



SAN DIEGO UNIFIED SCHOOL DISTRICT

Instructional Module to Enhance the Teaching of

HARCOURT MATH

California Edition

GRADE 6

Module 8

Algebra: Patterns and Relationships

KEY MATHEMATICAL CONCEPTS FOR GRADE SIX - BIG IDEAS:

By the end of grade six, students will:

- Master the four arithmetic operations with positive and negative whole numbers, positive fractions, and decimals. They accurately solve problems involving fractions, ratios, proportions, and percentages.
- Understand the concepts of mean, median and mode of data sets, and how to calculate the range. They analyze data and sampling processes for possible bias and misleading conclusions. They calculate the probabilities for compound events and understand the difference between independent and dependent events.
- **Write verbal expressions and sentences as algebraic expressions and equations; they evaluate algebraic expressions, solve simple linear equations, and graph and interpret their results. They analyze and use tables, graphs, and rules to solve problems involving rates and proportions.**
- Deepen their understanding of the measurement of plane and solid shapes and use this understanding to solve problems.

Key Mathematical Concepts for Module 8

- Recognize, extend, describe, generalize, and represent geometric and numerical patterns.
- Create and represent numerical and geometric patterns.
- Use multiple representations of functional relationships and translate between the representations (words, numbers, models, graphs, and equations).
- Write, solve, and graph inequalities.
- Given one representation of an inequality, translate between the different representations, i.e. words, equations, and number lines.
- Identify, locate, and graph points, relationships, and transformations on a coordinate plane.
- Identify and generalize linear and nonlinear relationships in equations, geometric and numerical patterns, graphs, and tables.

<u>Chapter 28: Patterns</u> Lesson 28.1: Problem Solving Strategy: <i>Find a Pattern</i> Lesson 28.2: Patterns in Sequences Lesson 28.3: Number Patterns and Functions Lesson 28.4: Geometric Patterns	<u>Chapter 30: Graph Relationships</u> Lesson 30.1: Inequalities on a Number Line Lesson 30.2: Graph on a Coordinate Plane Lesson 30.3: Graph Functions Lesson 30.4: Problem Solving Skill: <i>Make Generalizations</i> Lesson 30.5: MATH LAB: Explore Linear and Nonlinear Relationships Lesson 30.6: Graph Transformations
<u>Chapter 29: Geometry in Motion</u> Lesson 29.1: Transformations of Plane Figures Lesson 29.5: Symmetry	

MODULE 8: UNIT 9: ALGEBRA: Patterns And Relationships

DAY 1: - LESSON 30.2; pp. 560-563

MATERIALS:	TR63 Graph Paper and TR67 or 68 coordinate plane paper, transparency and student copy in plastic "white board" or consumable for each student; TE p. 561: CHALLENGE 30.2; transparency and 1 copy per student
LESSON FOCUS:	Graph on the Coordinate Plane
CA STANDARD:	MR 2.1; (MR 2.4)
Purpose of Lesson: Math Background: TE p. 560A	At the end of the lesson students will be able to use an ordered pair to describe a location on the coordinate plane.
Warm-up/ Routine(s):	NUMBER OF THE DAY 30.2; TE p. 560A or PROBLEM OF THE DAY 30.2; TE p. 560A
LAUNCH: <u>Books Closed:</u> Use the vocabulary when describing location of points and press students to use the vocabulary when explaining strategy or rule (vertical, horizontal, x -axis, y -axis, quadrants, origin and ordered pair).	Students determine the rule for plotting the point for an ordered pair (<i>may not be necessary for all classes</i>). <ul style="list-style-type: none"> Display transparency similar to 4 quadrants on p. 560 without plotting any points. Label it as the students label theirs. Write an ordered pair, silently model moving across the x-axis and up or down y-axis, plot the point and label it A on the graph. Write a second ordered pair in another quadrant and have a student model plotting that point. Ask students to write the ordered pair for a point you place on the graph and label C (<i>Private Think Time</i> followed by partner work). Discuss and repeat with another point. Ask students to verbalize the rule to plot or identify an ordered pair on a coordinate graph. (<i>Private Think Time</i>, then small group) Chart and test the rule. (Press students to include "origin" in the rule).
EXPLORE: <i>Stretching Figures</i> , p. 577 is a richer task and is recommended unless students have had very little opportunity to plot ordered pairs.	CHALLENGE 30.2: TE p. 561 or CHALLENGE: "Stretching Figures", p. 577: For either task: <ul style="list-style-type: none"> Students label quadrants, x- and y-axis and origin. Partners work together to complete the figure and make observations about the points in each quadrant: <i>"What do all the ordered pair for points in Quadrant I have in common?" "...Quadrant II?" "...III?" "...IV?"</i> For CHALLENGE: "Stretching Figures", p. 577: <ul style="list-style-type: none"> Use questions TE p. 577
Practice: If "Stretching Figures" is used, the summary should include the effect of doubling both or one of the coordinates.	p. 563, #42, 43 (Skip if working on the "Stretching Figures" task.)

