



SAN DIEGO CITY SCHOOLS

Department of Mathematics

Instructional Module to Enhance the Teaching of

PRENTICE HALL

PRE-ALGEBRA

California Edition 2001

GRADE 7

Module 1

Algebraic Expressions and Integers

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KEY MATHEMATICAL CONCEPTS GRADE SEVEN

"BIG IDEAS":

By the end of grade seven, students will:

- Know the properties of, and compute with, rational numbers by manipulating numbers and equations. Know and use different representations of fractional numbers (fractions, decimals, and percents) and are proficient at changing from one to another. Understand and use factoring of numerators and denominators and properties of exponents.

Note: Negative fractions are formally introduced and studied for the first time.

- Increase their facility with ratio and proportion, compute percents of increase and decrease, and compute simple and compound interest.
- Graph linear functions and understand the idea of slope and its relation to ratio. Solve simple linear equations and inequalities over the rational numbers.
- Know the Pythagorean theorem and solve problems in which they compute the length of an unknown side.

Note: The Pythagorean theorem is probably the first true theorem that the students will have seen.

- Know how to compute the surface area and volume of basic three-dimensional objects and understand how area and volume change with a change in scale.
- Make conversions between different units of measurement. Know and use various forms of displays for data sets.

(Notes from Mathematics Framework for California Public Schools, Grade Seven, p149-152.)

Key Mathematical Concepts Addressed in Chapter 1 – Algebraic Expressions and Integers

- AF 1.1, 1.2, 1.4 Use variables to write expressions and order of operations to evaluate algebraic expressions.
- ***NS 2.5** Interpret absolute value of a number using a number line.
- ***NS 1.2, AF 1.3** Add and subtract integers. (Introduce multiplying/dividing integers.)
- AF 1.5 Represent quantitative relationships graphically (coordinate plane).
- MR 1.1, 1.2, 2.4 Make and test conjectures using inductive reasoning.

MODULE 1: Algebraic Expressions and Integers

DAY 1: LESSON 1-3, pp 13 - 16

LESSON FOCUS:	Evaluate variable expressions and solve word problems by evaluating expressions.
CA STANDARD:	AF 1.2
Purpose of Lesson:	At the end of the lesson students will be able to substitute a value for a variable and evaluate a variable expression to solve a real world problem.
Warm-up/ Routine(s):	Write on board: <i>Writing Variable Expressions</i> 1) Nine more than a number y 2) 4 less than a number n 3) A number z times 3 4) A number a divided by 12 5) 6 times the quantity 4 plus a number c <i>Students translate the word phrases into variable expressions.</i>
LAUNCH:	TE p13 <i>Connecting to Students' Lives:</i> (Babysitting - pay per hour, i.e. $\$2/h$ where h is the number of hours worked) Have students suggest some examples & compute what the sitter would make.
EXPLORE: Materials: Overhead of chart, p. 15, Calories Per Hour . . .	On board or on an overhead, make chart, p15, <i>Calories Per Hour Used by a 100-lb Walker</i> . Do a & b together as a class. Have partners write their own story statements & find out how many calories would be used for a participant in a walking marathon from Pt. Loma to Qualcomm Stadium. At some time during the race, walkers use each of the four types of walking on the chart. The average walker takes about 10 hours, some finished in less than that time and others take a great deal longer. Give your walker a name & write about his/her progress in the race. Share at tables & if time with class. Teacher moves from group to group, helping students clarify which values are variables/which coefficients.
Practice:	In small groups: Textbook p16; #36 (Carnival) Textbook p15 # 1-10 Check Understanding
SUMMARIZE:	In sharing, look for partner stories that correctly use hours as variable & number of calories as coefficient with a clear explanation about "why" this is done & "what" it tells us about the runner.
Closure:	Time to reflect back on the purpose of the lesson, and help students make meaningful connections .
Homework:	Textbook: p16 #35. <i>Statistics</i> *(Babies born) Textbook p16; Mixed Review #38-44 *Extension: <i>Approximate number of babies born in a week? A month?</i>

