Third Generation CAPT Mathematics Content Specifications

All CAPT mathematics items are written in a real world context and require students to **solve a problem**. In addition, all open-ended CAPT items will require students to show their work **OR** explain their **reasoning**, thereby **communicating** their understanding of the relevant mathematics. All CAPT items are devised to measure one or more of the following Expected Performances:

ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS		
Patterns and functional relationships can be represented and analyzed using a variety of		
	strategies	, tools and technologies.
How do patterns and	functions help us describe of	data and physical phenomena and solve a variety of problems?
Students should	Performance Standards	Expected Performances
1.1 Understand and	a. Describe relationships	(1) Identify, describe, create and generalize numeric, geometric and
describe patterns	and make	statistical patterns with tables, graphs, words and symbolic rules.
and functional	generalizations about	(2) Make and justify predictions based on patterns.
relationships.	patterns and functions.	(3) Identify the characteristics of functions and relations, including
		domain and range.
		(4) Describe and compare properties and classes of linear, quadratic
		and exponential functions.
1.2 Represent and	a. Represent and analyze	(1) Represent functions and relations on the coordinate plane.
analyze	linear and non-linear	(2) Identify an appropriate symbolic representation for a function or
quantitative	functions and relations	relation displayed graphically or verbally.
relationships in a	symbolically and with	(3) Recognize and explain the meaning of the slope and x- and y-
variety of ways.	tables and graphs.	intercepts as they relate to a context, graph, table or equation.
		(4) Evaluate and interpret the graphs of linear, exponential and
		polynomial functions.
1.3 Use operations,	a. Manipulate equations,	(1) Model and solve problems with linear, quadratic and absolute
properties and	inequalities and	value equations and linear inequalities.
algebraic symbols	functions to solve	(2) Determine equivalent representations of an algebraic equation or
to determine	problems.	inequality to simplify and solve problems.
equivalence and		(3) Solve systems of two linear equations using algebraic or
solve problems.		graphical methods.

NUMERICAL AND PROPORTIONAL REASONING:			
Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify			
calculations using a variety of strategies, tools and technologies.			
	How are quantitative re	elationships represented by numbers?	
Students should	Performance Standards	Expected Performances	
2.1 Understand that a	a. Extend the	(1) Compare, locate, label and order real numbers on number lines,	
variety of	understanding of	scales, coordinate grids and measurement tools.	
numerical	number to include	(2) Select and use an appropriate form of number (integer, fraction,	
representations can	integers, rational	decimal, ratio, percent, exponential, scientific notation, irrational)	
be used to describe	numbers and real	to solve practical problems involving order, magnitude,	
quantitative	numbers.	measures, labels, locations and scales.	
relationships.	b. Interpret and represent	(1) Use technological tools such as spreadsheets, probes, computer	
	large sets of numbers	algebra systems and graphing utilities to organize and analyze	
	with the aid of	large amounts of numerical information.*	
	technologies.		
2.2 Use numbers and	a. Develop strategies for	(1) Select and use appropriate methods for computing to solve	
their properties to	computation and	problems in a variety of contexts.	
compute flexibly	estimation using	(2) Solve problems involving scientific notation and absolute value.	
and fluently, and to	properties of number	(3) Develop and use a variety of strategies to estimate values of	
reasonably	systems to solve	formulas, functions and roots; to recognize the limitations of	
estimate measures	problems.	estimation; and to judge the implications of the results.	
and quantities.	b. Solve proportional	(1) Use dimensional analysis to determine equivalent rates.	
	reasoning problems.	(2) Solve problems using direct and inverse variation.	

*Concepts in *italics* will NOT be tested on CAPT, but should be included in Core instruction.

GEOMETRY AND MEASUREMENT Shapes and structures can be analyzed, visualized, measured and transformed using a variety			
How do geometric relationships and measurements help us to solve problems and make sense of our world?			
Students Should	Performance Standards	Expected Performances	
3.1 Use properties and characteristics of two- and three- dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems,	 a. Investigate relationships among plane and solid geometric figures using geometric models, constructions and tools. b. Develop and evaluate mathematical arguments using reasoning and proof. 	 Use models and constructions to make, test and summarize conjectures involving properties of geometric figures. Use geometric properties to solve problems in two and three dimensions. Determine and compare properties of classes of polygons. Recognize the validity of an argument. Create logical arguments to solve problems and determine geometric relationships. 	
3.2 Use spatial reasoning, location and geometric relationships to solve problems.	a. Verify geometric relationships using algebra, coordinate geometry and transformations.	 (1) Interpret geometric relationships using algebraic equations and inequalities, and vice versa. (2) Describe how a change in measurement of one or more parts of a polygon or solid may affect its perimeter, area, surface area and volume and make generalizations for similar figures. (3) Apply transformations to plane figures to determine congruence, similarity, symmetry and tessellations. 	
3.3 Develop and apply units, systems, formulas and appropriate tools to estimate and measure.	a. Solve a variety of problems involving one-, two- and three- dimensional measurements using geometric relationships and trigonometric ratios.	 Select appropriate units, scales, degree of precision, and strategies to determine length, angle measure, perimeter, circumference and area of plane geometric figures. Use indirect methods including the Pythagorean Theorem, <i>trigonometric ratios</i>* and proportions in similar figures to solve a variety of measurement problems. Judge the reasonableness of answers to direct and indirect measurement problems. Use two-dimensional representations and formal and informal methods to solve surface area and volume problems. 	
*Concepts in <i>italics</i> will N	OT be tested on CAPT, but st	hould be included in Core instruction	
V V	VORKING WITH DATA	A: PROBABILITY AND STATISTICS	
Data can be an	alyzed to make informed dec	isions using a variety of strategies, tools and technologies.	
How can c	ollecting, organizing and dis	splaying data help us analyze information and make	
Students should	Performance Standards	Expected Performances	
4.1 Collect, organize and display data using appropriate statistical and graphical methods.	a. Create the appropriate visual or graphical representation of real data.	 (1) Collect real data and create meaningful graphical representations of the data. (2) Develop, use and explain applications and limitations of linear and nonlinear models and regression in a variety of contexts. 	
4.2 Analyze data sets to form hypotheses and make predictions.	 a. Analyze real-world problems using statistical techniques. a. Understand and apply 	 (1) Estimate an unknown value between data points on a graph (interpolation) and make predictions by extending the graph (extrapolation). (2) Use data from samples to make inferences about a population and determine whether claims are reasonable or false. (3) Determine and use measures of spread and central tendency to describe and compare sets of data. (1) Determine outcomes and solve problems involving the 	
apply basic concepts of probability.	the principles of probability in a variety of situations.	 (2) Explore the concepts of conditional probability in real-world contexts. (3) Apply theoretical and experimental probabilities appropriately to solve problems and predict experimental results. 	

CAPT Formula Chart

Questions on the CAPT Mathematics Assessment measure students understanding of mathematical processes and **not** their ability to recall information. Standard formulas and information are provided and will be available to students to use throughout the assessment.

Students will NOT be prompted to use the Formula Chart on specific questions. It is important that they are familiar with the chart and have practice using it prior to the administration of CAPT.