<p>SUMMARIZE/ Closure:</p>	<ul style="list-style-type: none"> • Discuss p. 563, #43 • "In which Quadrant will each of the following ordered pairs be located, and how do you know?" (List about 2 ordered pairs from each of the 4 quadrants. Partner, then whole group discussion) • Partners alternate describing how to predict the quadrant of a given ordered pair, and specific verbal instructions for plotting the point (listener follows verbal instructions exactly as given). <p>TE p. 563; Lesson Quiz 30.2; #1-4</p>
<p>HOMEWORK:</p> <p>p. 563; #46-48</p>	<ul style="list-style-type: none"> • Create a design or figure and connect the points on a 4-quadrant graph. (To be used for Warm-up Day 2.) • On a separate paper, write the ordered pairs that can be used so someone else can recreate the same figure. (For "Stretching Figures" groups, the task could include creating a similar to the "stretched" figure task.) • MIXED REVIEW AND TEST PREP: p. 563; #46-48

MODULE 8: UNIT 9: ALGEBRA: Patterns And Relationships

DAY 2: - LESSON 28.1; pp. 524-525

MATERIALS:	Graph paper; circle counters
LESSON FOCUS:	Find a Pattern
CA STANDARD:	NS 2.0 Key Standard; MR 1.1; (NS 2.3 Key Standard; MR 2.4)
Purpose of Lesson: Math Background: TE p. 524A	At the end of the lesson students will be able to solve problems by using the strategy <i>find a pattern</i> and be able to translate between representations of a pattern.
Warm-up/ Routine(s):	Students trade (homework) designs from Day 1 and solve, <i>or</i> NUMBER OF THE DAY; TE p. 524A
LAUNCH: p. 524: <u>Books closed</u>	<ul style="list-style-type: none"> • Read the skydiving problem on top of p. 524 and have students compare it to the picture. • Model the skydivers with counters or sketch for 1 second, 3 seconds, 5 seconds (See ALTERNATIVE TEACHING STRATEGY TE p. 524B) • Display the table on p. 524 through 7 seconds only.
EXPLORE: p. 524	<ul style="list-style-type: none"> • Students complete the next 4 parts of the table and write descriptions of the patterns they see in the table for the <i>Time, Skydivers Added,</i> and <i>Total Skydivers.</i> • Use the patterns to determine at how many seconds there will be 81 skydivers. • "What would be the 10th number in the pattern for the total skydivers?" <p>Discuss reasoning with the whole class if needed for scaffolding before moving to the second pattern.</p>
Practice: TE p. 524B	Students complete the second pattern in the last paragraph of ALTERNATIVE TEACHING STRATEGY, TE p. 524B
SUMMARIZE/ Closure: TE p. 525	<ul style="list-style-type: none"> • Discuss different strategies students employed when analyzing the patterns. • "How does organizing the data in a table help when analyzing a pattern?" • DISCUSS: TE p. 525: <i>What rule was used to create this pattern: 2, 6, 18, 54?</i> TE p. 525; Lesson Quiz 28.1 or p. 525, #1
HOMEWORK	<ul style="list-style-type: none"> • p. 525, #2, 7 • Create a number pattern and write the rule on the back (may be exchanged with partner on Day 3). • Complete Warm-up design graphs, if assigned.

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DAY 3: - LESSON 28.1; pp. 524-525

MATERIALS:	Graph paper for each student (consumable or in plastic "white board")
LESSON FOCUS:	Find a Pattern
CA STANDARD:	NS 2.0 Key Standard; MR 1.1; (NS 2.3 Key Standard; MR 2.4)
Purpose of Lesson: Math Background: TE p. 524A	At the end of the lesson students will be able to solve problems by using the strategy <i>find a pattern</i> and be able to translate from graphical representations of a pattern to other equivalent representations.
Warm-up/ Routine(s):	<i>Discuss</i> the graphs students created from Day 1 homework <i>or</i> PROBLEM OF THE DAY 28.1; TE p. 524A. Extension: Ask students to write the problem as an algebraic expression. ($2n + 3 = 15$; $n = 6$)
LAUNCH: Task is a modification of problem #1 on p. 525	<ul style="list-style-type: none"> • <i>Exchange student written patterns</i> completed for homework and select one or two to <i>discuss</i>. • <i>Introduce/discuss</i> briefly the subject of exercise plans to get in shape (running, weight lifting, sit-ups, etc.) • Tell the students that they are going to determine Alex's exercise plan for doing push-ups by <i>making and analyzing a graph</i>. From the graph they will <i>describe</i> the plan in words and <i>represent</i> it in a table and a equation.
EXPLORE: p. 525	<p>Find a Pattern using a graph and translate the graph into an equation and a table:</p> <ul style="list-style-type: none"> • <i>Display</i> a graph with the following filled in: <ul style="list-style-type: none"> • Title: <i>Alex's Push-ups Per Day</i>, y-axis labeled <i>Number of Push-ups</i>, numbered in increments of 2; x-axis labeled <i>Days</i> with increments of one. • After partners label the graph, they: <ul style="list-style-type: none"> • <i>Plot</i> the following ordered pairs: (1,7) (2,12) (3,17) • <i>Determine the pattern</i> from the graph. <ul style="list-style-type: none"> • "How many push-ups will Alex do on the 10th day?" • "On which day will Alex do 42 push-ups if he continues the pattern?" • <i>Complete</i> a table for the first 5 days. • <i>Write a rule</i> in words for finding the number of push-ups Alex will do on any day (i.e. "Multiply the number of days times five and add two more push-ups to that number", or "Take one away from the number of days and multiply that by 5; then add the 7 from the first day"). • <i>Write</i> an equation for finding the number push-ups completed on any day. (i.e. $5n + 2 = p$ or $5(n - 1) + 7 = p$)
Practice:	<ul style="list-style-type: none"> • Extension, if needed: <ul style="list-style-type: none"> • <i>Display</i> an equation to represent Marco's plan for push-ups: $6(n - 1) + 1 = p$

