



OHIO GRADUATION TESTS WORKBOOK
MATHEMATICS



877-OHIOEDU (Voice)
614-387-0970 (TTY)
www.ode.state.oh.us

The Ohio Department of Education
does not discriminate on the basis of race, color, national origin, sex, religion,
age or disability in employment or the provision of services.

CONTENTS

MATHEMATICS OGT WORKBOOK

INTRODUCTION

Information for Families	i
Information for Coaches	ii
Information for Students	1

PLAN

Introduction	3
Planning Process	4
Performance Verbs	10
Test-Taking Tips	11
Plan-Do-Study-Act Chart	12
Content Standards	13

DO

Introduction	18
Item 31, 2003	19
Item 44, 2004	21
Item 42, 2003	23
Item 2, 2004	25
Item 34, 2003	27
Item 28, 2003	29
Item 42, 2004	31
Item 9, 2004	33
Item 5, 2003	35
Item 15, 2003	38
Item 26, 2004	40
Item 10, 2003	42
Item 20, 2003	48

STUDY

Introduction	50
Reflection Worksheet	51

ACT

Introduction	55
Action Planning	56

REFERENCES

Item 44, 2004	58
Item 42, 2003	59
Item 2, 2004	61
Item 28, 2003	63
Item 42, 2004	65
Item 9, 2004	66
Item 15, 2003	67
Item 26, 2004	69
Item 20, 2003	72

ADDITIONAL RESOURCES	78
-----------------------------------	-----------

INTRODUCTION

INFORMATION FOR FAMILIES

This guide is for students who have not passed a section of the Ohio Graduation Tests (OGT). Five guides are available: Reading, Writing, Mathematics, Science and Social Studies. They have been developed to help students take personal responsibility for their own learning. Each guide introduces students to a thinking strategy called mind mapping. This strategy helps students understand how they can think through test problems.

There are two purposes built into the guides. The first purpose is to help students develop a learning plan to work through test items that come from OGT practice tests. This plan helps students develop an understanding of test questions related to the state academic content standards and benchmarks.

Each guide walks students through the four stages in a learning plan:

PLAN – Students identify a coach and set up a meeting to review their OGT results. They see how well they performed on each standard and identify areas in need of improvement. Then they develop a schedule for working through the rest of the guide.

DO – Students work through several test items using the mind-mapping strategy. They see examples of mind mapping for some test items and try creating some on their own.

STUDY – Students are asked to think about what they have done. This is also called reflection. They complete a worksheet prior to setting up another meeting with their coach. During this meeting, students will review what they have discovered and set goals to improve their performance on the next test.

ACT – The coach helps the student develop an action plan to prepare for retaking an OGT.

The second purpose is to introduce students to a strategy that should help them improve their test-taking skills. The mind-mapping strategy has two parts. To make it work, students have to self-talk while they draw a picture of what they are thinking. The students are learning how to think about their thinking as they draw these visual maps.

If your student has decided to use this guide, there is a role that you can play. Praise your student for taking ownership. Support his or her learning. Help your student identify a coach who will be able to meet his or her learning needs. Encourage your student to stick with it! Monitor your student's work with his or her action plan. Your willingness to carry out this role is a critical factor in your student's success.

INTRODUCTION

INFORMATION FOR COACHES

This guide is for students who have not passed a section of the Ohio Graduation Tests (OGT). Five guides are available: Reading, Writing, Mathematics, Science and Social Studies. They have been developed to help students learn how to take personal responsibility for their own learning. Each guide also introduces students to a thinking strategy called mind mapping. This strategy helps students understand how they think through test problems.

The format of the guides requires students to select a coach who will guide them. If you have been asked to be a coach, then you have a major role to play in ensuring that your student has the support and encouragement necessary to be successful. You should thoroughly familiarize yourself with the guide, and be prepared to monitor and adjust material presented to fit your individual student. Be sure to look at the items recommended for coaches in the resource section of the guide.

By using this guide, you will help students develop a plan to work through test items from OGT practice tests. This plan helps students develop a deeper understanding of test questions related to the benchmarks in Ohio's academic content standards. As a coach, you will assist your student in working through the Plan-Do-Study-Act (PDSA) cycle. It is a scientific approach for developing improvement goals.

Each guide walks students through the four stages in a PDSA cycle. As a coach, you will assist your student to:

- PLAN** – Set up a meeting to review OGT results with your student. Guide your student in identifying his or her performance level for each content standard. Assist in specifically identifying the standards and benchmarks that are in need of improvement. Help develop a schedule for working through the remainder of the guide.
- DO** – Help your student work through several test items using the mind-mapping strategy. Your student will have a chance to view model examples of mind mapping for selected test items and then will try some on his or her own. As a coach, you will need to make a decision in terms of the level of support you will provide in this stage. Based upon the needs of your student, you may choose to work through each item example with your student, guide your student through a few examples and then let him or her proceed on his or her own or have your student tackle the entire section independently. Regardless of your decision, check in with your student to see how he is doing so that you can intervene if necessary.
- STUDY** – After your student finishes the DO section, help your student to think about or reflect upon his or her work by completing a worksheet prior to setting up another meeting with you. During this STUDY meeting, your student will review what he or she has discovered about his or her own learning. The next step is to guide your student in setting some future goals to improve his or her score when he or she retakes the test.
- ACT** – You will now help your student develop an action plan that will list steps to be taken in preparation for retaking the OGT. Continue to monitor and support your student through the action plan timeline.

(continued)

INTRODUCTION

INFORMATION FOR COACHES

The mind-mapping strategy in this guide is a method for organizing content knowledge visually. The strategy has two parts. To make it work, students need to self-talk while they draw a visual picture of what they are thinking. Each guide offers students the opportunity to learn how to use this strategy as they think through test items specific to the content area being studied. The strategy aims to help students improve their test-taking skills through enhancing their metacognitive processing. Students who are able to think metacognitively:

- Are aware of how their mind processes information;
- Are able to plan a course of action and select an appropriate strategy to work through the problem presented;
- Monitor their thinking as they apply the selected strategy; and
- Reflect on their thinking by evaluating the outcome of their action.

Robert Marzano (2003) references Paivio's (1990) "dual-coding theory" of information storage in his study of instructional strategies that result in higher levels of achievement for students. This research discovered that students store knowledge in two forms:

- Linguistically (language-based) – involves the senses of hearing and seeing and our ability to store actual statements in our long-term memory.
- Non-linguistically (visual imagery-based) – which is expressed through mental pictures or graphic representations of learning and understanding.

The more students use both systems of representation – linguistic and non-linguistic – while they are learning new concepts, the better they are able to recall knowledge and think about it in an efficient and effective manner.

You play a vital role in the life of the student you choose to coach through this learning model. Stay connected and consistently focus on the progress your student is making toward established goals. As you identify further learning needs, help locate and ensure that your student has access to appropriate instruction and intervention. Ability to pass the OGT is critical to a student's future and can be achieved if appropriate assistance is provided. Good luck – and enjoy the process!

INTRODUCTION

INFORMATION FOR STUDENTS MATHEMATICS

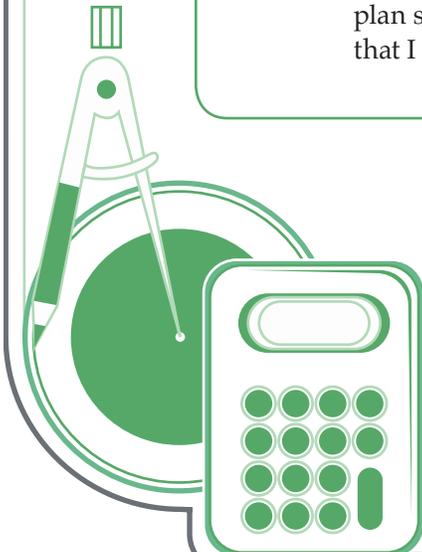


Hi, my name is Jason. I'm going to be your personal tutor. As you work through this guide, you will plan your own learning and learn how to use a strategy called mind mapping. This strategy will help you understand how your mind thinks through test questions and may help you score higher on your Mathematics OGT the next time you take it.

Like you, I needed to do better on the Math OGT. I decided to take some real action steps to understand the mathematics standards and benchmarks and to improve my test-taking skills. I'm going to walk you through the steps I took to prepare myself for retaking the Math OGT. These action steps helped me – I think they will help you, too.

Here's how this guide is set up. You will develop a Plan-Do-Study-Act (PDSA) to work through test questions from the OGT practice tests. This guide takes you through the four stages in a PDSA:

- PLAN** – You will choose a coach and set up a meeting to review your Math OGT results. Together, you will use your Score Report to identify the mathematics standards that you did well with and those that need more work. Then you'll develop a schedule for working through the rest of the guide.
- DO** – You will work through several test questions using the mind-mapping strategy. You will see how I worked through test items and then you will try some on your own. It's important to remember that these will not be the questions you will see when you retake the test. However, we can learn by reviewing past questions and thinking about how to approach other questions that we will be given. I learned a lot about how I think and how to draw a map of what's going on in my head.
- STUDY** – After you finish the DO section, you will be asked to think about what you have done. You will set up another meeting with your coach. During this meeting, you will review what you have learned and set some goals based upon what you discovered about yourself.
- ACT** – Your coach will help you develop an action plan that will list steps to prepare yourself for retaking the mathematics test. I shared my action plan so you will know how to do this. I'm working my plan right now so that I will be proficient or higher the next time I take the test.



This is my Plan-Do-Study-Act (PDSA) mind map. As you work through the guide, think about your work as building a pyramid where each new block is helping you to reach your ultimate goal – passing the Math OGT!

INTRODUCTION

PDSA MIND MAP MATHEMATICS

Step 1: Review the guide.

Step 2: Select a coach and set a meeting time.

Step 3: Gather your test results and work through the planning template.

PLAN

1

Step 4: Work through the test questions using mind mapping.

Step 5: Complete the reflection questions.

2

DO

Step 6: Think about your thinking by completing the reflection worksheet.

Step 7: Set a meeting with your coach and review your progress.

STUDY

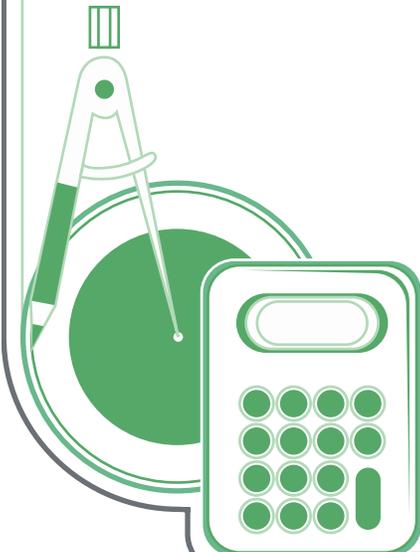
3

Step 8: Develop an action plan.

Step 9: Tackle your action plan!

4

ACT



PLAN

INTRODUCTION MATHEMATICS



The first stage in a Plan-Do-Study-Act (PDSA) is to build the PLAN. The PLAN should help us to learn more about the math standards and benchmarks. And it should also include some new ways for us to think about test questions. I used the PDSA learning plan to keep track of my progress as I worked through the guide.

There are three steps in the planning process:

Step 1: Review the guide.

Step 2: Select a coach and set a meeting time.

Step 3: Gather your test results and work through the planning template.

Here's what I did for each of the steps.

Ideas to Consider:

I read over each introduction section for Plan-Do-Study-Act.

Target Date for Completion:

August 10

1

PLAN

Review the guide.

Ideas to Consider:

I used a brainstorming process to identify and help select a coach. I asked my best choice and set up a meeting time.

Target Date for Completion:

*Identify Coach, August 10
Meeting, August 17*

2

PLAN

Select a coach
and set a meeting
time.

Ideas to Consider:

Before meeting with my coach, I checked with the guidance counselor, science teacher and my parents to collect testing data, classroom grades and reports.

Target Date for Completion:

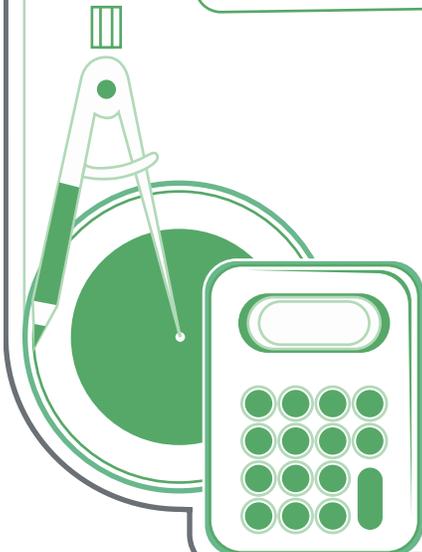
August 17

(Take this information to the meeting with my coach.)

3

PLAN

Gather your test
results and work
through the
planning template.



PLAN

PLANNING PROCESS MATHEMATICS

1

Review the guide.

Skim through the guide. Then go back and take time to read the introduction to each section. This will give you a good idea of how the guide is set up and what you will be doing in each stage of the PDSA.

A coach is someone that will agree to guide and work with you. It must be someone that you trust and with whom you feel comfortable. It should be someone who is available to meet with you on a regular basis. And he or she should have a pretty good understanding of math content.

I built a chart and determined my criteria for selecting a coach. Then I thought about people I might ask. You can see my list included my math intervention teacher, Ms. Bracey. She worked with me during a special period three times a week to help me catch up in math. My friend David came next. He does really well in math and has helped me with some of my homework assignments this past year. I also listed my math teacher, Mrs. Price.

2

Select a coach and set up a meeting time.

Once I had people identified, then I took one at a time and checked them against my criteria. You can look at my chart to get an idea of how I thought through each person and finally decided to ask Ms. Bracey.

