

GRADE 7

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 to 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 for 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.

7.(1) Mathematical Process Standards

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

TEKS	STUDENT EXPECTATION
7.1(A)	apply mathematics to problems arising in everyday life, society, and the workplace
7.1(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
7.1(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
7.1(D)	communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate
7.1(E)	create and use representations to organize, record, and communicate mathematical ideas
7.1(F)	analyze mathematical relationships to connect and communicate mathematical ideas
7.1(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

7.(2) Number and Operations

The student applies mathematical process standards to represent and use rational numbers in a variety of forms.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	7.2(A)	extend previous knowledge of sets and subsets using visual representations to describe relationships between sets of rational numbers

7.(3) Number and Operations

The student applies mathematical process standards to represent addition, subtraction, multiplication, and division while solving problems and justifying solutions.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	7.3(A)	add, subtract, multiply, and divide rational numbers fluently
Readiness	7.3(B)	apply and extend previous understanding of operations to solve problems using addition, subtraction, multiplication, and division of rational numbers

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Category 2: Proportionality

7.(4) Proportionality

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

STAAR Standard	TEKS	STUDENT EXPECTATION
Readiness	7.4(A)	represent constant rates of change in mathematical and real-world problems given pictorial, tabular, verbal, numeric, graphical and algebraic representations, including $d = rt$
Supporting	7.4(B)	calculate unit rates from rates in mathematical and real-world problems
Supporting	7.4(C)	determine the constant of proportionality ($k = y/x$) within mathematical and real-world problems
Readiness	7.4(D)	solve problems involving ratios, rates, and percents, including multi-step problems involving percent increase and percent decrease, and financial literacy problems
Supporting	7.4(E)	convert between measurement systems, including the use of proportions and the use of unit rates

Proportionality

7.(5) Proportionality

The student applies mathematical process standards to use geometry to describe or solve problems involving proportional relationships.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	7.5(A)	generalize the critical attributes of similarity, including ratios within and between similar shapes
Supporting	7.5(B)	describe π as the ratio of the circumference of a circle to its diameter
Readiness	7.5(C)	solve mathematical and real-world problems involving similar shapes and scale drawings

Proportionality

7.(6) Proportionality

The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	7.6(A)	represent sample spaces for simple and compound events using lists and tree diagrams
Not Tested	7.6(B)	select and use different simulations to represent simple and compound events with and without technology
Supporting	7.6(C)	make predictions and determine solutions using experimental data for simple and compound events
Supporting	7.6(D)	make predictions and determine solutions using theoretical probability for simple and compound events
Supporting	7.6(E)	find the probabilities of a simple event and its complement and describe the relationship between the two

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Category 2: Proportionality

7.(6) Proportionality

The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships.

STAAR Standard	TEKS	STUDENT EXPECTATION
Not tested	7.6(F)	use data from a random sample to make inferences about a population
Readiness	7.6(G)	solve problems using data represented in bar graphs, dot plots, and circle graphs, including part-to-whole and part-to-part comparisons and equivalents
Readiness	7.6(H)	solve problems using qualitative and quantitative predictions and comparisons from simple experiments
Readiness	7.6(I)	determine experimental and theoretical probabilities related to simple and compound events using data and sample spaces

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Category 3: Expressions, Equations, and Relationships

7.(7) Expressions, Equations, and Relationships

The student applies mathematical process standards to represent linear relationships using multiple representations.

STAAR Standard	TEKS	STUDENT EXPECTATION
Readiness	7.7(A)	represent linear relationships using verbal descriptions, tables, graphs, and equations that simplify to the form $y = mx + b$

Expressions, Equations, and Relationships

7.(8) Expressions, Equations, and Relationships

The student applies mathematical process standards to develop geometric relationships with volume.

STAAR Standard	TEKS	STUDENT EXPECTATION
Not Tested	7.8(A)	model the relationship between the volume of a rectangular prism and a rectangular pyramid having both congruent bases and heights and connect the relationship to the formulas
Not Tested	7.8(B)	explain verbally and symbolically the relationship between the volume of a triangular prism and a triangular pyramid having both congruent bases and heights and connect that relationship to the formulas
Not Tested	7.8(C)	use models to determine the approximate formulas for the circumference and area of a circle and connect the models to the actual formulas

Expressions, Equations, and Relationships

7.(9) Expressions, Equations, and Relationships

The student applies mathematical process standards to solve geometric problems.

STAAR Standard	TEKS	STUDENT EXPECTATION
Readiness	7.9(A)	solve problems involving the volume of rectangular prisms, triangular prisms, rectangular pyramids, and triangular pyramid
Readiness	7.9(B)	determine the circumference and area of circles
Readiness	7.9(C)	determine the area of composite figures containing combinations of rectangles, squares, parallelograms, trapezoids, triangles, semicircles, and quarter circles
Supporting	7.9(D)	solve problems involving the lateral and total surface area of a rectangular prism, rectangular pyramid, triangular prism and triangular pyramid by the determining the area of the shape's net

Expressions, Equations, and Relationships

7.(10) Expressions, Equations, and Relationships

The student applies mathematical process standards to use one-variable equations and inequalities to represent situations.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	7.10(A)	write one-variable two-step equations and inequalities to represent constraints or conditions within the problem

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Category 3: Expressions, Equations, and Relationships

7.(10) Expressions, Equations, and Relationships

The student applies mathematical process standards to use one-variable equations and inequalities to represent situations.

STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	7.10(B)	represent solutions for one-variable, two-step equations and inequalities on number lines
Supporting	7.10(C)	write a corresponding real-world problems given one-variable, two-step equation or inequality

Expressions, Equations, and Relationships

7.(11) Expressions, Equations, and Relationships

The student applies mathematical process standards to solve one-variable equations and inequalities.

STAAR Standard	TEKS	STUDENT EXPECTATION
Readiness	7.11(A)	model and solve one-variable, two-step equations and inequalities
Supporting	7.11(B)	determine if the given value(s) make(s) one-variable, two-step equations and inequalities true
Supporting	7.11(C)	write and solve equations using geometry concepts including the sums of angles in a triangle, and angle relationships

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Category 4: Measurement and Data

7.(12) Measurement and Data

The student applies mathematical process standards to use statistical representations to analyze data.

STAAR Standard	TEKS	STUDENT EXPECTATION
Readiness	7.12(A)	compare two groups of numeric data using comparative dot plots or box plots by comparing their shapes, centers, and spreads
Supporting	7.12(B)	use data from random sample to make inferences about a population
Supporting	7.12(C)	compare two populations bases on data in random samples from these populations, including informal comparative inferences about differences between the two populations

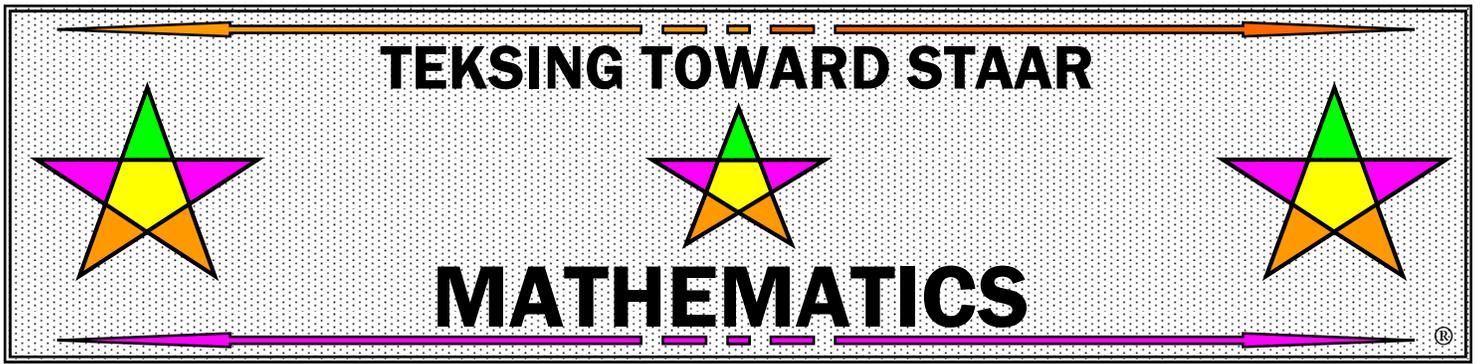
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Category 5: Personal Financial Literacy

7.(13) 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.

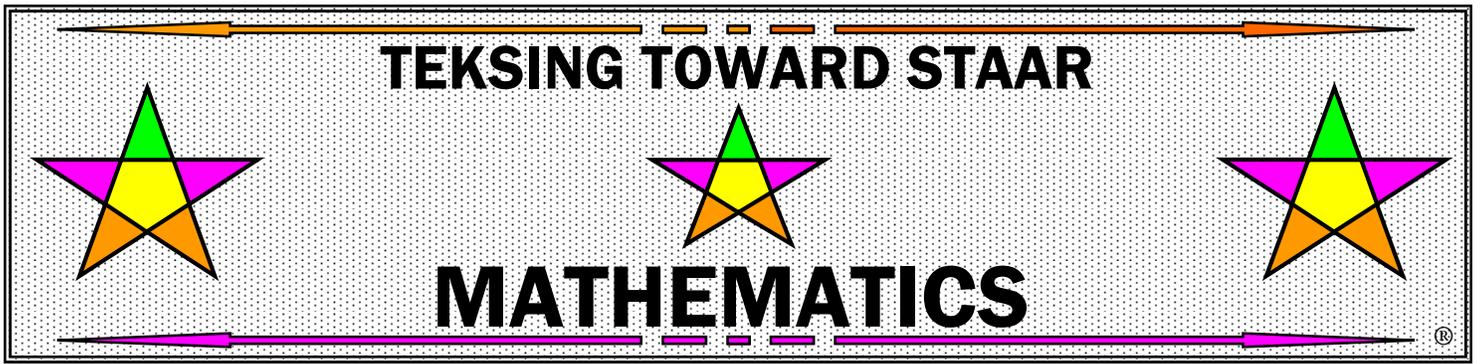
STAAR Standard	TEKS	STUDENT EXPECTATION
Supporting	7.13(A)	calculate the sales tax for a given purchase and calculate income tax for earned wages
Supporting	7.13(B)	identify the components of a personal budget, including income; planned savings for college, retirement, and emergencies; and fixed and variable expenses, and calculate what percentage each category comprises of the total budget
Supporting	7.13(C)	create and organize a financial assets and liabilities record and construct a net worth statement
Supporting	7.13(D)	use a family budget estimator to determine the minimum household budget and average hourly wage needed for a family to meet its basic needs in the student's city or another large city nearby
Supporting	7.13(E)	calculate and compare simple interest and compound interest earnings
Supporting	7.13(F)	analyze and compare monetary incentives, including sales, rebates, and coupons



