematical arguments.

I will ask useful questions to clarify or help others.

I will reason based on my observations about data.

I will compare two plausible arguments and CHOOSE the MOST EFFECTIVE.

I will improve their arguments.

I will analyze situations by breaking them into cases.

I will justify my conclusions and communicate them to others.

I will CONSTRUCT and CRITIQUE arguments!

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CCSS.MP3

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MP 3 – CONSTRUCT viable arguments and CRITIQUE the reasoning of others.

Questions you can ask during homework time to encourage MP3

- Is there anything you forgot to do when you solved this problem? [1]
- Convince me that your strategy for solving a problem makes sense. Explain why another strategy is not the best way to solve the problem.[2]
- How do you know that your answers are correct? [1]

Other questions:

- _____
- _____
- _____

Ways you can connect everyday experiences to MP3

- Comparison shopping: The next time you find yourself having to choose between two dental offices, types of phones, or brands of laundry soap, consider asking your child to give their opinions on the decision. Ask them to provide reasons for their preference based on facts.

- Reading a story/watching a movie: When you are reading to your child or watching a movie together, ask her questions like, “Do you think the character is making a good decision?”, “Which choice should they make and why?” and, “Why do you think that character is wrong?”

Other Suggestions:

- _____

MODEL

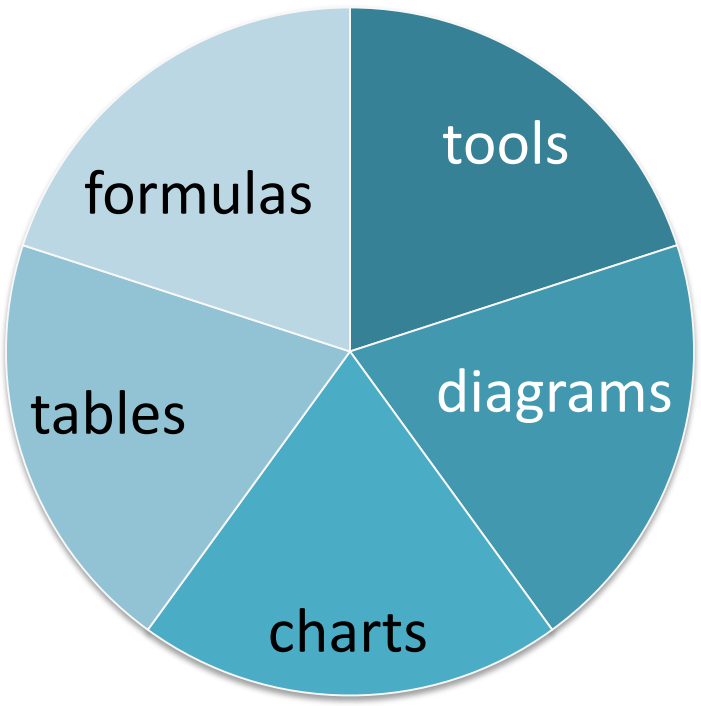
with mathematics.

I will make assumptions & approximations to **SIMPLIFY** a complicated situation.

I will **REGULARLY** check that my results **MAKE SENSE** in the context of the problem.

I will **APPLY** math I have learned to everyday life.

I will use



to show the relationships between two quantities.

I will reflect

on the method of modeling *I chose* and make adjustments if necessary.

I will **MODEL** with math!

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MP 4 – MODEL with mathematics.

Questions you can ask during homework time to encourage MP4

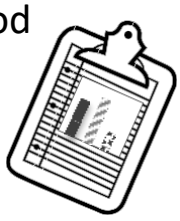
- How can you organize information to solve this math problem? Will a list or table help?[2]
- What picture might you draw to show this math problem in a different way?
- Why does your answer make sense?[1] Show me using a diagram or drawing.

Other questions:

- _____
- _____
- _____
- _____

Ways you can connect everyday experiences to MP4

- Displaying information: A chart, table, or graph is a more visually-interesting way to communicate. Consider asking your child to make a chart for household chores, listing each family members' names, his or her duties, and the days of the week chores are assigned. Bar graphs help to display information in an organized manner; so the next time you are on a long trip, ask your child to create a bar graph to display the number of fast-food restaurants he or she sees while you are driving to your destination.



Other Suggestions:

- _____

USE appropriate TOOLS strategically.

I will **EXPLAIN** how the instructional tools help me to represent the answer or part of the answer in another way.

I will **CONSIDER THE USEFULNESS** of the following tools when solving a mathematical problem:
paper & pencil,
concrete models,
a ruler, a protractor,
a calculator,
a spreadsheet,
a computer program.

I will **USE ESTIMATION SKILLS** to evaluate the reasonableness of the answers I get when I use instructional tools such as a calculator.