Name	Criteria				
	I trust this person.	This person understands math.	This person has time to meet with me.	This person would be willing to work with me.	This person is patient and understands how I learn.
Ms. Bracey	✓	✓	✓	✓	✓
David	✓	✓	He has a job so may not have enough time to help me.	If he has enough time, he would.	✓
Mrs. Price	✓	✓	She teaches almost every period, so probably would not have time to fit me in.	I'm not sure she would have any extra time, so probably would not want to commit to the time.	✓

STEP 2 CONTINUED ON NEXT PAGE

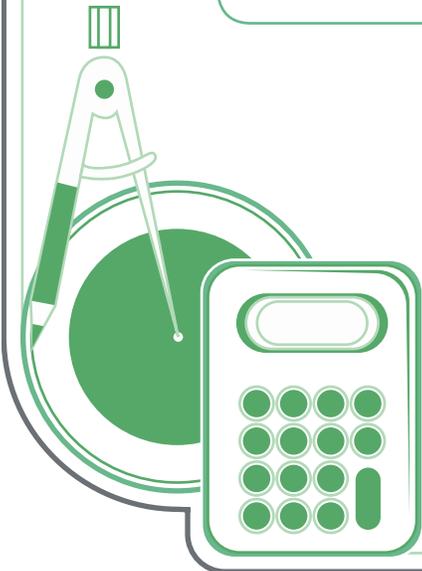
PLAN

PLANNING PROCESS MATHEMATICS

Here's a chart for you to use. First, set your criteria and then try to come up with at least three people who might be a good coach. Check each person against your criteria and make a selection.

Name	Criteria				

Once you have decided on your coach, the next step is to ask. I asked Ms. Bracey and of course she said yes. We set up a time to meet so that she could look over the guide and help me get started.



PLAN

PLANNING PROCESS MATHEMATICS

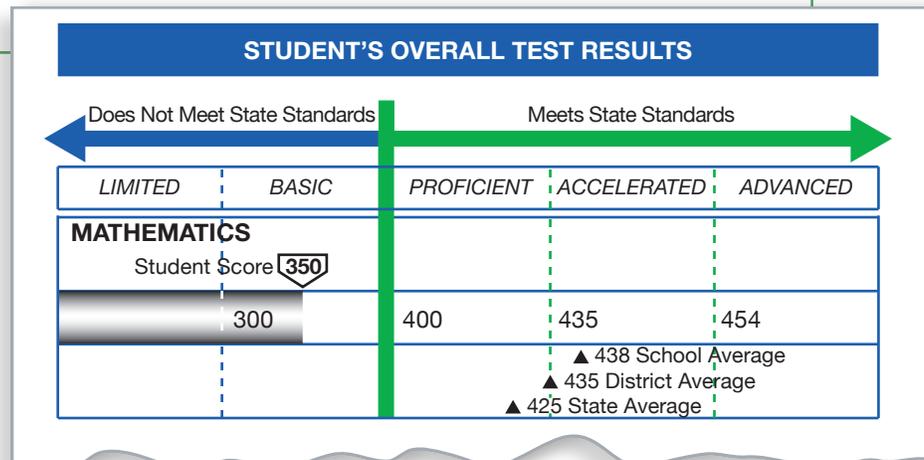
Now for step three, you need to gather your test results and use the Mathematics Standards and Benchmarks Worksheet to self-assess your current knowledge of math content. This worksheet contains information on all the key math concepts that we need to know. It will help you to decide which benchmarks you feel you understand and which ones you don't.

Before I set up my meeting with Ms. Bracey, I talked with my math teacher, Mrs. Price, about getting some information on how I had done in math class. I also talked with my guidance counselor, who had records of my results from a ninth-grade practice test that we took at school.

3

Gather your test results and work through the planning template.

At our meeting, Ms. Bracey, now serving as my coach, looked over this information with me. We then looked over the Ohio Graduation Tests Family Report that came to my home. It has information on how I did on each of the five OGT tests. First, we looked at my results and saw that I scored at the basic level in math and I need to be at proficient or above.



STEP 3 CONTINUED ON NEXT PAGE

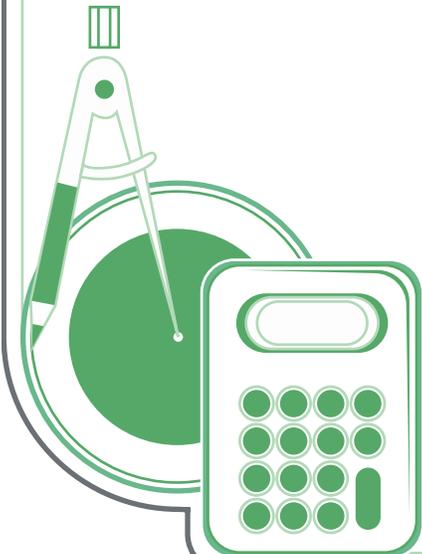
PLAN

PLANNING PROCESS MATHEMATICS

Then we looked at my overall performance with the mathematics content standards.

STUDENT PERFORMANCE IN CONTENT STANDARDS

Ohio Content Standards for MATHEMATICS	Lower	About the Same	Higher	What
Number, Number Sense and Operations Understanding number systems and operations, computing fluently and making reasonable estimates.		◆		
Measurement Estimating and measuring by selecting and using appropriate units, tools and technologies.	◆			
Geometry and Spatial Sense Understanding and using spacial reasoning to analyze mathematical situations and solve problems.		◆		
Patterns, Functions and Algebra Understanding and using patterns, relations and functions in solving mathematical problems.	◆			
Data Analysis and Probability Understanding how to collect, organize, represent, interpret and analyze data to answer questions.	◆			



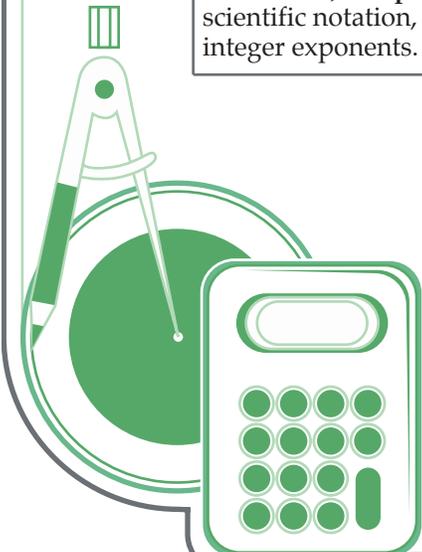
STEP 3 CONTINUED ON NEXT PAGE

PLAN

PLANNING PROCESS MATHEMATICS

Using everything we had learned about my performance, we worked through the entire worksheet. This took us about 45 minutes. Here's my self-assessment of the Number, Number Sense and Operations Mathematics standard as an example:

Benchmarks:	Self-assessment:	
	Know this	Needs further study
A. Use scientific notation to express large numbers and numbers less than one.	✓	
B. Identify subsets of the real number system.	✓	
C. Apply properties of operations and the real number system and justify when they hold for a set of numbers.	✓	
D. Connect physical, verbal and symbolic representations of integers, rational numbers and irrational numbers.	✓	
E. Compare, order and determine equivalent forms of real numbers.	✓	
F. Explain the effects of operations on the magnitude of quantities.	✓	
G. Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.	✓	
H. Find the square root of perfect squares, and approximate the square root of non-perfect squares.		✓
I. Estimate, compute and solve problems involving scientific notation, square roots and numbers with integer exponents.		✓



After we completed the benchmarks worksheet, my coach helped me to build a timeline for completing the other sections of the guide. I wrote the dates into my PDSA plan.

We thought it might also be a good idea to have Mrs. Price take a look at the plan, because she might have some other ideas on what I needed to work on. And I promised to check with Ms. Bracey every week to let her know how things were going.

STEP 3 CONTINUED ON NEXT PAGE

PLAN

PLANNING PROCESS MATHEMATICS

Plan-Do-Study-Act

Jason's Mathematics PDSA Schedule

PDSA Steps	Ideas to Consider	Target Completion Date	Date Completed
PLAN 1. Review the guide.	<i>I read over each introduction section for Plan-Do-Study-Act.</i>	August 10	✓
PLAN 2. Select a coach and set a meeting time.	<i>I used a brainstorming process to identify and help select a coach. I asked my best choice and set up a meeting time.</i>	August 10 Meeting set – August 17	✓
PLAN 3. Gather your test results and work through the planning template.	<i>Before the meeting with my coach, I checked with the guidance counselor, math teacher and my parents to collect testing data, classroom grades and reports.</i>	August 17 (Take this information to the meeting.)	✓
DO 4. Work through the mind-mapping test questions.	<i>My coach helped me develop a timeline and worked through a couple of the test questions with me to help me get started. Then I was on my own.</i>	August 30 (I planned for 45-60 minute work sessions.)	✓ Had all the questions completed by August 29!
DO 5. Complete the reflection questions for each test question.	<i>I completed all the reflection questions and checked with my coach when I had a problem.</i>		
STUDY 6. Think about your thinking by completing the reflection worksheet.	<i>I spent time reviewing my maps and my responses to the reflection questions. I filled out the reflection worksheet.</i>	August 31	✓
STUDY 7. Set a meeting with your coach and review your progress.	<i>I called my coach and we set up another meeting to review my results.</i>	September 2	✓
ACT 8. Develop an action plan.	<i>Together we developed an action plan to put into place before I was scheduled to retake the OGT.</i>	September 2	✓
ACT 9. Tackle your action plan!	<i>I had six weeks to work on my plan. With lots of support, I did it. I felt ready to retake the test.</i>	Mid-October Ready for retake!	



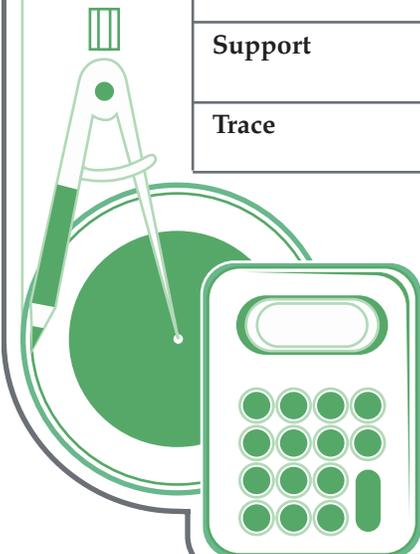
PLAN

PERFORMANCE VERBS MATHEMATICS

With my learning plan completed, I decided to review the other items in the PLAN section of the guide before starting on the DO section.

First, I looked over the information on the different types of thinking that are in the mathematics benchmarks. Teachers refer to these as performance verbs. The chart included in the guide reminds me of the types of verbs that I'll see in the test questions.

<i>Performance Verb</i>	<i>What it means</i>
Analyze	To think about the different parts of a problem or situation to figure out the traits of the whole (e.g., looking at several two-dimensional perspectives to decide a type of three-dimensional object).
Compare	To look at traits or qualities to find out what is alike and what is different. "Compare" is usually stated as "compare with." You are to highlight similarities, but differences may be mentioned.
Describe	To represent a thought or an idea, such as noting changes taking place over time.
Evaluate	To determine the value of something for a given purpose based on certain standards or criteria (e.g., explaining the pros, cons and/or results of a decision).
Explain	To make clear or give reason for something (e.g., explaining factors that cause a certain kind of reaction).
Formulate	To express a thought or an idea based on the review of information (e.g., coming up with a category to organize what seem to be objects or events that are not alike).
Infer	To extend information beyond what is directly stated (e.g., extracting data from a graph).
Predict	To use what is already known to make a statement about what will happen in the future.
Summarize	To condense information (e.g., stating the main points of an argument).
Support	To show evidence to back a conclusion or argument (e.g., citing people with similar points of view).
Trace	To describe a path or sequence (e.g., to explain the chronology of events).



PLAN

TEST-TAKING TIPS MATHEMATICS

I also reviewed the test-taking tips on the different types of questions just to refresh my memory.

- Get plenty of rest.
- Eat breakfast and dress comfortably on each day of testing.
- Be confident of your ability and give your best effort.

General Test Tips

- Read the directions carefully.
- If the question is asking for facts, do not give your personal opinion on the topic.
- Make an outline before writing. This way your response will be more organized and fluid.
- Address all parts of the question.
- Focus on one main idea per paragraph.
- If you have time left at the end, proofread your work and correct any errors.

Short-Answer and Extended-Response Tips

Unlike the Ohio Ninth-Grade Proficiency Tests, the Ohio Graduation Tests include more than just multiple choice questions.

There are three different kinds of questions on the OGT:

Types of Questions

- 1) Multiple choice;
- 2) Short answer; and
- 3) Extended response.

- Read the entire question before attempting to answer it.

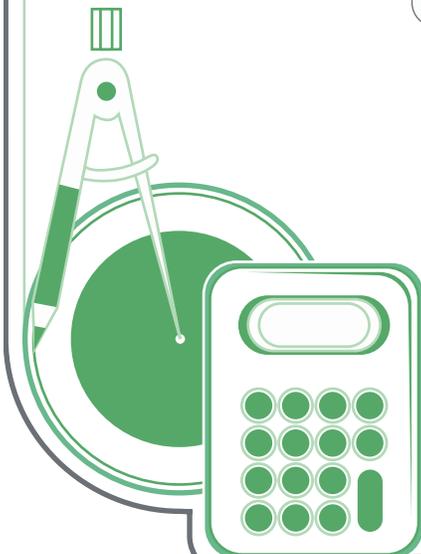
- First, try to answer the question without looking at the choices. Then, look at the choices to see if your answer is the same as, or close to, one of the choices.

- Read carefully any question using the words "not" or "except."

- Don't keep changing your answer. Usually your first choice is the right one, unless you did not read the question correctly.

