A. Mathematical Processes and B. Number Operations and Relationships
(From the WKCE-CRT Mathematics Assessment Framework, Beginning of Grade 10)

A. Mathematical Processes

• Use reasoning and logic to: Perceive patterns, Identify relationships, formulate questions, pose problems, make conjectures, justify strategies and test reasonableness of results.
• Communicate mathematical ideas and reasoning using the vocabulary of mathematics in a variety of ways, e.g., using words, numbers, symbols, pictures, charts, tables, diagrams, graphs, and models.
• Connect mathematics to the real world as well as within mathematics.
• Create and use representations to organize, record and communicate mathematical ideas.
• Solve and analyze routine and non-routine problems.

B. Number Operations and Relationships *

Subskill: Concepts
• Compare and order real numbers.
• Analyze and solve problems using percents.
• Apply proportional reasoning and ratios in mathematical and real world contexts.

Subskill: Computation
• Compare, perform, and explain operations on real numbers with and without context e.g. transitivity, rate of change, exponential functions, scientific notation, roots, powers, reciprocals, absolute value, ratios, proportions, percents.
• Determine reasonableness of answer.

* Slightly modified to reflect “Sharing the 10th Grade Descriptors”
Examining the 10th Gr. Descriptors: What’s “New” for 8th Graders?

The 8th Grade Classroom Assessments Based on State Standards were created to reflect the 10th grade state descriptors and the MPS learning targets for 8th grade. The 10th grade state descriptors should be used by both 8th and 9th grade math teachers. See your MTL for the document, “Sharing the 10th Grade Descriptors”, or visit the Portal (math page, inside the teacher community), for the delineated shared responsibilities.

The 10th grade state descriptors contain both previously introduced and new concepts. It is the intent of the 8th - 9th Grades Math Assessment Pilot, after considerable feedback from Kevin McLeod, UWM Mathematics Professor and Co-Investigator, MMP, to emphasize the new concepts. Alerting teachers to what is new for 8th graders should have classroom implications.

The 8th grade math CABS are therefore split into two categories. First, a series of “Power CABS” which can be used to assess student understanding of concepts not found in earlier grade level state descriptors. Second, a series of CABS not denoted with “Power” which can be used to assess student understanding of concepts found in both earlier state descriptors and in the 10th grade descriptors.

The chart below identifies the descriptors that are new to 8th grade as determined by the 8th - 9th Grades Math Assessment Pilot, 2006-2007.

### B. Number Operations and Relationships:

<table>
<thead>
<tr>
<th>Objective/Subskill</th>
<th>10th Gr. Descriptor Piece that is “New”</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.a</td>
<td>“Compare and order real numbers”</td>
<td>Comparing and ordering whole numbers, fractions and decimals has been done in earlier grades but not the set of real numbers.</td>
</tr>
<tr>
<td>B.a</td>
<td>“Analyze problems using percents”</td>
<td>Solving problems using percents is not new to 8th grade but analyze is. Do you have to solve when you analyze?</td>
</tr>
<tr>
<td>B.a</td>
<td>“Apply ratios in mathematical and real-world contexts”</td>
<td>Ratios not mentioned in earlier grades, but proportional thinking is.</td>
</tr>
<tr>
<td>B.b</td>
<td>“Compare, perform, and explain operations on real numbers with and without context e.g. transitivity, rate of change, exponential functions, scientific notation, roots, powers, reciprocals, absolute value, ratios, proportions, percents.”</td>
<td>All new to 8th grade due to “real numbers” and some of the examples given.</td>
</tr>
</tbody>
</table>
**Mathematics Grade 8**  
**Classroom Assessment Based on Standards**  
CABS Identifier: “Closest Time”

**MPS Learning Target: Number Operations and Relationships**

**MPS Learning Target #1:** Explain comparisons and operations on real numbers and use proportional reasoning (including ratios and percents) to solve problems with and without contexts.

