Building *Your* 21st Century Math Program

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Redlands USD
Vision

The vision for RUSD 2025 will focus on five key areas:

- **E** ENHANCED LEARNING THROUGH INNOVATION
- **X** EXCELLENCE IN ACADEMICS
- **C** COLLABORATIVE COMMUNITY AND PARENT PARTNERSHIPS
- **E** EQUALITY THROUGH EQUITY
- **L** LEARNING IN SAFE AND SECURE ENVIRONMENTS

Answers

1. Let g = the cost of a large glass of lemonade; then $4g + 65 > 250$.
2. The solution is $g > 46.25$. Since they can only sell whole glasses of lemonade, the solution means that they sold 47 or more glasses of lemonade.
3. 

Getting Started

Lemonade at the Pool

The concession stand at a local swimming pool sells small and large glasses of freshly squeezed lemonade. This weekend, they made more than $250 selling glasses of lemonade. A large glass of lemonade sells for $4.00, and the total sales generated from selling small glasses of lemonade was $65.

1. Write an inequality to represent the relationship between the amount they made and the number of large glasses they sold.

2. Solve the inequality. Interpret the solution in terms of the problem situation.

3. Graph the solution set on the number line.

M3-156 • TOPIC 3: Multiple Representations of Equations

Claims for the Mathematics Summative Assessment

Overall Claim for Grades 3–8 "Students can demonstrate progress toward college and career readiness in mathematics."
Overall Claim for Grade 11 "Students can demonstrate college and career readiness in mathematics."

Claim #1 – Concepts & Procedures "Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency."
Claim #2 – Problem Solving "Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem solving strategies."
Claim #3 – Communicating Reasoning "Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others."
Claim #4 – Modeling and Data Analysis "Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems."

SANTA BARBARA County Education Office
William J. Cirone, Superintendent

SMARTER Balanced Assessment Consortium
Content Specifications: Claims and Targets

CLAIM 2: PROBLEM SOLVING
Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem solving strategies.

Target	ALL GRADES
A	Apply mathematics to solve well-posed problems arising in everyday life, society, and the workplace. ***DOK 2, 3***
B	Select and use appropriate tools strategically. ***DOK 1, 2***
C	Interpret results in the context of a situation. ***DOK 2***
D	Identify important quantities in a practical situation and map their relationships (e.g. using diagrams, two-way tables, graphs, flowcharts, or formulas). ***DOK 1, 2, 3***

CLAIM 3: COMMUNICATING REASONING
Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.

Target	ALL GRADES
A	Test propositions or conjectures with specific examples. ***DOK 2***
B	Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. ***DOK 3, 4***
C	State logical assumptions being used. ***DOK 2, 3***
D	Use the technique of breaking an argument into cases. ***DOK 2, 3***
E	Distinguish correct logic or reasoning from that which is flawed, and – if there is a flaw in the argument – explain what it is. ***DOK 2, 3, 4***
F	Base arguments on concrete referents such as objects, drawings, diagrams, and actions. ***DOK 2, 3***
G	At later grades, determine conditions under which an argument does and does not apply. (For example, area increases with perimeter for squares, but not all plane figures.) ***DOK 3, 4***

CLAIM 4: MODELING AND DATA ANALYSIS
Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.

Target	ALL GRADES
A	Apply mathematics to solve problems arising in everyday life, society, and the workplace. ***DOK 2, 3***
B	Construct, autonomously, chains of reasoning to justify mathematical models used, interpretations made, and solutions proposed for a complex problem. ***DOK 2, 3, 4***
C	State logical assumptions being used. ***DOK 1, 2***
D	Interpret results in the context of a situation. ***DOK 2, 3***
E	Analyze the adequacy of and make improvements to an existing model or develop a mathematical model of a real phenomenon. ***DOK 3, 4***
F	Identify important quantities in a practical situation and map their relationships (e.g. using diagrams, two-way tables, graphs, flowcharts, or formulas). ***DOK 1, 2, 3***
G	Identify, analyze and synthesize relevant external resources to pose or solve problems. ***DOK 3, 4***

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

COMMON CORE
STATE STANDARDS INITIATIVE

CCSS WHERE TO FOCUS GRADE 6 MATHEMATICS

MATH | 6 | F

MATHEMATICS | GRADE 6 | FOCUS

This document shows where students and teachers should spend the large majority of their time in order to meet the expectations of the Standards.

