TEKSING TOWARD STAAR

MATHEMATICS ®

GRADE 6

Open-Ended Problem Solving Projections

Organized by TEKS Categories

OVERVIEW

The Projection Masters for Problem-Solving were created with all students in mind and provide teachers with large print projections for problem-solving questions that address all TEKS. Each Projection Master is correlated to a specific Category and TEKS.

The Projection Masters for Problem-Solving document includes a general set of questions that should be addressed by students as they solve the problems and during class discussions of the solution process for each problem. Teachers should make a copy of these questions and distribute for each student to keep in his/her math notebook.

The Problem-Solving Questions include the following:

1. What is the main idea of this problem?
2. What are the supporting details in this problem?
3. What skills, concepts, and understanding of math vocabulary are needed to be able to answer this question?
4. Did this problem involve mathematics arising in everyday life, society, or the work place?
5. What is a good problem-solving strategy for this problem?
6. Can you explain how you used any math tools, mental math, estimation, or number sense to solve this problem?
7. Did this problem involve using multiple representations (symbols, diagrams, graphs, language)?
8. Did you use any relationships to10 solve this problem?
9. How can you justify your solution?
10. How can you check for reasonableness of your solution to this problem?

These Projection masters can be utilized for instruction, guided practice or independent practice. These materials can be utilized with a whole class, small groups, and/or tutorial settings.

NOTE: There is no answer key provided for the Projection Masters or Problem-Solving as the authors' philosophy is that each teacher should create a personalized Solutions Manual so the teacher becomes more familiar with the Revised TEKS and assessment of the Revised TEKS, as well as formulates various solution strategies for each question. Teachers are encouraged to communicate with the authors regarding discussion of any questioning this document.

AUTHORS' VISION FOR IMPLEMENTATION

Students work with a partner pair to answer the open-ended problems. The teacher projects the problem then sets a time limit prior to students beginning their work. Partner pairs are given specific "share" questions from the 1-10 on the Problem-solving Questions page. The process should be followed by students for all open-ended questions is to answer questions 1-3, then complete the solution to the problem, and then finally answer questions 4-10.

The teacher calls time and the partner pairs guide the class discussion on their "share" assignments, Students who did not complete the solution to the problem prior to the time limit must complete recording in a different color.

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Mathematical Process Standards

These student expectations will not be listed separately. They will be incorporated into assessments for TEKS in other categories since the application of mathematical process standards is part of each knowledge statement for all other TEKS.

6.(1) Mathematical Process Standards

The student uses mathematical processes to acquire and demonstrate mathematical understanding.

TEKS	STUDENT EXPECTATION
6.1(A)	apply mathematics to problems arising in everyday life, society, and the workplace
6.1(B)	use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution
6.1(C)	select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems
6.1(D)	communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate
6.1(E)	create and use representations to organize, record, and communicate mathematical ideas
6.1(F)	analyze mathematical relationships to connect and communicate mathematical ideas
6.1(G)	display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication

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Category 1: Number and Operations

6.(2) Number and Operations
The student applies mathematical process standards to represent and use rational numbers in a variety of forms.

6.(3) Number and Operations
The student applies mathematical process standards to represent addition, subtraction, multiplication, and division while solving problems and justifying solutions.

Category 2: Proportionality

6.(4) Proportionality

The student applies mathematical process standards to develop an understanding of proportional relationships in problem situations.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	**6.4(A)**	compare two rules verbally, numerically, graphically, and symbolically in the form of $y = ax$ or $y = x + a$ in order to differentiate between additive and multiplicative relationships
Readiness	**6.4(B)**	apply qualitative and quantitative reasoning to solve prediction and comparison of real-world problems involving ratios and rates
Supporting	**6.4(C)**	give examples of ratios as multiplicative comparisons of two quantities describing the same attribute.
Supporting	**6.4(D)**	give examples of rates as the comparison by division of two quantities having different attributes, including rates as quotients
Readiness	**6.4(E)**	represent ratios and percents with concrete models, fractions, and decimals.
Supporting	**6.4(F)**	represent benchmark fractions and percents such as 1%, 10%, 25%, 33 1/3%, and multiples of these values using 10 by 10 grids, strip diagrams, number lines, and numbers
Readiness	**6.4(G)**	generate equivalent forms of fractions, decimals, and percents using real-world problems, including problems that involve money
Readiness	**6.4(H)**	convert units within a measurement system, including the use of proportions and unit rates