Multiple Choice Tips

Then it was time to move to the DO section. This is going to take some time; in fact, you might want to schedule the work over several days like I did in my plan. I decided to work on at least two questions per day and to set aside 45-60 minutes each time I worked. Find a quiet place to work and get yourself organized for learning. Take a deep breath and dive right in!



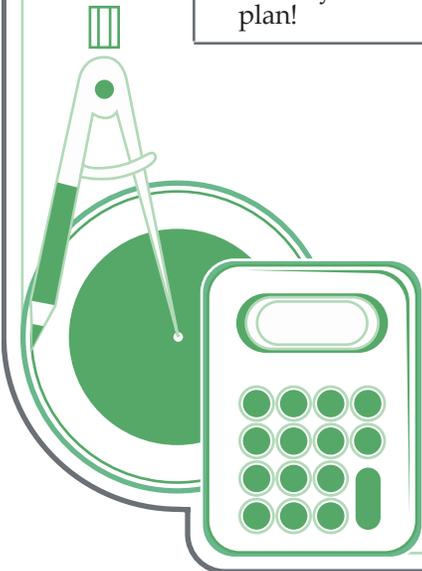
PLAN

PLAN-DO-STUDY-ACT CHART MATHEMATICS

Plan-Do-Study-Act

Name: _____

PDSA Steps	Ideas to Consider	Target Completion Date	Date Completed
PLAN 1. Review the guide.			
PLAN 2. Select a coach and set a meeting time.			
PLAN 3. Gather your test results and work through the planning template.			
DO 4. Work through the mind-mapping test questions.			
DO 5. Complete the reflection questions for each test question.			
STUDY 6. Think about your thinking by completing the reflection worksheet.			
STUDY 7. Set a meeting with your coach and review your progress.			
ACT 8. Develop an action plan.			
ACT 9. Tackle your action plan!			



PLAN

CONTENT STANDARDS MATHEMATICS

Mathematics Standards and Benchmarks Worksheet

Name: _____

Performance Level: _____

Performance Level Needed: _____

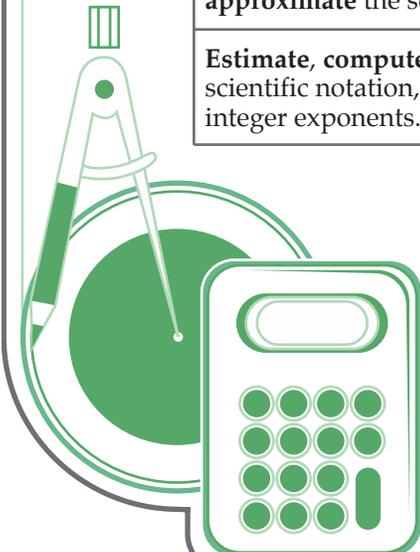
Mathematics Scale Score: _____

Score Needed: _____

Content Standard: Number, Number Sense and Operations

Understanding number systems and operations, computing fluently and making reasonable estimates.

Benchmarks:	Self-assessment:	
	Know this	Needs further study
Use scientific notation to express large numbers and numbers less than one.		
Identify subsets of the real number system.		
Apply properties of operations and the real number system and justify when they hold for a set of numbers.		
Connect physical, verbal and symbolic representations of integers, rational numbers and irrational numbers.		
Compare, order and determine equivalent forms of real numbers.		
Explain the effects of operations on the magnitude of quantities.		
Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.		
Find the square root of perfect squares, and approximate the square root of non-perfect squares.		
Estimate, compute and solve problems involving scientific notation, square roots and numbers with integer exponents.		

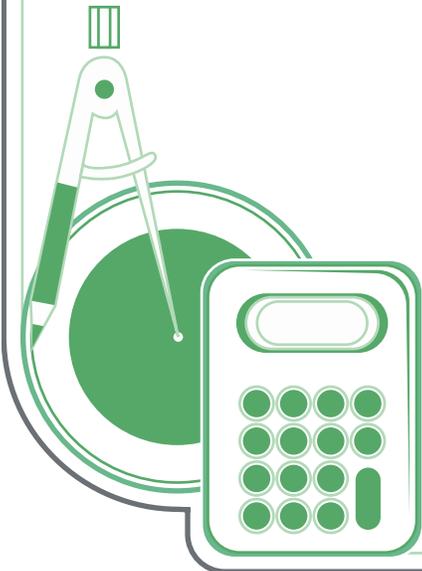


PLAN

CONTENT STANDARDS MATHEMATICS

Mathematics Standards and Benchmarks Worksheet (continued)

Content Standard: Measurement Estimating and measuring by selecting and using appropriate units, tools and technologies.		
Benchmarks:	Self-assessment:	
	Know this	Needs further study
Solve increasingly complex non-routine measurement problems and check for reasonableness of results.		
Use formulas to find surface area and volume for specified three-dimensional objects accurate to a specified level of precision.		
Apply indirect measurement techniques, tools and formulas, as appropriate, to find perimeter, circumference and area of circles, triangles, quadrilaterals and composite shapes, and to find volume of prisms, cylinders and pyramids.		
Use proportional reasoning and apply indirect measurement techniques, including right triangle trigonometry and properties of similar triangles, to solve problems involving measurements and rates.		
Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.		
Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.		

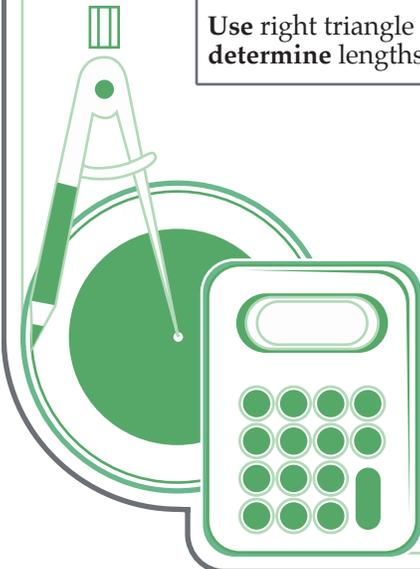


PLAN

CONTENT STANDARDS MATHEMATICS

Mathematics Standards and Benchmarks Worksheet (continued)

Content Standard: Geometry and Spatial Sense Understanding and using spatial reasoning to analyze mathematical situations and solve problems.		
Benchmarks:	Self-assessment:	
	Know this	Needs further study
Formally define geometric figures.		
Describe and apply the properties of similar and congruent figures, and justify conjectures involving similarity and congruence.		
Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines.		
Use coordinate geometry to represent and examine the properties of geometric figures.		
Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools, such as straightedge, compass and technology.		
Represent and model transformations in a coordinate plane and describe the results.		
Prove or disprove conjectures and solve problems involving two- and three-dimensional objects represented within a coordinate system.		
Establish the validity of conjectures about geometric objects, their properties and relationships by counter-example, inductive and deductive reasoning, and critiquing arguments made by others.		
Use right triangle trigonometric relationships to determine lengths and angle measures.		



PLAN

CONTENT STANDARDS MATHEMATICS

Mathematics Standards and Benchmarks Worksheet (continued)

Content Standard: Data Analysis and Probability Understanding how to collect, organize, represent, interpret and analyze data to answer questions.		
Benchmarks:	Self-assessment:	
	Know this	Needs further study
Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatter plots, measures of center and variability.		
Evaluate different graphical representations of the same data to determine which is the most appropriate representation for an identified purpose.		
Compare the characteristics of the mean, median and mode for a given set of data, and explain which measure of center best represents the data.		
Find, use and interpret measures of center and spread, such as mean and quartiles, and use those measures to compare and draw conclusions about sets of data.		
Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis.		
Construct convincing arguments based on analysis of data and interpretation of graphs.		
Describe sampling methods and analyze the effects of method chosen on how well the resulting sample represents the population.		
Use computing techniques, such as permutations and combinations, to determine the total number of options and possible outcomes.		
Design an experiment to test a theoretical probability, and record and explain results.		
Compute probabilities of compound events, independent events, and simple dependent events.		
Make predictions based on theoretical probabilities and experimental results.		

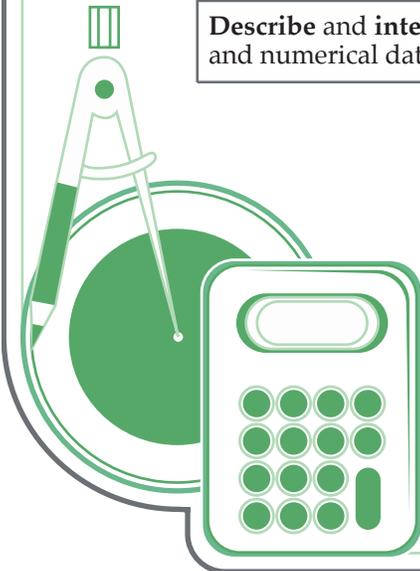


PLAN

CONTENT STANDARDS MATHEMATICS

Mathematics Standards and Benchmarks Worksheet (continued)

Content Standard: Patterns, Functions and Algebra		
Understanding and using patterns, relations and functions in solving mathematical problems.		
Benchmarks:	Self-assessment:	
	Know this	Needs further study
Generalize and explain patterns and sequences in order to find the next term and the n^{th} term.		
Identify and classify functions as linear or nonlinear, and contrast their properties using tables, graphs or equations.		
Translate information from one representation (words, tables, graph or equation) to another representation of a relation or function.		
Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations.		
Analyze and compare functions and their graphs using attributes, such as rates of change, intercepts and zeros.		
Solve and graph linear equations and inequalities.		
Solve quadratic equations with real roots by graphing, formula and factoring.		
Solve systems of linear equations involving two variables graphically and symbolically.		
Model and solve problem situations involving direct and inverse variation.		
Describe and interpret rates of change from graphical and numerical data.		



DO

INTRODUCTION MATHEMATICS



The second stage in a PDSA is to DO what you have planned.

There are two steps in the doing process:

Step 4: Work through the test questions using mind mapping.

Step 5: Complete the reflection questions.

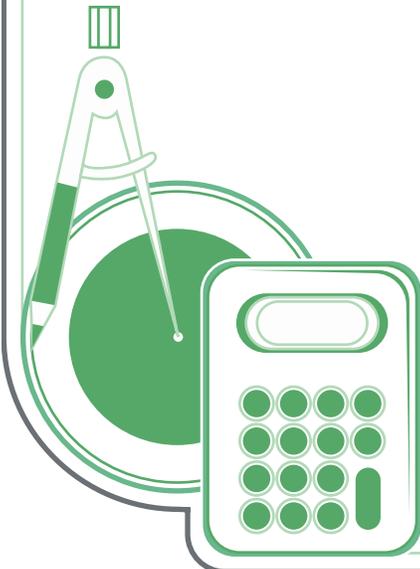
You will spend some time working through test questions. I picked eight multiple-choice, three short-answer and two extended-response questions for you to practice.

For some items, I'm going to model the mind-mapping strategy by showing you my mind map and talking you through my thinking. For others, I've given you some key ideas to jump start your thinking and begin creating your own map. Go ahead and talk to yourself (out loud if you like) while you draw your map.

For other test questions you are going to be on your own. After you finish your work, you can take a look at my mind maps. These are in the back of the guide in the Reference section. Your mind map may look different from mine. In fact, you might have solved the problem in a different way, and that is okay. The important thing is that you should have the same right answer.

I've listed the math standard and benchmark for each question. Do your thinking and mapping for each question and don't forget to complete the reflection box. This is going to be very important to you when you move into the Study stage of the PDSA. Your reflections will help you develop your next action plan.

Are you ready? Take your time. There is no clock ticking. You can spend as much time as you need on each test question. Good luck and have some fun!



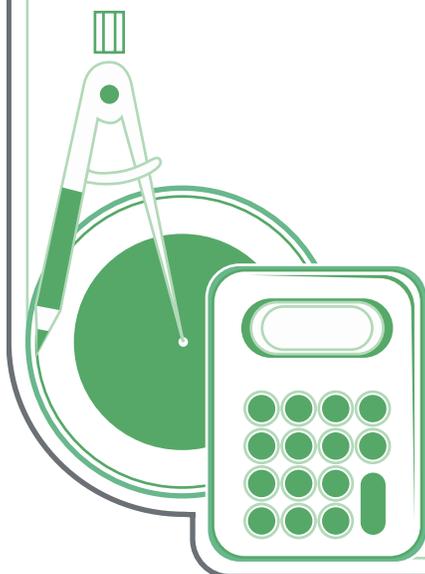
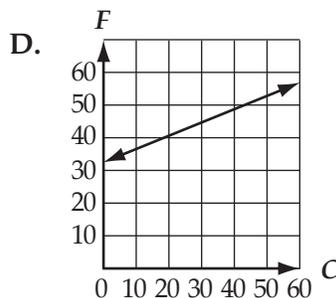
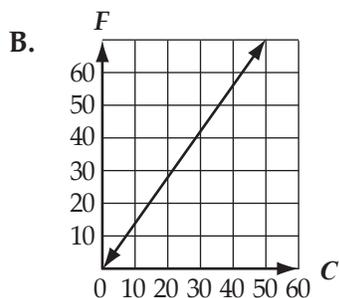
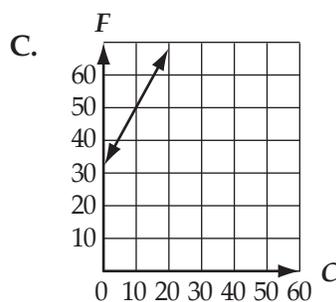
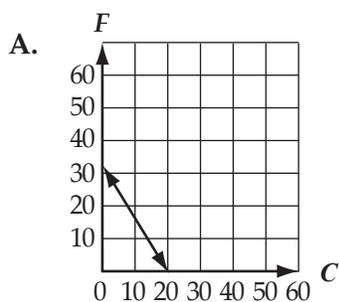
Standard: Patterns, Function and Algebra

Benchmark F: Solve and graph linear equations and inequalities.