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TEKS CATEGORY 1 **Numbers and Operations**



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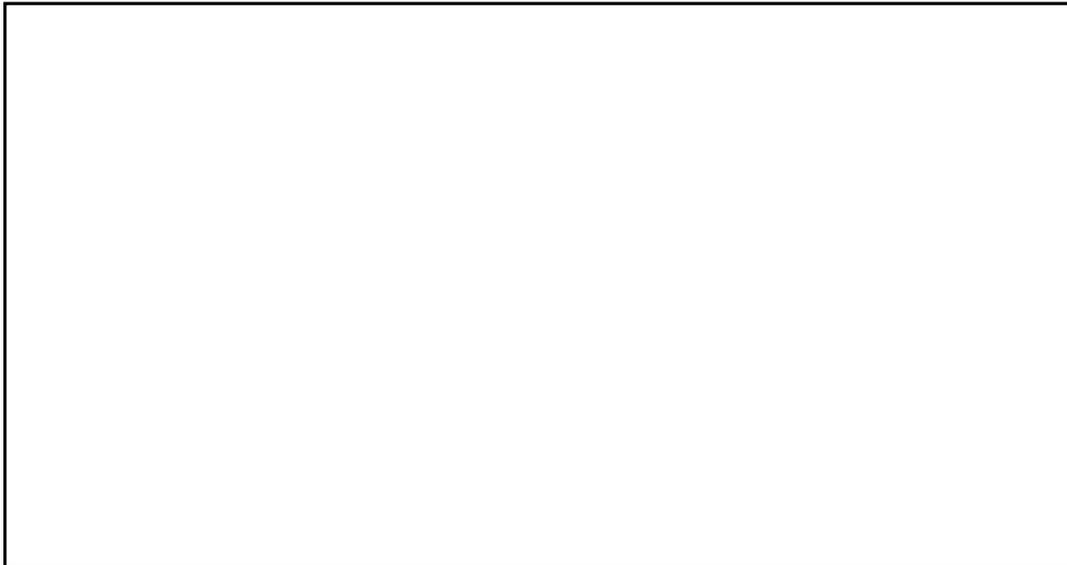
TEKS CATEGORY 1 7.2A

7.2A Problem Solving 1

Draw a Venn diagram to show the relationship between the factors of 25 and 40. Be sure to label your diagram.

Factors of 25: _____

Factors of 40: _____



What factors do they have in common?

Where do they appear in the diagram?

7.2A Problem Solving 2

Problem 1: Which of the following statements are true? Use T or NT.

- _____ 1. All counting numbers are greater than 0.
- _____ 2. Any rational number can be expressed as the ratio of two integers.
- _____ 3. All whole numbers are also integers.
- _____ 4. All rational numbers are also whole numbers.
- _____ 5. The set $\{8, 8.5, 10, -23\}$ are all rational numbers.
- _____ 6. The set $\{-3, 19, 20, 0, -1\}$ are all integers.

For any statement you listed as not true, explain your reasoning.

Problem 2: Place a \checkmark in each column that the given number belongs to.

	Rational Number	Integer	Whole Number
-6			
0			
3.5			
$\frac{12}{4}$			
-2.5			

7.2A Problem Solving 3

Problem 1: Draw a Venn diagram to show the relationship among integers, whole numbers, natural numbers and rational numbers.

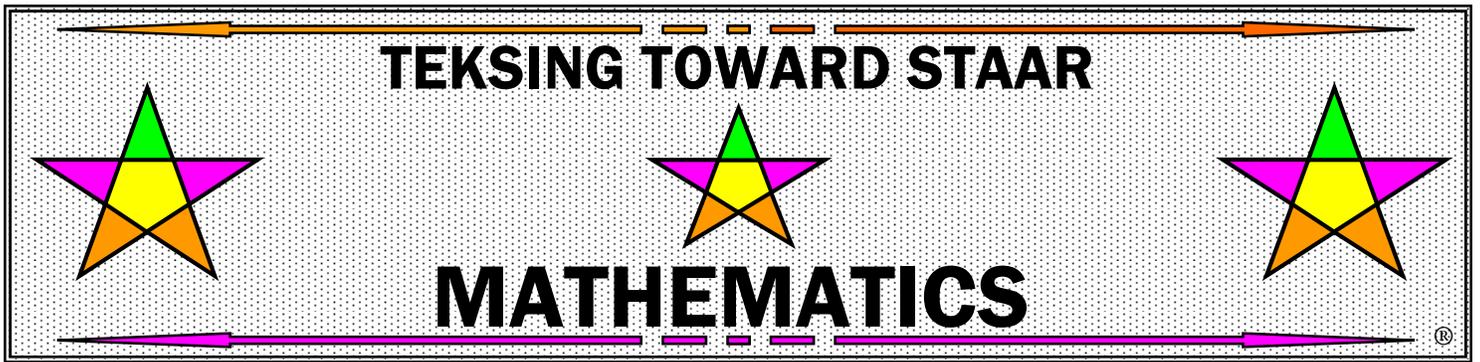
Problem 2: Using a W for whole numbers, I for integers and R for rational numbers, identify all the sets of numbers the following belong to.