Not all content in a given grade is emphasized equally in the Standards. Some clusters require greater emphasis than others based on the depth of the ideas, the time that they take to master, and/or their importance to future mathematics or the demands of college and career readiness. More time in these areas is also necessary for students to meet the Standards for Mathematical Practice.

To say that some things have greater emphasis is not to say that anything in the Standards can safely be neglected in instruction. Neglecting material will leave gaps in student skill and understanding and may leave students unprepared for the challenges of a later grade.

Students should spend the large majority[1] of their time on the major work of the grade (■). Supporting work (□) and, where appropriate, additional work (○) can engage students in the major work of the grade.[2, 3]

MAJOR, SUPPORTING, AND ADDITIONAL CLUSTERS FOR GRADE 6

Emphases are given at the cluster level. Refer to the Common Core State Standards for Mathematics for the specific standards that fall within each cluster.

Key: ■ Major Clusters □ Supporting Clusters ○ Additional Clusters

6.RP.A	■	Understand ratio concepts and use ratio reasoning to solve problems.
6.NS.A	■	Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
6.NS.B	○	Compute fluently with multi-digit numbers and find common factors and multiples.
6.NS.C	■	Apply and extend previous understandings of numbers to the system of rational numbers.
6.EE.A	■	Apply and extend previous understandings of arithmetic to algebraic expressions.
6.EE.B	■	Reason about and solve one-variable equations and inequalities.
6.EE.C	■	Represent and analyze quantitative relationships between dependent and independent variables.
6.G.A	□	Solve real-world and mathematical problems involving area, surface area, and volume.
6.SP.A	○	Develop understanding of statistical variability.
6.SP.B	○	Summarize and describe distributions.

HIGHLIGHTS OF MAJOR WORK IN GRADES K–8

K–2	Addition and subtraction – concepts, skills, and problem solving; place value
3–5	Multiplication and division of whole numbers and fractions – concepts, skills, and problem solving
6	Ratios and proportional relationships; early expressions and equations
7	Ratios and proportional relationships; arithmetic of rational numbers
8	Linear algebra and linear functions

REQUIRED FLUENCIES FOR GRADE 6

6.NS.B.2	Multi-digit division
6.NS.B.3	Multi-digit decimal operations

1 At least 65% and up to approximately 85% of class time, with Grades K–2 nearer the upper end of that range, should be devoted to the major work of the grade. For more information, see Criterion #1 of the K–8 Publishers' Criteria for the Common Core State Standards for Mathematics www.achievethecore.org/publisherscriteria.
2 Refer also to criterion #3 in the K–8 Publishers' Criteria for the Common Core State Standards for Mathematics www.achievethecore.org/publisherscriteria.
3 Note, the critical areas are a survey of what will be taught at each grade level; the major work is the subset of topics that deserve the large majority of instructional time during a given year to best prepare students for college and careers.

CCSS WHERE TO FOCUS GRADE 7 MATHEMATICS

MATH 7 F

MATHEMATICS GRADE 7 FOCUS

This document shows where students and teachers should spend the large majority of their time in order to meet the expectations of the Standards.

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Students should spend the large majority[1] of their time on the major work of the grade (■). Supporting work (□) and, where appropriate, additional work (○) can engage students in the major work of the grade.[2, 3]

MAJOR, SUPPORTING, AND ADDITIONAL CLUSTERS FOR GRADE 7

Emphases are given at the cluster level. Refer to the Common Core State Standards for Mathematics for the specific standards that fall within each cluster.

Key: ■ Major Clusters □ Supporting Clusters ○ Additional Clusters

7.RP.A	■	Analyze proportional relationships and use them to solve real-world and mathematical problems.
7.NS.A	■	Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
7.EE.A	■	Use properties of operations to generate equivalent expressions.
7.EE.B	■	Solve real-life and mathematical problems using numerical and algebraic expressions and equations.
7.G.A	○	Draw, construct and describe geometrical figures and describe the relationships between them.
7.G.B	○	Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.
7.SP.A	□	Use random sampling to draw inferences about a population.
7.SP.B	○	Draw informal comparative inferences about two populations.
7.SP.C	□	Investigate chance processes and develop, use, and evaluate probability models.