I will **USE TOOLS** strategically.

CCSS.MP5

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MP 5 – USE appropriate TOOLS strategically.

Questions you can ask during homework time to encourage MP5

- What tools do you have from class that might help you?
- Explain how a tool you used helped you solve a problem.
- Now that you've used a calculator, how do you know the calculation is correct?
- _____

Ways you can connect everyday experiences to MP5

- Baking: When a recipe calls for 2 ¼ cups of flour, which is the best measuring tool to use?
- Cooking: Considering how some foods need more volume (filled up space)

when they are cooked, which pot size would work best for the dish you are making?

- Housework: Some household cleaners have abrasive textures to scrub out dirt and residue; others don't. Depending on the job, one "tool" might be favored over the other. When would a non-abrasive "tool" work better?
- Yard work: Sometimes, a large mower is needed. Sometimes, pruning shears can handle the task better. How do you determine which one to use?

Other suggestions:

- _____

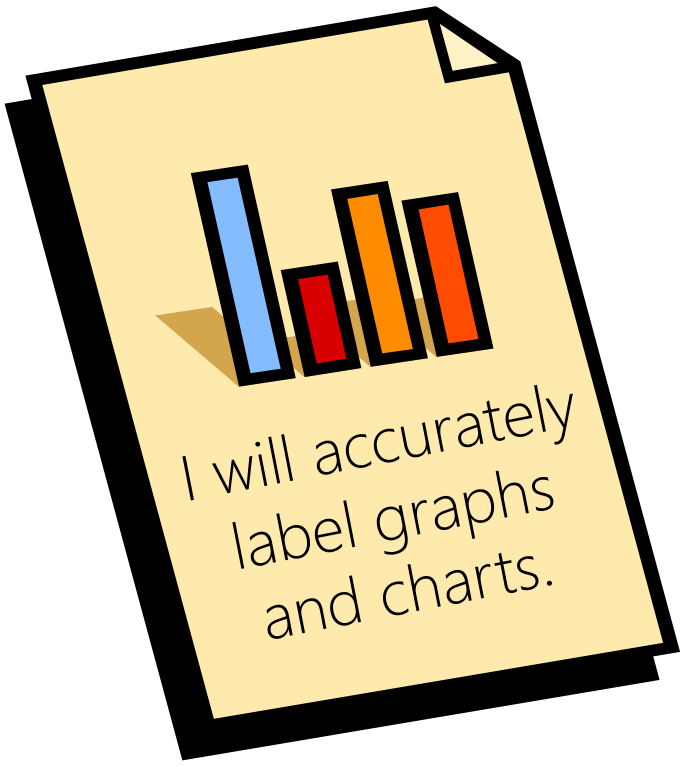
_____

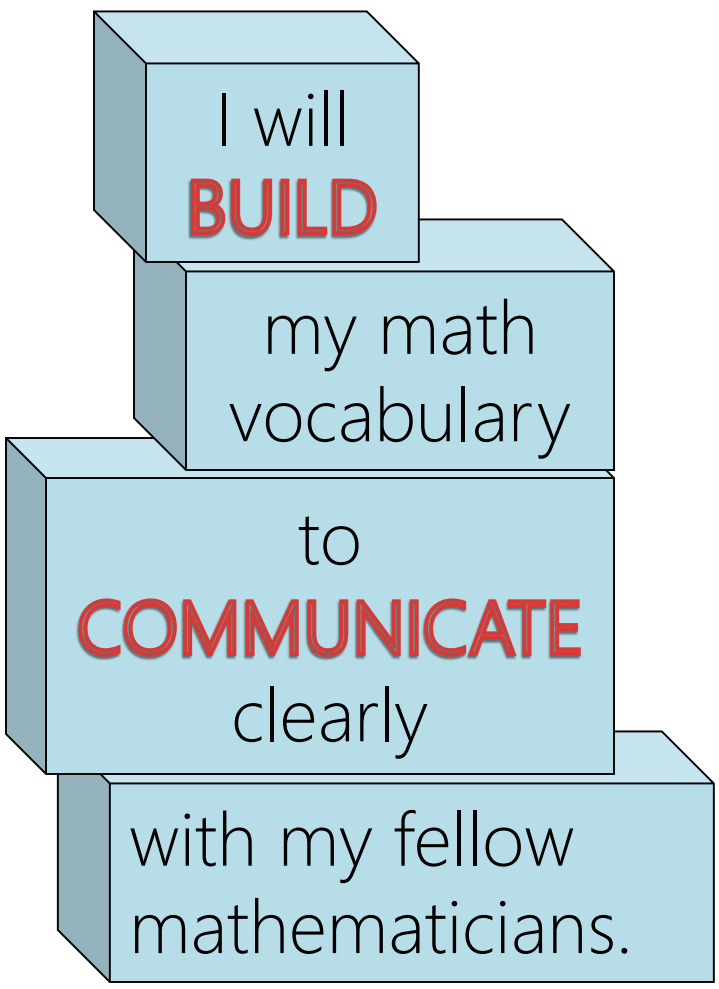
Attend to

PRECISION.