	CAP	T Formula Cha	rt
π equals app	proximately	3.14	
Circumference)	circle	$C = 2\pi r$
Area		triangle	$A = \frac{1}{2} bh$
		trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$
		circle	$A = \pi r^2$
Surface Area		right cylinder	$S = 2\pi rh + 2\pi r^2$
		sphere	$S = 4\pi r^2$
Volume		rectangular prism	V = lwh
		cylinder	$V = \pi r^2 h$
		cone	$V = \frac{1}{3}\pi r^2 h$
		sphere	$V = \frac{4}{3}\pi r^3$
Pythagorean 7	Theorem	right triangle	$a^2 + b^2 = c^2$
			a b
	Measure	ement Convers	ions
Length	1 kilometer 1 meter = 1 1 centimete	Metric r = 1,000 meters 100 centimeters er = 10 millimeters	Customary 1 mile = 5,280 feet
Volume	1 liter = 1,0	000 milliliters	1 gallon = 4 quarts 1 quart = 2 pints 1 pint = 2 cups 1 cup = 8 ounces
Weight and Mass	1 kilogram 1 gram = 1	= 1,000 grams ,000 mi ll igrams	1 ton = 2,000 pounds 1 pound = 16 ounces
Time	1 year = 36 1 year = 52	65 days 2 weeks	9998086698

Other Useful Formulas

The following formulas are **not** included on the CAPT formula chart. However, these formulas can be useful in solving some of the contextual problems found on the CAPT in a more efficient manner.

Have students solve problems using a variety of strategies including using specific formulas.



Probability:
Theoretical Probability $P(event) = \frac{Number of Favorable Outcomes}{Total Number of Outcomes}$ Experimental Probability $P(event) = \frac{Number of Successes}{Number of Trials}$ General Formulas for Surface Area (SA) and Volume (V):

General Prisms V = BhSA = sum of the areas of the faces

Third Generation CAPT Scoring Rubric

Score 3

The student has demonstrated a **full and complete** understanding of all concepts and processes essential to this application. The student has addressed the task in a mathematically sound manner. The response contains evidence of the student's competence in problem-solving and reasoning, computing and estimating, and communicating to the full extent that these processes apply to the specified task. The response may, however, contain minor arithmetic errors that do not detract from a demonstration of full understanding. Student work is shown or an explanation is included.

Score 2

The student has demonstrated a **reasonable** understanding of the essential mathematical concepts and processes in this application. The student's response contains most of the attributes of an appropriate response including a mathematically sound approach and evidence of competence with applicable mathematical processes, but contains flaws that do not diminish the evidence that the student comprehends the essential mathematical ideas addressed in the task. Such flaws include errors attributed to faulty reading, writing, or drawing skills; errors attributed to insufficient, non-mathematical knowledge; and errors attributed to careless execution of mathematical processes or algorithms.

Score 1

The student has demonstrated a **partial** understanding of some of the concepts and processes in this application. The student's response contains some of the attributes of an appropriate response, but lacks convincing evidence that the student fully comprehends the essential mathematical ideas addressed by this task. Such deficits include evidence of insufficient mathematical knowledge; errors in fundamental mathematical procedures; and other omissions or irregularities that bring into question the extent of the student's ability to solve problems of this general type.

Score 0

The student has demonstrated **merely an acquaintance** with the topic. The student's response is associated with the task in the item but contains few attributes of an appropriate response. There are significant omissions or irregularities that indicate a lack of comprehension in regard to the mathematical ideas and procedures necessary to adequately address the specified task. No evidence is present to suggest that the student has the ability to solve problems of this general type.



Third Generation CAPT Mathematics Assessment Blueprint

The CAPT Mathematics assessment contains open-ended (OE) items and grid items for each content standard as shown below.

Number of Items and Points Across Standards			
CAPT Mathematics	OE Items (3 points each)	Grid Items (1 point each)	Total Points
Algebraic Reasoning	2	6	12
Numerical & Proportional Reasoning	2	6	12
Measurement and Geometry	2	6	12
Working with Data	2	6	12
	8 OE Items	24 Grid Items	48 Points

The number and type of items can vary from year to year and are delineated according to the components of the four content standards. The components come directly from the 2005 Connecticut Mathematics Framework. Refer back to pages 9 - 11 for details.

Content Standard		Number of Points	
	1.1	4-5	
1. Algebraic Reasoning	1.2	4-5	
	1.3	2-3	
2. Numerical and	2.1	3-4	
Proportional Reasoning	2.2	8-9	
3 Coometry and	3.1	3-5	
5. Geometry and Mossurement	3.2	2-3	
Wieasurement	3.3	5-6	
1 Statistics and	4.1	3	
4. Statistics and Drobability	4.2	4-5	
rrobability	4.3	4-5	

Connecticut Framework Performance Standard	Released Item	Sample Activity
1.1a	<u>3-Level Pyramid</u>	Sequencer
	Bacterial Growth	
	Population of Hartford	
	Baseball Card	
	Increasing Population	
	Graphic Design Charges	
	Martha's Sales	
1.2a	Hot Air Ballooning	Possible or Not?
	Walk to the Stadium	Linear Function Machine
	Hang Gliding	Movie Lines
	Coffee Special	Interpreting the "Real-Life" Meaning of Graphical Representations Also fits 1.3 and 4.1
	Used Car Values	
1.3a	Stopping Distance	Modeling Orbital Debris Problems
	Pressure	Supply and Demand – An Application of Linear Equations
	Canadian Dollars	
	History Tests	
	Health Club	
	Industrial Electricity Use	
2.1a	Water Quality Data	The Tortoise and the Hare
	Highest Points in New England	Rational Numbers
	Machine Part	Pythagoras' Mystery Tablet
	Organism Length	
	Eric's T-shirt Shop (1)	
2.2a	Eric's T-shirt Shop (2)	Compound Interest
	Final Exam	
	Health Club (1)	
	<u>Health Club</u> (2)	
	Presidential Election	
	City Construction	

Connecticut Framework Performance Standard	Released Item	Sample Activity
2.2a cont.	Katharine Hepburn	
	Bloodhound	
	Picnic Food	
	Lunch in Mystic	
2.2b	World Population	Planets in Proportion
	Maple Syrup	
	Boston Marathon	
	Fastest Runner	
	Kendra's Travels	
	<u>Great Pyramid (</u> 1)	
3.1a	Geometric Figure	<u>3-D Visualization Activity</u>
	Great Pyramid (2)	
	Paper Range	
	Entertainment Center	
3.1b	<u>Planetarium</u>	Perplexing Parallelograms
3.2a	Tile Company	Trasmographer 2
	Cheesecake Pans	Symmetries and Their Properties
	Hugo's Pizza	Relationships Between Area and Perimeter
	Two Silos	
	<u>Tile Company</u>	
	Computer Lab	
3.3a	City Construction	Black Kingdom of the Nile
	Paving with Asphalt	Surface Area and Volume
	Emily's Quilt	
	American Flag	
	Cargo Ship	
	Maple Syrup	
	<u>Stair Railing</u>	
3.3a continued	Land Area of Tolland County	

	Soup Cans	
	City Construction	
	Ice Chest Capacities	
	Building a Cabin	
4.1a	Frog Population	Exploring Linear Relationships Also fits 4.2
	Population of New London County	Investigating Linear Relationships Also fits 4.2
		Interpreting the "Real-Life" Meaning of Graphical Representations
4.2a	Historical Documents	Measures
	Joseph's Final Grade	
	Danbury Temperatures	
	Website Visitors	
	Katharine Hepburn	
4.3a	Sum of the Toss	Birthday Paradox
	Katharine Hepburn	Stick or Switch
	Mary's Number Cubes	Simple Monty Hall
	Chocolate Candy	
	Carnival Spinner	
	Bear Cubs	

Released CAPT Items by Expected Performance

GI – Grid-in Problem 1 point for a correct response

OE - Open Ended ProblemScored with the 0 - 3 point CAPT Rubric

Note: The link after each item will bring you to the first page of the document that contains **all** the mathematics items released for that year along with scored student work samples if available. **You will have to scroll to find the exact item.**

Algebraic Reasoning: Patterns and Functions

Expected Performance 1.1a(1)

3-Level Pyramid – GI

Ellis works at a grocery store in Stamford. He is building pyramids of cans for a display. To build
a 3-level pyramid, Ellis used 10 cans, as shown in the diagram below.

3-Level Pyramid



If he follows the same pattern, how many cans will Ellis use to build a 7-level pyramid?