$\{9, -5, 14, -15\}$ _____

$\left\{\frac{22}{7}, 3.14, 4, 0\right\}$ _____

$\left\{-24, -6.1, \frac{8}{3}, -9\right\}$ _____

$\{1, 2, 3, 4, 5, 6\}$ _____

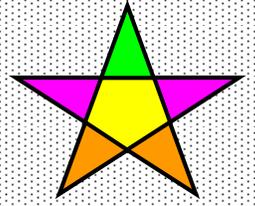
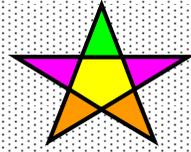
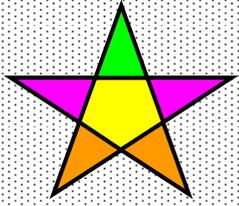


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TEKS CATEGORY 2 Proportionality

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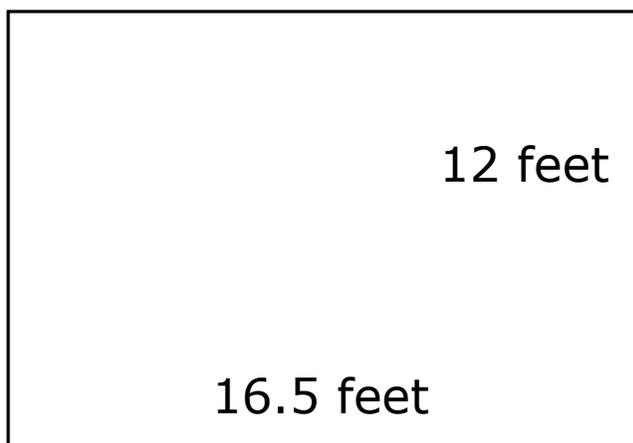
**TEKS CATEGORY 2
7.4B**

7.4B Problem Solving 1

Problem 1: Marcia's family drove 145 miles in 2.5 hours. What was their average rate per hour? Show your work.

Problem 2: A cattle tank with a capacity of 250 gallons is filled in 30 minutes. At what rate in gallons per minute is the tank filling? Show your work.

Problem 3: A construction worker can lay the tile floor of the rectangular room shown below in 8 hours. What is the unit rate of square feet per hour? What formulas do you need to use? Show your work.

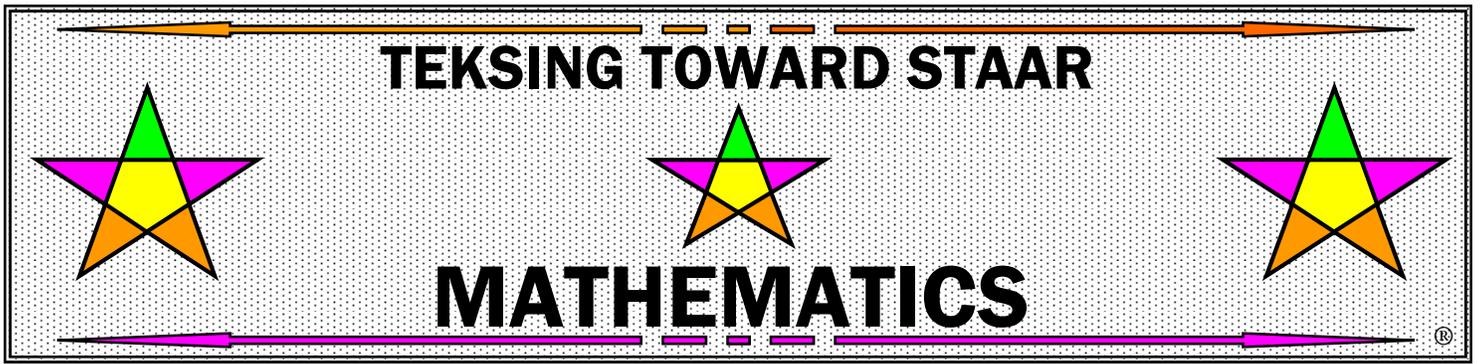


7.4B Problem Solving 2

Problem 1: Recently 10,000 euros were equivalent to \$13,702 US dollars. What is the unit rate of euro per dollar? Dollar per euro?

Problem 2: Marcella bought 5 gallons of gas for \$15.45. What was the price per gallon?

Problem 3: T-shirts at a Dallas Stars game are launched into the crowd at a rate of 4 shirts in 3 minutes? How many t-shirts would be launched in 15 minutes?



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**TEKS CATEGORY 2
7.6D**

7.6D Problem Solving 1

Problem 1: A box contains 14 marbles. There are 6 red, 5 green, and 3 white marbles in the box. Without looking, Joanne pulls 1 marble from the box, replaces it, and then she pulls another marble from the box.

- What is the probability the first marble is white and the second marble is red? Show your work.
- What is the probability both marbles are green?
- What is the probability that neither marble is green?

Problem 2:

- What is the probability that a 1-6 number cube will land on an odd number?
- What is the probability that a 1-6 number cube will land on a number greater than 4?

7.6D Problem Solving 2

A box contains 20 marbles. There are 7 red, 8 green, and 5 white marbles in the box. Without looking, Lisa pulls 1 marble from the box, puts the marble back, and then pulls a second marble from the box.