Proportionality

6.(5) Proportionality

The student applies mathematical process standards to solve problems involving proportional relationships.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	**6.5(A)**	represent mathematical and real-world problems involving ratios and rates using scale factors, tables, graphs, and proportions
Readiness	**6.5(B)**	solve real-world problems to find the whole given a part and the percent, to find the part given the whole and the percent, and to find the percent given the part and the whole, including the use of concrete and pictorial models
Supporting	**6.5(C)**	use equivalent fractions, decimals, and percents to show equal parts of the same whole

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Category 3: Expressions, Equations, and Relationships

6.(6) Expressions, Equations, and Relationships
The student applies mathematical process standards to use multiple representations to describe algebraic relationships.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	**6.6(A)**	identify independent and dependent quantities from tables and graphs
Supporting	**6.6(B)**	write an equation that represents the relationship between independent and dependent quantities from a table
Readiness	**6.6(C)**	represent a given situation using verbal descriptions, tables, graphs, and equations in the form $y = kx$ or $y = x + b$

Expressions, Equations, and Relationships

6.(7) Expressions, Equations, and Relationships
The student applies mathematical process standards to develop concepts of expressions and equations.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	**6.7(A)**	generate equivalent numerical expressions using order of operations, including whole number exponents and prime factorization
Readiness	**6.7(B)**	distinguish between expressions and equations verbally, numerically, and algebraically
Supporting	**6.7(C)**	determine if two expressions are equivalent using concrete models, pictorial models, and algebraic representations
Supporting	**6.7(D)**	generate equivalent expressions using the properties of operations: inverse, identity, commutative, associative, and distributive properties

Expressions, Equations, and Relationships

6.(8) Expressions, Equations, and Relationships
The student applies mathematical process standards to use geometry to represent relationships and solve problems.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	**6.8(A)**	extend previous knowledge of triangles and their properties to include the sum of angles of a triangle, the relationship between the lengths of sides and measures of angles in a triangle, and determining when three lengths form a triangle
Supporting	**6.8(B)**	model area formulas for parallelograms, trapezoids, and triangles by decomposing and rearranging parts of these shapes
Supporting	**6.8(C)**	write equations that represent problems related to the area of rectangles, parallelograms, trapezoids, and triangles and volume of right rectangular prisms where dimensions are positive rational numbers
Readiness	**6.8(D)**	determine solutions for problems involving the area of rectangles, parallelograms, trapezoids, and triangles and volume of right rectangular prisms where dimensions are positive rational numbers

Category 3: Expressions, Equations, and Relationships

6.(9) Expressions, Equations, and Relationships
The student applies mathematical process standards to use equations and inequalities to represent situations.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	**6.9(A)**	write one-variable, one-step equations and inequalities to represent constraints or conditions within the problem
Supporting	**6.9(B)**	represent solutions for one-variable, one-step equations and inequalities on number lines
Supporting	**6.9(C)**	write corresponding real-world problems given one-variable, one-step equations or inequalities

Expressions, Equations, and Relationships

6.(10) Expressions, Equations, and Relationships
The student applies mathematical process standards to use equations and inequalities to solve problems.

STAAR Standard	TEKS	STUDENT EXPECTATION
Readiness	**6.10(A)**	model and solve one-variable, one-step equations and inequalities that represent problems, including geometric concepts
Supporting	**6.10(B)**	determine if the given value(s) make(s) one-variable, one-step equations or inequalities true

Category 4: Measurement and Data

6.(11) Measurement and Data
The student applies mathematical process standards to use coordinate geometry to identify locations on a plane.

STAAR Standard	TEKS	STUDENT EXPECTATION
Readiness	**6.11(A)**	Graph points in all four quadrants using ordered pairs of rational numbers

Measurement and Data

6.(12) Measurement and Data
The student applies mathematical process standards to use numerical or graphical representations to analyze problems.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	**6.12(A)**	represent numeric data graphically, including dot plots, stem-and-leaf plots, histograms, and box plots
Supporting	**6.12(B)**	use the graphical representation of numeric data to describe the center, spread and the shape of the data distribution
Readiness	**6.12(C)**	summarize numeric data with numerical summaries, including the mean and median (measures of center) and the range and interquartile range (IQR) (measures of spread) and use these summaries to describe the center, spread, and shape of data distribution
Readiness	**6.12(D)**	summarize categorical data with numerical and graphical summaries, including the mode, the percent of values in each category (relative frequency table), and the percent bar graph, and use these summaries to describe the data distribution

Measurement and Data

6.(13) Measurement and Data
The student applies mathematical process standards to use numerical or graphical representations to solve problems.