2001 Released Item

Bacterial Growth – GI

Judy works for a doctor. She placed a sample of bacteria in a culture dish and recorded the number of bacteria present each 30 minutes beginning at 12:00 P.M. The table shows Judy's data.

Bacterial Growth		
Time	Number of Bacteria Present	
12:00 р.м.	150	
12:30 р.м.	600	
1:00 р.м.	2400	

If the pattern of bacterial growth remains constant, how many bacteria should be present in the culture dish at 2:00 P.M.?

Algebraic Reasoning: Patterns and Functions Expected Performance 1.1a(2)

Population of Hartford – OE

In the 1990 Census, the population of Hartford was recorded as 139,739. In the 2000 Census, the recorded population of Hartford had declined to 127,275.

Government planners are trying to project the city's population in 2030.

One planner makes the assumption that the population will continue to decrease by the SAME AMOUNT of people in each of the next three ten-year periods. Another planner makes the assumption that the population will continue to decrease by the SAME PERCENT in each of the next three ten-year periods.

- a. Calculate the projected population of Hartford in 2030 using each of the two planners' approaches and the difference between the two projections. Show or explain how you got your answer.
- b. Which assumption—decreasing by the SAME AMOUNT or by the SAME PERCENT—do you think most accurately projects the population? Explain your reasoning.

2006 Released Item

Baseball Card – GI

An ad for a special baseball card that was posted on the Internet claims that the value of the card "doubles every year." Jerome buys the card for \$40 at the end of the year 2001. If the value of the card does indeed double every year, in what year will the value of the card first reach \$5000?

Increasing Population – OE

The population of Pleasanton has been increasing by approximately the same percentage each decade. The table below shows the town's population in selected years since 1950.

•		
Year	Population	
1950	6451	
1960	7423	
1970	8548	
1980	9814	
1990	11,280	

Pleasanton Population

By what percent has the population of Pleasanton been increasing? Show your work or explain how you found your answer.

If the pattern continues, what will be the town's approximate population in the year 2010? Show your work or explain how you found your answer.

2003 Released Item

Algebraic Reasoning: Patterns and Functions

Expected Performance 1.1a(4)

Graphic Design Charges – OE

For an original graphic design, Lee charges a fixed fee of \$50 plus \$25 for each hour that he works. His main competitor charges a fixed fee of \$40 plus \$30 for each hour that he works on a design. Lee's competitor advertises that his rates are cheaper. Is Lee's competitor correct? Explain your reasoning. The grid in your answer book is provided in case you decide to use a graph as part of your explanation.

2003 Released Item

Martha's Sales – OE

Martha works as a salesperson for Momentum Sales. She earns \$1,000 per month plus 15% commission on her sales.

- a. Write an equation that expresses T, her income for one month as a function of x, her total sales for the month.
- b. River City Sales, another company in the same town, has offered Martha a job that will pay her \$500 per month plus 20% commission on her sales. The benefits and working conditions are equally good at both companies. Explain why Martha should or should not accept the job at River City Sales. Support your answer by finding *x*, the average total sales for the month she would need to at least equal her present income at Momentum Sales.

Algebraic Reasoning: Patterns and Functions

Expected Performance 1.2a(1)

Hot Air Ballooning – OE

A hot air balloon pilot took her new balloon on a test flight. She made the balloon ascend to an altitude of 1,500 feet at 300 feet per minute. Then, for 30 minutes, she flew it at an altitude that varied between 1,600 and 1,400 feet. Finally, she made it descend for landing at a rate of 150 feet per minute.

- a. Construct a graph on the grid provided in your answer booklet to represent the flight of the balloon. Use altitude as a function of time. Remember to title the graph and label the axes.
- b. About how long was the total flight time of the balloon? Show your work or explain how you found your answer.

Walk to the Stadium – OE

Ernest walked to the stadium to watch a football game. The graph below illustrates his walking speed on the trip.



- a. About how many miles did Ernest walk to the stadium?
- b. Based on the information in the graph, describe what may be happening during his walk to the stadium. Be sure to include a description of each change shown in the graph.

Hang Gliding –OE



Josephine likes to go hang gliding. She took off from a hillside at an elevation of 700 feet. During the first 5 minutes, she went down to 500 feet. Then she rode for another 5 minutes up to a height of 600 feet. She then descended at a rate of 200 feet every 15 minutes until she landed.

- a. Using the grid provided, construct a graph to represent Josephine's flight. Use height as a function of time and remember to label the axes.
- b. How many minutes did her flight take? Show your work or explain how you found your answer.



Algebraic Reasoning: Patterns and Functions Expected Performance 1.2a(2)

Coffee Special – GI

A store sells gournet coffee at a discount with the purchase of a coffee maker that costs 26.00. The graph below shows the total price in dollars, *T*, for a coffee maker plus the amount of coffee in pounds, *P*.



Carl plans to buy a coffee maker and four pounds of coffee. How much does the store charge per pound for the gourmet coffee?

Algebraic Reasoning: Patterns and Functions

Expected Performance 1.2a(4)

Used Car Values – OE

The value of a \$12,800 car decreases according to the formula

$$V = 12,800(0.8)^{n}$$

where n is the number of years since it was purchased.

- a. Use the formula to complete the table in your answer booklet.
- b. If you bought a \$12,800 car, how many years would it take for its value to first fall below \$2000? Show or explain how you got your answer.

Years Since Purchase	Value of Car (to the nearest dollar)
1	
2	
5	
10	
15	
20	

2002 Released Item

Algebraic Reasoning: Patterns and Functions

Expected Performance 1.3a(2)

Stopping Distance – GI

The relationship between the distance d, in feet, required to stop a vehicle and s, the speed in miles per hour that the vehicle was traveling, is given by the equation

$$d = \frac{0.0155s^2}{f}$$

where f represents the coefficient of friction between the tires and the road.

It took a car 205 feet to stop. What speed was the car traveling? Use f = 0.3 and round your answer to the nearest mile per hour.

Pressure – GI

Underwater pressure can be found using the formula

$$p = 1 + \frac{d}{33}$$

where p is the pressure (in atmospheres), and d is the depth of the water in feet.

If a scuba diver is experiencing 3.4 atmospheres of pressure, what is the depth of the diver? Round your answer to the nearest whole foot.

2006 Released Item

Canadian Dollars – GI

On Monday, the following equation gave the exchange rate between the value of the Canadian dollar (C) and the U.S. dollar (U):

On Tuesday, the exchange rate had changed to the following equation:

On Monday, Bradley changed \$40 U.S. to Canadian dollars at Monday's exchange rate. He did not spend any of the money, and on Tuesday he changed it back to U.S. dollars at Tuesday's exchange rate. How much money (in U.S. dollars) did Bradley LOSE in this process?

2006 Released Item

History Tests – GI

In the course of a semester, a history teacher gave his class two tests (with scores represented by T_1 and T_2) and two quizzes (with scores represented by Q_1 and Q_2). When he prepared the final grades for each student's report card, he used the formula

Report Card Grade =
$$\frac{2T_1 + 2T_2 + Q_1 + Q_2}{6}$$

A student received the grades 84 and 91 on his two tests and 78 and 82 on his two quizzes. What was his final report card grade?

Algebraic Reasoning: Patterns and Functions

Expected Performance 1.3a(3)

Health Club – OE

Two local health and fitness centers, Fitness First and Healthy Life are in your neighborhood. The copies of their ads are shown below:

Fitness First

\$49.00/month for the first family member• plus• \$29.00/month each additional family member•

Healthy Life

\$65.00/month for the first family member• plus• \$21.00/month each additional family member•

- a.- Write an equation in your answer booklet that shows C, the total monthly charges for a family with N members at Fitness First.
- b. Write an equation in your answer booklet that shows C, the total monthly charges for a family with N members at Healthy Life.
- c.- Find the number of family members for which the charges for the two health and fitness centers are equal.

