Mathematics Station Activities

for Common Core State Standards

Grade 8

WALCH EDUCATION®

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Introduction

This revised edition of the *Mathematics Station Activities for Common Core State Standards, Grade 8* includes a collection of updated and improved station-based activities to provide students with opportunities to practice and apply the mathematical skills and concepts they are learning. It contains sets of activities that are tightly aligned to both the Mathematical Practices and the five Grade 8 Common Core Mathematics domains: The Number System; Expressions and Equations; Functions; Geometry; and Statistics and Probability. These enhancements have been carried out based on continuing refinement of Common Core implementation. You may use these activities in addition to direct instruction, or instead of direct instruction in areas where students understand the basic concepts but need practice. The Discussion Guide included with each set of activities provides an important opportunity to help students reflect on their experiences and synthesize their thinking. It also provides guidance for ongoing, informal assessment to inform instructional planning.

Implementation Guide

The following guidelines will help you prepare for and use the activity sets in this book.

Setting Up the Stations

Each activity set consists of four stations. Set up each station at a desk, or at several desks pushed together, with enough chairs for a small group of students. Place a card with the number of the station on the desk. Each station should also contain the materials specified in the teacher's notes, and a stack of student activity sheets (one copy per student). Place the required materials (as listed) at each station.

When a group of students arrives at a station, each student should take one of the activity sheets to record the group's work. Although students should work together to develop one set of answers for the entire group, each student should record the answers on his or her own activity sheet. This helps keep students engaged in the activity and gives each student a record of the activity for future reference.

Forming Groups of Students

All activity sets consist of four stations. You might divide the class into four groups by having students count off from 1 to 4. If you have a large class and want to have students working in small groups, you might set up two identical sets of stations, labeled A and B. In this way, the class can be divided into eight groups, with each group of students rotating through the "A" stations or "B" stations.

Assigning Roles to Students

Students often work most productively in groups when each student has an assigned role. You may want to assign roles to students when they are assigned to groups and change the roles occasionally. Some possible roles are as follows:

- Reader—reads the steps of the activity aloud
- Facilitator—makes sure that each student in the group has a chance to speak and pose questions; also makes sure that each student agrees on each answer before it is written down
- Materials Manager—handles the materials at the station and makes sure the materials are put back in place at the end of the activity
- Timekeeper—tracks the group's progress to ensure that the activity is completed in the allotted time
- Spokesperson—speaks for the group during the debriefing session after the activities

Timing the Activities

The activities in this book are designed to take approximately 15 minutes per station. Therefore, you might plan on having groups change stations every 15 minutes, with a two-minute interval for moving from one station to the next. It is helpful to give students a "5-minute warning" before it is time to change stations.

Since the activity sets consist of four stations, the above time frame means that it will take about an hour and 10 minutes for groups to work through all stations. If this is followed by a 20-minute class discussion as described below, an entire activity set can be completed in about 90 minutes.

Guidelines for Students

Before starting the first activity set, you may want to review the following "ground rules" with students. You might also post the rules in the classroom.

- All students in a group should agree on each answer before it is written down. If there is a disagreement within the group, discuss it with one another.
- You can ask your teacher a question only if everyone in the group has the same question.
- If you finish early, work together to write problems of your own that are similar to the ones on the student activity sheet.
- Leave the station exactly as you found it. All materials should be in the same place and in the same condition as when you arrived.

Debriefing the Activities

After each group has rotated through every station, bring students together for a brief class discussion. At this time, you might have the groups' spokespersons pose any questions they had about the activities. Before responding, ask if students in other groups encountered the same difficulty or if they have a response to the question. The class discussion is also a good time to reinforce the essential ideas of the activities. The questions that are provided in the teacher's notes for each activity set can serve as a guide to initiating this type of discussion.

You may want to collect the student activity sheets before beginning the class discussion. However, it can be beneficial to collect the sheets afterward so that students can refer to them during the discussion. This also gives students a chance to revisit and refine their work based on the debriefing session.