STAAR Standard	TEKS	STUDENT EXPECTATION
Readiness	**6.13(A)**	interpret numeric data summarized in dot plots, stem-and-leaf plots, histograms and box plots
Supporting	**6.13(B)**	distinguish between situations that yield data with and without variability

Category 5: Personal Financial Literacy

6.(14) Personal Financial Literacy

The student applies mathematical processes standards to develop an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	**6.14(A)**	compare the features and costs of a checking account and a debit card offered by different local financial institutions
Supporting	**6.14 (B)**	distinguish between debit cards and credit cards
Supporting	**6.14 (C)**	balance a check register that includes deposits, withdrawals, and transfers
Not Tested	**6.14 (D)**	explain why it is important to establish a positive credit history
Supporting	**6.14 (E)**	describe the information in a credit report and how long it is retained
Supporting	**6.14 (F)**	describe the value of credit reports to borrowers and to lenders
Supporting	**6.14 (G)**	explain various methods to pay for college, including through savings, grants, scholarships, student loans, and work-study
Supporting	**6.14 (H)**	compare the annual salary of several occupations requiring various levels of post-secondary education or vocational training and calculate the effects of the different annual salaries on lifetime income

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TEKS CATEGORY 1

Numbers and Operations

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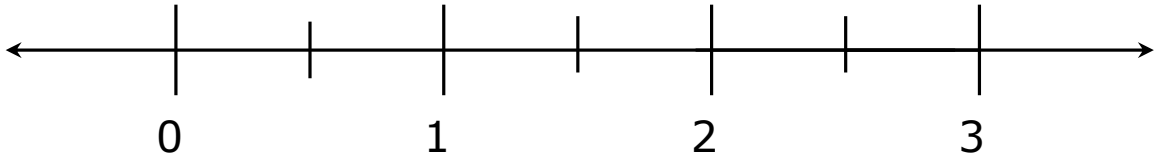
GRADE 6

Open Ended Problem Solving Projections

TEKS CATEGORY 1
6.2C

6.2C Problem Solving 1

Locate and label 2.17, $\frac{3}{2}$, 0.043, and $\frac{2}{3}$ on the number line.



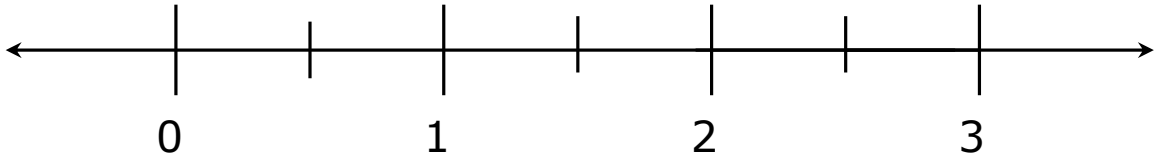
Which number is closest to 1?

Which number is the smallest?_____ Where is it located on the number line in relation to the other numbers?

Which number is the largest? _____ Where is it located on the number line in relation to the other numbers?

6.2C Problem Solving 2

Locate and label 2.17, $\frac{3}{2}$, 0.043, and $\frac{2}{3}$ on the number line.



Which number is closest to 1?

Which number is the smallest?_____ Where is it located on the number line in relation to the other numbers?

Which number is the largest? _____ Where is it located on the number line in relation to the other numbers?

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Open Ended Problem Solving Projections

TEKS CATEGORY 1
6.3E

6.3E Problem Solving 1

Problem 1: Find the following products.

$\frac{3}{8} \times 32 =$ $10\frac{1}{2} \times 7\frac{1}{3} =$ $18 \times 0.4 =$ 0.5×1.3

If you are multiplying two fractions do you need a common denominator? Explain your answer.

Explain how to determine the position of the decimal point in the product of two decimals?

Problem 2: Mikel's test had 40 questions. Each question was worth 2.5 points. Mikel answered only $\frac{9}{10}$ of the questions and she missed $\frac{1}{9}$ of those she answered. What was Mikel's score on the test? Show your work.