	<ul style="list-style-type: none"> • Use the equation to compare Alex's exercise plan with Marco's. • Plot Marco's graph with Alex's graph and make observations about the two plans.
SUMMARIZE/ Closure:	<ul style="list-style-type: none"> • "What strategies did you use to find the pattern from the graph and derive the equation?" • "What causes the points to form a straight line?" (Constant change increasing by 5 for every day) • "How does this pattern show up in the table?" • After discussion of the students' generalizations of the pattern in words and equation, ask, "How is this same pattern of increasing the number of push-ups every day by 5 represented in the equation?" "... in the table?" "...in the generalization using words?" • Have students who worked on extension present their graphs and observations. • "Do you think the boys will be able to stick with their plans?" "Why or why not?"
HOMEWORK	<p>p. 525, #3 and 4: Create a table and an equivalent graph to represent the pattern in problem #3. Verify the equation using the graph and the table. Explain your strategies for #4.</p>

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DAY 4: - LESSON 28.2; pp. 526-528

MATERIALS:	Counters or tiles (about 50 per group)
LESSON FOCUS:	Patterns in Sequences
CA STANDARD:	NS 2.0 Key Standard; NS 2.3 Key Standard; (MR 1.1; MR 2.4)
Purpose of Lesson: Math Background: TE p. 526A	At the end of the lesson the students will be able to find patterns in sequences.
Warm-up/ Routine(s):	TE p. 526B; GEOMETRY CONNECTION
LAUNCH: p. 526 Partner Work ↓ Whole group	<ul style="list-style-type: none"> • p. 526: Without looking at the explanations in the book, students build the first 3 triangular arrays for the triangular number pattern as the teacher builds or draws them on the overhead/board. • Using <i>Private Think Time</i>, students determine the next 3 figures in the sequence. • Partners discuss observations about the pattern. • Whole group discussion of observations about the pattern. <i>In the context of the discussion, introduce/use the vocabulary (triangular arrays/numbers, sequence, term) and press students to make observations using the vocabulary.</i> • Chart strategies students used to generalize a pattern from the sequence. Bring up the operation used in the pattern. (addition)
EXPLORE: Partner Work TE p. 526: REASONING p. 576: MATH DETECTIVE	<ul style="list-style-type: none"> • Build the first three square numbers with the students, using counters/tile (see TE p. 526: REASONING). • Students use counters/sketches for the next two or three figures in the pattern and generalize a rule. • Without building all of the intervening figures, students describe the 20th figure in the pattern. • Represent the rule with words and with an equivalent equation. • p. 576: MATH DETECTIVE, Cases 1-4 (Assign different starting numbers for groups),
Practice:	p. 528; #18 and then choose among #7, 10, 15, and 17 (or selected problems to meet the needs of students)
SUMMARIZE/ Closure:	<ul style="list-style-type: none"> • Chart strategies/reasoning students used to find a pattern when they were given some terms in the sequence. Push for verbalization of decisions to try one operation over another when analyzing a pattern. • Independent assessment: <ul style="list-style-type: none"> • Students make a number sequence and explain the rule. • Lesson Quiz 28.2: TE p. 528. Choose one or two sequences.
HOMEWORK	<ul style="list-style-type: none"> • TE p. 528: WRITE • p. 528, #18 (and #19)

MODULE 8: UNIT 9: ALGEBRA: Patterns And Relationships

DAY 5: - LESSON 28.3; pp. 529-531

MATERIALS:	Plastic "white board"
LESSON FOCUS:	Number Patterns and Functions
CA STANDARD:	NS 2.0 Key Standard; MR 1.1; (NS 2.3 Key Standard; AF 1.1; MR 1.3; MR 2.5)
Purpose of Lesson: Math Background: TE p. 529A	At the end of the lesson students will be able to write an equation to represent a function.
Warm-up/ Routine(s):	QUICK REVIEW; p. 529: <i>Choose appropriate problem(s) for review.</i>
LAUNCH: <u>Books Closed</u> The meaning of function does not come from the definition, but from discussing it explicitly in different contexts over time. We can provide multiple opportunities for students to describe the relationship between two quantities and the equation that represents the function. Students need opportunities to see that graphs and tables can also be equivalent representations of functions.	<ul style="list-style-type: none"> • Display the table for Example 2, p. 530. • Sketch on board or overhead the first function machine as shown in ALTERNATIVE TEACHING STRATEGY, TE p. 531. • Students draw the first labeled function machine and four blank machines on paper as teacher draws on board (paper copy can be placed in plastic "white board"). • Use the first four columns of the table from Example 2, p. 530 as the input and output in the function machines. <ul style="list-style-type: none"> • <i>What operation(s) happen to the input numbers to result in the output numbers?</i> (With students, fill out 1x1, 2x2, 3x3 and 4x4 in the center of the function box.) In the first labeled box, have the students write the equation (function) with x on the input and y on the output. • Discuss the meaning of function in the context of the function box (p. 529 and 529A). • Refer to other equations that are charted (i.e. The number of push-ups Alex does depends on the number of days he does them. The money earned depends on the hours worked. For Alex the function is $5n+2 = p$. <i>The area of a square depends on the length of the side.</i>)
EXPLORE: p. 531	Partners/groups choose one green and one yellow table on p. 531 . Use the function machine or other strategies to write an equation to represent each function.
Practice:	Write equations to represent functions for #9-12 on p. 531 . Use the equation to find the missing term in the table.
SUMMARIZE/ Closure:	Select students to explain their equations that represent the functions. Assess: DISCUSS and WRITE: TE p. 532 TE p. 532: Lesson Quiz 28.3; #1
HOMEWORK	Teacher choice