The grid is provided in case you would like to use a graphical solution for this problem.



Industrial Electricity Use – OE

A utility company offers electricity to industrial users at a rate of 8 cents per kilowatt-hour. The company also offers a fixed annual rate of \$1,200,000 for unlimited use of electricity.

- a. Graph each of these two rates as a line on the grid in your answer booklet.
- b. Explain why a large industrial user of electricity would choose to pay the fixed annual rate. Use the information in your graph to support your answer.



Industrial Electricity Use

Numerical and Proportional Reasoning

Expected Performance 2.1a(1)

Water Quality Data - OE

The South Central Connecticut Regional Water Authority monitors the water quality throughout south central Connecticut. The table shows recent data on the amounts of certain pollutants found in Lake Gaillard.

Pollutant	Maximum Allowed (in mg/L)	Amount of Pollutants Found in a Sample of Lake Water (in mg/L)
Barium	2.0	0.01
Cadmium	0.005	0.0
Chloride	250.0	9.0
Fluoride	4.0	0.99
Iron	0.3	0.012
Manganese	0.05	0.027
Mercury	0.002	0.0

Lake Gaillard Water Quality Data

One environmental scientist recommends that the maximum allowable levels of all the pollutants found in the lake be reduced to 10% of their present levels. If this reduction is made, which pollutants found in the lake would be *greater* than the reduced maximum allowable level recommended by this scientist? Show or explain how you determined your answer.

2002 Released Item

Highest Points in New England – GI

The drawing shows the highest point of land in each New England state.

The Highest Point in Each New England State



0. Based on the information in the drawing, what is the approximate height in feet of the highest point of land in Vermont?

Machine Part - OE

Daniel and Sheri both work at a Connecticut company that manufactures machine parts. During quality control testing they must check the thickness of a machine part. The thickness of the part should be 0.06 mm, and be within an acceptable range of plus or minus 10% of 0.06 mm. The chart shows a quality control sample of ten parts and their thicknesses.

Part	Thickness (mm)
Α	0.056
В	0.069
С	0.057
D	0.061
Е	0.047
F	0.070
G	0.059
Н	0.053
	0.061
J	0.062

- a) What are the minimum and maximum acceptable thicknesses for the machine part? Show your work or explain how you found your answer.
- b) How many of the parts in the sample above are within the acceptable range for the thickness of a part? Show your work or explain how you found your answer.
- c) Graph the range of acceptable thicknesses for the part on the number line in your answer book.

c.)

Organism Lengths - OE

Students in a biology class measured and recorded the lengths of different microscopic organisms. The results are recorded in the table below.

Organism	Length (millimeters)
A	0.00065
В	4.72×10^{-4}
с	8 10,000
D	?

Organism Lengths

- a. A fourth organism (D) was measured and found to be $\frac{1}{40}$ the length of organism B. What was the length of organism D? Show your work or explain how you found your answer.
- b. Which of the four organisms in the table was **longest**? Show your work or explain how you found your answer.

2007 Released Item

Numerical and Proportional Reasoning

Expected Performance 2.1a(2)

Eric's T-shirt Shop – GI

On Fridays Eric has a T-shirt special in his shop.

Eric's T-Shirts Friday Special

Buy 2 shirts at the regular price of \$20 each Get the third shirt at $\frac{1}{2}$ price

Eric's Friday special is equivalent to what single discount on 3 shirts? Give your answer to the nearest whole percent.

Numerical and Proportional Reasoning

Expected Performance 2.2a(1)

Eric's T-shirt Shop – GI

Eric owns a T-shirt shop. Eric has been selling 50 T-shirts each day at a price of \$20. He finds that for each \$1 reduction in price, he can sell 5 more each day. At what price (in dollars) should he sell the T-shirts in order to maximize his daily income from their sales?

2002 Released Item

Final Exam – OE

Ms. Jackson let her students know that their final exam contained three groups of questions:

- 16 multiple-choice questions, worth $1\frac{1}{2}$ points each;
- 16 short-answer questions, worth $2\frac{1}{2}$ points each;
- 3 essay questions, worth 12 points each.
- a. What **percent** of the final exam is each group worth? Show your work or explain how you found your answer.
- b. Beatrice has a semester average of 89 before she takes the final. She knows that the final is worth 25% of her total semester average. What is the greatest number of questions Beatrice can miss and still raise her final semester average to at least 90? Show your work or explain how you found your answer.

Health Club – GI

Two local health and fitness centers, Fitness First and Healthy Life are in your neighborhood. Copi of their ads are shown below. Use the ads to answer questions 9 and 10.

Fitness First \$49.00/month for the first family member• plus• \$29.00/month each additional family member•

Healthy Life \$65.00/month for the first family member• plus• \$21.00/month each additional family member•

A family pays \$128/month at Healthy Life. How many people are in this family?

2001 Released Item

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Health Club – GI

Healthy Life plans to increase all of its monthly charges by 20%. What will a family of four expect to pay per month after the increases?

Presidential Election – GI

The chart shows the winning candidate in each presidential election from 1960 to 2000. It also shows the candidate who received the most votes in Connecticut.

Presidential Election Year	Winning Candidate	Candidate Receiving Most Votes in Connecticut							
1960	Kennedy	Kennedy							
1964	Johnson	Johnson							
1968	Nixon	Humphrey							
1972	Nixon	Nixon							
1976	Carter	Ford							
1980	Reagan	Reagan							
1984	Reagan	Reagan							
1988	Bush	Bush							
1992	Clinton	Clinton							
1996	Clinton	Clinton							
2000	Bush	Gore							

In what percent of the elections did the candidate receiving the most votes in Connecticut win the election? Round your answer to the nearest whole percent.

2006 Released Item

City Construction – GI

The penalty clause in a road construction contract reads, "The construction contractor must pay a fine of \$1500 plus \$375 per day for each day that work continues *after* the promised finish date of June 1." If the contractor paid a fine of \$10,875, how many days late was the construction job?

2001 Released Item

Katharine Hepburn – GI

For the 2 decades from 1950 to 1969, what was the percent of Hepburn's films for which she was nominated for best actress? Round your answer to the nearest whole percent.

Numerical and Proportional Reasoning

Expected Performance 2.2a(2)

Bloodhound - GI

The bloodhound, a type of dog, has 4.0×10^9 scent receptors in its nose. A typical human has 1.2×10^7 scent receptors. How many times more scent receptors does a bloodhound have than a human? Round your answer to the nearest whole number.

2007 Released Item

Numerical and Proportional Reasoning

Expected Performance 2.2a(3)

Picnic Food - GI

Each summer, a high school sponsors a picnic for new students, their parents and teachers. Last year, 65 pounds of hamburger patties were cooked to serve between 250 and 300 people. This year, the school expects between 325 and 375 people.

Estimate the number of pounds of hamburger patties that should be ordered.

2007 Released Items

Lunch in Mystic - OE

Martin needs to estimate the cost of a lunch for himself and 12 of his friends at a Mystic restaurant. He knows that:

- the highest priced menu item is \$8.85;
- the lowest priced item is \$4.35;
- drinks are \$0.90 each with free refills;
- everyone will have a \$1.75 dessert;
- a 6% sales tax will be added to his bill;
- · he will leave the server a 15% tip based on the bill after tax is added; and
- he will pay the bill in cash.

What is a reasonable estimate for the price of the lunch? Show or explain how you arrived at your estimate.

Numerical and Proportional Reasoning

Expected Performance 2.2b(1)

World Population – GI

In recent years the world's population has increased at a rate of approximately 10,900 people per hour. This number is equal to how many people per second? Round your answer to the nearest whole number.