MODULE 1: Algebraic Expressions and Integers

DAY 2: LESSON 1-4, pp 17 - 21

LESSON FOCUS:	To represent integers on a number line and order integers. To find the opposites and absolute values
CA STANDARD:	<i>NS 2.5 (Key Standard)</i> MR 2.5
Purpose of Lesson:	At the end of the lesson, students will be able to represent on a number line & order integers and find opposites & absolute values.
Warm-up/ Routine(s):	<u><i>Mental Math:</i></u> Draw a long number line -10 to 10 on board. Pass out post-its to 4-5 students with integers on them. (Direct them to place the number appropriately along the number line.) <u><i>Materials:</i></u> Post-its with integers on them Small groups discuss placement - share out as class <u>describing the number in reference to how far it is from 0</u> (Reference: p18, Example 2).
LAUNCH: <u><i>Vocabulary:</i></u> Opposites, absolute value	Introduction to opposites & absolute value: Ask students: "What is the same about 3 and -3?"
EXPLORE: <u><i>Materials:</i></u> Use tape to mark off a long number line on classroom floor	Develop Understanding: Pass out large cards with integers on them to 4-5 students. As each student takes his/her place along the number line, ask for a volunteer to stand at the integer's opposite. Students describe their position along the number line in reference to the distance that they are from zero. Direct Teaching: (Ref: p18, Part 2). -That distance is called <i>absolute value</i> and it is written this way $ 3 $. Put on board: 2 -8 -10 10 -5 1 -6 -4 4 Students write absolute value for each/volunteers write on board to check.
Practice:	Textbook p19; Check Understanding, #1-10
SUMMARIZE:	What do you know about the distance from zero of an integer and its opposite? How is that related to absolute value? How far is zero from zero on the number line? What would the absolute value of zero be?" EXPLAIN your thinking.
Closure:	Time to reflect back on the purpose of the lesson, and help students make meaningful connections .
Homework:	Textbook: p21, Mixed Review, #63-68 Extension: p21, Critical Thinking, #62

MODULE 1: Algebraic Expressions and Integers

DAY 3: LESSON 1-5, pp 23 -28

LESSON FOCUS:	To use models, number lines and rules to add integers
CA STANDARD:	NS 1.2 (Key Standard) AF 1.3 (Key Standard)
Purpose of Lesson:	At the end of the lesson, students will be able to solve integer problems using addition.
Warm-up/ Routine(s):	Number Sense: Order of Operations (Review) Simplify the following expressions: $4 + 15 \div 3$ $10 - 1 \times 7$ $3 \cdot 5 - 8 \div 4 + 6$ $2[(13 - 4) \div 3]$
LAUNCH:	TE p23, Connecting to Students' Lives <i>Ask students to think of a number; add five; subtract 3; subtract five; add three. What is the result? Why? (Inverse of a number: "doing and undoing") You may want to do a couple of these until students fully grasp the concept.</i>
EXPLORE: Materials: Two color counters or color tiles Vocabulary: Zero pair	❖ INTRODUCE CONCEPT: See below for "Human Number Line" model Teacher reviews p22, EX 1 and 2, highlighting "zero pair" model. Use 2-color chips; +/- tiles; etc. Ask students to complete p22, 1-16, using their models.
Practice:	Textbook p26; 1-12 Check Understanding <u>OR</u> Reteaching Worksheet TE p28
SUMMARIZE:	"Why can you add or remove any number of the zero pairs?" "What is a simple rule for addition of integers?"
Closure:	Time to reflect back on the purpose of the lesson, and help students make meaningful connections .
Homework:	Textbook p27; #51 and 68; <i>and if appropriate</i> Practice or Reteach Worksheet, p 28

- ❖ **HUMAN MODEL ON A NUMBER LINE:** Create a large number line (masking tape works well) on the floor or wall where students can see. Mark: -10; -5; 0; 5; 10 with tape hash marks. Model by always starting at zero and always facing forward (toward the positive). A positive number means to step that many steps toward the positive and a negative number means to step that many paces **backward** toward the negative. (*Note: DO NOT TURN AROUND - walk backward!*)
- ❖ Example: $3 + 4 = 7$ Start at 0; walk 3 steps forward to 3; walk 4 steps forward to 7.
- ❖ Example: $-3 + (-2) = -5$ Start at 0; walk backward 3 steps to -3; walk 2 steps backward to -5.
- ❖ Example: $3 + (-2) = 1$ Start at 0; walk 3 steps forward to 3; walk 2 steps backward to 1.
- ❖ Example: $3 + (-5) = -2$ Start at 0; walk 3 steps forward to 3; walk 5 steps backward to -2.