Standards Correlations

The standards correlations below and on the next page support the implementation of the Common Core State Standards. This book includes station activity sets for the Common Core domains of The Number System; Expressions and Equations; Functions; Geometry; and Statistics and Probability. The following table provides a listing of the available station activities organized by Common Core standard.

The left column lists the standard codes. The first number of the code represents the grade level. The grade number is followed by the initials of the Common Core domain name, which is then followed by the standard number. The middle column of the table lists the title of the station activity set that corresponds to the standard(s), and the right column lists the page number where the station activity set can be found.

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Standards Correlations

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Materials List

Class Sets

- calculators
- rulers
- protractors

Station Sets

- 4 spherical objects of varying sizes (Ping-Pong balls, orange, basketball, globe, etc.)
- algebra tiles (10 blue, 10 yellow, 20 green, 40 red)
- colored pens or pencils
- geoboard and rubber bands for each group member
- graphing calculator
- measuring tape
- mini marshmallows
- scissors
- small square tiles or small square pieces of paper
- spaghetti noodles
- tape

Ongoing Use

- graph paper
- index cards (prepared according to specifications in teacher notes for many of the station activities)
- number cubes (numbered 1–6)
- pencils
- scrap paper

The Number System

Set 1: Rational and Irrational Numbers

Instruction

Goal: To provide opportunities for students to develop concepts and skills related to rational and irrational numbers and use rational approximations of irrational numbers for a variety of purposes

Common Core State Standards

The Number System

Know that there are numbers that are not rational, and approximate them by rational numbers.

8.NS.1. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion, which repeats eventually into a rational number.

8.NS.2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2).

Expressions and Equations

Work with radicals and integer exponents.

8.EE.2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

Student Activities Overview and Answer Key

Station 1

Students use two number cubes to generate two numbers. They work together to arrange the two numbers as a rational number and an irrational number. Students give their reasoning behind creating rational and irrational numbers for the same two numbers.

Answers

1–4. Answers will vary.

Instruction

Station 2

Students use a calculator to write decimal expansions for several given numbers. They work together to identify repeating decimals and terminating decimals (rational numbers), and they make a conjecture about the numbers whose decimal expansions are neither repeating nor terminating (these numbers are irrational).

Answers: 1. 0.875; 2. $0.\overline{2}$; 3. $4.1\overline{6}$; 4. 9; 5. 1.4142136; 6. 3.1415926; 7. 15.625; 8. $0.08\overline{3}$

Terminating decimals: $^{7}/_{8}$, $\sqrt{81}$, $(2.5)^3$

Repeating decimals: $^{2}/_{9}$, $4\ ^{1}/_{6}$, $^{1}/_{12}$

Neither: $\sqrt{2}$, π (these numbers are irrational)

Station 3

Students are given a set of ten cards with numbers on them. The goal is to sort the cards into two piles. One pile should contain only rational numbers, and the other should contain only irrational numbers. Once students have sorted the cards, they reflect on the strategies they used.

Answers: Rational: $^{3}/_{5}$, $0.\overline{8}$, $\sqrt{4}$, $\sqrt{16}$, –2, 0, 4.173

Irrational: $\sqrt{2}$, $\sqrt{5}$, π

Possible strategies: Begin by looking for whole numbers, fractions, and repeating or terminating decimals. These are all rational. For radicals, determine whether the radicand is a perfect square. If so, the number is rational. If not, the number is irrational.

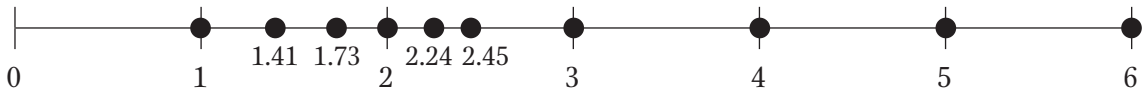
Station 4

Students will roll a number cube and compare the number they rolled to the square root of the number they rolled. They will approximate the square root of the number when necessary and place it on the number line.