31. The formula for converting temperature on the Celsius scale, C , to the Fahrenheit scale, F , is

$$F = \frac{9}{5} C + 32.$$

Which graph represents this equation?





I read the problem very carefully and the theme is temperature. What do I know for sure about Fahrenheit and Celsius scales?

$$F = \frac{9}{5} C + 32$$

is the equation I use to convert between scales.

I am going to have to recognize the graph for the equation. I have to think back on what I learned in class.

1

From science class I remember that freezing is 32 degrees Fahrenheit. That point will have to be on the graph so which graphs include this point?

Looks like my options are A, C and D.

At least I know that B is not the correct choice.

2

3

If the equation is

$$F = \frac{9}{5} C + 32$$

then that is in the form $y = mx + b$ where m is the slope and b is the y -intercept. So let me check this again. The y -intercept is 32. That is true in all choices except B. The slope is $\frac{9}{5}$, rise over run, up 9 as it moves to the right 5.

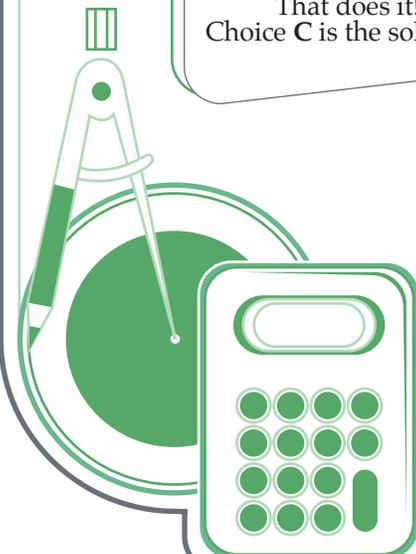
Choice A is a negative slope, so that can't be it.

4

Choice C goes up about 2 squares for every square it moves to the right. 2 over 1 is 2; 9 over 5 is almost 2.

Choice D goes up about 1 square as it goes 2 squares to the right. That is 1 over 2 which is equal to $\frac{1}{2}$. Not even close to $\frac{9}{5}$.

That does it! Choice C is the solution.



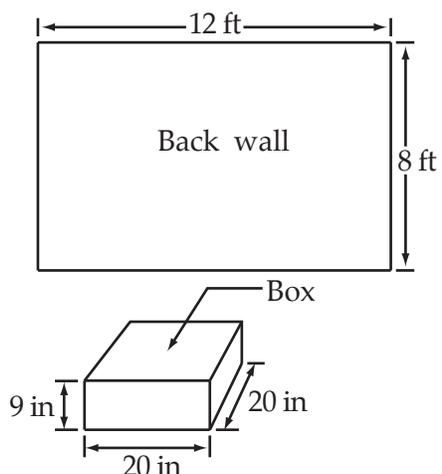
1. What did you notice about Jason's mind map?

2. Jason was able to recall information that he remembered about how to solve math equations. Were you able to understand how he thought through this problem? If not, what part did you not understand?

Standard: Measurement

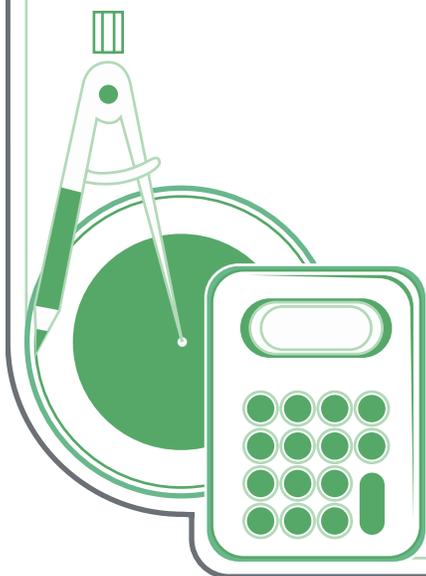
Benchmark E: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.

44. Identical boxes are to be stacked along the back wall of a storage room from floor to ceiling. The diagram shows the dimensions of the back wall and the dimensions of one of the boxes, which has a square base.



Which of these is the best estimate of the maximum number of boxes that can be stacked against the entire back wall?

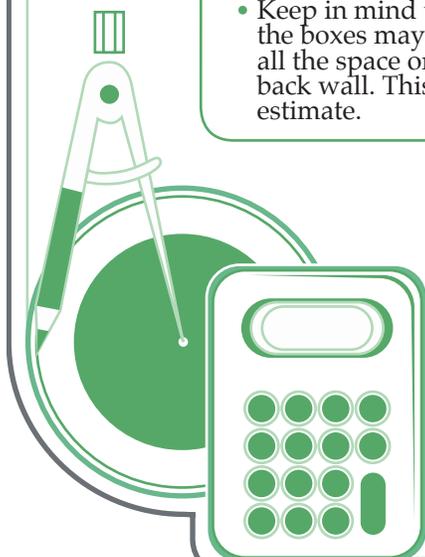
- A. 200
- B. 70
- C. 50
- D. 15



Use the Talking Points to help you create your map.

Talking Points

- Read the problem very carefully. You may need to read it more than once.
- Determine the information given in the problem.
- Notice the labels on the measurements.
- It might be a good idea to make a picture or drawing.
- Make sure you use the same measurement units for all distances.
- Sketch in the number of boxes in one column (vertical).
- Sketch in the number of boxes in one row (horizontal).
- Determine the number of boxes. Can you do this without drawing every box?
- Keep in mind that the boxes may not fill all the space on the back wall. This is an estimate.



1. Did the Talking Points help you think about your thinking as you drew your mind map? What helped? What did not?

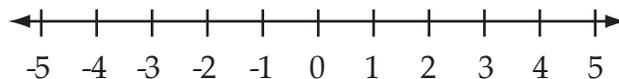
2. Were you able to create a complete mind map for the problem? If not, what part of the problem did you have trouble working through?

3. Take a look at Jason's mind map and self-talk in the Reference section. What did you discover about the way Jason tackled the problem?

Standard: Number, Number Sense and Operations

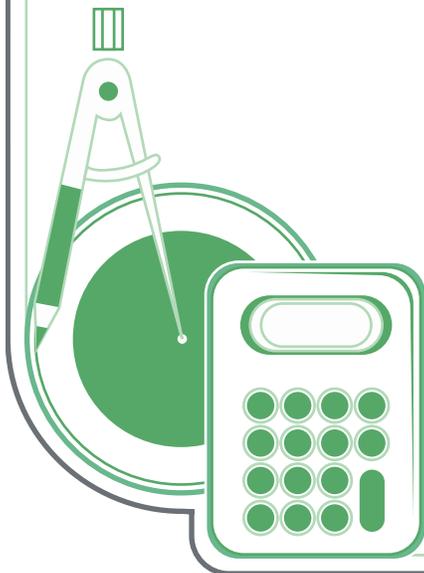
Benchmark D: Connect physical, verbal and symbolic representations of integers, rational numbers and irrational numbers.

42. Let x represent any number on the real number line below.



Which of these represents the distance, in units, from x to 3?

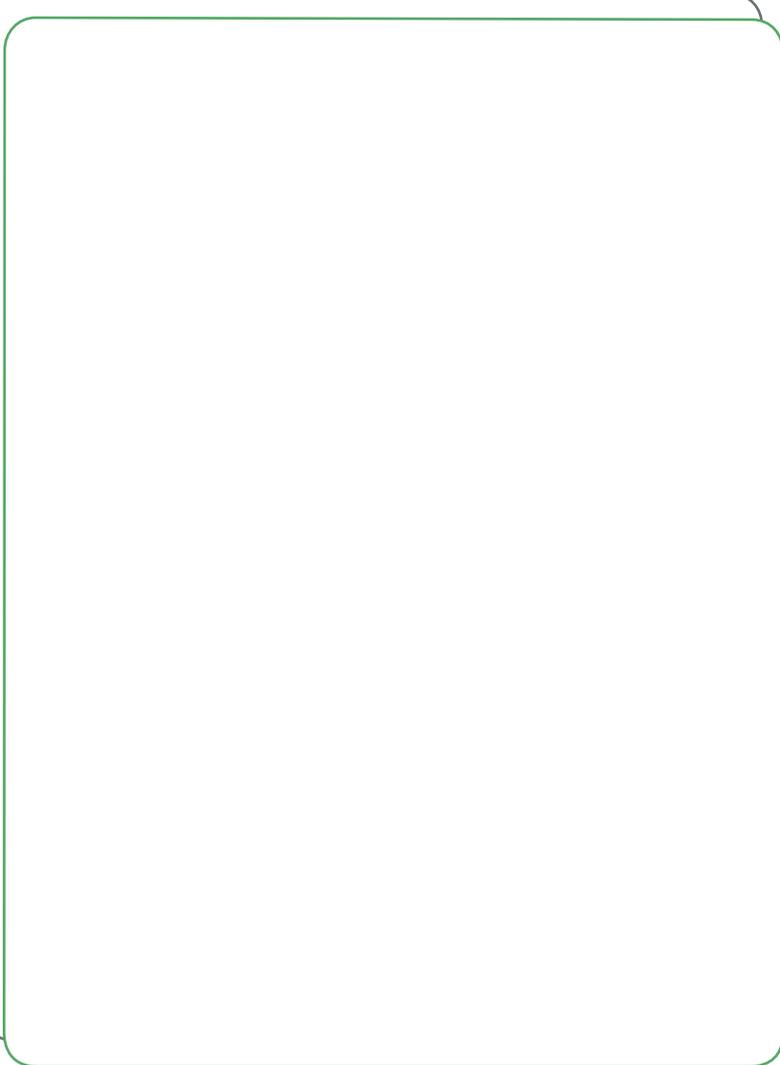
- A. $|x|$
- B. $x - 3$
- C. $|x| - 3$
- D. $|x - 3|$



Use the Talking Points to help you create your map.

Talking Points

- Read the problem very carefully.
- Determine the information given in the problem.
- What question is being asked? What will you have to do?
- Did you think of substituting a number for x in all four choices?
- Substituting values for x for different situations (a number less than 3, a number greater than 3 or 3) may help you better understand this problem.
- How far is it from 3 to your chosen number?
- What must be true about a distance?
- Can a distance be negative?
- If a distance cannot be negative, then what mathematical notation guarantees the distance to be positive?
- Make sure your selected choice is true for any value you substitute for x .



1. Did the Talking Points help you think about your thinking as you drew your mind map? What helped? What did not?

2. Did you have a good understanding of number lines and how to solve this problem? If not, what might you do to improve your understanding?

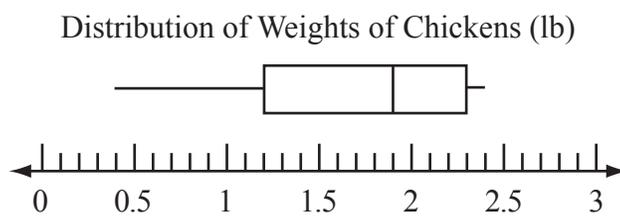
3. Take a look at Jason's mind map and self-talk in the Reference section. What did you discover about the way Jason worked through the problem?



Standard: Data Analysis and Probability

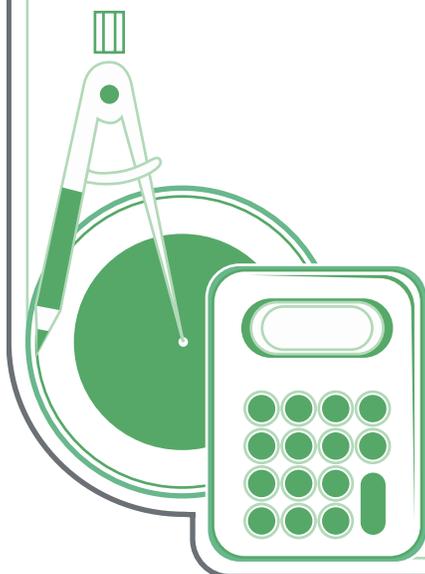
Benchmark A: Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatter plots, measures of center and variability.

2. The box-and-whisker plot below describes the weights of a sample of 100 chickens.



What statement can be made about the data, using the graph alone?

- A. The range of the weights is 3 lb.
- B. The median weight is less than 2 lb.
- C. Twenty-five percent of the chickens weigh less than 1 lb.
- D. Fifty percent of the chickens weigh more than 2 lb.

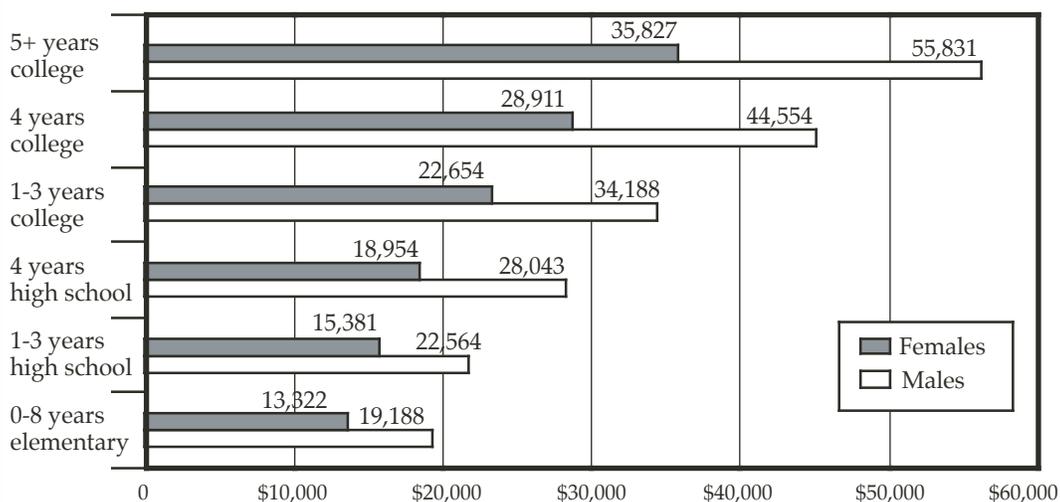


Standard: Data Analysis and Probability

Benchmark E: Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis.