6.3E Problem Solving 2

Problem 1: Find the following quotients.

$48 \div \frac{8}{3} =$ $10\frac{1}{2} \div 3\frac{1}{2} =$ $104 \div 0.4 =$ 0.5×1.3

If you are dividing two fractions do you need a common denominator? Explain your answer.

Explain how to determine the position of the decimal point in the quotient of two decimals?

Problem 2: The Smyth family purchased a large screen television for their den. The television cost a total of $1440. If they pay for the television in 24 months or less they do not have to pay interest on the purchase. What will be the payments if they pay for the television in 24 equal payments?

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TEKS CATEGORY 2

Proportionality

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Open Ended Problem Solving Projections

TEKS CATEGORY 2 6.4C

6.4C Problem Solving 1

Problem 1: There were 36 teams and 144 golfers registered for a golf tournament. Complete the following statements concerning this situation.

The number of teams is _____ times the number of golfers registered for a golf tournament.

The number of golfers is _____ times the number of teams registered for a golf tournament.

Problem 2: In a large box of chocolate chip cookies and sugar cookies, the ratio of the number of chocolate chip to the number of sugar cookies is 3:4. Complete the following statements concerning this situation.

The number of chocolate chip cookies is _____ times the number of sugar cookies in the box.

The number of sugar cookies is _____ times the number of chocolate chip cookies in the box.

Problem 3: In a bag of marbles, there are 30 red, 20 blue, 40 green, and 10 white marbles. Complete the following statements concerning this situation.

The number of white marbles is _____ times the number of blue marbles in the bag.

The number of red marbles is _____ times the number of white marbles in the bag.

The number of red marbles is _____ times the number of green marbles in the bag.

6.4C Problem Solving 2

Problem 1: The number of boys in Mrs. Sims' fifth period class is proportional to the number of girls in the class. The class of 30 students has 12 boys. Complete the following statement concerning the students in her class.

The number of girls in the class is _____ times the number of boys in the class.

Problem 2: Garza's grocery sells a fruit basket that has 10 pieces of fruit and 4 of the pieces are oranges. Complete the following statement concerning the fruit basket.

The number of oranges in the fruit basket is _____ times the total number of pieces of fruit.

Problem 3: Joseph's little brother has 6 stuffed bears and 4 stuffed dogs. Complete the following statement concerning his stuffed animals.

The number of stuffed bears Joseph's little brother has is _____ times the number of stuffed dogs.

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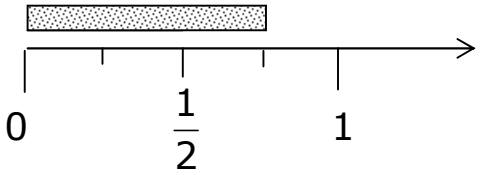
TEKS CATEGORY 2 6.5C

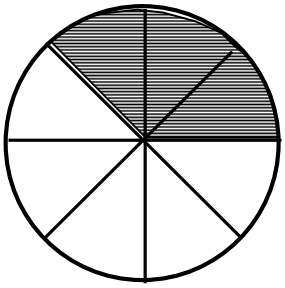
6.5C Problem Solving 1

Problem 1: What fraction, decimal and percent are represented by the model below?



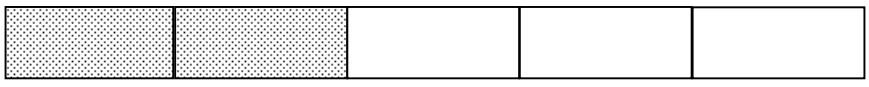
Fraction: _____ Decimal: _____
Percent: _____

Problem 2: What fraction, decimal and percent are represented by the model below?



Fraction: _____ Decimal: _____
Percent: _____

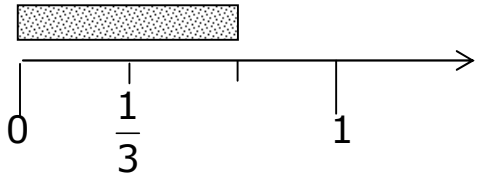
Problem 3: What fraction, decimal and percent are represented by the model below?