Answers

1–4. Answers will vary depending on the number rolled. Answers for each possible roll, rounded to the nearest hundredth:

Number rolled	Square root	Value of square root
1	$\sqrt{1}$	1
2	$\sqrt{2}$	1.41
3	$\sqrt{3}$	1.73
4	$\sqrt{4}$	2
5	$\sqrt{5}$	2.24
6	$\sqrt{6}$	2.45



5. Sample answer: Round the irrational number to the hundredths place to approximate where it should be placed on the number line.

Materials List/Setup

Station 1 two number cubes

Station 2 calculator

Station 3 10 index cards with the following numbers written on them:
$\frac{3}{5}$, $0.\overline{8}$, $\sqrt{4}$, $\sqrt{16}$, –2, 0, 4.173, $\sqrt{2}$, $\sqrt{5}$, π

Station 4 number cube; calculator

Instruction

Discussion Guide

To support students in reflecting on the activities and to gather formative information about student learning, use the following prompts to facilitate a class discussion to "debrief" the station activities.

Prompts/Questions

1. How can you tell if a number is rational or irrational?
2. Is every whole number rational? Why or why not?
3. How can you use a calculator to help you decide if a number is rational?
4. How can you compare an irrational number to a rational number?

Think, Pair, Share

Have students jot down their own responses to questions, then discuss with a partner (who was not in their station group), and then discuss as a whole class.

Suggested Appropriate Responses

1. A rational number can be expressed exactly by a ratio of two integers. An irrational number cannot be expressed exactly by a ratio of two integers.
2. Yes. Every whole number may be written as a fraction with a denominator of 1.
3. Use the calculator to convert the number to a decimal. If the decimal is repeating or terminating, the number is rational.
4. Round the decimal of the irrational number to one place value beyond the rational number you are comparing it with, then determine which number is larger or smaller.

Possible Misunderstandings/Mistakes

- Assuming that any square root is irrational
- Not realizing that any number written as a fraction must be rational
- Incorrectly converting between fractions and decimals
- Incorrectly rounding

The Number System

Set 1: Rational and Irrational Numbers

Station 1

Use the two number cubes provided for problems 1–4.

1. Roll each number cube and record the results in the boxes below.

2. Work with other students to arrange these two numbers so they make up a rational number. Write your answer below. Give a reason for your answer.

3. Work with other students to arrange these two numbers so that they are irrational. Write your answer below. Give a reason for your answer.

4. Repeat the process three more times.

The Number System

Set 1: Rational and Irrational Numbers

Station 2

You will need a calculator for this activity.

Use the calculator to help you write each of the following numbers as a decimal. Work together to decide how to use the calculator to convert the numbers to decimals.

1. $\frac{7}{8}$
2. $\frac{2}{9}$
3. $4\frac{1}{6}$
4. $\sqrt{81}$
5. $\sqrt{2}$
6. π
7. $(2.5)^3$
8. $\frac{1}{12}$

Work together to identify the numbers that have terminating decimals. Write them below.

_____

Work together to identify the numbers that have repeating decimals. Write them below.

_____

Write the numbers that do not appear to have terminating or repeating decimals.

_____

What can you say about the numbers that don't have terminating or repeating decimals?

_____

_____

The Number System

Set 1: Rational and Irrational Numbers

Station 3

You will find a set of 10 cards at this station. The cards have the following numbers written on them:

$0 \qquad \frac{3}{5} \qquad \sqrt{2} \qquad 0.\overline{8} \qquad \pi \qquad \sqrt{4} \qquad \sqrt{16} \qquad -2 \qquad \sqrt{5} \qquad 4.173$

Work with other students to sort the cards into two piles. One pile should contain only rational numbers. The other pile should contain only irrational numbers.