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DAY 6: - LESSON 28.3/30.3; pp. 529-531/ pp. 564-565 Reference

MATERIALS:	Graph paper (consumable and/or in plastic "white board"); function machines from Day 5
LESSON FOCUS:	Number Patterns and Functions
CA STANDARD:	NS 2.0 Key Standard; MR 1.1; (NS 2.3 Key Standard; AF 1.1 Key Standard; MR 1.3; MR 2.5)
Purpose of Lesson: Math Background: TE p. 529A and TE p. 564A Reference	At the end of the lesson students will be able to write an equation to represent a function and be able to represent functions with ordered pairs, graphs, and equations.
Warm-up/ Routine(s):	Select one or two problems from the (Day 5) homework.
LAUNCH: <u>Books Closed</u> Money earned depends on hours worked. TE p. 529B/p. 529 ALTERNATIVE TEACHING STRATEGY	<ul style="list-style-type: none"> • <i>Post</i> the problem about Delia and the camera from the top of p. 529. <i>Display</i> a graph, a table and an equation that represent the function in the problem (copy of the graph is on TE p. 529B and the table and equation are on page 529). <u>Save chart for Day 11.</u> • Students <i>make observations</i> about the pattern they see in the table and the graph and how that relates to the equation. • <i>"All of these are equivalent representations of the same function. Discuss how they are similar."</i> • <i>"How does the table represent the ordered pairs for the graph of the function?"</i> • <i>"How does the graph represent the equation?"</i> • Students <i>represent</i> the first four rows of the table in the function machines.
EXPLORE: Students work first in "Private Think Time" and then in partners or small groups.	<p>Company A charges \$3.00 plus \$0.75 a mile for a cab ride. Company B charges \$5.00 plus \$0.50 a mile for a cab ride.</p> <ul style="list-style-type: none"> • <i>"How would you decide which cab to hire?"</i> • <i>Justify</i> decision using an explanation, a graph, a table, and an equation representing the cost of riding in each company's cab.
Practice:	Continue working on problem. <u>Collect student work for use Day 7.</u>
SUMMARIZE/ Closure:	<p>Select 2 or 3 groups to <i>share solutions</i>. Press students to <i>make connections</i> between the representations. (<i>"How is the cost per mile represented in the graph, the table and the equation? How is the point where the two tables show the same cost represented in the graph? How do we represent that the two equations are equal? How is the \$3 or \$5 charge represented in the graph, table and equation?"</i>)</p> <ul style="list-style-type: none"> • Press students to refer to the <i>different representations</i> of the function when explaining their decision.
HOMEWORK	p. 532, MIXED REVIEW AND TEST PREP: #20-24

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DAY 7: - LESSON 28.3/30.3; pp. 529-531/pp. 564-565 Reference

MATERIALS:	Graphical Representation of the Taxi Cab task from Day 6 (transparency and 1 copy per student);
LESSON FOCUS:	Number Patterns and Functions
CA STANDARD:	NS 2.0 Key Standard; MR 1.1; (NS 2.3 Key Standard; AF 1.1 Key Standard; MR 1.3; MR 2.5)
Purpose of Lesson: Math Background: TE p. 529A and TE p. 564A Reference	At the end of the lesson students will be able to write an equation to represent a function and be able to represent functions with ordered pairs, graphs, and equations.
Warm-up/ Routine(s):	Select a variety of patterns from the QUICK REVIEW on p. 533 as well as some from TE p. 533; RETEACH 28.4.
LAUNCH:	<i>Distribute</i> the graphical representation of the costs for Company A and Company B from the Taxicab Task on Day 6 and <i>discuss</i> the task to be done independently. (Students will <i>graph the new function</i> on the same graph with the other two.)
EXPLORE:	Individual Assessment: Company C charges \$6 plus \$0.40 a mile. "How many miles would you have to travel to save money using Company C?" • Represent the function using a graph, a table and an equation. • Justify your decision using the graph, table and equation when explaining your reasoning.
Practice:	Post tables from Example 1 , p. 530 and ADDITIONAL EXAMPLES 1 and 2: TE p. 530. • Students work in pairs to represent each function as an equation.
SUMMARIZE/ Closure:	<i>Discuss solutions</i> to the assessment. Focus on <i>justification</i> for the answer using equivalent representations of the function.
HOMEWORK	p. 536, #4, 7, 10, 13, 16 and 18