**Wisconsin Assessment Framework for Mathematics**

**Objective:** B. Number Operations and Relationships  
**Subskill:** Concepts  
**Descriptor:**  
Compare and order real numbers.

**Objective:** A. Mathematical Processes  
**Descriptors:**
- Communicate mathematical ideas and reasoning using the vocabulary of mathematics in a variety of ways (e.g. using words, numbers, symbols, pictures, charts, tables, diagrams, graphs, and models).
- Solve and analyze routine and non-routine problems.

Which of the following is closest to 15 seconds?

A) 14.7 seconds  
B) 15.02 seconds  
C) 14.09 seconds  
D) 14.099 seconds

Explain your choice using words, pictures, and/or numbers.

Adapted from the U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP)

Developed by the Milwaukee Mathematics Partnership (MMP) with support by the National Science Foundation under Grant No. 0314898.
Mathematics Grade 8
Classroom Assessment Based on Standards

**Power** CABS Identifier: “Number Line Location”

<table>
<thead>
<tr>
<th>MPS Learning Target: Number Operations and Relationships</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MPS Learning Target #1:</strong> Explain comparisons and operations on real numbers and use proportional reasoning (including ratios and percents) to solve problems with and without contexts.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wisconsin Assessment Framework for Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective:</strong> B. Number Operations and Relationships</td>
</tr>
<tr>
<td><strong>Subskill:</strong> Concepts</td>
</tr>
<tr>
<td><strong>Descriptor:</strong></td>
</tr>
<tr>
<td>Compare and order real numbers.</td>
</tr>
</tbody>
</table>

| **Objective:** A. Mathematical Processes |
| **Descriptors:** |
| • Use reasoning and logic to perceive patterns, identify relationships, formulate questions, pose problems, make conjectures, justify strategies, and test reasonableness of results |
| • Communicate mathematical ideas and reasoning using the vocabulary of mathematics in a variety of ways (e.g. using words, numbers, symbols, pictures, charts, tables, diagrams, graphs, and models). |
| • Create and use representations to organize, record, and communicate mathematical ideas. |
| • Solve and analyze routine and non-routine problems. |

Using the number line below,

What number would be located at point P? __________

What is the value of the interval being used? __________

Indicate on the number line the approximate location of the $\sqrt{31}$.

```
| | | | | | | | | | | |
---|---|---|---|---|---|---|---|---|---|
5.55 | P | 5.56
```
Justify your placement of $\sqrt{31}$ on the number line.
According to the relationships suggested by the four examples above, what is required to give a sum of 144?
Show another strategy for solving this problem.
MPS Learning Target: Number Operations and Relationships

MPS Learning Target #1: Explain comparisons and operations on real numbers and use proportional reasoning (including ratios and percents) to solve problems with and without contexts.

Wisconsin Assessment Framework for Mathematics

Objective: B. Number Operations and Relationships
Subskill: Computation
Descriptor:
Compare, perform, and explain operations on real numbers with and without context e.g. transitivity, rate of change, exponential functions, scientific notation, roots, powers, reciprocals, absolute value, ratios, proportions, percents.

Objective: A. Mathematical Processes
Descriptors:
• Communicate mathematical ideas and reasoning using the vocabulary of mathematics in a variety of ways (e.g. using words, numbers, symbols, pictures, charts, tables, diagrams, graphs, and models).
• Solve and analyze routine and non-routine problems.

If $n$ is a negative integer, which of these is the largest number?

A. $3 - n$
B. $3 + n$
C. $\frac{3}{n}$
D. $3n$

Justify your answer.
MPS Learning Target: Number Operations and Relationships

MPS Learning Target #1: Explain comparisons and operations on real numbers and use proportional reasoning (including ratios and percents) to solve problems with and without contexts.

Wisconsin Assessment Framework for Mathematics

Objective: B. Number Operations and Relationships
Subskill: Concepts and Computation
Descriptors:
• Compare and order real numbers.
• Determine reasonableness of answer.