HIGHLIGHTS OF MAJOR WORK IN GRADES K–8

K–2	Addition and subtraction – concepts, skills, and problem solving; place value
3–5	Multiplication and division of whole numbers and fractions – concepts, skills, and problem solving
6	Ratios and proportional relationships; early expressions and equations
7	Ratios and proportional relationships; arithmetic of rational numbers
8	Linear algebra and linear functions

1 At least 65% and up to approximately 85% of class time, with Grades K–2 nearer the upper end of that range, should be devoted to the major work of the grade. For more information, see Criterion #1 of the K–8 Publishers' Criteria for the Common Core State Standards for Mathematics www.achievethecore.org/publisherscriteria.
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CCSS WHERE TO FOCUS GRADE 8 MATHEMATICS

MATH | 8 | F

MATHEMATICS | GRADE 8 | FOCUS

This document shows where students and teachers should spend the large majority of their time in order to meet the expectations of the Standards.

Not all content in a given grade is emphasized equally in the Standards. Some clusters require greater emphasis than others based on the depth of the ideas, the time that they take to master, and/or their importance to future mathematics or the demands of college and career readiness. More time in these areas is also necessary for students to meet the Standards for Mathematical Practice.

To say that some things have greater emphasis is not to say that anything in the Standards can safely be neglected in instruction. Neglecting material will leave gaps in student skill and understanding and may leave students unprepared for the challenges of a later grade.

Students should spend the large majority[1] of their time on the major work of the grade (■). Supporting work (□) and, where appropriate, additional work (○) can engage students in the major work of the grade.[2, 3]

MAJOR, SUPPORTING, AND ADDITIONAL CLUSTERS FOR GRADE 8

Emphases are given at the cluster level. Refer to the Common Core State Standards for Mathematics for the specific standards that fall within each cluster.

Key: ■ Major Clusters □ Supporting Clusters ○ Additional Clusters

8.NS.A	□	Know that there are numbers that are not rational, and approximate them by rational numbers.
8.EE.A	■	Work with radicals and integer exponents.
8.EE.B	■	Understand the connections between proportional relationships, lines, and linear equations.
8.EE.C	■	Analyze and solve linear equations and pairs of simultaneous linear equations.
8.F.A	■	Define, evaluate, and compare functions.
8.F.B	■	Use functions to model relationships between quantities.
8.G.A	■	Understand congruence and similarity using physical models, transparencies, or geometry software.
8.G.B	■	Understand and apply the Pythagorean Theorem.
8.G.C	○	Solve real-world and mathematical problems involving volume of cylinders, cones and spheres.
8.SP.A	□	Investigate patterns of association in bivariate data.

HIGHLIGHTS OF MAJOR WORK IN GRADES K–8

K–2	Addition and subtraction – concepts, skills, and problem solving; place value
3–5	Multiplication and division of whole numbers and fractions – concepts, skills, and problem solving
6	Ratios and proportional relationships; early expressions and equations
7	Ratios and proportional relationships; arithmetic of rational numbers
8	Linear algebra and linear functions

1 At least 65% and up to approximately 85% of class time, with Grades K–2 nearer the upper end of that range, should be devoted to the major work of the grade. For more information, see Criterion #1 of the K–8 Publishers' Criteria for the Common Core State Standards for Mathematics www.achievethecore.org/publisherscriteria.
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3 Note, the critical areas are a survey of what will be taught at each grade level; the major work is the subset of topics that deserve the large majority of instructional time during a given year to best prepare students for college and careers.

CCSS
WHERE TO FOCUS
GRADES K–8
MATHEMATICS

An important subset of the major work in grades K–8 is the progression that leads toward middle school algebra.

