Common Core State Standards Station Activities for Mathematics II

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Introduction

This revised edition of the *Common Core State Standards Station Activities for Mathematics II* 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 following Common Core conceptual categories and domains for high school mathematics: Number and Quantity; Algebra (Seeing Structure in Expressions; Reasoning with Equations and Inequalities; Arithmetic with Polynomials and Rational Expressions); Functions; Geometry (Congruence; Similarity, Right Triangles, and Trigonometry; Circles); 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 10 minutes per station. Therefore, you might plan on having groups change stations every 10 minutes, with a 2-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 each activity set consists of four stations, the above time frame means that it will take about 50 minutes for groups to work through all stations.

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.

Guide to Common Core State Standards Annotation

As you use this book, you will come across annotation symbols included with the standards for several station activities. The following descriptions of these annotation symbols are verbatim from the Common Core State Standards Initiative website, at http://www.walch.com/CCSS/00002.

Symbol: ★

Denotes: Modeling Standards

Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (★).

From http://www.walch.com/CCSS/00003

Symbol: (+)

Denotes: College and Career Readiness Standards

The evidence concerning college and career readiness shows clearly that the knowledge, skills, and practices important for readiness include a great deal of mathematics prior to the boundary defined by (+) symbols in these standards.

From http://www.walch.com/CCSS/00004

Standards Correlations

The standards correlations that follow support the implementation of the Common Core State Standards for Mathematics II. This book includes station activity sets for the Common Core conceptual categories of Number and Quantity, Algebra, Functions, Geometry, and Statistics and Probability. The table that follows provides a listing of the available station activities organized by standard.

The left column lists the standard codes. The first letter of the code represents the Common Core conceptual category. This letter is followed by a dash and the initials of the domain name, which is then followed by the standard number. The middle column lists the title of the station activity set that corresponds to the standard, and the right column lists the page number where the station activity set can be found. The full text of the Common Core State Standards for Mathematics may be accessed at http://www.walch.com/CCSS/00005.

CCSS addressed	Set title	Page number
Number and Quantity		
N–CN.1 N–CN.2 N–CN.3 (+)	Operations with Complex Numbers	1
Algebra: Seeing Structure in Expressions		
A–SSE.3a★	Factoring	9
A–SSE.3b★ F–IF.7a★ F–IF.8a F–BF.3	Quadratic Transformations in Vertex Form	17
Algebra: Reasoning with Equations and Inequalities		
N–CN.7 A–SSE.3a★ A–REI.4b	Solving Quadratics	35
Algebra: Arithmetic with Polynomials and Rational Expressions		
A–APR.1	Operations with Polynomials	44
Functions		
A–REI.10 F–IF.7a★	Graphing Quadratic Equations	57

(*continued*)

Standards Correlations

CCSS addressed	Set title	Page number
Geometry: Congruence		
G–CO.9	Parallel Lines and Transversals	71
G–CO.11	Rhombi, Squares, Kites, and Trapezoids	83
G–CO.12 G–CO.13	Circumcenter, Incenter, Orthocenter, and Centroid	94
Geometry: Similarity, Right Triangles, and Trigonometry		
G–SRT.1b G–SRT.2	Similarity and Scale Factor	108
G–SRT.6 G–SRT.7 G–SRT.8★	Sine, Cosine, and Tangent Ratios, and Angles of Elevation and Depression	122
Geometry: Circles		
G–C.1 G–C.2 G–C.4 (+) G–C.5	Special Segments, Angle Measurements, and Equations of Circles	133
G–C.2 G–C.5	Circumference, Angles, Arcs, Chords, and Inscribed Angles	145
Statistics and Probability		
S–CP.1★ S–CP.2★ S–CP.3★	Probability	159