Write your results below.

Rational: _____

Irrational: _____

Work together to check that you have sorted the numbers correctly. Describe any strategies you could use to solve this problem.

_____

_____

_____

NAME:

The Number System

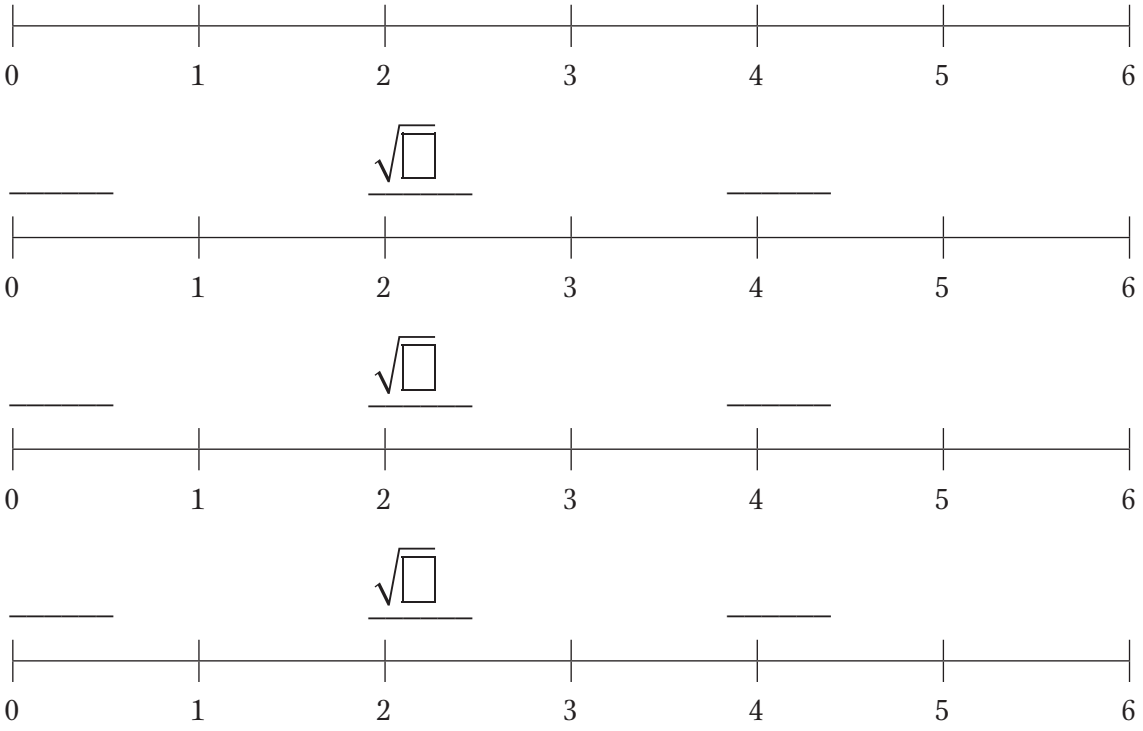
Set 1: Rational and Irrational Numbers

Station 4

At this station, you will find a number cube and a calculator. Follow these steps for each problem:

- Roll the number cube. Write the result on the first line next to the problem number.
- Then, write the same number in the box under the square root symbol on the second line.
- Use your calculator to find the value of the square root of the number you rolled. Round to the nearest hundredth and write this number on the third line.
- Finally, place the original number you rolled and the square root of that number on the number line.

	Number rolled	**Square root**	**Calculated value of square root**
1.	_____	$\sqrt{\square}$ _____	_____
2.	_____	$\sqrt{\square}$ _____	_____
3.	_____	$\sqrt{\square}$ _____	_____
4.	_____	$\sqrt{\square}$ _____	_____



5. What strategy did you use to place the irrational numbers on the number line?

_____

_____

_____