K

Know number names and the count sequence

Count to tell the number of objects

Compare numbers

Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from

Work with numbers 11-19 to gain foundations for place value

1

Represent and solve problems involving addition and subtraction

Understand and apply properties of operations and the relationship between addition and subtraction

Add and subtract within 20

Work with addition and subtraction equations

Extend the counting sequence

Understand place value

Use place value understanding and properties of operations to add and subtract

Measure lengths indirectly and by iterating length units

2

Represent and solve problems involving addition and subtraction

Add and subtract within 20

Understand place value

Use place value understanding and properties of operations to add and subtract

Measure and estimate lengths in standard units

Relate addition and subtraction to length

3

Represent & solve problems involving multiplication and division

Understand properties of multiplication and the relationship between multiplication and division

Multiply & divide within 100

Solve problems involving the four operations, and identify & explain patterns in arithmetic

Develop understanding of fractions as numbers

Solve problems involving measurement and estimation of intervals of time, liquid volumes, & masses of objects

Geometric measurement: understand concepts of area and relate area to multiplication and to addition

4

Use the four operations with whole numbers to solve problems

Generalize place value understanding for multi-digit whole numbers

Use place value understanding and properties of operations to perform multidigit arithmetic

Extend understanding of fraction equivalence and ordering

Build fractions from unit fractions by applying and extending previous understandings of operations

Understand decimal notation for fractions, and compare decimal fractions

5

Understand the place value system

Perform operations with multi-digit whole numbers and decimals to hundredths

Use equivalent fractions as a strategy to add and subtract fractions

Apply and extend previous understandings of multiplication and division to multiply and divide fractions

Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition

Graph points in the coordinate plane to solve real-world and mathematical problems*

6

Apply and extend previous understandings of multiplication and division to divide fractions by fractions

Apply and extend previous understandings of numbers to the system of rational numbers

Understand ratio concepts and use ratio reasoning to solve problems

Apply and extend previous understandings of arithmetic to algebraic expressions

Reason about and solve one-variable equations and inequalities

Represent and analyze quantitative relationships between dependent and independent variables

7

Apply and extend previous understanding of operations with fractions to add, subtract, multiply, and divide rational numbers

Analyze proportional relationships and use them to solve real-world and mathematical problems

Use properties of operations to generate equivalent expressions

Solve real-life and mathematical problems using numerical and algebraic expressions and equations

8

Work with radical and integer exponents

Understand the connections between proportional relationships, lines, and linear equations**

Analyze and solve linear equations and pairs of simultaneous linear equations

Define, evaluate, and compare functions

Use functions to model relationships between quantities

* Indicates a cluster that is well thought of as a part of a student's progress to algebra, but that is currently not designated as major by the assessment consortia in their draft materials. Apart from the one asterisked exception, the clusters listed here are a subset of those designated as major in the assessment consortia's draft documents.
** Depends on similarity ideas from geometry to show that slope can be defined and then used to show that a linear equation has a graph which is a straight line and conversely.

Guiding Principles for School Mathematics

Full statements of the Guiding Principles follow; *Principles to Actions* elaborates the unique importance of each, as summarized briefly below each statement. The first Guiding Principle, Teaching and Learning, has primacy among the Guiding Principles, with the others serving as the Essential Elements that support it.

Teaching and Learning. *An excellent mathematics program requires effective teaching that engages students in meaningful learning through individual and collaborative experiences that promote their ability to make sense of mathematical ideas and reason mathematically.*

The teaching of mathematics is complex. It requires teachers to have a deep understanding of the mathematical content that they are expected to teach and a clear view of how student learning of that mathematics develops and progresses across grades. It also calls for teachers to be skilled at using instructional practices that are effective in developing mathematics learning for all students. The eight Mathematics Teaching Practices (see fig. 1) describe the essential teaching skills derived from the research-based learning principles, as well as other knowledge of mathematics teaching that has emerged over the last two decades.

Access and Equity. *An excellent mathematics program requires that all students have access to a high-quality mathematics curriculum, effective teaching and learning, high expectations, and the support and resources needed to maximize their learning potential.*

Equitable access means high expectations, adequate time, consistent opportunities to learn, and strong support that enable students to be mathematically successful. Instead of one-size-fits-all practices and the differential expectations for students who are placed in different academic tracks, equitable access means accommodating differences to meet a common goal of high levels of learning by all students.

Curriculum. *An excellent mathematics program includes a curriculum that develops important mathematics along coherent learning progressions and develops connections among areas of mathematical study and between mathematics and the real world.*

A robust curriculum is more than a collection of activities; instead, it is a coherent sequencing of core mathematical ideas that are well articulated across the grades. Such an effective curriculum incorporates problems in contexts from everyday life and other subjects whenever possible. These tasks engage students and generate interest and curiosity in the topics under investigation.