MODULE 8: UNIT 9: ALGEBRA: Patterns And Relationships

DAY 8: - LESSON 28.4; pp. 533-535

MATERIALS:	Optional: 50 tiles per group for p. 535; #11; Overhead of TE p. 533; PRACTICE 28.4
LESSON FOCUS:	Geometric Patterns
CA STANDARD:	MR 1.1; (MR 1.2; MR 2.0)
Purpose of Lesson: Math Background: TE p. 533A	At the end of the lesson the students will be able to recognize, describe, and extend patterns of geometric figures.
Warm-up/ Routine(s):	On overhead: TE p. 533; PRACTICE 28.4
LAUNCH: ENGLISH LANGUAGE LEARNERS, TE p. 533B ADDITIONAL EXAMPLES, TE p. 534	<ul style="list-style-type: none"> • <i>Post</i> 1 or 2 of the letter patterns from ENGLISH LANGUAGE LEARNERS, and <i>discuss</i>. TE p. 533B (This is as a bridge to patterns that are not numerical). • <i>Display</i> a repeating pattern, a non-repeating pattern and a fractal: Examples 1 and 2 on p. 533 and Example 4 on ADDITIONAL EXAMPLES, TE p. 534. • Students work together to <i>draw</i> the next 3 figures in each pattern.
EXPLORE:	<ul style="list-style-type: none"> • <i>Discuss</i> the patterns: <ul style="list-style-type: none"> • <i>How</i> are the patterns similar and different? • <i>Classify</i> each pattern as repeating or not repeating. • <i>What</i> do you notice about this pattern, which is called a fractal? • <i>Post</i> sketch of the fractal from Example 4 on Pg. 534. Students work on the next stage of that pattern and describe the pattern with partner • Partners Choose from Patterns #2-7 p. 535.
Practice:	p. 535: #11, 8 and 9
SUMMARIZE/ Closure: TE p. 535	<ul style="list-style-type: none"> • <i>Discuss</i> a repeating and non-repeating sequence and strategies students used to determine the pattern and draw the next figure in the sequence. • <i>Discuss #8</i>. <i>Why is it a fractal? How did you determine the number of shaded squares in Stage 3?</i> • Lesson Quiz 28.4: TE p. 535
HOMEWORK	<ul style="list-style-type: none"> • Find a geometric pattern at home or at school (quilt, tablecloth, wallpaper, dishes, tile). Copy the pattern and classify it as repeating or non-repeating. • p. 535; # 10 (Represent solution with a graph and a table.)

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DAY 9: - ASSESSMENT AND TEACHER'S CHOICE

MATERIALS:	Centimeter cubes
LESSON FOCUS:	Patterns
CA STANDARD:	
Purpose of Lesson:	
Warm-up/ Routine(s):	
LAUNCH:	Performance Assessment 6.9A: PA 75; <i>What's the Pattern</i>
EXPLORE:	
Practice:	
SUMMARIZE/ Closure:	Time to reflect back on the purpose of the lesson, and help students make meaningful connections .
HOMEWORK	

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DAY 10: - LESSON 30.1: pp. 558-559

MATERIALS:	Number lines, TR13, in plastic "white board"; transparency of TR13; chart paper with the 5 inequality symbols recorded
LESSON FOCUS:	Inequalities on a Number Line
CA STANDARD:	AF 1.0; (MR 1.1; MR 2.4)
Purpose of Lesson: Math Background: TE p. 558A	At the end of the lesson students will be able to solve algebraic inequalities and graph them on a number line.
Warm-up/Routine:	NUMBER OF THE DAY 30.1; TE p. 558A
LAUNCH: Reference TE p. 558B Post the 5 inequality symbols and their meaning for reference Use Math Background; TE p. 558A, as teacher reference.	On the board, transparency, or chart paper display the following inequalities in equivalent representations of graph on number line and symbols (see p. 558). Color in the circle on the graph to indicate \geq or \leq and leave the circle obviously open to indicate just $>$ or $<$. <ul style="list-style-type: none"> • Sketch the elevator sign (p. 558) and a matching number line and symbolic representation for greater than or equal to 3500 pounds. • Also display four symbolic representations of inequalities and their equivalent graphs (p. 559, #2-5). • Partners/groups, after <i>Private Think Time</i>, use the chart of inequality symbols to determine how to translate a symbolic inequality into its graphical representation (since the only difference is the open or shaded circle, the line graph must be drawn very clearly). • Push students to compare the graphs and generalize (i.e. "What is the difference in a graph for "x is greater than 5" and a graph of "x is greater than or equal to 5?")
EXPLORE: ALTERNATIVE TEACHING STRATEGY; (Modified): TE p. 558B	ALTERNATIVE TEACHING STRATEGY (Modified): TE p. 558B (Use the examples in the book or create other inequality statements): <ul style="list-style-type: none"> • Read aloud the inequality statements. Students write the symbolic representation under one of the blank number lines on TR13. (Change the second statement to "20 or more years" and the third one to "12 minutes or less" to include all 4 inequality symbols.) • Students work together to graph the symbolic representations of the inequalities. • Partners/groups create inequality statements, exchange with other partners or groups who then represent the statements symbolically and graphically.
Practice: pp. 558-559	Solve inequalities (See Example 2 p. 558): <ul style="list-style-type: none"> • Students solve the equation $x - 2 = 3$. $x = 5$ Discuss strategies including balancing both sides by adding 2 to each side to isolate the variable. • Write $x - 2 < 5$ and ask the students to use what they know about solving equations to solve the inequality and graph the result. (Use number line paper, TR13, to graph it) Discuss similarity between solving an equation and solving an inequality. • p. 559; #16, 17, 20 and 23
SUMMARIZE/ Closure:	<ul style="list-style-type: none"> • Discuss #23 and one or two student created inequalities • ASSESS: DISCUSS AND WRITE: TE p. 559
HOMEWORK	p. 559: #12-15 and #25-28

