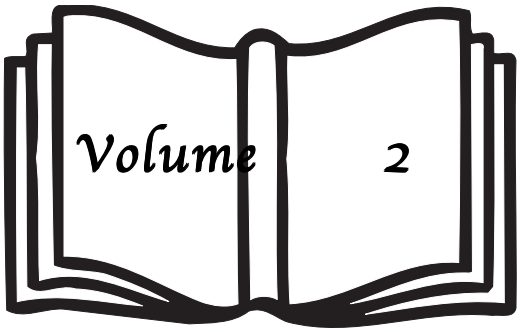
Grade Eight

Classroom

Strategies



The learner will understand and compute with real numbers.

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1.01 Develop number sense for the real numbers.

Notes and textbook references

a) Define and use irrational numbers.

A. **Transparency for number set structure** (Blackline Master I - 5) Teachers may use this transparency to help students understand which real number sets are subsets of each other and which numbers belong to each subset.

Looking for Pythagoras from the Connected Math™ series provides good investigations that develop the idea of what square roots (and irrational numbers) are. Due to the fact that it is taught in conjunction with Pythagorean Theorem the lessons also address SCOS objective 1.01 c). Use estimates of irrational numbers in appropriate situations.

B. Cut index cards in half vertically. Using about 15 cards, write either a rational or irrational number on each card. Place students in groups of three or four. Give each group a set of cards with the instructions to separate the cards into a group of rationals and a group of irrationals. Students then need to write the reason each number was placed into the irrational group. Check card placement and reasons. Reasons should include that the decimal representation of a number is not repeating or terminating.

C. **Real Number Hexagon** (Blackline Masters I - 6 through I - 8)

Part I: Organize students in pairs. Give each pair one copy of Blackline Master I - 6. Assign each pair one of the subsets of the real number system (rational, irrational, integer, natural or real) and a colored pencil. For example, all pairs finding rational numbers would use blue; all pairs finding integers would use red, etc. Each pair should color in the number circles that belong in the assigned subset. Groups should share with class to generalize the rules for each subset.

Notes and textbook references

Part II: Give each student a copy of Blackline Master I - 8 Reference Chart that has number examples. Students need to indicate the categories to which each number belongs. (See Key below.)

Number	Real	Rational	Irrational	Integer	Natural
4	x	x		x	x
$\sqrt{4}$	x	x		x	x
-3	x	x		x	
$\frac{1}{2}$	x	x			
$\sqrt{\frac{1}{9}}$	x	x			
$0.33\overline{3}$	x	x			
0.25	x	x			
0.171771777...	x		x		
$\sqrt{7}$	x		x		
π	x		x		

Part III: Play the **Real Number Race** (a copy of Blackline Master I - 6 per team, spinner or cube (or Blackline Master I - 7), one marker per student (up to six players)

Notes and textbook references

Each player chooses a side of the board from which to start. On each player's first turn, s/he will spin the spinner and get a real number set or subset. S/he then moves her/his marker to any circle on her/his side of the board that contains a number from that set. Play continues with the next player.

Once the player is on the board, on her/his next turn s/he can move only to a circle adjacent to his position that contains a number from the number set he spins. Players may not occupy the same space at the same time.

The winner is the first player to reach the zero ring. If a player moves to an incorrect circle, the opponents should challenge her/him; a wrong move has the penalty of being moved back to the beginning.

Note: Instead of using the spinner provided, students may roll a fair number cube (each number on the cube would correspond to a section of the spinner).

Notes and textbook references

b) Compare and order.

A. Create a number line on the wall of your classroom using tape (they now make colored duct tape – you could use red and black to emphasize the difference between positive and negative numbers). Give students various rational and irrational numbers (such as $\sqrt{5}$, $-\sqrt{12}$, three-eighths, -8, etc) on Post-it™ Notes. Students will estimate the value of the numbers by placing the number appropriately on the number line. Class discussion can stem from how and where students choose to place their numbers.

If you prefer a more individualized approach, make reusable number lines on laminated sentence strips. Give students a variety of numbers and have them locate the numbers on the number line using overhead markers.

As an extension to this activity, after students have estimated the value of the numbers they then could classify each number as real, rational, irrational, whole, natural, or integer.

B. Use sentence strips to create number lines. Laminate these number lines. Give students a set of numbers {6, -3, -25, -9, -1.5}. Students use vis-a-vis pens to plot the numbers on the number line. Students can then place the set of numbers in order from least to greatest based on the placement on the number line.

C. Create enough index cards so that each student will have one. On each index card write one number. Make sure numbers from each of the subsets are represented. Sample numbers can be those from the reference chart on Blackline I - 6 or the Real Number Hexagon. Give each student a card. Ask all students who are holding a natural number to come to the front of the room and line up from least to greatest. As they hold up their card, classmates should determine if the lineup is correct. Students at their seat should also hold up their cards to ensure that all natural numbers are in line. Repeat this process for the other Real number subsets.