Tools and Technology. *An excellent mathematics program integrates the use of mathematical tools and technology as essential resources to help students learn and make sense of mathematical ideas, reason mathematically, and communicate their mathematical thinking.*

Available tools and technology help teachers and students visualize and concretize mathematics abstractions, and when these resources are used appropriately, they support effective teaching and meaningful learning.

Assessment. *An excellent mathematics program ensures that assessment is an integral part of instruction, provides evidence of proficiency with important mathematics content and practices, includes a variety of strategies and data sources, and informs feedback to students, instructional decisions, and program improvement.*

Effective assessment supports and enhances the learning of important mathematics by furnishing useful formative and summative information to both teachers and students. Productive mathematics assessment is a process that is

coherently aligned with learning goals and makes deliberate use of the data gathered as evidence of learning and provides guidance for next instructional steps and programmatic decision making. Students learn to assess and recognize high quality in their own work.

Professionalism. *In an excellent mathematics program, educators hold themselves and their colleagues accountable for the mathematical success of every student and for personal and collective professional growth toward effective teaching and learning of mathematics.*

Effective schools communicate a tangible sense of the professional imperative to grow personally and collectively and to hold one another accountable for this growth. Professionals who are responsible for students' mathematics learning are never satisfied with their accomplishments and are always working to increase the impact that they have on their students' mathematics learning. Moreover, they cultivate and support a culture of professional collaboration and continual improvement that is driven by an abiding sense of interdependence and collective responsibility.

Effective Mathematics Teaching Practices
Establish mathematics goals to focus learning. *Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions.*
Implement tasks that promote reasoning and problem solving. *Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies.*
Use and connect mathematical representations. *Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving.*
Facilitate meaningful mathematical discourse. *Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.*
Pose purposeful questions. *Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships.*
Build procedural fluency from conceptual understanding. *Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems.*
Support productive struggle in learning mathematics. *Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships.*
Elicit and use evidence of student thinking. *Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning.*

Teaching Students to

THINK, COMMUNICATE, COLLABORATE & CREATE

through Effective Teaching Principles

4 Claims:

Concepts & Procedures, Problem Solving, Communicate Reasoning, Modeling & Data Analysis

Math Goals

(Dual Targets)

Content Target:

Practice Target

COMMON CORE STATE STANDARDS INITIATIVE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

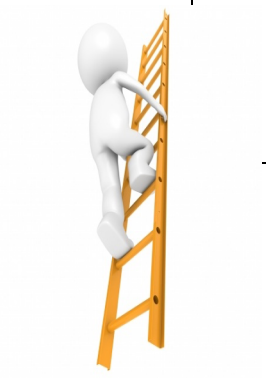
Representations

Meaningful Discourse

Purposeful Questioning

Procedural from Conceptual

Tasks & Access

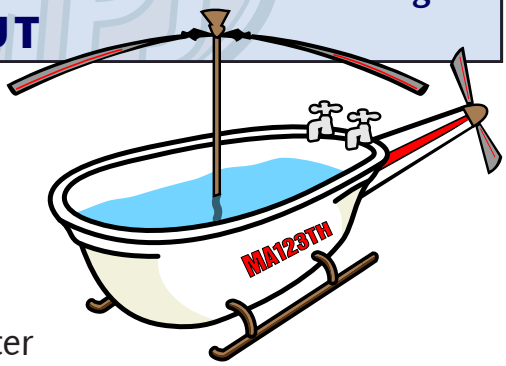


Productive Struggle

Evidence of Student Thinking

Rigor: Fluency, Deep Understanding, Application, Dual Intensity

TUBICOPTERS & MORE

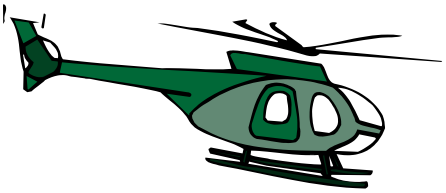


HELICOPTER

1) Why does the graph plot horizontally when the helicopter stays stationary?

2) Why does the graph plot horizontally when the helicopter goes up?

3) Why does the graph plot oblique lines (diagonally) when the helicopter goes forward?