Objective: A. Mathematical Processes
Descriptors:
• Communicate mathematical ideas and reasoning using the vocabulary of mathematics in a variety of ways (e.g. using words, numbers, symbols, pictures, charts, tables, diagrams, graphs, and models).
• Solve and analyze routine and non-routine problems.

In which of these pairs of numbers is $\sqrt{5}$ greater than the first number but less than the second number?

A. 1 and 2
B. 2 and $\frac{5}{2}$
C. $\frac{5}{2}$ and $\frac{11}{4}$
D. $\frac{11}{4}$ and 3

Show your work and explain why your answer is reasonable.

Adapted with permission from the TIMSS and PIRLS International Study Center, Lynch Education, Boston College.

Developed by the Milwaukee Mathematics Partnership (MMP) with support by the National Science Foundation under Grant No. 0314898.
In each set below, put the real numbers in order from least to greatest.

A. $2.3, \sqrt{9}, \frac{-7}{5}, -6, 3.3, 0$

B. $\left(\frac{3}{4}\right), 2, \frac{56}{9}, 0, (-2)^2, 3.5$

C. $2^2, 0, 4.7, \pi, \frac{5}{\sqrt{2}}, |4.5|$
Paxolai purchases a video game that costs $45.00. She uses two coupons when she buys the video game. The first coupon gives 25% off of the regular price. The second coupon is for $5.00 off the price of any video game. When the clerk rings up Paxolai’s purchase, he takes the $5.00 off first and then applies the 25% discount.

How much does Paxolai pay for the video game?

Answer: ________

Show all your work.
Would the price that Paxolai paid for the video game have increased, decreased or stayed the same if the clerk had taken the 25% discount first and then taken off the $5.00 coupon?

Answer: __________________

Explain your thinking.
Three brothers, Bob, Dan and Mark, receive a gift of $45,000 from their father. The money is shared among the brothers in proportion to the number of children each one has. Bob has two children. Dan has 3 children, and Mark has 4 children.

How much money does Mark get?

Answer: _____________

Show all your work.
Toni’s net pay last week was $128.35. Her paycheck also said that her gross pay was $168.88.

What percent of her pay was taken out for taxes?

Answer: ________________

Show all your work.
Explain to Toni how you determined what percent was taken out for taxes.
In a rectangle, one side is 3 times as long as its adjacent side. What is the ratio of the short side to the perimeter of the rectangle?

Answer: ________________

Justify your answer using words, pictures, and/or numbers.
MPS Learning Target: Number Operations and Relationships

MPS Learning Target #1: Explain comparisons and operations on real numbers and use proportional reasoning (including ratios and percents) to solve problems with and without contexts.

Wisconsin Assessment Framework for Mathematics

Objective: B. Number Operations and Relationships
Subskill: Concepts
Descriptor: Apply proportional reasoning and ratios in mathematical and real world contexts.

Objective: A. Mathematical Processes
Descriptors:
• Communicate mathematical ideas and reasoning using the vocabulary of mathematics in a variety of ways (e.g. using words, numbers, symbols, pictures, charts, tables, diagrams, graphs, and models).
• Solve and analyze routine and non-routine problems.

In a rectangle with side 1 measuring 7 inches, and side 2 measuring 21 inches, what is the ratio of the length of side 1 to the perimeter of the rectangle?

Answer: __________________

Justify your answer using words, pictures, and/or numbers.
An object that weighs 150 pounds on earth, weighs 25 pounds on the moon.

An object that weighs 50 pounds on the moon, weighs 5 pounds on a newly discovered planet, Googledorf.

An object that weighs 420 pounds on earth would weigh how many pounds on Planet Googledorf?

Answer: _________________

Show all your work.
MPS Learning Target: Number Operations and Relationships

MPS Learning Target #1: Explain comparisons and operations on real numbers and use proportional reasoning (including ratios and percents) to solve problems with and without contexts.