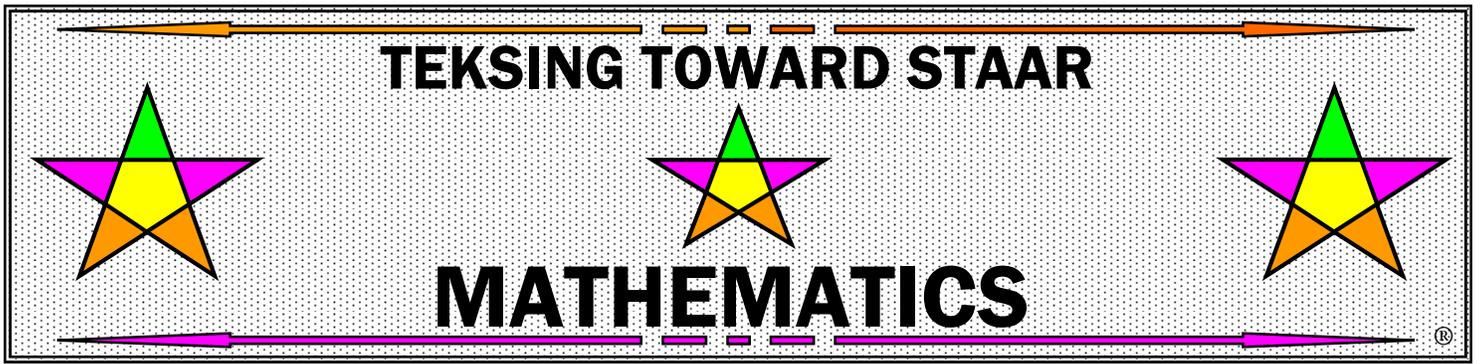
- What is the probability the first marble is green and the second marble is red? _____ Show your work.
- What is the probability both marbles are green? _____ Show your work.
- What is the probability both marbles are white? _____ Show your work.
- Which has the greater probability of occurring?

Drawing 2 green marbles

or

Drawing a red and then a white?

Explain your decision.

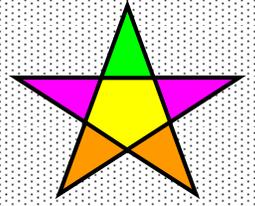
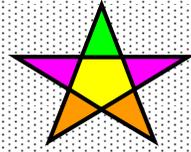
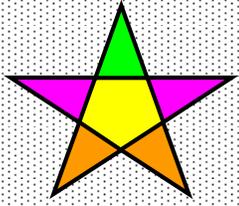


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TEKS CATEGORY 3
**Expressions, Equations
and Relationships**

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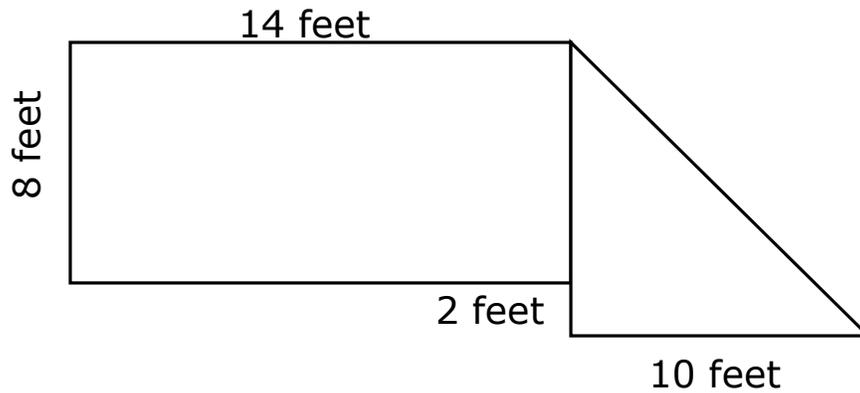
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**TEKS CATEGORY 3
7.9C**

7.9C Problem Solving 1

Problem 1: The shape below consists of one rectangle and one right triangle. Determine the area of the shape.

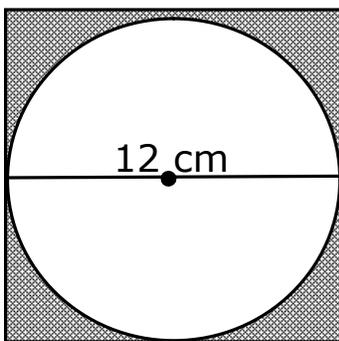


The area of the rectangle is _____ square feet.

The area of the triangle is _____ square feet.

The total area of the figure is (_____ + _____) square feet or _____ square feet.

Problem 2: Find the area to the nearest hundredth that is shaded below.



Work:

The area of the square is _____ sq cm.

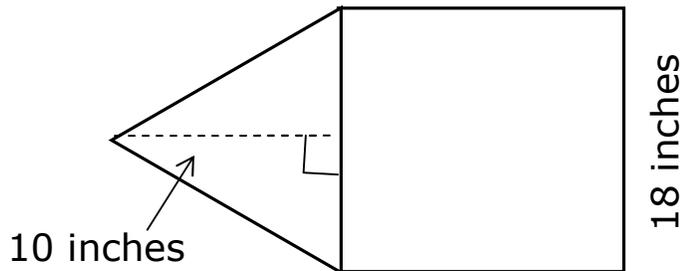
The area of the circle is _____ sq cm.