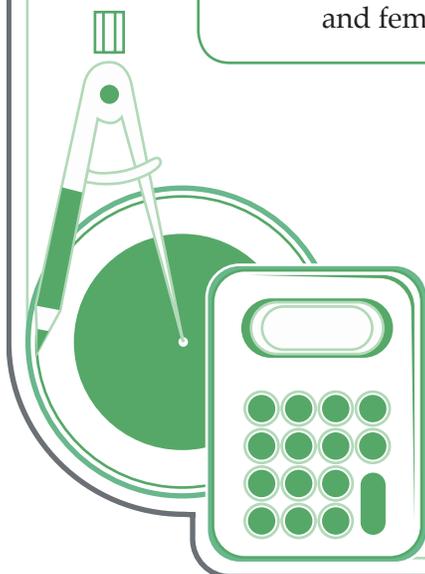
34. The graph below compares earnings categorized by level of schooling for males and females.

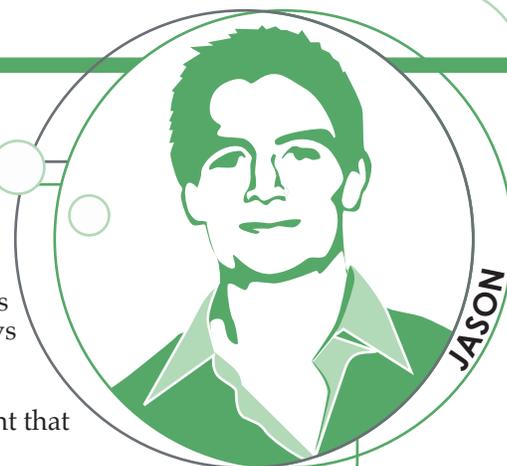
Mean Money Earnings, by Educational Attainment and Gender, 1990



Which of the following statements is true based on the graph?

- A. Gender does not appear to have an impact on earnings.
- B. Education level does not appear to have an impact on earnings.
- C. The more educated a female, the wider the earnings gap between her and her male counterpart.
- D. As education level increases, the earnings gap narrows between males and females.





A graph! Those are always easy for me. The males are the light color bars and the females are the shaded bars. Look at that! Males always earn more money.

Back to the problem. I need to find the statement that is TRUE.

1

Choice A

Gender? That must be males and females.

At each level of education, the males always earn more money. So gender does matter.

2

Choice A is NOT TRUE.

3

Choice B

Education level? As the level of education increases, the bars get longer which means the people earn more money. So education does make a difference.

Choice B is NOT TRUE.

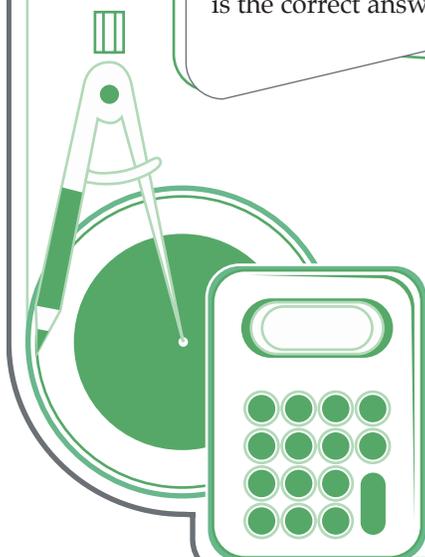
4

Choice C – The gap? The gap is the difference in the length of the bars for males and females. There is just a little difference at the bottom of the graph and a lot at the top of the graph. So the gap gets wider when more education is involved. That makes Choice C TRUE. This must be it. But just to be sure ...

Choice C is the correct answer.

Choice D – The gap narrows as education increases. I just saw that the gap widens. So Choice D is NOT TRUE.

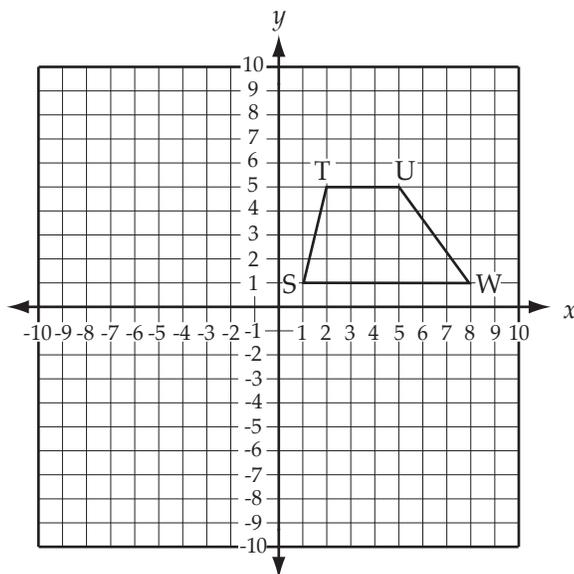
This graph shows that men and women are not paid equally even when they have the same education. That doesn't seem fair, does it? Now I know what my Mother means when she says she has to work more hours to earn the same amount of money my Dad does!



Standard: Geometry and Spatial Sense

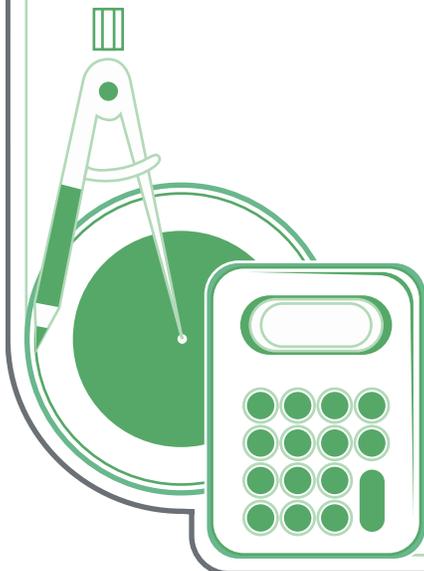
Benchmark F: Represent and model transformation in a coordinate plane and describe results.

28. The quadrilateral STUW has vertices at the coordinates (1, 1), (2, 5), (5, 5), and (8, 1), as shown.



What are the coordinates of the vertices of quadrilateral STUW when it is reflected over the x -axis?

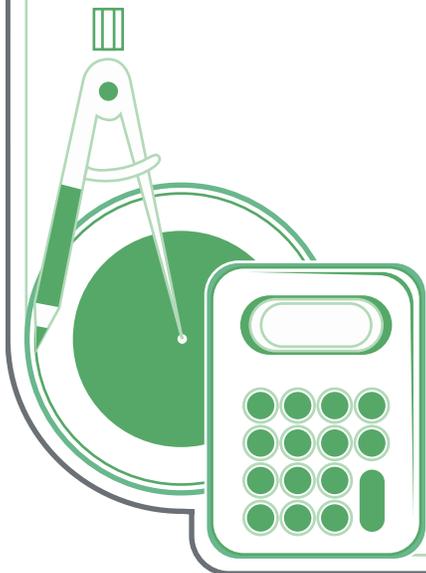
- A. (1, 1), (2, 5), (5, 5), (8, 1)
- B. (-1, 1), (-2, 5), (-5, 5), (-8, 1)
- C. (-1, -1), (-2, -5), (-5, -5), (-8, -1)
- D. (1, -1), (2, -5), (5, -5), (8, -1)



Standard: Number, Number Sense and Operations

Benchmark G: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.

42. A DVD player is on sale for 15% off the regular price of \$135. After the price reduction, a 5% sales tax is added. How much will a customer pay?
- A. \$141.75
 - B. \$120.49
 - C. \$114.75
 - D. \$109.01



Standard: Patterns, Function and Algebra

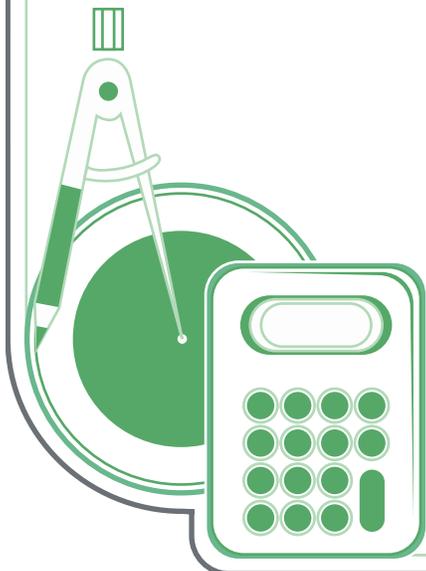
Benchmark C: Translate information from one representation (words, tables, graph or equation) to another representation of a relation or function.

9. The table below shows values for x and y .

x	y
0	-1
1	0
2	3
3	8
4	15
5	24

Which of these equations represents the relationship between x and y ?

- A. $y = x - 1$
- B. $y = x + 19$
- C. $y = x^2 - 1$
- D. $y = 2x^2 - 5$



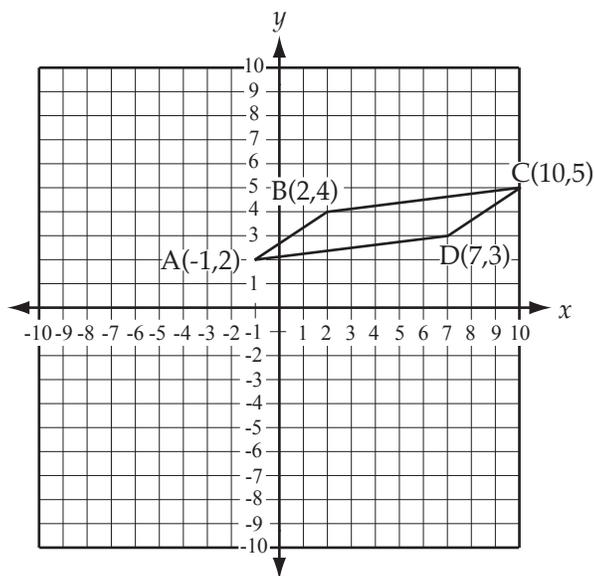
Standard: Geometry and Spatial Sense

Benchmark A: Use coordinate geometry to represent and examine the properties of geometric figures. Formally define geometric figures.

Standard: Mathematical Processes

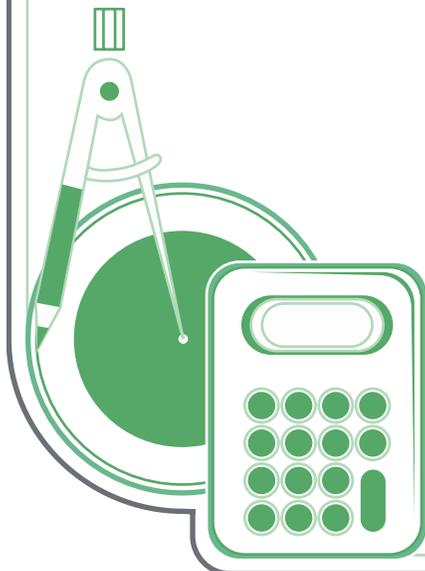
Benchmark D: Apply reasoning processes and skill to construct logical verifications or counter-examples to test conjectures and to justify and defend algorithms and solutions.

28. Four points are connected with line segments, as shown on the coordinate plane below.



In your **Answer Document**, find the slope of each side.

Determine if the shape is a parallelogram. Show your work or provide an explanation to support your answer.





JASON

Oh good, I like it when I have a graph to help me. I am given four points connected by segments to form the figure in the picture. They want me to find the slope of each side and determine if the shape is a parallelogram.

I'll work on the slopes first. I remember that slope is rise over run OR the change in y over the change in x .

1

All points are given as (x, y) . I will start with the slope of line segment AB. Point A is $(-1, 2)$ and point B is $(2, 4)$. Change in y (rise) is from 2 to 4 \Rightarrow up 2. Change in x (run) is from -1 to 2 \Rightarrow right 3.

So that makes the slope of segment AB = $\frac{2}{3}$.

2

3

On to line segment BC. Point B is $(2, 4)$ and point C is $(10, 5)$. Change in y (rise) is from 4 to 5 \Rightarrow up 1. Change in x (run) is from 2 to 10 \Rightarrow right 8.

So that makes the slope of segment BC = $\frac{1}{8}$.

4

I'm half way around the figure, only two to go. Line segment CD. Point C is $(10, 5)$ and point D is $(7, 3)$. Change in y (rise) is from 5 to 3 \Rightarrow down 2 \Rightarrow -2. Change in x (run) is from 10 to 7 \Rightarrow left 3 \Rightarrow -3.

So that makes the slope of segment CD = $\frac{-2}{-3} = \frac{2}{3}$.

5

Now, for the slope of line segment DA. Point D is $(7, 3)$ and point A is $(-1, 2)$. Change in y (rise) is from 3 to 2 \Rightarrow down 1 \Rightarrow -1. Change in x (run) is from 7 to -1 \Rightarrow left 8 \Rightarrow -8.

So that makes the slope of segment DA = $\frac{-1}{-8} = \frac{1}{8}$.

That takes care of the first part of this question: on to the second part...

NEXT PAGE

Is the figure a parallelogram?