Fraction: _____ Decimal: _____
Percent: _____

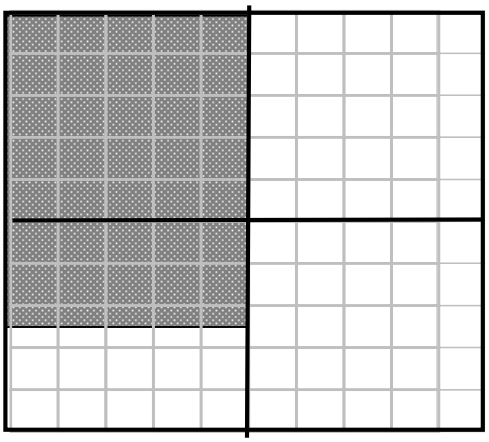
6.5C Problem Solving 2

Problem 1: What fraction, decimal and percent are represented by the model below?



Fraction: _____ Decimal: _____
Percent: _____

Problem 2: What fraction, decimal and percent are represented by the model below?



Fraction: _____ Decimal: _____
Percent: _____

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TEKS CATEGORY 3

Expressions, Equations, and Relationships

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Open Ended Problem Solving Projections

TEKS CATEGORY 3 6.6A

6.6A Problem Solving 1

Problem 1: The table below shows the costs of various purchases of gasoline.

Gasoline Purchases

Gallons	6	8	10	15	18	20	25
Cost	$18.60	$24.80	$31.00	$46.50	$55.80	$62.00	$77.50

The cost of the gasoline depends upon the number of gallons purchased.

The dependent quantity in this situation is _____.

The independent quantity in this situation is _____.

Problem 2: The table below shows the number of cookies in various bags.

Cookies

Number of Bags	3	5	7	10	12
Number of Cookies	54	90	126	180	216

Complete the sentences:

- The number of _____ depends upon the number of _____.
- The dependent quantity in this situation is_____.
- The independent quantity in this situation is _____.

6.6A Problem Solving 2

Problem 1: Mr. Lomax is a roofer who puts shingles on buildings. The table shows how many squares of shingles he can put on a roof during different lengths of time.

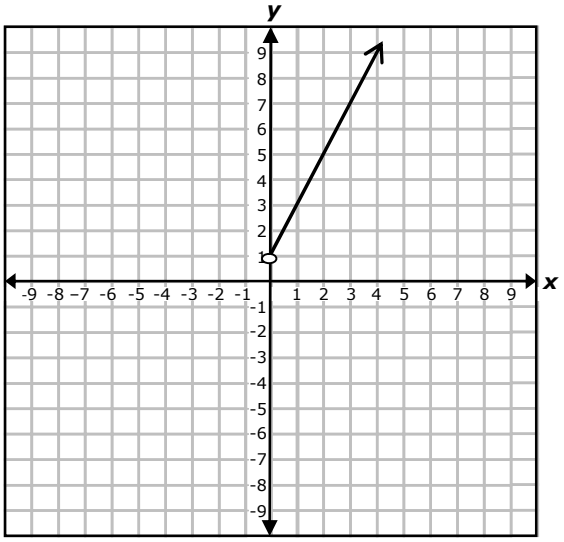
Roofing Pattern

Number of Hours	2	3	4	5	6	7
Number of Shingle Squares	5	7.5	10	12.5	15	17.5

Complete the sentences:

- The number of _____ depends upon the number of _____.
- The dependent quantity in this situation is _____.
- The independent quantity in this situation is _____.

Problem 2: The graph on the coordinate grid below shows the relationship between the length and width of a family of rectangles. The length is graphed on the vertical axis.



- What is the dependent quantity?
- What is the independent quantity?

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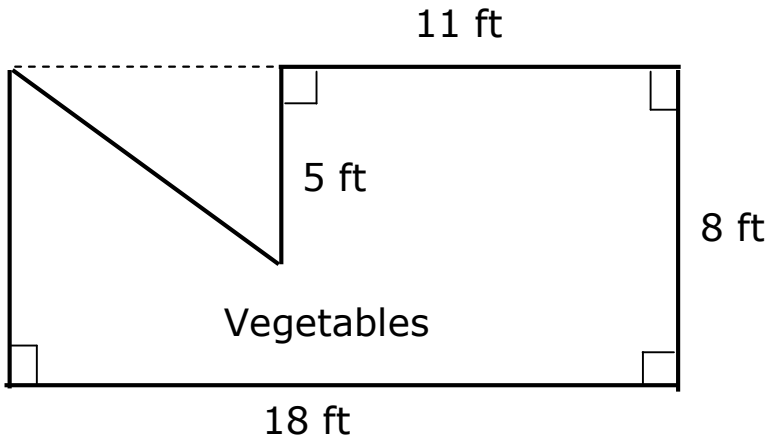
TEKS CATEGORY 3 6.8D