The shaded area is (_____ - _____) sq cm or

_____ sq cm.

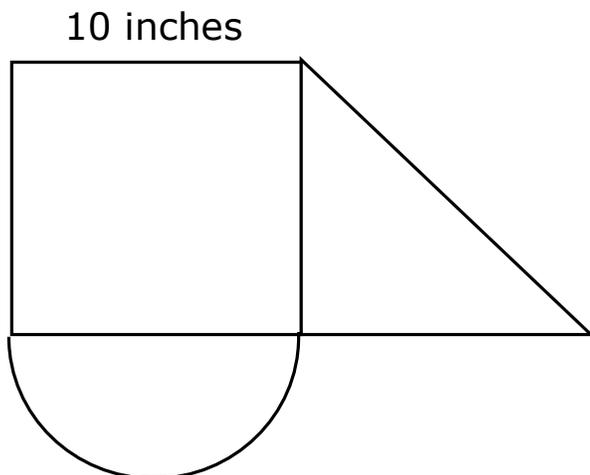
7.9C Problem Solving 2

Problem 1: The composite figure below consists of one square and one isosceles triangle.



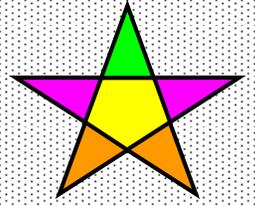
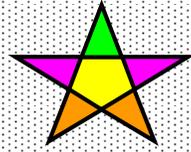
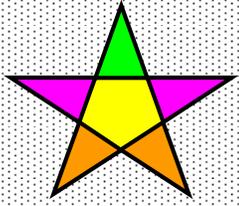
- Find the area of the composite figure. Show all your steps in finding the individual areas that make up the composite figure.
- What percent of the area of the figure is contained in the square? Round to nearest tenth if necessary.

Problem 2: The figure below is comprised of 1 square, 1 isosceles right triangle, and one semicircle.



Find the area of the composite figure. Show all your steps in finding the individual areas that make up the composite figure.

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**TEKS CATEGORY 3
7.10A**

7.10A Problem Solving 1

Problem 1: Two angles of a triangle are congruent. The third angle measures 50° . Write an equation that can be used to find the measure of the two congruent angles.

Problem 2: The measure of one angle of a supplementary pair is represented by $(2x + 20)^\circ$. The measure of the other angle is represented by $(4x - 20)^\circ$.

Draw and label a sketch to represent this situation.

Write an equation that can be used to determine the measure of the two angles.

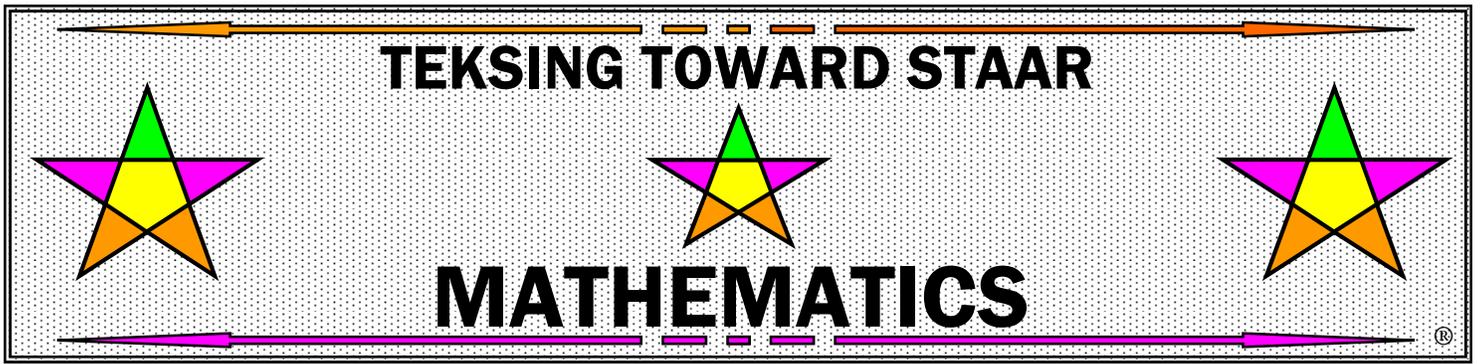
7.10A Problem Solving 2

Problem 1: The sum of two numbers is greater than 350. The larger number is 50 more than twice the smaller number, s . Write an inequality that can be used to determine the possible values of the smaller number.

Problem 2: The perimeter of a rectangle is less than 40 centimeters. The length is 8 centimeters more than the width, w .

Write an inequality that can be used to determine the range of values for the dimensions of the rectangle.