MODULE 1: Algebraic Expressions and Integers

DAY 4: LESSON 1-6, pp 29 - 34

LESSON FOCUS:	Use models, number lines and rules to subtract integers
CA STANDARD:	NS 1.2 (Key Standard)
Purpose of Lesson:	At the end of the lesson, students will be able to solve integer problems using subtraction.
Warm-up/ Routine(s):	<u>Number Sense:</u> Order of Operations (Review) $12 - 8 \div 2$ $4(4) - 2$ $21 \div 7 + 14$ $[2 + (6 \cdot 8)] - 1$
LAUNCH:	TE p29 Connecting to Students' Lives (Skateboard) TE p29, #1-3 Try This (center of page): Using models, have students subtract. <i>How can you subtract: $4 - 8 =$ Using a Model? (2-color chips; +/- tiles; etc)</i> Ask students to circle the terms that are separated by an addition or subtraction (operation) sign; and add as many "zero pairs" as needed.
EXPLORE:	❖ See below for "Human Number Line" model Ask students to complete Textbook p31, #14-19 using their model(s).
Practice:	Use models to solve: Textbook p31; 1-10; Check Understanding
SUMMARIZE:	"What is a simple rule for subtraction of integers?" "Why can you add or remove any number of the zero pairs?"
Closure:	Time to reflect back on the purpose of the lesson, and help students make meaningful connections .
Homework:	Text p33 Error Analysis Reteaching Worksheet TE p33 using models. Draw the models to show solution.

- ❖ **HUMAN MODEL ON A NUMBER LINE:** Create a large number line (masking tape works well) on the floor or wall where students can see. Mark: -10; -5; 0; 5; 10 with tape hash marks. Model by always starting at zero and facing forward (toward the positive). A positive number means to step that many steps toward the positive and a negative number means to step that many paces backward toward the negative. NOTE: DO NOT TURN AROUND for addition. **TURN AROUND** for subtraction, as it is the opposite of addition, and follow addition "rules".
- ❖ Example: $3 - 4 = -1$ Start at 0; walk 3 steps forward to 3; **TURN AROUND** for subtraction, which is opposite of addition; now walk 4 steps forward to -1.
- ❖ Example: $-3 - (-2) = -1$ Start at 0; walk backward 3 steps to -3; **TURN AROUND** for subtraction, which is opposite of addition; walk 2 steps backward to -1.
- ❖ Example: $3 - (-2) = 5$ Start at 0; walk 3 steps forward to 3; **TURN AROUND** for subtraction, which is opposite of addition; walk 2 steps backward to 5.
- ❖ Example: $3 - (-5) = 8$ Start at 0; walk 3 steps forward to 3; **TURN AROUND** for subtraction, which is opposite of addition; walk 5 steps backward to 8.

MODULE 1: Algebraic Expressions and Integers

DAY 5: LESSON 1-6, pp 29 - 34

LESSON FOCUS:	To use models, number lines and rules to subtract integers
CA STANDARD:	NS 1.2 (Key Standard)
Purpose of Lesson:	At the end of the lesson, students will be able to solve integer problems using subtraction.
Warm-up/ Routine(s):	<u>Number Sense:</u> Order of Operations (Review) Compare. Use $<$ or $>$ or $=$ to complete each statement. $15 \cdot 3 - 2$ ___ $15 \cdot (3 - 2)$ $8 + 12 \div 4$ ___ $(8 + 12) \div 4$ $12 \div 3 + 9 \cdot 4$ ___ $12 \div (3 + 9) \cdot 4$
LAUNCH: Materials: Overhead of game board, transparent chips or markers	<u>Integer Four-in-a-Row:</u> See following page(s) of Module. On transparency, begin by playing with the whole class.
EXPLORE: Materials: Copy of game board for each pair of students, different kind of markers for each player	Duplicate and distribute <u>Integer Four-in-a-Row:</u> See following page(s) of Module 2 for partner play. Use the 2-color counters as markers.
Practice:	<u>Integer Choices:</u> See following page(s) of the Module.
SUMMARIZE:	<i>What strategies helped you line up your markers in a row? Why did it work? What did it help you know as you played the game? What do you know about subtracting a negative number from a positive number? A negative number subtracted from a negative number?</i>
Closure:	Time to reflect back on the purpose of the lesson, and help students make meaningful connections .
Homework:	p. 28, # 69-72 p. 28, Mixed Review, # 74 - 81