I will specify units of measure.

I will use the correct mathematical terms when communicating my methods & results.

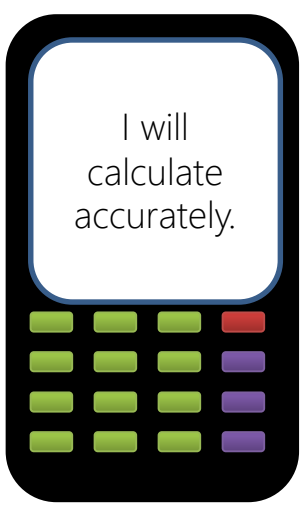




I will know the **MEANINGS** of commonly used mathematical **SYMBOLS**, like:

=	<	>	π	≈	≠

and I will use them accordingly.



I will be mathematically **PRECISE**!

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CCSS.MP6

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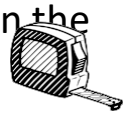
MP 6 – ATTEND to precision.

Questions you can ask during homework time to encourage MP6

- Should you add any measurement units to this problem?
- Did you check your math problem twice to be sure you have the right answer? [1]
- What are some new math vocabulary words you are learning this week? Define them using words, pictures or numbers.
- _____
- _____

Ways you can connect everyday experiences to MP6

- Sewing: Having the exact amount of fabric can save money and time. What strategies do you use to make sure your sewing measurements are precise?
- Construction: The saying: "Measure twice, cut once" is often used in the building and construction industry. Why is this a wise practice?



- Accounting: Keeping accurate records of financial transactions is very important. Talk to your children about what it means to be precise in business and record-keeping.

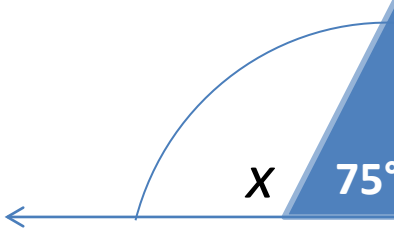
  Other suggestions:

- _____

_____

LOOK for & MAKE USE of STRUCTURE.

I will extend lines in existing geometric shapes to help me solve problems.



I will look at problems from multiple perspectives.

I will use what **I KNOW** to help me *figure out* what I DON'T KNOW.

I will look at the BIG PICTURE while also concentrating on the details.

I will **LOOK** for and **USE STRUCTURE**!

CCSS.MP7

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MP 7 – LOOK for & MAKE USE of structure.

Questions you can ask during homework time to encourage MP7

- What math rules did you use to solve these math problems?
- Is there anything you already know or see in the shape or diagram that can help you identify the answer to the problem?[3]
- _____
- _____

Ways you can connect everyday experiences to MP7

- Mechanical repairs: Fixes to mechanical devices often require making educated guesses about the structural problem that lies within the machine.

  

  Ask your child to make a few educated guesses before opening up the mechanical device to see what's wrong.

- Budgeting: Household and business expenses should follow a structure. Working with expected income and expenditures, we often have to make predictions about future events based on information we have at the moment. Whenever you are planning for your expenses or budget, consider including your child in on the conversation so she can see how you use structure to determine your family's spending and saving habits.

  

Other Suggestions:

- _____

_____

LOOK for and EXPRESS regularity in REPEATED REASONING.

I will look for and REPETITION and REPETITION in my calculations.

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181...

I will look closely and try to determine a **PATTERN**.

I will look for
1) general methods
&
2) *shrtcts.*

I will continually evaluate my work,

PAUSING to look for *patterns* and *repetition*.

I will **LOOK** for and **EXPRESS** regularity in **repeated reasoning**!

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CCSS.MP8

MP 8 – LOOK for and EXPRESS regularity in repeated reasoning.

Questions you can ask during homework time to encourage MP8

- Are there shortcuts you can take to solve this problem?
- Do you notice any similarities between this problem and others you've done before?
- What patterns do you notice when trying to solve this problem?
- _____

Ways you can connect everyday experiences to MP8

- Housework: Have you ever experienced that a task is completed more quickly after you establish a rhythm, like when sweeping/mopping a large room, cleaning a series of windows, or doing a large batch of laundry? How do these tasks require that you are constantly looking at the big picture and details at the same time?
- Design: Designing takes artistic and mathematical skill. Laying tiles, landscaping, and decorating are some examples of jobs which require art and math skills. What kinds of tips and tricks are learned after doing these jobs for a long time?

Other suggestions:

- _____

_____

- _____

_____