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DAY 11: - LESSON 30.3: pp. 564-565

MATERIALS:	1 piece of chart paper per group; graph paper (consumable or in plastic "white board" for each student)
LESSON FOCUS:	Graph Functions
CA STANDARD:	AF 1.1; MR 2.0; (MR 2.5; MR 3.2)
Purpose of Lesson: Math Background: TE p. 564A	At the end of the lesson students will be able to represent functions with ordered pairs, graphs, and equations
Warm-up/ Routine(s):	PROBLEM OF THE DAY; 30.3: TE p. 564A
LAUNCH: <u>Books Closed:</u> Refer to Lesson 28.3, including the Math Background on p. 529A	Refer to the graph and the table representing the problem of Delia and the camera or the taxicab problem(see Day 6, Lesson 28.3). <ul style="list-style-type: none"> • Assign each group one point on the graph; students write the ordered pairs for one of the points on the graph by using the graph and the table. • Record four ordered pairs from the graph and discuss strategies for using the graph and the table to determine the ordered pairs. • Review the concept of function and the representations for a function from Lesson 28.3, Day 6.
EXPLORE:	Display and discuss the lightning situation (top of page 564). " <i>When you see a flash of lightning, count the seconds until you hear thunder. A count of 5 seconds means you are 1 mile from the lightning?</i> " <ul style="list-style-type: none"> • At the top of graph paper, display the question, "<i>How Far Away is the Lightning?</i>". • Groups represent the function with <i>a graph, an equation, a table, and ordered pairs</i>. (Scaffold setting up the graph for individual groups or the whole class, as needed.) Each student records the four representation of the function on individual graph paper using plastic "white board" or consumable paper; then the group records the representations on a chart paper for display.
Practice:	Complete the Lightning Task, in groups.
SUMMARIZE/ Closure:	<ul style="list-style-type: none"> • Decide on an order for presentation of the group papers (Display all papers for the summary, but select 2 or 3 for explanation and discussion.) • Use the student explanations and discussion to press students to translate between the representations and make explicit the concept of a function. Include opportunities for all students to verbalize their thinking to a partner and make the thinking public to the whole class. Some examples to choose from according to needs of class: <ul style="list-style-type: none"> • Use the function machine from Day 5, Lesson 28.3 to represent the ordered pair and the equation. (For every input there is only one output in a function and in the function machine. "<i>How is this represented in</i>

<p>SUMMARIZE/ Closure:</p>	<p><i>the graph, table and equation?”)</i></p> <ul style="list-style-type: none"> • The variables and which one is dependent on the other; the use of x and y generically to represent that relationship with the y-axis representing the dependent variable. • <i>How</i> the change in distance over time is represented in the graph, the table and the equation. • Strategies students used to determine the equation that represents the function in the lightning problem. • Use of the table, the graph and the equation to represent and solve problems (i.e. <i>Find the distance if the elapsed time is 45 seconds. If the distance is 3 miles, what is the time?</i>) • In journals or on the back of the chart paper returned to each table, students write reflection on their learning about the meaning and representations of a function during this task.
<p>HOMEWORK</p>	<p>p. 565, #8: Write a problem involving a function and bring to the group on Day 12</p> <p>MIXED REVIEW AND TEST PREP: p. 565, #9 and #11-13</p>

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DAY 12: - LESSON 30.3: pp. 564-565

MATERIALS:	Graph paper (in plastic and then consumable for homework)
LESSON FOCUS:	Graph Functions
CA STANDARD:	AF 1.1; MR 2.0; (MR 2.5; MR 3.2)
Purpose of Lesson: Math Background: TE p. 564A	At the end of the lesson students will be able to represent functions with ordered pairs, graphs, and equations
Warm-up/ Routine(s):	QUICK REVIEW: p. 564 and QUICKWRITE: TE p. 565: Assess: DISCUSS
LAUNCH: p. 565, #8	Homework problem involving a function (p. 565, #8): <ul style="list-style-type: none"> Groups determine if each problem represents a function. Teacher chooses one or two problems to have students <i>display and discuss</i> with class.
EXPLORE:	Partner/Group work: Additional Example , TE p. 564 and #4 p. 565. Scaffold as needed for different groups
Practice:	p. 565, #7
SUMMARIZE/ Closure:	<ul style="list-style-type: none"> Questions: <i>What are the advantages of using a graph over a table? When is it more efficient to use an equation to find a solution instead of a graph or table?</i> <i>Discuss</i> the meaning of a function and how the meaning is illustrated in the problems they have completed in the last two days. Lesson Quiz 30.3: TE p. 565 (Finish the graphs for homework.)
HOMEWORK	<ul style="list-style-type: none"> Finish Lesson Quiz 30.3 p. 565, #3 and #6

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DAY 13: - LESSON 30.4: pp. 566-567