MODULE 1: Algebraic Expressions and Integers

DAY 6: LESSON 1-7, pp 35-39

LESSON FOCUS:	Use inductive reasoning to make predictions & formulate conjectures about patterns.
CA STANDARD:	MR 1.1; MR 1.2; MR 2.4
Purpose of Lesson:	At the end of the lesson, students will be able to write rules for patterns & make predictions and test conjectures.
Warm-up/ Routine(s):	Number Sense: Daily Skills Warm Up, Lesson 1-6, TE p 29 - Overhead (OH)
LAUNCH: <u>Vocabulary:</u> Inductive reasoning, Conjecture <u>Materials:</u> Make a square card similar to the diagram in Example 1, p35	Introduce vocabulary: <i>Inductive reasoning</i> is making conclusions based on patterns you observe. A <u>conclusion</u> by inductive reasoning is a <i>conjecture</i> . Turn the card clockwise and ask students for their "observation" about what's happening & their "prediction" of what the card will look like next. Help students differentiate between observation & conjecture & understand that they are using inductive reasoning to come to a conclusion. Do on board with students: Patterns, EXAMPLE 2, p35 & EX. 3, p36, a, b, c ***HELP STUDENTS WRITE A RULE FOR EACH PATTERN!
EXPLORE:	Turn to p39 and begin the pattern seen in #23. Go slowly row by row so students have an opportunity to start seeing what is happening. Have them copy the pattern. Student partners add three more rows, then find the sum of each row and predict the sum of the numbers of the ninth row, 12 th row, 20 th row . . . Ask students to work together at their tables to find as many patterns as they can. Challenge them to write a rule for what is happening as the pattern continues to grow.
Practice:	Check Understanding, p38, 1 - 8
SUMMARIZE:	<u>QUICK WRITE:</u> <i>When does a conclusion become a conjecture? Give an example.</i>
Closure:	Time to reflect back on the purpose of the lesson, and help students make meaningful connections .
Homework:	Success Building & Problem Masters booklet, p102, Finding Patterns

MODULE 1: Algebraic Expressions and Integers

DAY 7: LESSON 1-9, pp 44-49

LESSON FOCUS:	To multiply integers using repeated addition, models, patterns and rules
CA STANDARD:	NS 1.2 (Key Standard)
Purpose of Lesson:	By the end of the lesson, students will be able to solve integer problems using multiplication.
Warm-up/ Routine(s):	<u>Mental Math</u> : TE p49 in lower margin Checkpoint/ Mini-Assessment (on overhead)
LAUNCH:	TE p44 Connecting to Students' Lives (Video games) (500 cents + -25 + -25 + -25 . . .) TE p44 <i>Introduce the Concept</i> : Teacher copies the table and together with students completes the operations discovering & discussing the patterns that occur. TE p45 Example #2: Teacher copies and together with students completes expanding the pattern from positive to negative multiplier. Students discover/ discuss the patterns that occur. <u>Note</u> : Refer to " opposite of " when referencing $-1(5) = -5$; $1(5) = 5$; - means "the opposite of", SO $-1(5) =$ the opposite of 5 or -5. AND $-2(-5) = 10$; $2(-5) = -10$; - means "the opposite of", SO $-2(-5) =$ the opposite of -10 or +10.
EXPLORE: Reference: p 45	Have student partners extend patterns in the same manner: -3 (4) -3 (-4) -2 (15) -2 (-15) Partners try to write generalized rules for multiplying integers: Product of 2 integers with same sign = Product of 2 integers with different sign = Product of zero =
Practice:	P 44, TRY THIS, #4, 5, 6
SUMMARIZE:	Share generalized rules - chart in student language with an example for each rule. <i>What patterns do you notice? Do the rules "make sense"? ...based on the patterns?</i>
Closure:	Time to reflect back on the purpose of the lesson, and help students make meaningful connections.
Homework:	P 45, TRY THIS, #8, 9, 10 Textbook p47: Check Understanding #1, 2, 3, 4, 6, 7, 9 Optional: Poster Report