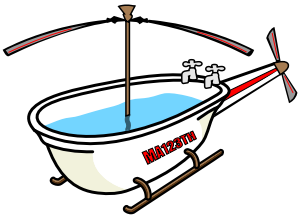
4) Why does the graph plot downward when the helicopter goes backwards? Is there a way to get the graph to "plot backwards?"

5) What determines the steepness of the graph?

6) If a horizontal line implies being in the same place at all times, what would a vertical line imply?

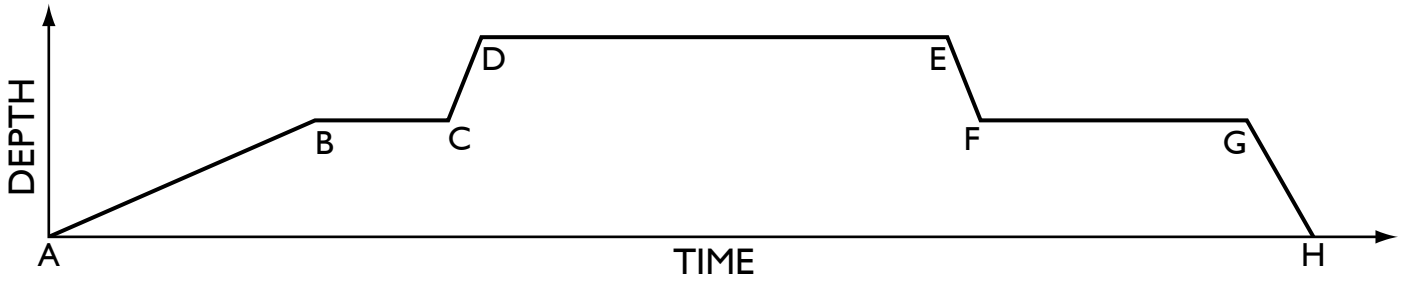
7) Sketch a graph of the time and distance for a helicopter that goes fast to the halfway point, hovers for awhile, then goes backwards fast until it is just shy of the starting point, then goes forward again slowly.

TUBICOPTERS (continued)



BATH TUB

The graph below represents the water level of a bath tub over time. It shows the tub filling, the water turned off, someone sitting in the tub, bathing, then getting out, drying off and finally the tub draining.

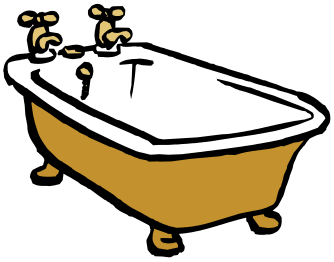


8) Mark the graph for each of these: fill, wait, sit, bath, out, dry, drain.

9) Why is the slope of $\overline{AB}$ positive while the slope of $\overline{GH}$ is negative?

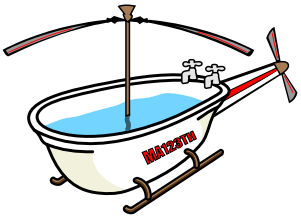
10) Why is the slope of $\overline{CD}$ greater than that of $\overline{AB}$?

11) Does the tub drain slower or faster than it fills? How can you tell?



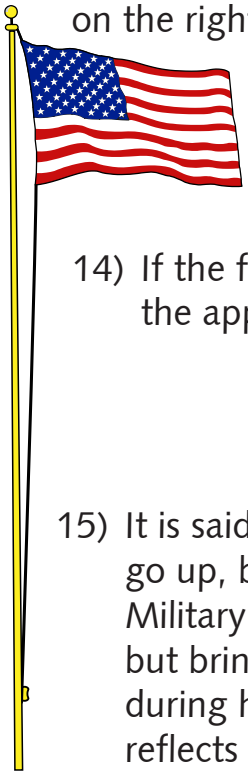
12) Why is $\overline{DE}$ higher than $\overline{BC}$? Why is $\overline{DE}$ longer than $\overline{FG}$?