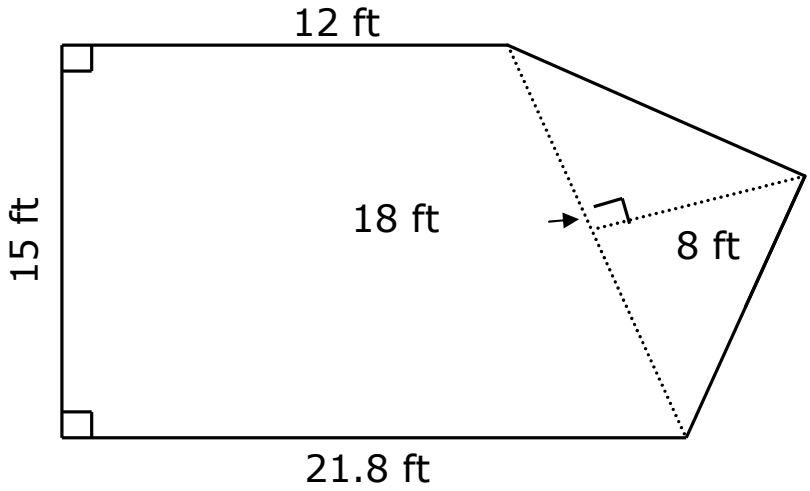
6.8D Problem Solving 1

Problem 1: The drawing below shows the dimensions of Mrs. Lowe's garden she will plant in vegetables.



What is the area of the vegetable garden?

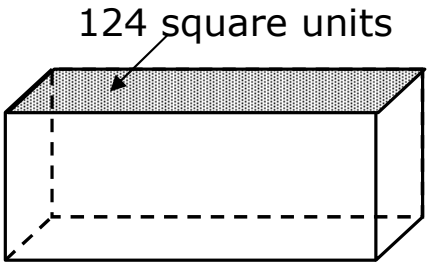
Problem 2: Susan sells hunting dogs. Shown below is an area of her property she enclosed so that the dogs could exercise properly.



What is the total area of the enclosed property in square feet?

6.8D Problem Solving 2

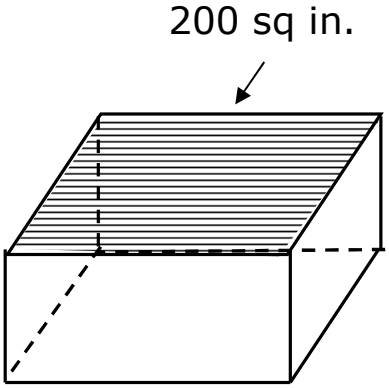
Problem 1: The volume of a container that is a rectangular prism is 620 cubic units. The area of the rectangular base of the container is 124 square units .



Record two possible sets of dimensions for the container.

Length (in units)	Width (in units)	Height (in units)	Area of Base (in square units)	Volume (in cubic units)
			124	620
			124	620

Problem 2: A prism has a volume of 800 cubic inches and a base area of 200 square inches.



- List four sets of possible dimensions of the prism.

  length _____ width _____height _____

  length _____ width _____height _____

  length _____ width _____height _____

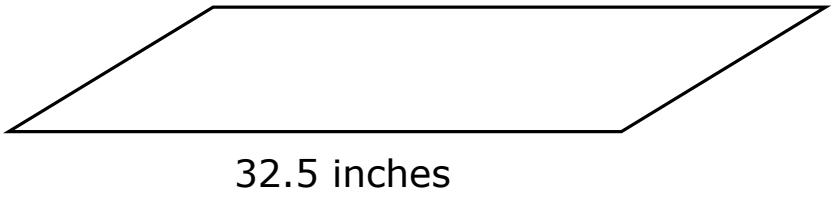
- What do all four sets of dimensions have in common?

6.8D Problem Solving 3

Problem 1: Find the area of the parallelogram shown below. Show your work.

If Betsy paints half of the parallelogram red, how many square inches will she paint red? Show your work.