D. A variation on activity C above is to cut index cards in half vertically. On each half of the card, place a number from the various Real number sets (choose various numbers from the Real Number Hexagon). Give each group a set of the cards. Ask students to place the Natural Numbers on their desk from least to greatest. Check with each group to ensure that correct numbers are displayed and the order is correct. Repeat this process for the other Real Number subsets.

c) Use estimates of irrational numbers in appropriate situations.

Notes and textbook references

A. One use of irrational numbers is square roots, when presented as the length of the side of a square. Students need to be able to simplify the radical. For example, to simplify $\sqrt{32}$, students need to first rewrite the number as a factor of a perfect square. Thirty-two can be re-written as $\sqrt{16} \bullet 2$. The square root of 16 is 4. The square root of 2 is irrational so the final answer becomes $4\sqrt{2}$.

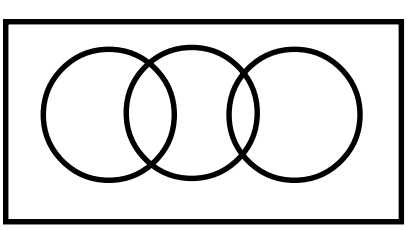
B. Students may estimate square roots to the nearest tenth by the following technique.

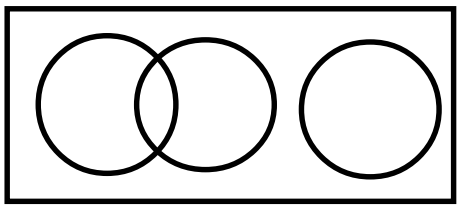
Example: Find $\sqrt{27}$

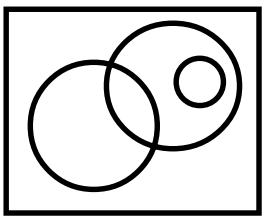
We know that $\sqrt{27}$ falls between 5 and 6 because 27 falls between 25 and 36. The difference between 25 and 36 is 11. The difference between 25 and 27 is 2. The fraction two-elevenths is a good approximation for the distance between 5 and $\sqrt{27}$. Since two-elevenths is approximately 0.2, 5.2 is a good approximation for $\sqrt{27}$. A more precise value is 5.196, but 5.2 is correct to the nearest tenth.

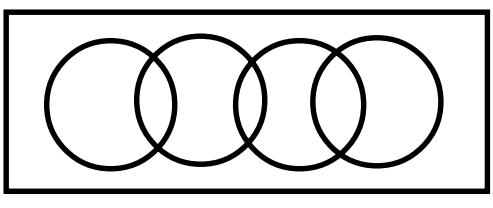
C. Teachers should note that there are multiple possibilities for Venn diagram configurations. Three mutually overlapping sets is the most recognized format but here are some others wiyh which students should become familiar. Have students assemble sets of real numbers that lend themselves to each of these configurations.

Blacklines for the overhead can be found at Blackline Masters I - 9 through I - 14.









Notes and textbook references

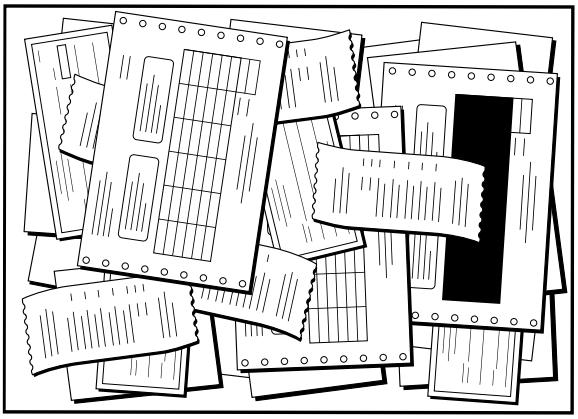
1.02 Develop flexibility in solving problems by selecting strategies and using mental computation, estimation, calculators or computers, and paper and pencil.

A. **Cooperative Problem-Solving Cards - Patterns**
(Blackline Masters I - 1 through I - 4) Each problem is presented on a set of three or four cards. Students should work in groups with each student contributing the information on his/her card. Cooperative problem solving allows the students to witness the thought processes of their peers. These problems contain patterns including integers, fractions, linear functions, ratio and proportions.

B. Websites that provide "Problems of the Week" :
www.mathforum.com/pow/ - This site provides problems of the week updated weekly at a variety of difficulty levels (pre-Algebra, Algebra, Geometry). Students can submit their answers online.

www.mathcounts.org - This site offers challenging problems.

C. Divide your class into groups of four and give a group of students a menu, catalog, train schedule, postage chart, payroll chart, etc. Have them write five questions from the information given. Write challenging questions for other groups. When the questions are written, have groups exchange problem sets. Each group earns one point for solving a question correctly, and two points for writing a question that stumps the other group.



D. Use Problems of the Week from various on-line sources. Expect students to give a detailed explanation of their solutions. Possible sources are:
www.mathcounts.org (This site has a problem of the week and warm-up section.)

http://www.figurethis.org/index.html
http://juliet.stfx.ca/people/fac/pwang/mathpage/grade8.html
http://www.mathforum.org/pow/

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