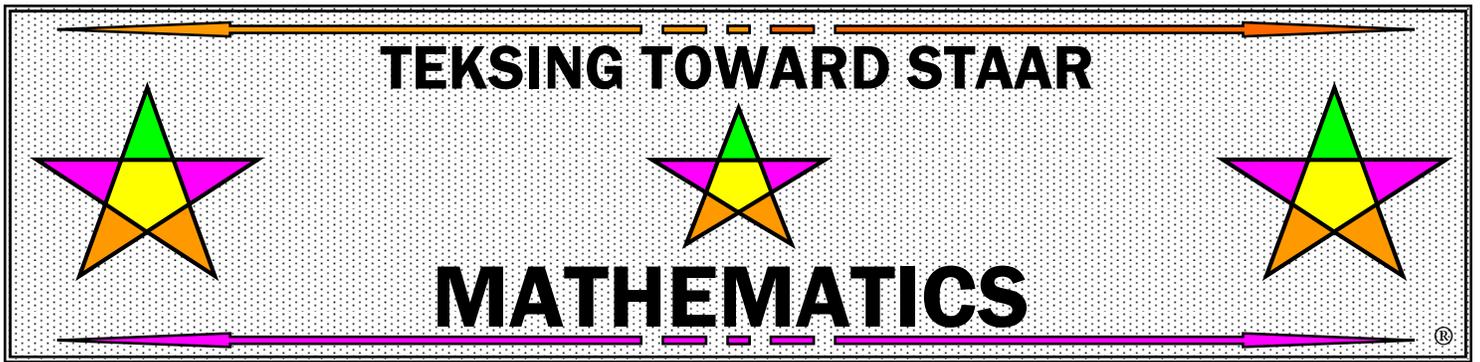
What subset of the rational numbers does the solution set belong?



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TEKS CATEGORY 4 **Measurement and Data**



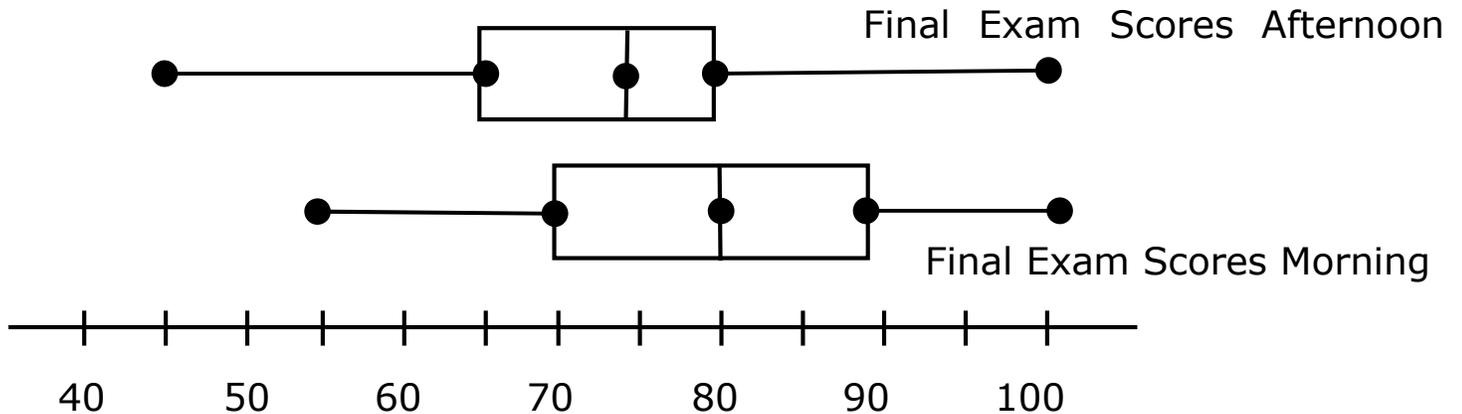
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**TEKS CATEGORY 4
7.12A**

7.12A Problem Solving 1

Ms. Smith compared the final exam scores from her morning classes and her afternoon classes. She used a box plot to compare the two sets of data.



Complete the following based on the box plots.

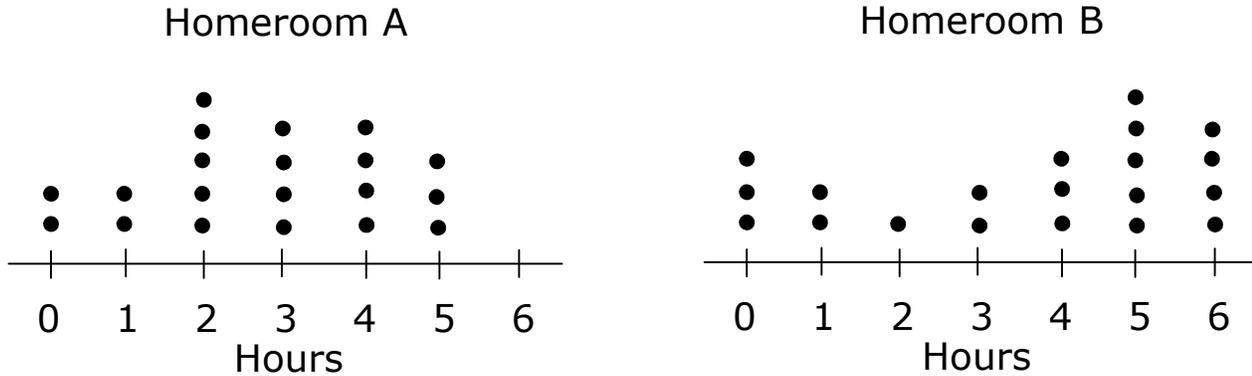
The _____ classes had a greater spread for their exam scores than the _____ classes. The _____ classes had a spread of 55 and the _____ classes had a spread of 40.

The _____ classes had a center of 75 and the _____ classes had a center of 80.

The _____ classes had a smaller interquartile range than the _____ classes.

7.12A Problem Solving 2

Two homeroom teachers polled their students about the number of hours they spend online each week. The results of their polls are shown in the two dot plots below.