Materials List

Class Sets

- calculators (standard and graphing)
- rulers

Station Sets

- algebra tiles (40 blue, 40 green, 40 red, and 40 yellow)
- compasses (at least 4)
- drinking straws
- fair coins (at least 2)
- marbles (1 each of red, green, yellow, and blue)
- markers (2 red, 1 black, 2 blue, and 2 green)
- notecards
- pieces of colored yarn (3 red and 3 blue)
- plastic coffee can lid
- protractors (at least 2)
- tape measure
- tracing paper
- uncooked spaghetti noodles

Ongoing Use

- colored pencils or pens
- graph paper
- index cards (prepared according to specifications in teacher notes for many of the station activities)
- number cubes
- pencils
- scissors
- tape
- white paper

Seeing Structure in Expressions

Set 1: Factoring

Instruction

Goal: To provide opportunities for students to practice factoring quadratic equations

Common Core State Standard

A–SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★

a. Factor a quadratic expression to reveal the zeros of the function it defines.

Student Activities Overview and Answer Key

Station 1

Given equations in the form $y = ax^2 + bx + c$, where a, b, and c are integers, students work in groups to factor by grouping. Students will use algebra tiles as needed.

Answers

1. $(x + 4)(x + 4)$
2. $(x - 7)(x + 5)$
3. $(x - 1)(x + 9)$
4. $(x - 4)(x + 7)$
5. $(x + 2)(x - 1)$
6. $(x + 3)(x + 6)$
7. $(x - 4)(x + 11)$
8. $(x - 10)(x - 3)$
9. $(x - 5)(x + 5)$

Station 2

Given equations in the form $y = ax^2 + bx + c$, where a, b, and c are real numbers, students factor by grouping.

Answers

1. $(3x + 5)(x - 2)$
2. $(x - 1)(5x + 4)$
3. $\left(x - 8\right)\left(x + 3\right)$
4. $(3x - 1)(x - 2)$
5. $(7x - 3)(x - 2)$
6. $(3x + 4)(5x - 1)$
7. $\left(x + 0.5\right)\left(x + 0.3\right)$
8. $\left(x + 0.2\right)\left(x - 0.12\right)$

Instruction

Station 3

Given equations in the form $y = ax^2 + bx + c$, where a, b, and c are real numbers, students work in groups to factor by grouping. Students will use algebra tiles as needed.

Answers

1. $4(x+2)(x-2)$
2. $3(x-1)(x-7)$
3. $5(2x+3)(x-6)$
4. $\frac{1}{2}(3x-1)(x-2)$
5. $\frac{2}{5}(x+4)(x-10)$
6. $7(x+3)(3x+1)$
7. $\frac{1}{9}(x-5)(x-2)$
8. $\frac{3}{4}(4x-7)(x+2)$

Station 4

Students are given a set of 12 index cards, each inscribed with one of the following expressions: 6, 4, 5, 1/2 , 3, $(x-5)$, $(x+2)$, $(x-3)$, $(x+7)$, $(x+1)$, $(3x+2)$, and $(2x-1)$. They use grouping to factor a series of equations. Each card appears as a factor at least once in this series of equations. Then students combine their cards in pairs to come up with quadratic equations of their own.

Answers

1. $(x-5)(x+1)$
2. $4(3x+2)(2x-1)$
3. $6(x-3)(3x+2)$
4. $\frac{1}{2}(x+7)(x+2)$
5. $5(2x-1)(x+1)$
6. $3(x-5)(x-3)$
7. Answers will vary. Students should create three quadratic expressions that combine the factors on the cards.

Instruction

Materials List/Setup

Station 1 algebra tiles

Station 2 none

Station 3 algebra tiles

Station 4 algebra tiles; 12 index cards with the following written on them (one expression per card):
6; 4; 5; $\frac{1}{2}$; 3; $(x - 5)$; $(x + 2)$; $(x - 3)$; $(x + 7)$; $(x + 1)$; $(3x + 2)$; $(2x - 1)$

Instruction

Discussion Guide

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

Prompts/Questions

1. What are factors?
2. What is the Distributive Property? How does it apply to binomial factors?
3. How do you factor a quadratic equation?
4. If you factor a quadratic equation that is set equal to 0, what points on the equation's graph do the factors represent? Why?