2006 Released Item

Maple Syrup – GI

To make maple syrup, Ken must boil 40 gallons of maple tree sap to produce one gallon of syrup. Ken sells his maple syrup in containers that hold 1 quart. At that rate, how many **gallons** of maple tree sap must be boiled to make 1 quart of syrup?

2003 Released Item

Boston Marathon – GI

The 104th running of the 26.2 miles Boston Marathon occurred on April 17, 2000.

To qualify for the Boston Marathon, a runner must have a certified time in another marathon of 3 hours and 20 minutes. To the nearest tenth of a minute, what must be the runner's pace (minutes per mile) in order to complete the 26.2 miles in 3 hours and 20 minutes?

2002 Released Item

Fastest Runner – OE

The table shows the average speed of 3 runners.

Runner	Average Speed							
Kayla	14.0 miles per hour							
Brian	20.0 feet per second							
Ricardo	440 yards per minute							

Which of these runners is the fastest? Show your work or explain how you found your answer. 2005 Released Item

Kendra's Travels – OE

Kendra traveled to Europe and Japan on a business trip. In Europe, she exchanged 300 U.S. dollars for euros and spent 100 euros. She then went to Japan and exchanged her remaining euros for yen. She spent 10,000 yen while in Japan.

The exchange rate during the time she traveled is shown below.

1.00 U.S. Dollar = 0.821774 Euro
1.00 U.S. Dollar = 110.565 Japanese Yen

Kendra will exchange her remaining yen for U.S. dollars. How much money, in U.S. dollars, will she receive? Show your work or explain how you found your answer.

2007 Released Item

Numerical and Proportional Reasoning

Expected Performance 2.2b(2)

Great Pyramid – GI

It is estimated that it took 30 years to construct the Great Pyramid at Giza. The pyramid contains 2,300,000 limestone blocks. If the pyramid was constructed continuously, 24 hours a day for 30 years, how many blocks were placed on the pyramid per hour? Round your answer to the nearest whole block.

2005 Released Item

Measurement & Geometry

Expected Performance 3.1a(1)

Geometric Figure – OE

Delia's drafting teacher gave her these instructions for drawing a geometric figure to be used in a design for a birdhouse.

- draw isosceles $\triangle ABC$ so that $\angle A$ is a right angle
- draw line l through point A that is parallel to BC
- draw line m through point B that is perpendicular to BC
- label a point E at the intersection of lines l and m
- a. Draw the geometric figure in the space provided in your answer booklet.
- b. Delia was asked the measure of ∠EBA. What is the degree measure of ∠EBA? Show your work or explain how you found your answer.

Expected Performance 3.1a(2)

Great Pyramid - GI

The Great Pyramid at Giza is the only one of the famous "Seven Wonders of the Ancient World" that still exists today.



15. The base of the Great Pyramid is a square with each side 756 feet in length. Suppose a circle, as shown above, has a circumference equal to the perimeter of the base of the Great Pyramid. The height, h, of the Great Pyramid has the same measurement as the radius of this circle. What is the height, in feet, of the Great Pyramid? Use 3.14 for π and round your answer to the nearest whole foot.

2005 Released Item

Paper Range – GI

A discount store has a square floor with an area of 14,400 square meters. To test the range of its silent pager system, two employees stood in opposite corners of the floor, and one paged the other. To the nearest meter, what was the diagonal distance between the two employees?



Expected Performance 3.1a(3)

Entertainment Center – GI

José wants to buy a new TV that will fit the opening of his entertainment center. The height of the opening in his entertainment center is 27 inches. Usually, the opening of an entertainment center has a width-to-height ratio of 4:3.

What is the diagonal measurement of the opening in José's entertainment center?

2007 Released Item

Measurement & Geometry

Expected Performance 3.1b(2)

Planetarium – OE

The floor plan for a new building that will house a planetarium is shown in your answer booklet. The Side Rooms, A, B, C, D, and E, are all the same size, and the Exhibit Room is three times as large as a Side Room.

- a. What is the total area, in square feet, of the floor plan? Use 3.14 for π . Show your work or explain how you found your answer.
- b. The director of the building would like to have 6,000 square feet available for opening day ceremonies. Would the Exhibit Room have enough square footage for the director's needs? Use 3.14 for π . Show your work or explain how you found your answer.



Expected Performance 3.2a(1)

Tile Company – GI

10. The tile company manufactures kitchen tiles in the shape of regular hexagons, as shown below.



What is the degree measure of each interior angle of one of these tiles? 2004 Released Item

Measurement & Geometry

Expected Performance 3.2a(2)

Cheesecake Pans – OE

Mrs. Olivares' consumer science class is making two different-size cheesecakes for a fundraiser.

- · the large cheesecake pan has a diameter of 12 inches
- · the small cheesecake pan has a diameter of 4 inches



- a. If the pans are both 3 inches deep, how many times greater is the volume of the large pan than that of the small pan? Use 3.14 for π. Show your work or explain how you found your answer.
- b. When shipped, the cheesecakes will be covered on the top, bottom and sides with wax paper. What is the minimum amount of wax paper needed to completely cover a cheesecake that has the same volume as the large pan? Show your work or explain how you found your answer.

Hugo's Pizza – GI

Hugo ordered two circular pizzas, each with a diameter of 10 inches. Greg ordered one circular pizza with an area equal to the sum of the areas of Hugo's two pizzas. What was the **diameter** of Greg's pizza? (Use 3.14 for π and round your answer to the nearest hundredth of an inch.)

2002 Released Item

Two Silos – OE

A farmer has two grain silos, both shaped like right circular cylinders, with dimensions shown in the diagrams below.



- a. How much greater is the volume of Silo B than the volume of Silo A? Show your work or explain how you found your answer.
- b. The farmer has the same amount of grain stored in each of the two silos. Silo A is filled to the top. What is the height, in feet, of the level of the grain in Silo B? Show your work or explain how you found your answer.

2007 Released Item

Measurement & Geometry

Expected Performance 3.2a(3)

Tile Company – GI

Marisa works as an installer for the tile company. Marisa is installing a tile that is shaped like a
regular octagon. She placed a tile into position A for a customer to see.



The customer is not satisfied with the appearance of the tile, and has asked Marisa to rotate the tile into position **B**. Through how many degrees must Marisa rotate the tile in a clockwise direction to change it from position **A** to position **B**?

Expected Performance 3.2a(3)

Computer Lab – OE

You are in charge of moving one of the computers in a computer lab. The diagram below shows the current position of the computer.



- a. Your instructions indicate that you are to first rotate the computer 90° counterclockwise about its center. On the grid provided in your answer booklet, sketch the computer in its rotated position.
- b. Then you are to translate (slide) it 6 feet to the right. On the grid provided in your answer booklet, sketch the computer in its final position.

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Expected Performance 3.3a(1)

City Construction – GI

Use your inch ruler to help you answer this question.



Scale: 1 inch represents 120 feet

The scale drawing shows the city block in Hartford where new construction is taking place. What is the area of the city block in SQUARE FEET?

2001 Released Item

Paving with Asphalt – OE

Use your ruler to help you answer this question.

An asphalt company plans to pave a parking lot that is in the shape of a trapezoid, as shown in the scale drawing in your answer booklet. The parking lot surrounds a building.

Estimate the area that the company plans to pave. Show your work or explain how you found your estimate.



Measurement & Geometry

Expected Performance 3.3a(1)

Emily's Quilt - OE



Emily is planning a design for a quilt that uses a quilting block that contains 4 tetragrams (4-pointed stars) like the one shown above. The tetragram in the design has four-fold symmetry (contains 4 lines of symmetry). She began drawing the design for the pattern with one of the tetragrams centered at point (-4, 4) on the grid shown in your answer booklet.

- a. On the grid in your answer booklet, draw one tetragram that is a reflection of the original across the *y*-axis.
- b. Determine the area, in square inches, of one of the four tetragrams on the quilt block. Show your work or explain how you got your answer.