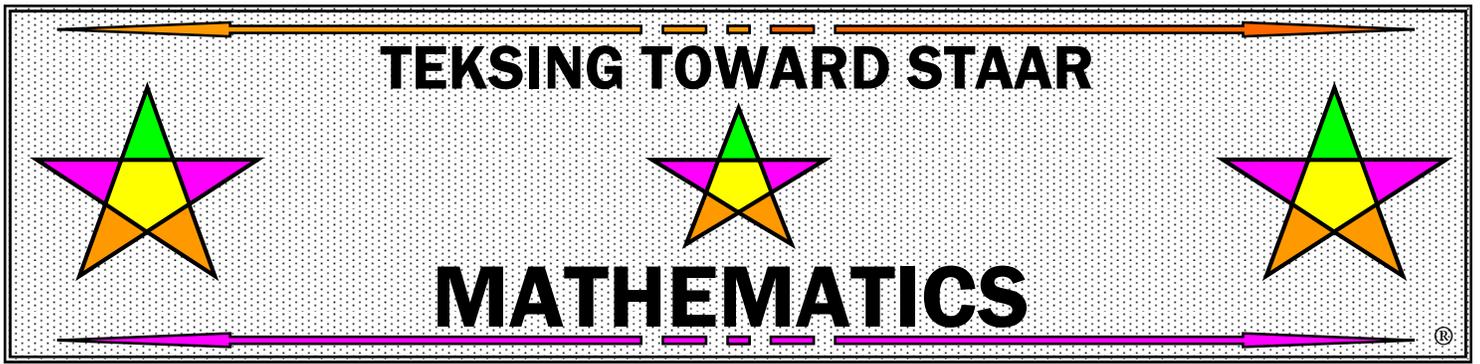
Complete the following based on the dot plots.

Homeroom _____ has a greater spread for their hours online than Homeroom _____.

Homeroom A has a center of _____ and Homeroom B has a center of _____.

The most common number of hours online in Homeroom A is ___ hours while in Homeroom B it is _____ hours.

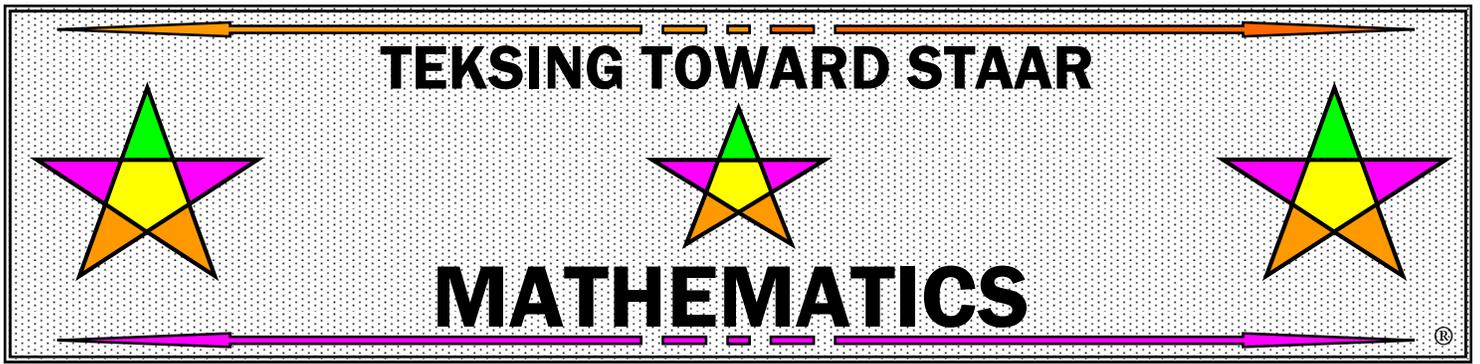
Homeroom ___ has data that showed students were online _____ hours than Homeroom _____.



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TEKS CATEGORY 5 Personal Financial Literacy



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**TEKS CATEGORY 5
7.13A**

7.13A Problem Solving 1

Problem 1: The sales tax in Edmond is 8.25%. If you spend \$235 on taxable items, what amount of tax should you expect to pay? Show your work.

Problem 2: Ms. Landon lives in a city that has a sales tax of 8%. After a purchase, she paid \$271.25 which included the tax. What was the cost before taxes? Show your work.

Problem 3: Explain how to find the pre-tax cost of an item if you know the final cost and the sales tax rate.

Problem 4: Suppose the final cost of an item is \$45.36. This cost includes an 8% sales tax. What was the cost of the item before the sales tax was calculated?

7.13A Problem Solving 2

Ms. Roberts earns a monthly gross pay of \$3,900. She pays \$648.75 a month withholding. Her husband has a yearly salary of \$63,000 and he has had \$9,300 withheld for federal taxes. Their total tax deductions are \$16,900. She and her husband file married jointly for their federal taxes.

- What should their taxable income be?
- How much tax have they already paid through withholding?

If Form 1040 line 43 (taxable income) is-		You are single	Married filing jointly	Married filing separately
At least	But less than	Your tax is-	Your tax is-	Your tax is-
\$85,000	\$85,050	\$17,185	\$13,114	\$17,540
\$85,050	\$85,100	\$17,198	\$13,126	\$17,554
\$85,100	\$85,150	\$17,210	\$13,139	\$17,568
\$85,150	\$85,200	\$17,223	\$13,151	\$17,582
\$85,200	\$85,250	\$17,235	\$13,164	\$17,596

- How much tax do they owe?
- Do they get a refund or owe more taxes? How much?