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. Factors are the quantities that are multiplied to produce a product.
2. The Distributive Property is a property of real numbers that allows the multiplication of a term to a sum of terms. With a pair of binomials that are being multiplied together, the Distributive Property is used twice. Take the first term in the first binomial and multiply it by each term in the second binomial, adding the products. Then take the second term in the first binomial and multiply it by each term in the second binomial, adding all the products together.
3. Rewrite the equation in $y = ax^2 + bx + c$ form, with all x expressions and constants on the same side of the equation. Find the factors of a and the factors of c that combine to create b.
4. They represent the x-intercepts, because those are the points at which $y = 0$.

Possible Misunderstandings/Mistakes

- Incorrectly factoring quadratic expressions
- Incorrectly factoring constants and coefficients
- Not understanding factoring
- Not understanding polynomial factoring
- Not simplifying the equation before factoring
- Making simple arithmetical errors in factoring

NAME:

Seeing Structure in Expressions

Set 1: Factoring

Station 1

Work as a group to factor each equation. Use the algebra tiles if you wish. Show all your work.

1. $y = x^2 + 8x + 16$

2. $y = x^2 - 2x - 35$

3. $y = x^2 + 8x - 9$

4. $y = x^2 + 3x - 28$

5. $y = x^2 + x - 2$

6. $y = x^2 + 9x + 18$

7. $y = x^2 + 7x - 44$

8. $y = x^2 - 13x + 30$

9. $y = x^2 - 25$

Seeing Structure in Expressions

Set 1: Factoring

Station 2

Factor each equation. Show all your work. Check your work by using distribution to find the product of your factors.

1. $y = 3x^2 - x - 10$

2. $y = 5x^2 - x - 4$

3. $y = x^2 - 5x - 24$

4. $y = 3x^2 - 7x + 2$

5. $y = 7x^2 - 17x + 6$

6. $y = 15x^2 + 17x - 4$

7. $y = x^2 + 0.8x + 0.15$

8. $y = x^2 + 0.08x - 0.024$

Seeing Structure in Expressions

Set 1: Factoring

Station 3

Work as a group to factor each equation. Use the algebra tiles if you wish. Show all your work.

1. $y = 4x^2 - 16$

2. $y = 3x^2 - 24x + 21$

3. $y = 10x^2 - 45x - 90$

4. $y = \frac{3}{2}x^2 - \frac{7}{2}x + 1$

5. $y = \frac{2}{5}x^2 - \frac{12}{5}x - \frac{80}{5}$

6. $y = 21x^2 + 70x + 21$

7. $y = \frac{x^2}{9} - \frac{5}{9}x - \frac{2}{9}x + \frac{10}{9}$

8. $y = 3x^2 + \frac{3}{4}x - \frac{21}{2}$

Seeing Structure in Expressions

Set 1: Factoring

Station 4

At this station, you will find algebra tiles and 12 index cards marked with the following expressions:

$$6;\ 4;\ 5;\ \frac{1}{2};\ 3;\ (x-5);\ (x+2);\ (x-3);\ (x+7);\ (x+1);\ (3x+2);\ (2x-1)$$

Work as a group to factor each equation below, using the index cards provided. You will also use the factors later in the activity. Use the algebra tiles if you wish. Show all your work.

1. $y = x^2 - 4x - 5$

2. $y = 24x^2 + 4x - 8$

3. $y = 18x^2 - 42x - 36$

4. $y = \frac{1}{2}x^2 + \frac{9}{2}x + 7$

5. $y = 10x^2 + 5x - 5$

6. $y = 3x^2 - 24x + 45$

7. Combine your factor cards to form three different quadratic equations. Write your equations below.