American Flag – OE

The picture below is a scale drawing of an actual American flag. The stars and some of the stripes are white. The background behind the stars is blue, and the darker stripes are red.



Estimate the percent of the flag that is red. Show your work or explain how you determined your estimate.

2003 Released Item

Cargo Ship – OE

Use your ruler to help you answer this question.

The captain of a cargo ship plans to leave Genoa and travel to Naples, Palermo and Cagliari before returning to Genoa as shown on the map of Italy below.



The distance from Naples to Palermo is 320 kilometers. The ship's average speed is 14 nautical miles per hour. **Estimate** the number of hours it will take the cargo ship to complete its round trip, not including stops at ports. Show your work or explain how you found your answer.

Expected Performance 3.3a(2)

Maple Syrup – GI

The diagram shows a grove of maple trees that is roughly rectangular in shape. The sap is collected by a network of plastic tubing that connects each tree to the **mainline**, which runs diagonally from one corner of the grove to the opposite corner.



Based on the measures in the diagram, what is the length of the mainline to the nearest yard?

Stair Railing – OE

Thuan plans to add a railing parallel to a flight of stairs that goes down to the cellar in his house. The stairs have the dimensions shown in the sketch below.



What will be the length of the railing from Point A to Point B? Show or explain how you got your answer.

Expected Performance 3.3a(3)

Land Area of Tolland County – OE

Use your centimeter ruler to help you answer this question.

Molly wanted to estimate the area of Tolland County in Connecticut. She made two copies of the outline of the county at a scale of 1 centimeter to 10 kilometers.



a. To make her first estimate, Molly drew 4 rectangles that completely enclosed the outline of the county as shown and found the total area of the rectangles.



1 centimeter represents 10 kilometers

What should Molly's first estimate be? Show or explain how you got your answer. b. To make her second estimate, Molly drew 3 rectangles that were completely inside the outline of the county as shown and found the total area of the rectangles.



1 centimeter represents 10 kilometers

What should Molly's second estimate be? Show or explain how you got your answer.

c. Molly wants to use her first two estimates of the area of Tolland County to make a final, more accurate estimate. How would you use Molly's two estimates to make a more accurate estimate? Show or explain how you got your answer.

Expected Performance 3.3a(4)

Soup Cans – GI

Latitia's Foods is introducing a new line of soups. The soups will be sold in cans that are 4 inches tall and have a diameter of 3 inches. The labels will wrap around the entire outside of each can, excluding the top and bottom.



Determine the area of the label. Round your answer to the nearest tenth of a square inch. 2007 Released Item

City Construction – GI

The city ran a contest to create a sculpture for the park. The winning design was a bronze prism. The area of the octagonal base of the prism is 7 square feet and the height of the prism is 14 feet. What is the volume of the prism in cubic feet?

Ice Chest Capacities – GI

One ice chest is shaped like a rectangular prism with the exterior dimensions shown below.



A second ice chest is shaped like a cylinder with the exterior dimensions shown.



The bottom, sides, and top of both ice chests are made of plastic that is 2 inches thick. Which of the two chests would hold the most ice? Show or explain your reasoning.

Building a Cabin - OE

Jane is planning to build a cabin that measures 30 by 24 feet.



- a) What will be the area of the roof (shaded)? Show your work or explain how you found your answer.
- b) A package of shingles costs \$25 and will cover a 10-foot by 10-foot area. How much will it cost for enough packages of shingles to cover the roof? Show your work or explain how you found your answer.

Working with Data: Probability and Statistics

Expected Performance 4.1a(1)

Frog Population – OE

A biologist conducted a study of the population of frogs in a large pond near Norwich. The population has been decreasing as shown in the table below.

Year	Population						
2000	2141						
2001	2010						
2002	1891						
2003	1778						
2004	?						

Frog Population

On the grid provided in your answer booklet, make a scatter-plot that shows the information from the table. Be sure to title your graph, choose an appropriate scale and label your axes.

Based on the pattern in the table or on your graph, what will be the approximate frog population in 2004? Show your work or explain how you found your answer.

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Population of New London County – OE

The table below shows the population of New London County, Connecticut, from 1950 to 2000.

Year	Population
1950	145,000
1960	186,000
1970	230,000
1980	238,000
1990	255,000
2000	259,000

- a. Make a scatter plot of the data. Be sure to label the axes.
- b. Make a reasonable prediction for the population in New London County in 2010. Explain how you found your answer.



Working with Data: Probability and Statistics Expected Performance 4.2a(1)

Historical Documents – GI

A financial analyst was asked to predict selling prices for some historical documents that would be sold at an auction. The scatterplot below shows the analyst's predicted price compared to the actual selling price for seven different items.



Historical Documents at Auction

Based on the trend shown in the graph, what selling price should be expected for an item predicted to sell for \$1000?

Working with Data: Probability and Statistics

Expected Performance 4.2a(3)

Joseph's Final Grade – GI

Joseph's final averages in science class are shown in the table below. What is the minimum score Joseph can get on the final exam in order to receive at least a 90 for his final grade?

	Homework	Quizzes	Tests	Final Exam
% Toward Final Grade	20	20	40	20
Average	93	92	85	?

2007 Released Item

Danbury Temperatures – OE

During a 10-day period, the daily high temperatures in Danbury were:

43°F, 45°F, 55°F, 51°F, 55°F, 49°F, 42°F, 53°F, 51°F, 55°F

- Find the three measures of central tendency (mean, median, and mode) for the set of temperatures.
- b. If the temperature on the 11th day was 82°F, which measure of central tendency would change the most? Show your work or explain how you found your answer.

2005 Released Item

Website Visitors – GI

The table below shows the number of visitors to the Internet sales company the last five months.

Month	Number of Visitors
April	3,526
May	2,377
June	12,035
July	5,350
August	8,018

What is the median number of visitors over the 5-month period?

Katharine Hepburn – GI

Connecticut native Katharine Hepburn was nominated for a record 12 Best Actress Oscars and has won the award 4 times. The table below gives some information about her career. Use it to answer questions 18 and 19.

Decade	Number of Films Made	Number of Oscar Nominations	Number of Oscars Won
1930–39	15	2	1
1940–49	11	2	0
1950–59	8	4	0
1960–69	3	3	2
1970–79	9	0	0
1980-89	8	1	1
1990-99	9	0	0

Career	of	Katharine	Hepburn
oaleel	٠.	Naurarnie	nepburn

For the 10-year period from 1930 through 1939, Hepburn averaged one film every *M* months. What is the value of *M*?

2001 Released Item

Working with Data: Probability and Statistics

Expected Performance 4.3a(1)

Sum of the Toss – OE

Larry has 2 six-sided number cubes, one red and one blue. The faces of one of them are numbered 1 through 6, and the faces of the other are numbered 7 through 12. Larry will toss the two cubes at the same time and find the sum of the two numbers that appear on the top faces.



On Larry's first toss, what is the probability that the sum will be a prime number? Show or explain how you got your answer.

Working with Data: Probability and Statistics

Expected Performance 4.3a(2)

Katharine Hepburn – GI

Meryl Streep is an actress whose career record for nominations and wins may one day rival Katharine Hepburn's.

Decade	Number of Films Made	Number of Oscar Nominations	Number of Oscars Won
1970–79	9	1	0
1980–89	15	7	2
1990-99	17	3	0

Career of Meryl Streep

Based upon Streep's record so far, what is the probability that she will win an Oscar the next time she is nominated? Express your answer as a decimal.

2001 Released Item

Mary's Number Cubes – GI

Mary rolls two number cubes with sides numbered from 1 to 6.



If she rolls a 3 on one of the cubes, what is the probability that the sum of the numbers facing up on both cubes is greater than or equal to 5? Express your answer as a decimal rounded to the nearest hundredth.