MATERIALS:	Alternative lessons (Teacher Choice): RETEACH 30.3: TE p. 565; CHALLENGE 30.3: TE p. 565; RETEACH 30.4: TE p. 566; CHALLENGE 30.4: TE p. 567
LESSON FOCUS:	Make Generalizations
CA STANDARD:	AF 1.1; MR 3.3; (MR 3.2)
Purpose of Lesson: Math Background: TE p. 566A	At the end of the lesson students will be able to solve problems by making generalizations.
Warm-up/Routine(s):	PROBLEM OF THE DAY 30.4; TE p. 566A
LAUNCH: p. 566; <u>Books closed</u> <i>See "Materials" above for alternative lesson suggestions.</i>	<i>Read</i> the science fair situation at the top of page 566 , but have students keep book closed to keep the situation problematic. <ul style="list-style-type: none"> <i>Write</i> the grape/raisin situation involving 4 pounds of grapes to 1 lb. of raisins. Facilitate students as they make a chart (See chart on p. 566) <i>"How many pounds of raisins can be made from 160 pounds of grapes?"</i> (Estimate first and explain reasoning behind the estimate.) <ul style="list-style-type: none"> <i>Discuss</i> the representation that would be most efficient to use to solve the problem and why (table, graph or equation).
EXPLORE: p. 566 <i>See "Materials" above for alternative lesson suggestions.</i>	<ul style="list-style-type: none"> Partners use the information in the table to <i>make a generalization and represent</i> it as an equation. <i>Verify</i> the equation using known data from the table. <i>Solve</i> the problem with the equation <i>Discuss</i> solutions if needed as scaffolding before moving to the next situation, particularly the verification of the generalization with the known data. <i>Display</i> the maple syrup situation (p. 566) with the question: <i>"How many gallons of sap does it take to make 25 gallons of maple syrup?"</i> <ul style="list-style-type: none"> <i>Estimate</i> privately and share estimate with partner. Partners/groups make table for first 5 gallons and then <i>generalize</i> the pattern into an equation. <i>Solve</i> the problem using the equation.
Practice:	p. 567: #1-4
SUMMARIZE/ Closure: TE p. 567	Discuss: <ul style="list-style-type: none"> <i>"How did you use the rows of the tables to help make the generalization?"</i> <i>"Why is it important to verify your generalization with data from the table?"</i> <i>"When is it more efficient to use a generalization to solve a problem than using a table?"</i> Assessment: Lesson Quiz 30.4: TE p. 567. Select one of the two problems and <i>include a table and explanation</i> of the reasoning used to make the generalization. Finish for homework if time is short.
HOMEWORK	<ul style="list-style-type: none"> Finish Quiz Problem p. 567: MIXED APPLICATIONS: Select problems from #6-9 as appropriate for class. Include <i>explanation and solution path</i>, which may include a diagram or sketch.

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DAY 14: - LESSON 30.5: pp. 568-569

MATERIALS:	Tile and/or graph paper in plastic or consumable (pattern can be shaded instead of built);
LESSON FOCUS:	Explore Linear and Nonlinear Relationships
CA STANDARD:	MR 1.1
Purpose of Lesson:	At the end of the lesson students will be able to explore linear and nonlinear relationships.
Warm-up/ Routine(s):	Select one problem from the (Day 13) homework.
LAUNCH: <u>Books Closed</u> Scaffold only as much as needed during this whole group part of the lesson. Scaffold the idea of recording all the representations but ask for the student thinking while going through the process.	<ul style="list-style-type: none"> • Activity 1, p. 568: <ul style="list-style-type: none"> • <i>Display</i> the first three stages of the pattern at the top of p. 568. • Students <i>build or draw</i> the stages and find the perimeter of each stage. • <i>Record</i> the perimeters in a table (see p. 568). • Have students <i>describe</i> what a graph of the perimeter and stages would look like. Use the word linear to describe a function whose ordered pairs form a straight line on a graph. • <i>Record</i> a generalization in words and an equation for the pattern. • <i>Verify</i> the equation using data from the table. • Use the equation to <i>find the perimeter</i> of two stages that would be too big to build or record efficiently in a graph or table.
EXPLORE: The students will generalize the perimeter and the area and graph them on the same coordinate plane, not just the area, which is in the directions.	<ul style="list-style-type: none"> • Activity 2, p. 569 (Modified to include perimeter): <ul style="list-style-type: none"> • <i>Build/draw</i> the first 4 stages of the pattern and find the perimeter of each stage. • <i>Represent</i> the function in a table • <i>Predict</i> what the graph will look like and then graph the pattern. • <i>Record</i> a generalization in words and an equation for the pattern. • <i>Verify</i> the equation using data from the table. • Use the equation to <i>find the perimeter</i> of two stages that would be too big to build or record efficiently in a graph or table.
Practice: <u>Open Books</u>	Activity 2: p. 569 <ul style="list-style-type: none"> • <i>Repeat</i> the process using the same pattern, only this time find the <u>area of each stage</u>. • <i>Graph</i> on the same coordinate plane with the perimeter graph
SUMMARIZE/ Closure: Refer to Think and <i>Discuss</i> : TE p. 569	Post graphs and the other representations for the perimeter and area. <ul style="list-style-type: none"> • <i>Private Think Time</i>, then partner/small group, then whole class: • <i>What do you notice about the similarities and differences between the graphs and other representations of the perimeters and areas of the same pattern?</i> <ul style="list-style-type: none"> • Press for students to <i>make connections</i> between the nonlinear graph, table, and equation. Why doesn't it form a straight line?
HOMEWORK	<p>p. 569: Students choose 2 problems from #1-4 to complete.</p> <p>p. 569: MIXED REVIEW AND TEST PREP: #5-9</p>