MODULE 1: Algebraic Expressions and Integers

DAY 8: LESSON 1-9, pp 44-49

LESSON FOCUS:	To divide integers using repeated addition, models, patterns and rules
CA STANDARD:	NS 1.2 (Key Standard)
Purpose of Lesson:	By the end of the lesson students will be able to solve integer problems using division.
Warm-up/ Routine(s):	<u>Mental Math</u> : Number Sense Daily Skills Warm Up Transparency, Lesson 1-9, TE p44
LAUNCH:	Refer students back to their chart of multiplication of integers rules. Ask students to provide an additional example for each rule.
EXPLORE:	<p>Put the following on board: $12 \div 3 =$ $-12 \div (-3) =$ $12 \div (-3) =$ $-12 \div 3 =$</p> <p>Students work with a partner & use what they know about the rules for multiplication of integers to try to figure out what the results might be for each expression. Once they have solutions, they check with their table group and explain to one another why they think their solutions are correct. Explanations should be based upon "because I know _____ about multiplying integers then I think . . ."</p> <p>Teacher facilitates conversation. (Depending upon the results, you may have to step in with direct instruction. You can demonstrate that division is simply multiplication by the reciprocal so students SEE what is happening. Trying to do this on a number line or repeated subtraction really gets messy & confusing even for the best of us!)</p> <p>Chart rules for division of integers with an example for each.</p>
Reference: p 46	
Practice:	P 46, TRY THIS, #11, 12, 13
SUMMARIZE:	<p><i>How are multiplication and division of integers similar?</i></p> <p><i>What patterns do you noticed?</i></p> <p><i>Do the rules "make sense"? ...based on the patterns?</i></p>
Closure:	Time to reflect back on the purpose of the lesson, and help students make meaningful connections .
Homework:	Textbook p47; Check Understanding #5, 8, 10, 11a,b,c & #25, 26, 31 - 34

MODULE 1: Algebraic Expressions and Integers

DAY 9: LESSON 1-10, pp 50 -54

LESSON FOCUS:	To name the four quadrants in the coordinate plane and to name and graph points in the coordinate plane
CA STANDARD:	AF 1.5
Purpose of Lesson:	At the end of the lesson, students will be able to name and graph points in the coordinate plane.
Warm-up/ Routine(s):	Mini-Assessment: CHECKPOINT 2, p 49 (Selected problems: #1, 4, 7, 9, 10, 11)
LAUNCH: Vocabulary: Coordinate plane, <i>x-axis</i> , <i>y-axis</i> , quadrant, origin, ordered pair, <i>x-coordinate</i> , <i>y-coordinate</i>	Ask students how many of them know how to play Battleship. Have someone briefly tell how it is played. Use Transparency 38, TE p3, as a visual for identifying <i>x-axis</i> and <i>y-axis</i> , quadrants, & origin. Use -3 and 4 as on ordered pair & demonstrate plotting the points. Make up a few more examples & plot.
EXPLORE: Materials: Graph paper, (rulers available)	By small groups: Assign Textbook p54; #59 and #60 Part a - d; 2 groups do #59 and #60a; 2 groups do #59 and #60b; and so on. Complete on graph paper and share transformations. Textbook p54; #58 <i>Open-ended</i>
Practice:	Have students exchange coordinates and draw partner's picture, following the ordered pairs.
SUMMARIZE:	QUICK WRITE: In your own words, explain how to plot this ordered pair: (-5, 6).
Closure:	Time to reflect back on the purpose of the lesson, and help students make meaningful connections .
Homework:	p 54, MIXED REVIEW, #62 - 68, and p 54, <i>JUSTIFY EACH STEP</i> Additionally, if assigned: Continue to work on Poster Report.