Chocolate Candy – OE

Below is a picture of a box of chocolate candies.



- a. If Malik chooses a piece of the candy at random, what is the probability that it is solid chocolate? Show your work or explain how you found your answer.
- b. Malik eats a total of 4 pieces of candy, 2 with nuts, 1 solid chocolate, and 1 with cream filling. He then gives the box to Fatima. If Fatima wants a piece of candy with nuts, what is the probability that she will pick one? Show your work or explain how you found your answer.
- c. Fatima also eats 4 pieces of candy and then gives the box to Samira. If the probability of Samira selecting a piece of candy with cream filling is 0.1875, how many cream-filled candies did Fatima eat? Show your work or explain how you found your answer.

Working with Data: Probability and Statistics

Expected Performance 4.3a(3)

Carnival Spinner – OE

At a carnival booth, contestants pick a color on a large spinner. A prize is won if the arrow stops on the color they pick. The spinner is divided into 8 equal sections, as shown in your answer booklet. Each section is colored green, yellow, red, or blue.

The results for a sample of spins are shown in the chart below.

Result	Number of Spins		
Green	38		
Yellow	58		
Red	35		
Blue	19		

Use the results to predict the color of each of the sections on the spinner, and label each section of the spinner with the letter of a color: (G) green, (Y) yellow, (R) red, or (B) blue. Show the mathematics you used or explain how you decided how many sections should be labeled with each letter.

2006 Released Item

Bear Cubs – OE

Maria read in the newspaper that a bear at the zoo gave birth to four female cubs and one male cub. To estimate the probability that at least four of five cubs would be female, Maria conducted the following simulation.

STEP 1: Toss 5 coins. "Heads (H)" will represent a female cub and "Tails" (T) will represent a male cub.

STEP 2: Repeat this simulation 20 times.

The results of Maria's simulation are shown below.

нтннт	нннтн	ттнтт	тнттн	тнннт
ттнтт	тнннн	нтнтн	тннтт	тттнн
тннтт	нтнтт	тнтнт	ттттт	тнтнн
нтннт	тнттн	нттнн	нтнтн	ннннт

Based on the results of Maria's simulation, what is the probability that at least four of five cubs would be female?

2003 Released Item

acceleration

CAPT Third Generation Vocabulary List

hour

accurate acre acute angle add algebraic equation algebraic expression angle approximate arc area argument (justification) arranged array at least average average rate of change axis (Axes) axis of symmetry bar graph base between _ and _ bias bisect calculate capacity Celsius center centimeter chance change (as in money) chart chord circle circle graph circular face circumference circumscribed classify clock (analog and digital) closest to column(s)combination combine complementary

compound interest cone congruent conjecture consecutive constant rate convert coordinate grid coordinates counterexample criteria cube cubic (feet, meters, etc.) cup cylinder data decimal decrease degree(s) degrees of rotational symmetry denominator density depth descent diagonal diagram diameter difference digit dilation dimensions directly proportional discount distance distance formula divide double bar graph double line graph dozen edge elapsed time elevation elliptical base enlarge equal

equation equiangular equilateral equivalent estimate evaluate even number event exactly expect expected value experimental probability exponential (function) exponents (positive & negative) expression exterior (angle) face factor Fahrenheit fair farthest fewer, fewest figure (e.g. geometric figure) fixed Rate foot formula(s) fraction fractional part frequency function gain gallon geometric solid gram graph greatest grid group growth (rate) half height(s) hexagon(al) highest horizontal axis

hundredth(s) hypotenuse image inch increase initial value (amount) input inscribed interior (angles) intersect intersection interval irregular isosceles kilogram kilometer larger/larger than least least likely length less/less than likely line graph line of best fit line of symmetry line plot line segment linear (function) liter locate long, longer, longest loss lowest mass mathematical information maximum mean measure(ment) median meter midpoint mile milligram milliliter millimeter

minimum minute

CAPT Third Generation Vocabulary List

mode month more/more than most most likely multiple multiply nearest negative number net (flat pattern) no less/more than non-linear (function) number line numerator numeric obtuse occurrence octagon(al) odd number odds one-dimensional operation order (numbers) order of Operations ordered pair ordinal numbers (first, second, etc.) ounce outlier output parallel parallelogram pattern pentagon(al) percent percentage perfect cube perfect square perimeter perpendicular pictograph pint

point (on a graph, number line or plane) polygon population density positive number possible pound predict prime Number prism probability product profit proportional pyramid Pythagorean Theorem **Ouadratic** (function) quadrilateral quart quotient radii radius random(lv) range rate of change ratio rational number reasonable reciprocal rectangle rectangular rectangular prism reflection regular polygon relationship represents revenue rhombus right angle right triangle rotation (including clockwise and counterclockwise)

round to... row same /the same as sample scale scalene triangle scatter plot schedule scientific notation second segment semicircle sequence set shaded shape short, shorter, shortest side similar simplify slope smaller/smaller than solve/solution sort speed sphere spinner square number square root square unit (cm., ft., etc.) stem-and-leaf plot substitution subtract sum supplementary surface area survey symbol symmetry table tall, taller, tallest

temperature tens tenth term (in a pattern) theoretical probability thousandths three-dimensional ton transformation translation trapezoid tree diagram trend trend line triangle triangular two-dimensional unit unknown unreasonable unshaded value variable varies directly velocity Venn diagram vertex vertical axis vertices volume week weight whole number width with/without replacement x-axis x-intercept yard y-axis year y-intercept

This list, while not exhaustive, includes vocabulary with which all teachers and students should be familiar. Some of the words may be found on the test or stem from ideas that students should be familiar with to solve contextual problems on CAPT. **Bold** words may be new vocabulary that should be used in Grades 9 and 10.

Sample Activities by Performance Standard

1.1a

Sequencer

This lesson includes student activities and interactives that allow students to investigate number patterns in sequences and recursions by specifying a starting number, multiplier, and add-on. http://www.shodor.org/interactivate/activities/sequencer/

1.2a

Possible or Not?

This interactive site includes a series of graphs of real world scenarios that students determine whether they are possible or not. Questions for exploration are included. http://www.shodor.org/interactivate/activities/impossible/index.html

Linear Function Machine

This interactive manipulative allows students to put the input into a function machine and get the output. Students are then able to write the linear function that "rules" the function machine. http://www.shodor.org/interactivate/activities/lfm/index.html

Movie Lines

This lesson allows students to apply their knowledge of linear equations and graphs in an authentic situation. Students plot data points corresponding to the cost of DVD rentals and interpret the results.

http://illuminations.nctm.org/LessonDetail.aspx?id=L629

Interpreting the "Real-Life" Meaning of Graphical Representations of Data: Unit Overview

This Unit Plan consists of lessons in which students interpret the slope and *y*-intercept of least squares regression lines in the context of real-life data. Students use an e-example applet to plot the data and calculate the correlation coefficient and equation of the least squares regression line. These lessons develop skills in connecting, communicating, reasoning, and problem solving as well as representing fundamental ideas about data.

http://illuminations.nctm.org/index_o.aspx?id=117

1.3a

Modeling Orbital Debris Problems

In this lesson, students examine the problem of space pollution caused by human-made debris in orbit to develop an understanding of functions and modeling. It allows the students an opportunity to use spreadsheets, graphing calculators, and computer graphing utilities. http://illuminations.nctm.org/index_d.aspx?id=376

Supply and Demand - An Application of Linear Equations

This grades 8-11 activity focuses on having students create and solve a system of linear equations in a real-world setting. By solving the system, students will find the equilibrium point for supply and demand. Students should be familiar with finding linear equations from two points or slope and *y*-intercept. Graphing calculators are not necessary for this activity, but could be used to extend the ideas found on sheet 3. NCTM Publication-Based Lesson Plans are adapted from NCTM's journals. This lesson plan appeared in the October 1991 edition of *Mathematics Teacher*. http://illuminations.nctm.org/LessonDetail.aspx?id=L724