I see that the slopes of segment AB and CD are both $\frac{2}{3}$ and I know that if the segments have the same slope then they are parallel. Segments BC and DA both have the slope $\frac{1}{8}$, so those two are parallel also. When both pairs of opposite sides are parallel then the quadrilateral is a parallelogram. Now to my written response:

$$AB: m = \frac{2}{3}$$

$$BC: m = \frac{1}{8}$$

$$AD: m = \frac{1}{8}$$

$$DC: m = \frac{2}{3}$$

Parallel lines have equal slopes. This figure is a parallelogram because AB is parallel to DC and BC is parallel to AD.

I got two points on this one!

$$m = \frac{\text{rise}}{\text{run}} = \frac{y-y}{x-x}$$

$$\frac{2-4}{-1-2} = \frac{-2}{-3} = \frac{2}{3} \quad \text{m of A}$$

$$\frac{4-5}{2-10} = \frac{-1}{-8} = \frac{1}{8} \quad \text{m of B}$$

$$\frac{5-3}{10-7} = \frac{2}{3} \quad \text{m of C}$$

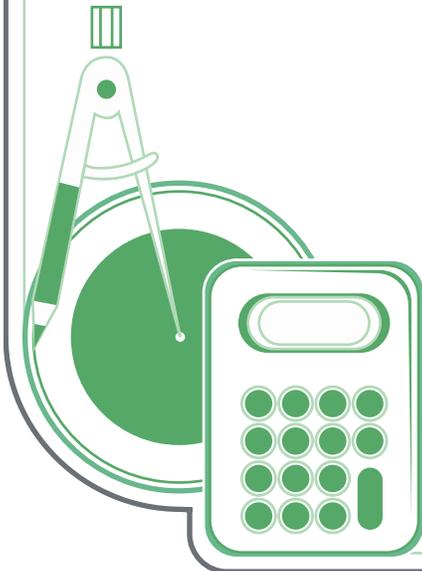
$$\frac{3-2}{7-(-1)} = \frac{1}{8} \quad \text{m of D}$$

Slope is rise over run so you put y over x and do configuration.

Another student wrote this response and only received one point.

1. What did you notice about the way that Jason worked through this question? What steps did he take in being sure that he answered the question completely?

2. Look at the student response that received one point. How would you rewrite this so that it had more information and would receive two points?



Standard: Number, Number Sense and Operations

Benchmark G: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.

Standard: Mathematical Processes

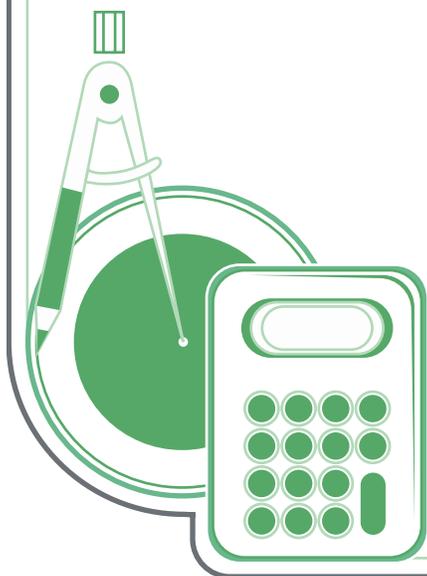
Benchmark D: Apply reasoning processes and skill to construct logical verifications or counter-examples to test conjectures and to justify and defend algorithms and solutions.

15. Two years ago Monique paid \$5.50 for the rookie baseball card of her favorite New York Yankees player. The card is now worth \$17.00. Sean, her brother, paid \$12.00 for his favorite card, and it has a current value of \$27.00.

Sean says that his card has increased more in value than Monique's card.

Monique says that her card has increased more in value than Sean's card.

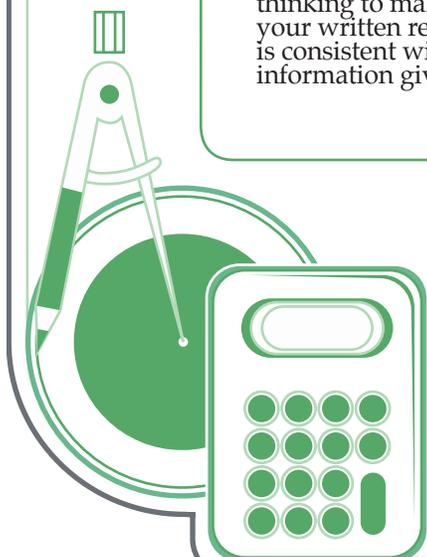
In your **Answer Document**, show how both Monique and Sean can be correct. Support your answer by showing work or providing an explanation.



Use the Talking Points to help you create your map.

Talking Points

- Read the problem very carefully. You may need to read it more than once.
- Determine the information given in the problem.
- What are you asked to do?
- Notice that this problem requires two separate solutions, one for each person.
- Increases can be measured in different ways: as a difference or as a percent or fraction.
- What can you say to show that Monique's card increased the most?
- What can you say to show that Sean's card increased the most?
- Did you write enough to support your conclusions?
- Reread your answer. Does it make sense?
- Double-check your thinking to make sure your written response is consistent with the information given.



1. Did the Talking Points help you figure out how to think through this problem? Explain why or why not.

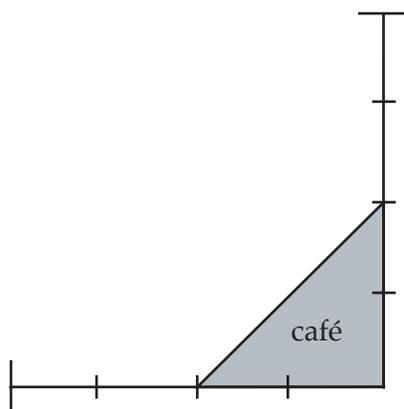
2. Compare your written response to Jason's and the other students in the reference section. After looking at those examples, what score do you think you would receive?

3. If you do not think you'd receive two points, what could you do to improve your response? Is it because you did not know how to solve the problem, or is it because you had trouble putting your answer into a clear response?

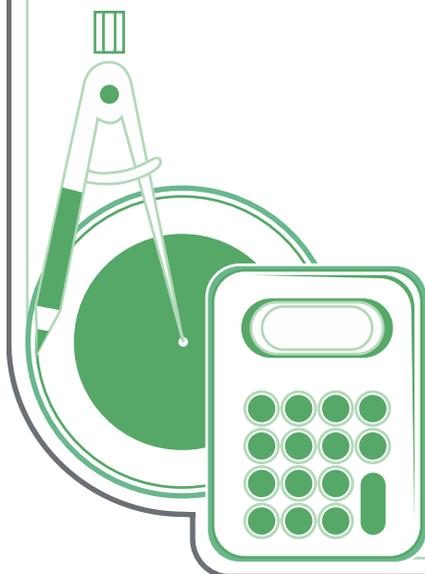
Standard: Measurement

Benchmark C: Apply indirect measurement techniques, tools and formulas, as appropriate, to find perimeter, circumference and area of circles, triangles, quadrilateral and composite shapes, and to find volume of prisms, cylinders and pyramids.

26. The floor plan of one room in a bookstore is a square with an area of 576 square feet. Part of this room is taken up by a café. The border of the café runs from the midpoints of two adjacent walls.



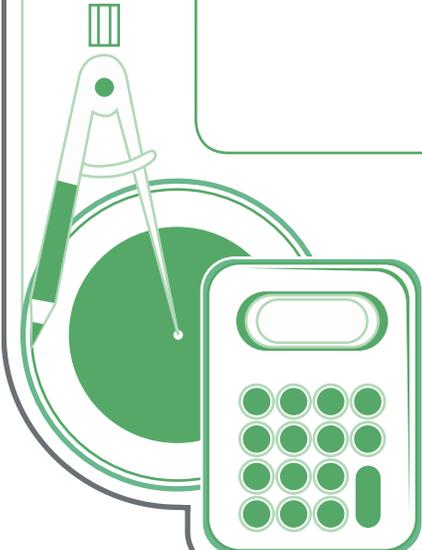
In your **Answer Document**, find the area, in square feet, of the café. Show your work or explain how you found your answer.



Use the Talking Points to help you create your map.

Talking Points

- Read the problem very carefully.
- Determine the information given in the problem.
- Is this problem about area or perimeter or both?
- Notice all the geometric vocabulary and think about the meaning of each word.
- The café is what fractional part of the whole bookstore?
- What is the best way to solve this problem?
- Does your answer seem reasonable based on the information you were given?
- Did you show enough work and explain it well enough to ensure that anyone reading your work will know how you arrived at your answer?



1. Look at the approach that Jason used to find the length of each side of the square. Did you use the same approach? If not, explain how your approach was different.

2. Were there parts of this problem that were difficult for you? Explain.

Standard: Data Analysis and Probability

Benchmark K: Make predictions based on theoretical probabilities and experimental results.

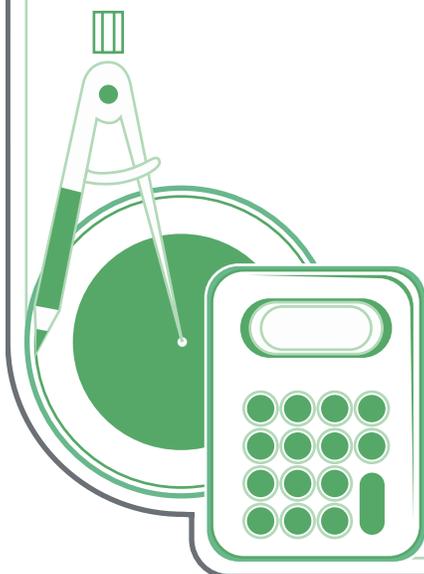
10. Anne, Brett, Carl and Danielle each rolled an identical small wooden cube. Each face of the cube is painted red, yellow or blue. The color of the top face is recorded each time the cube is rolled. The table below shows the results for three of the students after each had rolled the cube varying numbers of times.

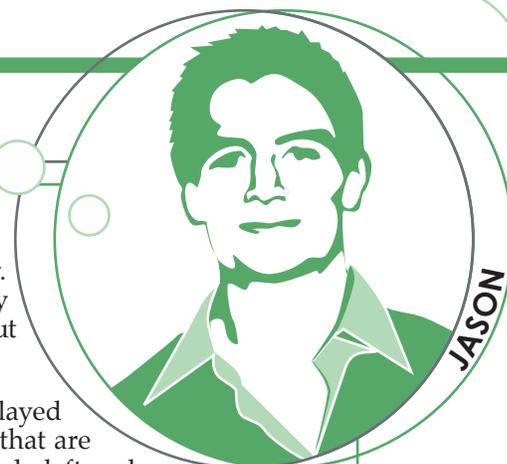
Result of Rolling Cubes

Name	Number of rolls	Number of times red face up	Number of times yellow face up	Number of times blue face up
Anne	10	3	4	3
Brett	30	4	14	12
Carl	60	12	27	21

In your **Answer Document**, predict the number of the faces on the cube that are red, the number that are yellow, and the number that are blue. Show your work or provide an explanation for how you predicted the number of faces that are each color.

Danielle will roll the cube 75 times. Predict the number of times the cube will land with red as the top face, yellow as the top face and blue as the top face. Show your work or provide an explanation for your predictions.





This is a biggie! It's worth four points, so I need to be sure to explain everything completely. After reading the first sentence, I am already confused because they mention four people but Danielle's name does not appear in the table.

These cubes remind me of the blocks we played with in kindergarten. I can visualize six faces that are all squares. I'll call them top, bottom, front, back, left and right. The color of the top face is recorded each time the cube is rolled.

Oh, it says the table shows the results of three students. I wonder what happened to Danielle?

I see that not all students rolled the cube the same number of times; that must be what they mean by varying numbers of times. I bet I'll need to use this table to solve the problem.

They want me to predict the number of faces of the cube that are painted red, yellow and blue, and I have to explain my prediction.

I remember we did this in Mrs. Wenning's class. We each rolled a cube for a minute and recorded the results. The data was interesting but we learned a lot more when we combined our data. So I think that is what I will do.

1

Result of Rolling Cubes

Name	Number of rolls	Number of times red face up	Number of times yellow face up	Number of times blue face up
Anne	10	3	4	3
Brett	30	4	14	12
Carl	60	12	27	21

Total rolls: 100

Red: 19

Yellow: 45

Blue: 36

2

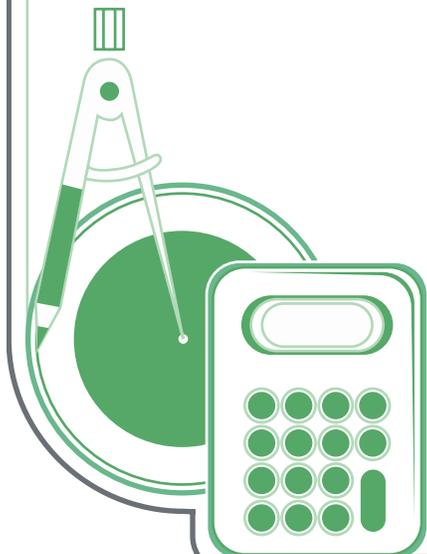
Red: $\frac{19}{100}$ of the time the top face of the cube was red.

Yellow: $\frac{45}{100}$ of the time the top face of the cube was yellow.

Blue: $\frac{36}{100}$ of the time the top face of the cube was blue.

It looks like about half the time the top face was yellow. Since there are six faces on each cube, then I think three are yellow.

NEXT PAGE



So there are three faces left. Since there are about twice as many blue as red, I think there are two blue faces and one red.

You know, since the total number of rolls is 100, maybe they wanted me to use percents for this problem. If the total rolls were not 100 then I would have used the fraction and my calculator to get the percent.

Let's try this. It's more precise.