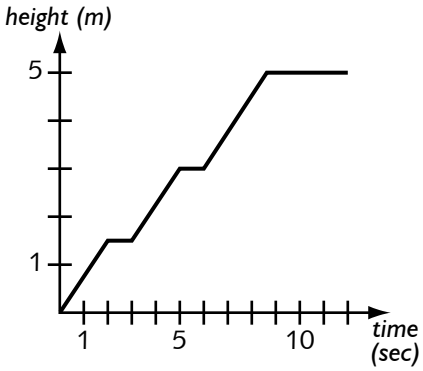
TUBICOPTERS (continued)



FLAG

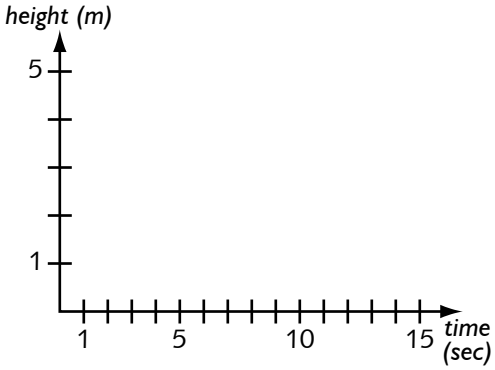
13) What was happening to the flag in the diagram on the right?





14) If the flag was raised to the top of the pole, what is the approximate height of the flagpole?

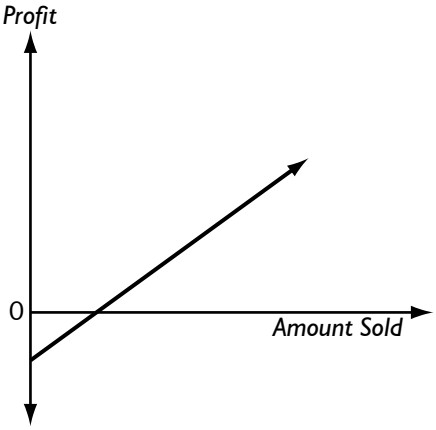
15) It is said that the American Flag is excited to go up, but sad to come down. Therefore, the Military raises the flag quickly with no pauses, but brings it down slowly, with small pauses during hand exchanges. Sketch a graph that reflects this method.



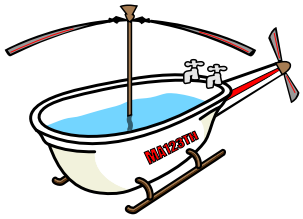
LEMONADE STAND

16) Why does the graph show profit values below zero?

17) What is the meaning of the point where the graph crosses the horizontal axis?

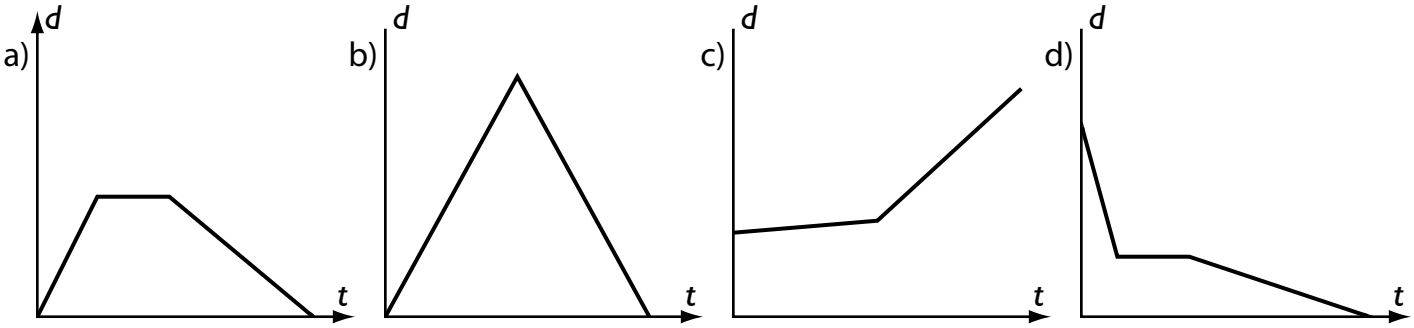


TUBICOPTERS (continued)



PRACTICE

Match each of the following scenarios with one of the graphs below.



18) Johnny runs up the street, but quickly turns and runs home at the same speed.

19) Jennifer is riding her bike home. She gets a flat tire. She can't fix it, so she walks the bike the rest of the way home.

20) Jamie is several blocks from home. She is walking to her friend's house which is even further from home. Halfway there, her friend picks her up in a car and she rides the rest of the way.

21) Jackson runs to his friend's house, hangs for a short while, and then walks home.