2.1a

The Tortoise and the Hare

In this activity, students develop patterns using two or more rational number quantities. They comprehend the concept of functions by understanding the relationship between these quantities and their sums.

http://education.ti.com/educationportal/activityexchange/activity_detail.do?cid=us&activityid=5_099_

Rational Numbers

Students review the definition of rational numbers as ratios and as terminating and repeating decimals. They also examine the reciprocal property of rational numbers and operations with rational numbers.

http://education.ti.com/educationportal/activityexchange/activity_detail.do?cid=us&activityid=4 413

Pythagoras' Mystery Tablet

This activity allows students to "discover" a type of number found on Pythagoras Tablet relating areas and the side length of squares. This applet has students make connections between decimals and fractions and identify numbers that square to a given number. http://mathforum.org/escotpow/solutions/solution.ehtml?puzzle=46#Open%20Applet

2.2a

Compound Interest

In this activity, students use the TI graphing calculator to calculate compound interest. They understand that in compound interest computations, the interest from the previous period is added to the current principal and the new total is used as the basis for calculating the interest. <u>http://education.ti.com/educationportal/activityexchange/activity_detail.do?cid=us&activityid=4</u> 393

2.2b

Planets in Proportion

By Idania Dorta, former Math teacher and Mathematics Consultant for Glencoe/McGraw-Hill Publishing.

This lesson looks at the distance and relative size of the rest of the planets with respect to Earth and the Sun. The activity will give students an opportunity to apply estimation strategies and proportional reasoning to determine a scale comparing the planetary bodies to Earth. Students will convert measurements of time and distance using scientific notation. Both the metric and customary units will be applied.

http://www.pbs.org/newshour/extra/teachers/lessonplans/math/mars_9-24.html

3.1a

3-D Visualization Activity

This lesson by Craig Russell allows students to explore cross-sections of polyhedra, make conjectures and test them using an interactive manipulative.

http://mathforum.org/te/exchange/hosted/russell/vis.student.html http://nlvm.usu.edu/en/nav/frames_asid_126_g_3_t_3.html

3.1b

Perplexing Parallelograms

In this lesson students use Multiple Strategies to Solve a Problem Involving the Area of Parallelograms and make and evaluate conjectures based on the problem. http://illuminations.nctm.org/LessonDetail.aspx?id=L709

3.2a

Trasmographer 2

This site includes an interactive applet that students explore transformations of n-sided polygons on the coordinate plane. Reflections can be performed across any line and rotations about any point. Exploration instructions, teacher notes and guiding questions are available. http://www.shodor.org/interactivate/activities/transform/index.html

Symmetries and Their Properties

This investigation will help you to understand how translations work and what happens when two or more translations are applied one after the other. http://illuminations.nctm.org/index_d.aspx?id=474

Relationships Between Area and Perimeter

Students will explore the relationship between *perimeter* and *area* of rectangles, use *algebraic language* to express the relationship, and the first *derivative* to maximize the general form of the area equation. <u>http://www.teacherlink.org/content/math/activities/ex-area/home.html</u>

3.3a

Black Kingdoms of the Nile

Students create a model of a pyramid and determine strategies that could have been used to pull very large stones to build the pyramid. Students will also use measurement and estimation skills. http://www.pbs.org/wonders/Classrm/lesson1.htm

Surface Area and Volume

This lesson includes an applet that allows students to explore the surface area and shapes of 3dimensional figures. <u>http://www.shodor.org/interactivate/activities/SurfaceAreaAndVolume/</u>

4.1a & 4.2a

Exploring Linear Relationships

In this lesson, students model linear data in a variety of settings that range from car repair costs to sports to medicine. Students can work alone or in small groups to construct scatterplots, interpret data points and trends, and investigate the notion of line of best fit. Pages for four activities are provided.

http://illuminations.nctm.org/index_d.aspx?id=298

Investigating Linear Relationships: The Regression Line and Correlation : Unit

Interactive computer-based tools provide students with the opportunity to easily investigate the relationship between a set of data points and a curve used to fit the data points. As students work with bivariate data in grades 9-12, they will be able to investigate relationships between the variables using linear, exponential, power, logarithmic, and other functions for curve fitting See Related 9-12 Data Analysis & Probability Standard. Using interactive tools like the one below, students can investigate the properties of regression lines and correlation. http://illuminations.nctm.org/index_o.aspx?id=135

4.2a

Measures

This interactive site allows students to explore how measures of single variable data change as the data changes. Exploration questions are included. Various measures allow for differentiation of the activity. <u>http://www.shodor.org/interactivate/activities/measures/index.html</u>

4.3a

Birthday Paradox

This lesson plan presents an activity which demonstrates the birthday paradox, using it as a springboard into a unit on probability. Explanation on the difficulty with probability; Use of the TI-83 graphing calculator to run a Monte Carlo simulation with the birthday paradox; Graphical analysis of the birthday-problem function. NCTM Publication-Based Lesson Plans are adapted from NCTM's journals. This lesson plan appeared in the April 2001 edition of <u>Mathematics Teacher Journal</u>.

http://illuminations.nctm.org/index_d.aspx?id=299

Stick or Switch

This article aimed at grades 7-12 students presents a version of a classic game-show scenario. You pick one of three doors in hopes of winning the prize. The host opens one of the two remaining doors which reveals no prize, then asks if you wish to "stick or switch." Which choice gives you the best chance to win? <u>http://illuminations.nctm.org/index_d.aspx?id=377</u>

Simple Monty Hall

This activity allows the user to simulate the standard Monty Hall Game. The user chooses a door, and then another door is opened to reveal a stinking pig. The player must then decide to stick

with the original choice or change. <u>http://www.shodor.org/interactivate/activities/monty3/index.html</u>

Other Internet Resources for the Mathematics Classroom

Link to NCTM – *Figure This*! <u>http://www.figurethis.org/challenges/challenge_index.htm</u> NCTM websites: <u>http://my.nctm.org/eresources/journal_home.asp?journal_id=6</u> <u>http://illuminations.nctm.org</u>

Interactives:

Interactive mathematics online: http://library.thinkquest.org/2647/index.html

National Library of Interactive Manipulatives: <u>http://nlvm.usu.edu/en/nav/index.html</u>

Activities to promote conceptual understanding: <u>http://www.shodor.org/interactivate/index.html</u>

Implementing the Standards: http://illuminations.nctm.org/index.asp

Explore Learning math gizmos: http://www.explorelearning.com/

Lesson Plans:

Complete resource for math and science education: <u>http://www.shodor.org/</u>

For the creation of dynamic worksheets try www.edHelper.com

To help students master essential math skills, set them up to practice on <u>www.mathessentials.com</u>

PBS Teacherline: http://www.pbs.org/teachersource/math.htm

American Statistical Association: http://www.amstat.org/education/index.cfm?fuseaction=k12

Seeing Math Interactive Software & Ideas: <u>http://seeingmath.concord.org/resources.html</u>

TI Activity Exchange for Math:

http://education.ti.com/educationportal/activityexchange/activity

<u>preview.do?cid=us&explorecategory=subject&exploresubcategory=subjectarea&subjectid</u> =5022&subjectname=Math&productcategory=S&productcategoryname=Subject

Court TV: www.courttv.com

Discovery: www.discovery.com

New York Times: www.nytimes.com/learning/students

Nova: www.pbs.org/wgbh/nova

Thirteen Ed: <u>www.thirteen.org/edonline</u>

Songs for Math: http://www.songsforteaching.com/mathsongsadvanced.htm

Assessment:

Balanced Assessment Tasks: <u>http://balancedassessment.concord.org/</u>

PALM library of performance tasks: http://palm.sri.com/standards/NCTMstandards6-8.html