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DAY 15: - LESSON 29.1; pp. 540-542

MATERIALS:	Cutouts for each pair to use when exploring transformations (See Pg. 540); TR62 graph paper; overhead cutouts and graph paper for teacher
LESSON FOCUS:	Transformation of Plane Figures
CA STANDARD:	MR 2.4; (MR 2.0; MR 2.2)
Purpose of Lesson: Math Background: TE p. 540A	At the end of the lesson students will be able to use translations, rotations, and reflections to transform geometric shapes.
Warm-up/ Routine(s):	PROBLEM OF THE DAY 29.1; TE p. 540A <i>or</i> QUICK REVIEW; p. 540
LAUNCH: Reference: Teach: Guided Instruction, TE p. 540	Introduce the three transformations: translation, rotation, and reflection. (Reference: TE p. 540 ; Teach: Guided Instruction)
EXPLORE:	<ul style="list-style-type: none"> • Examples on pp. 540-541 <i>OR</i> • ALTERNATIVE TEACHING STRATEGY, TE p. 540B
Practice:	Choose from RETEACH 29.1, PRACTICE 29.1 or problems on p. 542.
SUMMARIZE/ Closure:	<ul style="list-style-type: none"> • Select a couple of problems to discuss. • Assess: DISCUSS: TE p. 542 • Lesson Quiz 29.1, p. 542: Individual, followed by discussion of reasoning.
HOMEWORK	p. 542: #21 and #23-27

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DAY 16: - LESSON 29.5; pp. 550-553

MATERIALS:	Objects to illustrate symmetry (line and rotational); scissors, dark crayon and paper for each student; for each group: pattern blocks of a square, equilateral triangle, regular hexagon and trapezoid
LESSON FOCUS:	Symmetry
CA STANDARD:	MG 2.0; MR 2.4
Purpose of Lesson: Math Background: TE p. 550A	At the end of the lesson the students will be able to identify line symmetry and rotational symmetry.
Warm-up/ Routine(s):	NUMBER OF THE DAY 29.5; TE p. 550A and/or PROBLEM OF THE DAY 29.5; TE p. 550A
LAUNCH:	Select some objects to review line and rotational symmetry and have students give some examples (for 1 minute) in small groups. List one example of each type from each group.
EXPLORE:	MATH LAB Activities 1 and 2: pp. 550-551
Practice:	ALTERNATIVE TEACHING STRATEGY: TE p. 552
SUMMARIZE/ Closure:	<i>"How do you know whether a figure has line or rotational symmetry?"</i> Students use examples from the problems they did to <i>justify</i> their reasoning.
HOMEWORK	Teacher choice

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DAY 17: - LESSON 30.6; pp. 570-573

MATERIALS:	Graph paper, TR64; scissors; rectangular overhead picture of person or thing (see top of p. 570).
LESSON FOCUS:	Graph Transformations
CA STANDARD:	MR 2.5; (2.0; MR 2.4)
Purpose of Lesson: Math Background: TE p. 570A	To use transformations to change positions of figures on a coordinate plane
Warm-up/ Routine(s):	NUMBER OF THE DAY 30.6; TE p. 570A and/or PROBLEM OF THE DAY 30.6; TE p. 570A
LAUNCH: p. 570	p. 570, "Lincoln Picture" example. Use transparency of any picture. Instead of telling the students the name of the transformation, ask students to decide in groups after each move and then have them <i>name each translation</i> .
EXPLORE:	MATH LAB Activity, p. 570
Practice:	Select from RETEACH 30.6, PRACTICE 30.6, CHALLENGE 30.6, ALTERNATIVE TEACHING STRATEGY, TE p. 572 or p. 573, #8-11
SUMMARIZE/ Closure:	Select a couple of problems to have students <i>explain and discuss:</i> Assess: DISCUSS: p. 573 Lesson Quiz 30.6: TE p. 573
HOMEWORK	p. 573: #5-7 and #13-17

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DAY 18: - ASSESSMENT AND TEACHER'S CHOICE

MATERIALS:	
LESSON FOCUS:	
CA STANDARD:	
Purpose of Lesson:	
Warm-up/ Routine(s):	
LAUNCH:	
EXPLORE:	
Practice:	
SUMMARIZE/ Closure:	Time to reflect back on the purpose of the lesson, and help students make meaningful connections .
HOMEWORK	

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DAY 19 and 20: - LESSON 29.2; pp. 543-545

Optional Lesson

MATERIALS:	Pattern blocks, colored pencils or markers, paper, scissors, tape
LESSON FOCUS:	Tessellations
CA STANDARD:	MR 2.4; MG 2.0
Purpose of Lesson:	At the end of the lesson students will be able to use polygons to make tessellations and to make tessellations.
Warm-up/ Routine(s):	Teacher choice
LAUNCH:	Math Lab Activity 1; p. 543
EXPLORE:	Math Lab Activity 2; p. 544
Practice:	Continue with the Explore
SUMMARIZE/ Closure:	Time to reflect back on the purpose of the lesson, and help students make meaningful connections .
HOMEWORK	Teacher choice