19%	0.19 times 6 faces = 1.14 faces red
45%	0.45 times 6 faces = 2.7 faces yellow
36%	0.36 times 6 faces = 2.16 faces blue.

3

That's weird. I can't have a fractional part of a face. So I'll round to the nearest whole number.

1.14 > 1 face red
2.7 > 3 faces yellow
2.16 > 2 faces blue

The number of faces adds to six. That's good since I need six faces. That finishes that part of the problem.

Now on to the last paragraph. Finally Danielle is back. She rolled the cube 75 times. I'll use all the work I already did to help me make this prediction.

Since three of the six faces are yellow, $\frac{1}{2}$ of the time the top face will be yellow. $\frac{1}{2}$ of 75 is 37.5 yellow.

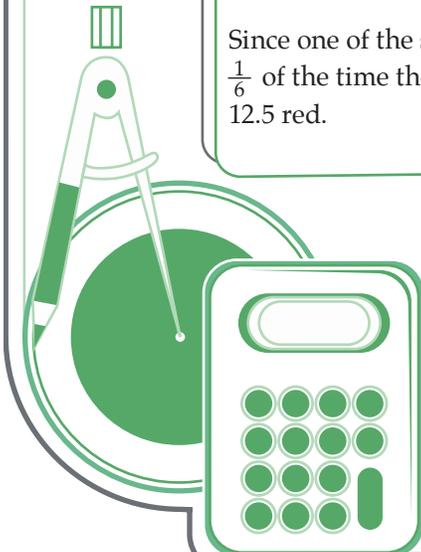
Since two of the six faces are blue, $\frac{1}{3}$ of the time the top face will be blue. $\frac{1}{3}$ of 75 is 25 blue.

Since one of the six faces are red, $\frac{1}{6}$ of the time the top face will be red. $\frac{1}{6}$ of 75 is 12.5 red.

4

These numbers add up to 75. She could not have rolled 12.5 red. So I'll have to round, but if I round both 37.5 and 12.5 to 38 and 13, I will have 76 rolls. So since this is a prediction, I'll say 37.5 is 37 and 12.5 is 13. That way the total will be 75.

My prediction for Danielle's rolls is approximately 37 yellow, 13 red and 25 blue.

NEXT PAGE 

Here's my response on the test. I'm going to double-check to be sure that I have all the important information and so I get four points!

5

Total Rolls: $10 + 30 + 60 = 100$

Total Reds: $3 + 4 + 12 = 19$

Total Yellows: $4 + 14 + 27 = 45$

Total Blues: $3 + 12 + 21 = 36$

Red sides: $\frac{19}{100} \times 6 \approx 1$

Yellow sides: $\frac{45}{100} \times 6 \approx 3$

Blue sides: $\frac{36}{100} \times 6 \approx 2$

Red = 1

Yellow = 3

Blue = 2

Danielle:

Red sides: $\frac{1}{6} \times 75 = 12.5$

Yellow sides: $\frac{3}{6} \times 75 = 37.5$

Blue sides: $\frac{2}{6} \times 75 = 25$

Red \approx 13 times

Yellow \approx 37 times

Blue \approx 25 times

I got four points on this one!

NEXT PAGE 

Here are some other ways that students showed their work. Can you see the difference in the responses? Extended response questions take time – be sure you take it! And double-check your work. Four points is worth a lot on these tests.

6

Red = 1
Yellow = 3
Blue = 2

	Red up	Yellow up	Blue up
Danielle	13	37	25

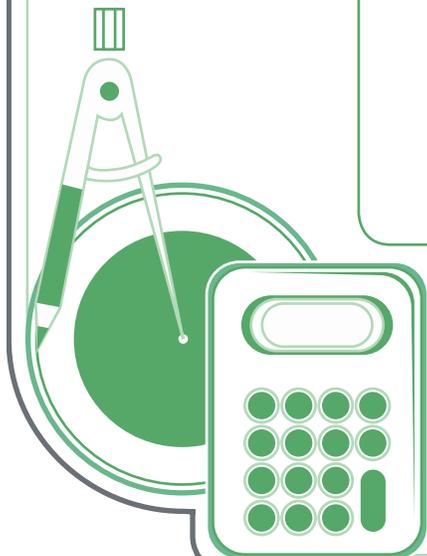
This one got only one point.

7

Red	Yellow	Blue
$\frac{19}{100}$	$\frac{45}{100}$	$\frac{36}{100}$
(about 20%)	(about 45%)	(about 35%)
↓	↓	↓
		
	6 sides in a cube	
↓	↓	↓
$\frac{19}{100} = \frac{1.14}{6}$	$\frac{45}{100} = \frac{2.7}{6}$	$\frac{36}{100} = \frac{2.16}{6}$
$\approx \frac{1}{6}$	$\approx \frac{3}{6}$	$\approx \frac{2}{6}$
1 Red side	3 Yellow sides	2 Blue sides

This one got two points.

NEXT PAGE 



8

The prediction is that only one face is red, two are blue and three are yellow because of the percentages of the cube when it was rolled.

If Danielle rolls the cube 75 times then I predict that her results will be as follows:

Name	# of rolls	Red	Yellow	Blue
Danielle	75	16	33	26

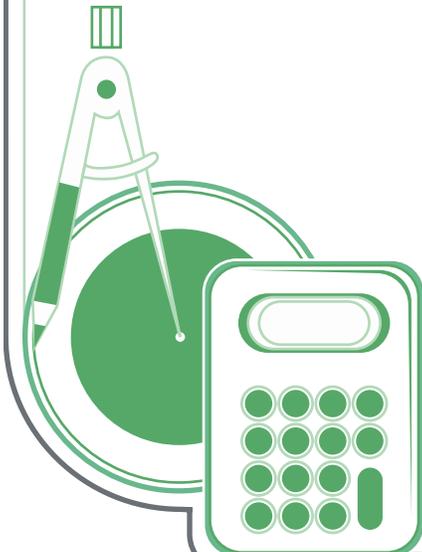
I figured this because the average percentage of each color and their roles were:

Red: 21%
Yellow: 44%
Blue: 35%

$75 \times$ (the percentage as a decimal) \approx my prediction for 75 rolls

Red: $75 \times (.21) \approx 16$
Yellow: $75 \times (.44) \approx 33$
Blue: $75 \times (.35) \approx 26$

This one got three points.



1. This question involved several steps. Where you able to follow Jason's logic in working through the problem? What steps were confusing to you? Would you have done it differently?

2. Look at the other examples of student responses. What did the student who received two points do incorrectly in responding to this question?

Standard: Patterns, Function and Algebra

Benchmark E: Analyze and compare functions and their graphs using attributes, such as rates of change, intercepts and zeros.

Standard: Mathematical Processes

Benchmark C: Translate information from one representation (words, table, graph or equation) to another representation of a relation or function.

Benchmark G: Write clearly and coherently about mathematical thinking and ideas.

20. To solve a math problem, Penny is graphing the equations $y = x^2$ and $y = x^2 + 1$. To graph the equations, she created the tables shown below.

$y = x^2$

x	y
-3	
-2	
-1	
0	
1	
2	
3	

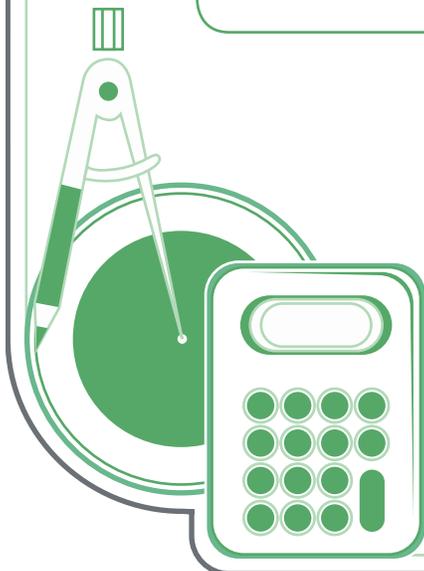
$y = x^2 + 1$

x	y
-3	
-2	
-1	
0	
1	
2	
3	

In your **Answer Document**, copy the tables above and find the y -values for each of the given x -values.

Use the grid provided to graph each equation using the pairs of x - and y -values.

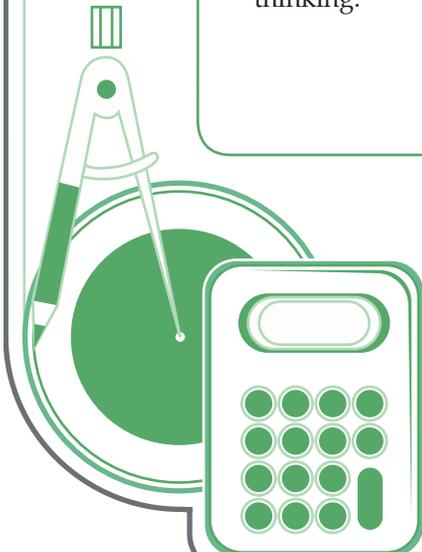
Based on the graphs you have completed, analyze how the graphs differ and write a hypothesis to describe how adding a number to x^2 changes the graph of x^2 .



Use the Talking Points to help you create your map.

Talking Points

- Read the problem very carefully. You may need to read it more than once.
- Read all information carefully, that includes text and diagrams.
- Circle the task(s) you are asked to do.
- Underline important information that will help you complete the task.
- This question requires several types of thinking. Review the performance verbs to be sure that you understand all that you will have to do.
- Choose a method for doing each task that makes sense to you.
- Is your result reasonable?
- Have you completely finished the each task?
- Write your response so that anyone would be able to understand your method and your thinking.



1. What steps did you take in thinking through this problem?

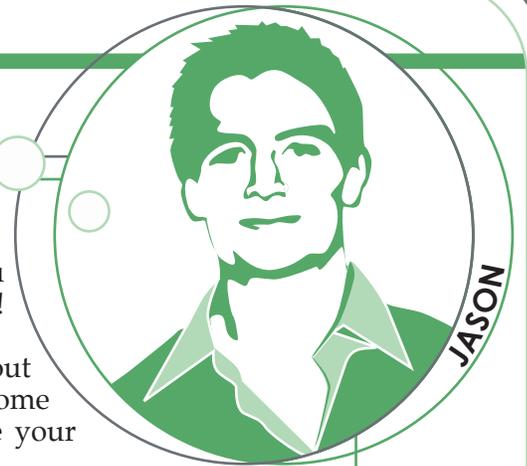
2. This problem required you to complete three different tasks. What were they?

3. What was the most difficult?

4. Take some time to compare your response to those in the reference section. What score would you give yourself?

STUDY

INTRODUCTION MATHEMATICS



How did the mind-mapping strategy work for you? I know it was hard work, but if you have reached this point, then I know you kept going!

Hopefully, you feel that you have learned more about the way you think through test questions and have some new ways to approach questions when you retake your math OGT.

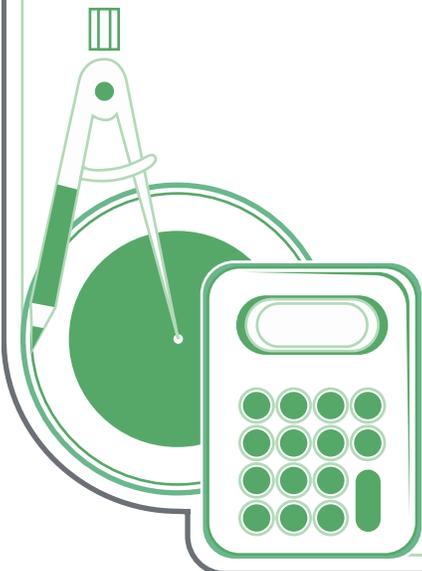
This next stage is about reflection and studying your results. There are two steps in the STUDY stage:

Step 6: Think about your thinking by completing the reflection worksheet.

Step 7: Set a meeting with your coach and review your progress.

To help you with Step 6, you will need your reflection question responses from your mind mapping and your standards and benchmarks worksheet from your planning. These items will help you to complete the reflection worksheet that is included in this section.

Respond to each of the sections on the reflection worksheet before setting up a meeting with your coach to review your progress (Step 7).



STUDY

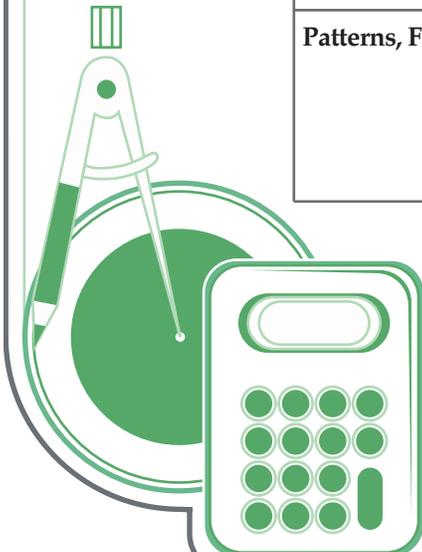
REFLECTION WORKSHEET MATHEMATICS

Reflection Worksheet for Mathematics Guide

Use the spaces below to identify content that is difficult for you.

- Review the questions in the DO section and identify specific questions that were difficult to answer. Check the benchmark related to the question, and indicate below the topics that you still need to study.
- Check the standards and benchmarks worksheet (from the PLAN section) and identify other benchmarks that you are unsure of.

