



1989 NCTM Curriculum and Evaluation Standards

2000 NCTM Principles and Standards for School Mathematics  
www.nctm.org

5

### NCTM Process Standards

- Connections
- Communication
- Problem Solving
- Reasoning and Proof
- Representation

How do the processes impact instruction?

2001 National Research Council  
www.nap.edu

2006 NCTM

7

### National Research Council's Strands of Proficiency

*Adding It Up, 2001*

- ▶ Adaptive Reasoning
- ▶ Strategic Competence
- ▶ Conceptual Understanding
- ▶ Productive Disposition
- ▶ Procedural Fluency

Intertwined Strands of Proficiency

## High School



## CCSS Standards for Mathematical Practice

The Common Core proposes a set of Standards for Mathematical Practice that all teachers should develop in their students.

The Mathematical Practice Standards are strongly informed by the NCTM Process Standards in *Principles and Standards for School Mathematics*. These standards form the basis for standards documents nationally and internationally.

## CCSS Standards for Mathematical Practice

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.

## NCTM Process Standards and the CCSS Mathematical Practice Standards

NCTM Process Standards	CCSS Mathematical Practices
Problem Solving	<ul style="list-style-type: none"> <li>• Make sense of problems and persevere in solving them.</li> <li>• Use appropriate tools strategically</li> </ul>
Reasoning and Proof	<ul style="list-style-type: none"> <li>• Reason abstractly and quantitatively.</li> <li>• Critique the reasoning of others.</li> <li>• Look for and express regularity in repeated reasoning</li> </ul>
Communication	<ul style="list-style-type: none"> <li>• Construct viable arguments</li> </ul>
Connections	<ul style="list-style-type: none"> <li>• Attend to precision.</li> <li>• Look for and make use of structure</li> </ul>
Representations	<ul style="list-style-type: none"> <li>• Model with mathematics.</li> </ul>



### Six step format of a number talk

1. Teacher presents the problem. Problems are presented in many different ways
2. Students are given time to figure out the answer.
3. Students share their answers.
4. Students share their thinking.
5. The class agrees on the "real" answer for the problem.
6. The steps are repeated for additional problems.

Here is a sample:

$$76 - 54$$

$$76 - 55$$

$$76 - 48$$

$$75 - 48$$

### Basic Facts:

▶  $7 \times 2 =$

▶  $7 \times 4 =$

▶  $7 \times 8 =$

### The Goal of Number Talks

- ▶ Develop conceptual understanding and computational fluency.
- ▶ Student think and reason like mathematicians.
- ▶ Students make connections and look for relationships
- ▶ Student share their strategies, learning to clarify and express their thinking which leads to developing mathematical language.

Teacher's role:

Ask clarifying questions

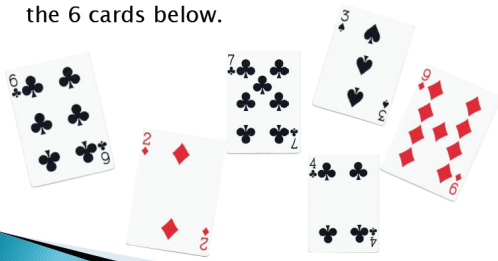
- ▶ Who would like to share their thinking?
- ▶ Who did it another way?
- ▶ How many people solved it the same way as Billy?
- ▶ Does anyone have any questions for Billy?
- ▶ Billy, can you tell us where you got that 5?
- ▶ How did you figure that out?
- ▶ What was the first thing your eyes saw, or your brain did?

Show and Tell Addition

$$\begin{array}{r} 32 \\ + 26 \\ \hline \end{array} \qquad \begin{array}{r} 46 \\ + 59 \\ \hline \end{array}$$

Close to 100

Write an equation using 2 two digit numbers with a sum that is closest to 100. Use 4 of the 6 cards below.



a.	$\begin{array}{r} 43 \\ \times 2 \\ \hline \end{array}$	b.	$\begin{array}{r} 37 \\ \times 9 \\ \hline \end{array}$	c.	$\begin{array}{r} 20 \\ \times 8 \\ \hline \end{array}$
d.	$\begin{array}{r} 58 \\ \times 7 \\ \hline \end{array}$	e.	$\begin{array}{r} 65 \\ \times 8 \\ \hline \end{array}$	f.	$\begin{array}{r} 32 \\ \times 5 \\ \hline \end{array}$
g.	$\begin{array}{r} 99 \\ \times 4 \\ \hline \end{array}$	h.	$\begin{array}{r} 87 \\ \times 3 \\ \hline \end{array}$	i.	$\begin{array}{r} 42 \\ \times 7 \\ \hline \end{array}$
j.	$\begin{array}{r} 38 \\ \times 4 \\ \hline \end{array}$	k.	$\begin{array}{r} 13 \\ \times 5 \\ \hline \end{array}$	l.	$\begin{array}{r} 39 \\ \times 6 \\ \hline \end{array}$
m.	$\begin{array}{r} 89 \\ \times 7 \\ \hline \end{array}$	n.	$\begin{array}{r} 74 \\ \times 3 \\ \hline \end{array}$	o.	$\begin{array}{r} 62 \\ \times 7 \\ \hline \end{array}$

### Less ... is More

Have a conversation about students' thinking.

$$28 \times 7 =$$

### Growing an idea...

$$3 \times 6$$

$$3 \times 60$$

$$3 \times 62$$

$$3 \times 68$$

$$3 \times 70$$

### Reasoning with Fractions

$$\frac{1}{2} + \frac{2}{3} =$$

### Reasoning with Fractions

$$\begin{array}{r} 5 \\ -2\frac{3}{5} \\ \hline \end{array}$$

## Connections: Division of Fractions



$$\frac{4}{5} \div \frac{2}{5}$$



$$\frac{5}{4} \times \frac{2}{5}$$

$$\frac{4}{5} \times \frac{5}{2}$$

## Connections: Division of Fractions



$$\frac{4}{5} \div \frac{2}{5}$$

## Making Connections

$$7.836 \times 4.92 = 3855312$$

$$534.6 \times 0.545 = 291357$$

$$51.1875 \div 1.05 = 4875$$

$$3.75 \div .05 = 750$$

31

## Deal or No Deal

- ▶ Marty offers his parents a new deal for his allowance. Rather than getting \$5 a week, he suggests they give him 1¢ for the first day, 2¢ for the second day, 4¢ for the third day and so on for the entire month of February. Should Marty's parents accept his deal?





What are the odds?



33



34



36