Wisconsin Assessment Framework for Mathematics
Objective: B. Number Operations and Relationships
Subskill: Concepts
Descriptor:
Analyze and solve problems using percents.

Objective: A. Mathematical Processes

• Communicate mathematical ideas and reasoning using the vocabulary of mathematics in a variety of ways (e.g. using words, numbers, symbols, pictures, charts, tables, diagrams, graphs, and models).
• Solve and analyze routine and non-routine problems.

Silvia hiked a 30-mile trail in 3 days. The first day, she hiked 50% of the total distance. The second day, she hiked 25% of the distance that remained. How many miles did she hike the third day?

A. \( \frac{3}{4} \)

B. \( \frac{71}{2} \)

C. \( \frac{111}{4} \)

D. \( \frac{221}{2} \)

Show all your work.
Tracy said, “I can multiply 6 by another number and get an answer that is smaller than 6.”
Pat said, “No, you can’t. Multiplying 6 by another number always makes the answer 6 or larger.”

Who is correct, and justify your answer.

Adapted from U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP)

Developed by the Milwaukee Mathematics Partnership (MMP) with support by the National Science Foundation under Grant No. 0314898.
One store, Price Pleasers, reduces the price of a stereo each week by 10 percent of the original price. Another store, Bargains Plus, reduces the price of a stereo each week by 10% of the previous week’s price. After 2 discounts have been taken, how will the prices at the two stores compare?

A. The price will be cheaper at Price Pleasers
B. The price will be the same at both stores.
C. The price will be cheaper at Bargains Plus.

Explain your reasoning.

Adapted from the U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP)

Developed by the Milwaukee Mathematics Partnership (MMP) with support by the National Science Foundation under Grant No. 0314898.
An insect population in a lab has $2^{16}$ insects. If the population doubles, how many insects will there be?

A) $2^{17}$  
B) $2^{32}$  
C) $4^{16}$  
D) $4^{32}$

Using what you know about exponents, justify your answer.
Mathematics Grade 8
Classroom Assessment Based on Standards

Power CABS Identifier: “Absolute Value”

MPS Learning Target: Number Operations and Relationships

MPS Learning Target #1: Explain comparisons and operations on real numbers and use proportional reasoning (including ratios and percents) to solve problems with and without contexts.

Wisconsin Assessment Framework for Mathematics

Objective: B. Number Operations and Relationships
Subskill: Computation
Descriptor:
Compare, perform, and explain operations on real numbers with and without context e.g. transitivity, rate of change, exponential functions, scientific notation, roots, powers, reciprocals, absolute value, ratios, proportions, percents.

Objective: A. Mathematical Processes
Descriptors:
• Communicate mathematical ideas and reasoning using the vocabulary of mathematics in a variety of ways (e.g. using words, numbers, symbols, pictures, charts, tables, diagrams, graphs, and models).
• Create and use representations to organize, record, and communicate mathematical ideas.
• Solve and analyze routine and non-routine problems.

Which of the following is a true statement?

A. \(|-3| = -2 + |-1|
B. |-3| = |-2 + 1|
C. |-3| = |-2| + -1
D. |-3| = |2 + 1|

Represent, on the number line, any and all numbers that have an absolute value of 3.

Adapted from the U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP)

Developed by the Milwaukee Mathematics Partnership (MMP) with support by the National Science Foundation under Grant No. 0314898.
The average distance from Venus to the Sun is $1.08 \times 10^8$ kilometers. Which of the following quantities is equal to this distance?

A. 10,800,000 kilometers  
B. 108,000,000 kilometers  
C. 1,080,000,000 kilometers  
D. 10,800,000,000 kilometers  
E. 108,000,000,000 kilometers

On April 4, 2007, the Voyager 1 Space probe was $1.5 \times 10^{10}$ kilometers away from the Sun. Approximately, how many times further is Voyager 1 from the Sun than Venus from the Sun?

Answer: ____________________________
Explain your reasoning using words, numbers, and/or pictures.