Problem 2: Look at the parallelogram below. It has an area of 146.25 square inches.



What is the height of the parallelogram? Show your work.

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TEKS CATEGORY 4

Measurement and Data

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Open Ended Problem Solving Projections

TEKS CATEGORY 4 6.11A

6.11A Problem Solving 1

Problem 1: Plot and label the following points on a coordinate grid.

$A(3, 4)$ $B(-2, 7)$ $C(-4, 5)$ $D(8, -6)$ $E(0, 8)$

Problem 2: Identify which Quadrant or axis the following points will be in or on when graphed on a coordinate grid.

_____(3, 9) _____(–2, –6) _____ (2, –6) _____(0, 6)

Problem 3: Explain how you determine which Quadrant a point will be located in when graphed.

Problem 4: Name 4 ordered pairs that would belong to the vertices of a rectangle with a length of 6 units and a width of 2.5 units.

6.11A Problem Solving 2

Problem 1: The coordinates below are the vertices of a rectangle. Plot and label the following points on a coordinate grid and connect the points to create rectangle *ABCD*.

$A(3, 4)$ $B(3, -2)$ $C(6, -2)$ $D(6, 4)$

What are the dimensions of the rectangle?
Base_____ Height _____

What is the perimeter of the rectangle?

What is the area of the rectangle?

Problem 2: Circle the ordered pairs below that would be in Quadrant II when graphed.

$(-2, -3)$ $(1, -3)$ $(-2, 3)$ $(4, -5)$

For those you did NOT circle, indicate which Quadrant they would be in by writing the Quadrant number beside the ordered pair.

Problem 3: Name 3 ordered pairs with non-integral coordinates that satisfy $x < 4$ and $y > 1.5$.

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TEKS CATEGORY 4 6.13B

6.13B Problem Solving 1

Problem 1: Select the situations below that yield data without variability.

How many student council members at Edison Middle School attended the meeting on Tuesday, March 1?

How many tickets were sold to see the new movie at the theatre?

How many sixth graders at Lee Middle School made the all A honor roll the first six weeks of the 2013-2014 school year?

How many students walk to school on Mondays?

Explain how you made your decision.

Problem 2: Select the situations below that yield data with variability.

How many students at Madison Middle School ride the bus to school?

How many students did Mrs. Berry teach piano lessons to on Saturday, March 3?

How many movies did sixth grade students watch?

What was the temperature on December 13, 2013, at 9:00 a.m. in Chicago?

What was the temperature on December 13 in Chicago?

Explain how you made your decision.

6.13B Problem Solving 2

Problem 1: Select the situations below that yield data without variability.

How many students eat in the lunch room?

How many sixth grade students at Hobart Middle School brought their lunch from home on Tuesday, September 3, 2013?

What is the area of a rectangle with a length of 5 inches and a width of 2 inches?

What is the area of a rectangle with a length of 5 inches?

Explain how you made your decision.

Problem 2: Select the situations below that yield data with variability.

How many sixth grade students wore shorts to school?

If gasoline costs $3.10 a gallon, what is the cost of 5 gallons?

If gasoline costs $3.10 a gallon, what is the cost to fill a tank?

How many nickels are in $5?

How many dimes are in collection of 20 nickels and dimes?

Explain how you made your decision.

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GRADE 6

Open Ended Problem Solving Projections

TEKS CATEGORY 5

Personal Financial Literacy

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GRADE 6

Open Ended Problem Solving Projections

TEKS CATEGORY 5 6.14H

6.14H Problem Solving 1

What are some things you must consider when deciding on a career?

Is salary the most important thing to consider? Why?

What type of benefits would you want when considering a job?

If you have decided on a yearly salary you want to make and find that it requires more education, will you be willing to get more education to attain your salary goal? Explain your answer.

6.14H Problem Solving 2

Sharon is searching career possibilities. She found that an air traffic controller requires an associate's degree and on- the-job training. The median salary is $122,530 a year in some parts of the country. She also found that a nurse practitioner requires a bachelor's degree in nursing and a masters or doctorate in nursing. The median salary is $89,960 a year. In 20 years, how much more would an air traffic controller earn than a nurse practitioner?

Which of these two jobs do you think would be the most stressful? Why?

Which of these two jobs do you think would give the employee the most personal satisfaction or sense of accomplishment? Why?

Do you think that is important in a career choice?