MODULE 1: Algebraic Expressions and Integers

DAY 10: LESSON 1-8, pp 40-43

LESSON FOCUS:	To develop generalizations and solve a problem by looking for a pattern
CA STANDARD:	MR 3.3
Purpose of Lesson:	At the end of the lesson, students will be able to identify a pattern and solve problems using patterns. Students will begin to make generalizations.
Warm-up/ Routine(s):	Number Sense: <u>Pico, Ferme, Bagel</u> - A Game of Logic (See Routines/ Warm-up Bank for directions)
LAUNCH:	<u>Handshake Problem</u> : TE p40 Additional Example to Check Understanding: <i>Each student on a committee with five members shakes hands with every other member. How many handshakes will there be in all?</i> (10) Model this exercise with the students.
EXPLORE:	Students work together to answer the following: <i>What if there were six members on the committee? Ten? Twenty?</i> <i>Explain in words what is happening to the pattern as the committee grows to more & more members.</i> Allow time for them to them to investigate & organize in any manner they wish. Focus is not the organization - it's the thinking & generalizing. Challenge students to verbally make a general statement about what is happening as the pattern grows. Move from group to group facilitating efforts.
Practice:	Textbook p42 #1; write a statement about how the pattern is growing.
SUMMARIZE:	Chart student statements & check with the pattern to see if each works. Try to make sure to ground each statement in the problem.
Closure:	Time to reflect back on the purpose of the lesson, and help students make meaningful connections .
Homework:	Solve each pattern problem and in words, explain how the pattern is growing. Textbook p43, #2, 4; MIXED REVIEW , 11 - 17 Additionally if assigned: Continue work on Poster Report

MODULE 1: Algebraic Expressions and Integers

DAY 11: LESSON Assessment

LESSON FOCUS:	Chapter Assessment - <u>Key Understandings</u> : Use addition, subtraction, multiplication and division of integers accurately in problem solving and using a variable & writing a variable expression.
CA STANDARD:	Chapter 1 Standards
Purpose of Lesson:	To assess student understanding(s) of using addition, subtraction, multiplication, & division of integers accurately in problem solving and using a variable & writing a variable expression
Warm-up/ Routine(s):	If assigned: <u>In small groups, share Poster Reports OR Overhead, AFTER THE LESSON, TE p18</u> , Write an integer to represent each situation.
LAUNCH:	Review test-taking skills
EXPLORE:	Chapter 1 Alternative Assessment (Duplicate Chapter 1 Support File p36)
Practice:	TE p16 Enrichment Worksheet for "early finishers"
SUMMARIZE:	Write a Chapter Reflection in Math Notebook. <i>What did you already know how to do from this chapter?</i> <i>What new or additional information/vocabulary did you learn?</i> <i>How do you think you did on the final assessment?</i> <i>What do you wish had been asked on the assessment, that was not, to demonstrate your further understanding of the content of this chapter?</i>
Closure:	<i>If you had to tell another student what the most important mathematical learning or understanding was in this chapter, what would you say? Why?</i>
Homework:	TE p16 Enrichment Worksheet

INTEGER FOOTBALL

Players: Two or more

Materials: Coin, Integer Cards, Football Field Game Board,
Paper Football Marker

Directions:

1. Cut out the Integer Cards, shuffle them, and place face down.
2. Each team starts on the 50-yard line.
3. A flip of the coin decides who will kick off.
4. The winner of the toss turns over the top card and adds the integer to 50. The result is the number of yards needed to score (negative numbers are desirable!).
5. The ball goes over to the other player or team after each play.
6. A team makes a touchdown and scores 6 points when the team's total play is zero.
7. To score the point after the touchdown, the team must draw any negative numbered card.
8. After each touchdown both sides return to the 50-yard line.
9. At half time, after 10-15 minutes, each side must begin at the 50-yard line.
10. The side with the greatest score at the end of the time period, 20-30 minutes, wins.