Standards to Review:	Topics for Study:
Number, Number Sense, and Operations	(Example: finding square roots and numbers with integer exponents.)
Measurement	
Geometry and Spatial Sense	(Example: Use coordinate geometry to represent and examine the properties of geometric figures.)
Data Analysis and Probability	
Patterns, Functions and Algebra	



STUDY

REFLECTION WORKSHEET MATHEMATICS

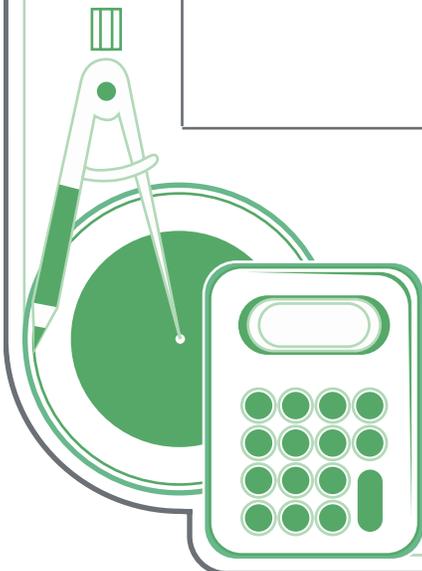
Reflection Worksheet for Mathematics Guide

(continued)

Use the spaces below to describe how you think through and respond to the different types of questions on the OGT.

- What strategies help you work through each of these types of questions?
- What type(s) of questions seem to be the most difficult for you to think through?

Multiple Choice	Short Answer	Extended Response
(Example: The talking points worked well.)	(Example: Highlighting what the question is asking made answering the question easier.)	(Example: Mind mapping before writing the response helped create a better answer.)



STUDY

REFLECTION WORKSHEET MATHEMATICS

Reflection Worksheet for Mathematics Guide

(continued)

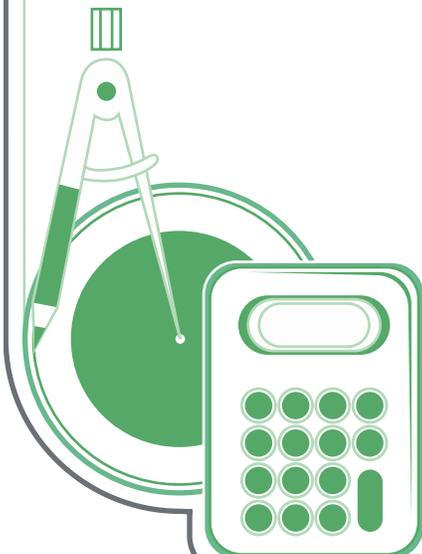
How did the self-talking and mind-mapping strategy work for you?

- Did the strategy help you think through the questions more completely?
- Did you find that self-talking helped you work through your thinking?
- What type of mind maps did you use most often?

What worked for you?	What didn't work for you?

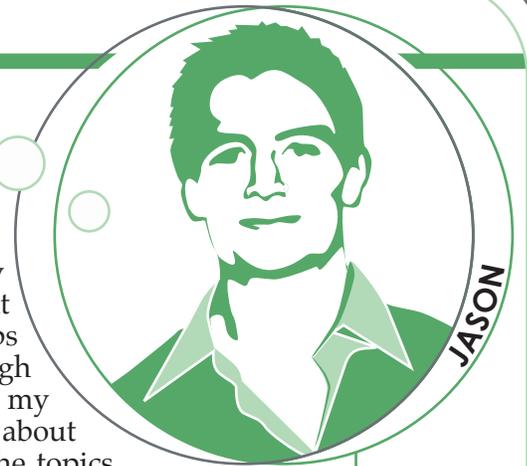
Brainstorm a list of actions that you might take to prepare yourself for retaking the math test. List resources that might help you prepare to be successful.

Action Steps to take ...	Resources that would help ...
(Example: Find a study buddy; set up tutoring sessions with a teacher.)	(Example: Use the Web sites listed in the Reference section to copy and practice other test questions.)



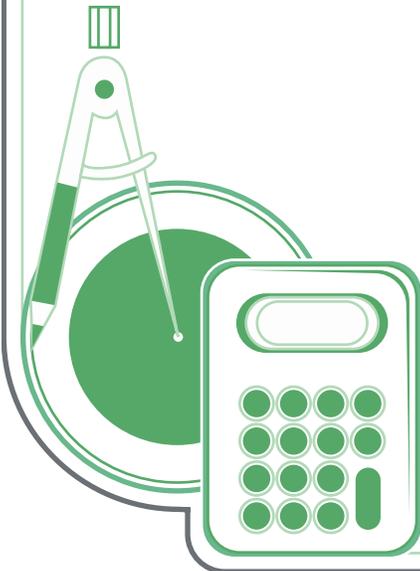
STUDY

MATHEMATICS



After I completed my reflection worksheet, I set up a meeting with my coach to review my progress. This meeting took about an hour. We spent about half of that time looking over my mind maps and I shared what I had learned about myself through the reflection responses. She was impressed with my reflection worksheet, because I took the time to think about what I had learned. I had also identified most of the topics that I need to work on.

She helped me think of some additional ideas that I could use to develop a plan of action for preparing for the OGT. She found some resources for me on the Internet to use. And we talked about how we could use my study hall and special help periods at school to plan for extra practice and review. We were ready to build an action plan – the last stage in the PDSA.



ACT

INTRODUCTION MATHEMATICS



One last task to complete, but it's a very big one! Based upon your strengths and needs, it's time to develop an action plan for retaking the math OGT.

There are two steps in this stage:

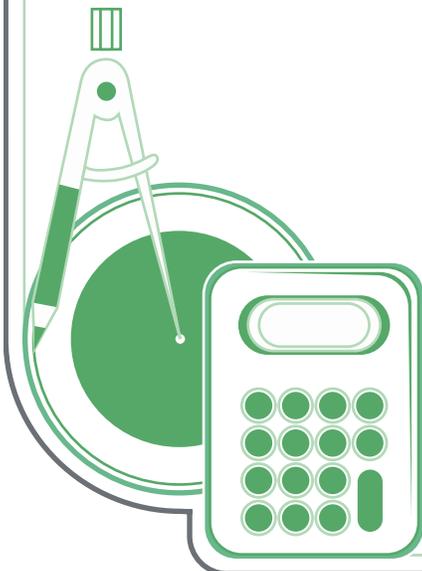
Step 8: Develop an action plan.

Step 9: Tackle your plan!

Your coach will help you write your plan. I'm going to share with you what Ms. Bracey and I worked out for my plan.

After we examined my work with mind mapping and discussed what standards and benchmarks I still needed to study further, we began to put together an action plan.

Here's what we came up with for me ...



ACT

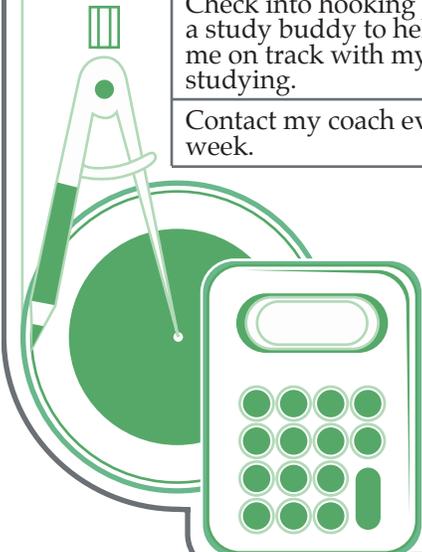
ACTION PLANNING MATHEMATICS

Action Planning for Mathematics OGT Retake

My personal goals

1. Meet the state requirement for graduation by obtaining a proficient rating on my Math OGT.
2. Stick to my Action Plan.
3. Contact my coach if I run into any trouble while working with my plan.

What I will do ...	When I will do it ...	Help I will need ...
Meet with my math teacher to see about tutoring sessions for the standards and benchmarks I need help with. Ask for materials to help me study.	September 2 Set up a meeting to discuss tutoring opportunities.	-Mrs. Price (teacher) -My Standards and Benchmarks Worksheet and my Reflection Worksheet -Materials recommended
Sign up for tutoring or extra help sessions at the high school.	As soon as possible and participate in all sessions until time for the retake.	-Parents (for transportation) -Ms. Bracey (Math intervention teacher)
Study 45-60 minutes extra every weekday (either through tutoring, extra help session at school, or on my own by practicing test items copied from the Ohio Department of Education Web site for the OGT). Use mind-mapping strategy in my study sessions. Log my progress in a study journal.	Every weekday – Monday through Friday	-Personal commitment -Coach's support and encouragement -Study journal
Check out other resources on the Ohio Department of Education Student Web site for other practice options. Build a plan to use these resources during my study periods.	Second week in September	-Ms. Bracey -Web site
Check into hooking up with a study buddy to help keep me on track with my daily studying.	Second week in September	-Mrs. Price -Ms. Bracey -Guidance Counselor
Contact my coach every week.	Every Wednesday morning before school	-My coach (Ms. Bracey)



ACT

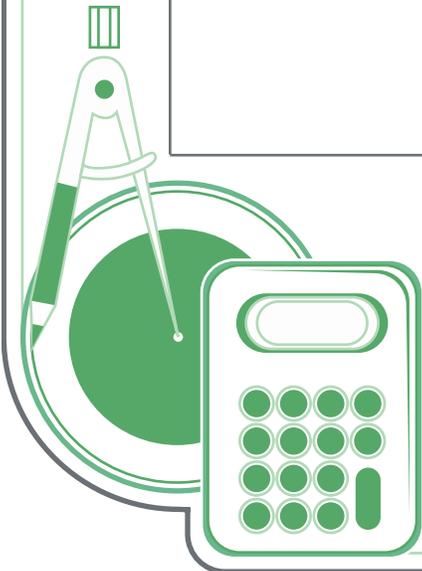
ACTION PLANNING MATHEMATICS

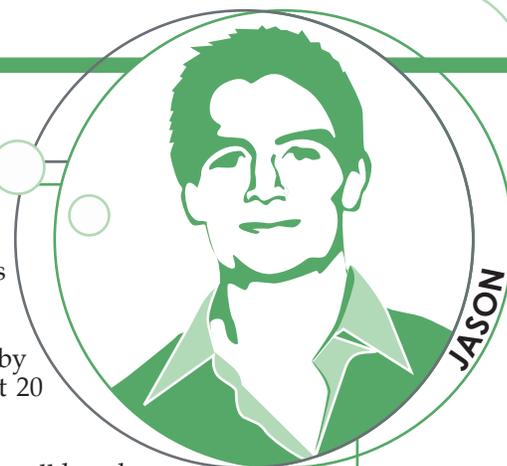
Action Planning for Mathematics OGT Retake

**My
personal
goals**

Here's a blank action planning template for you to fill out. After you develop it, make a copy for your coach and plan to keep him or her informed of the progress you are making.

What I will do ...	When I will do it ...	Help I will need ...





I better read this problem about three times before I start!

The box has a square base that is 20 inches by 20 inches. It will stick out from the wall about 20 inches.

The side of the box that will actually touch the wall has the dimensions 9 inches high by 20 inches wide.

But, I see that the back wall is measured in feet, so I think I will change those measures to inches. Since there are 12 inches in each foot, there will be 8 groups of 12 inches in the height of the back wall and 12 groups of 12 inches for the width of the back wall. That makes the height $8 \times 12 = 96$ inches and the width $12 \times 12 = 144$ inches.

1

I'll look at the height first. The wall is 96 inches and each box is 9 inches. Ten of the boxes would be 90 inches high and that extra 6 inches is not enough for another box.

2

So I can stack the boxes 10 high.

3

Now, for the width. The wall is 144 inches and each box is 20 inches. Seven of the boxes would be 140 inches. That is all that will fit.

So I can stack 7 boxes across

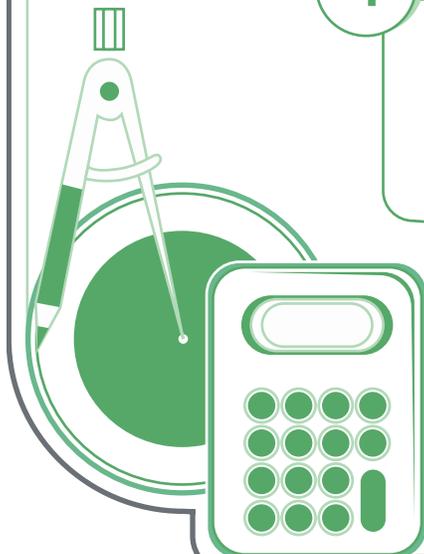
4

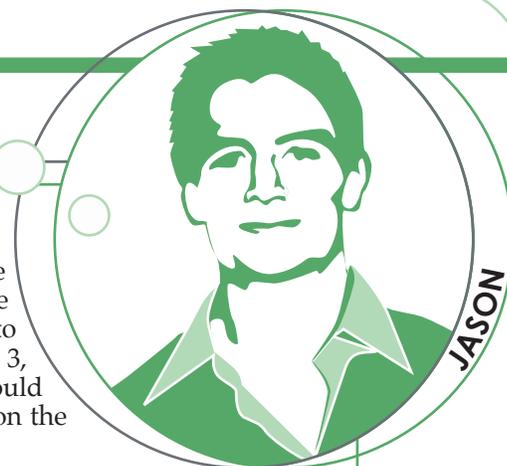
Since there are 7 boxes across and 10 high that means that 70 boxes would fit ($7 \times 10 = 70$).

I see 70 is one of the choices. It appears that Choice **B** is correct.

But maximum means MOST and Choice **A**, 200, is more. But there is no way to stack an additional 130 boxes in the little bit of space that is left over, no matter how you turn the boxes.

Therefore the only reasonable choice is **B**!





After reading the question and looking at the number line, I see that I have to find the distance between some number x and 3. This is going to be difficult. The number x could be less than 3, greater than 3 or equal to 3. That means it could be to the left of 3, or to the right of 3, or be 3 on the number line. Oh, boy!

Since the problem did not tell me a value for x , I can make x any number I want. Let's see, for a number less than 3, I will use $x = -1$; for a number greater than 3, I will use $x = 5$; and I will use $x = 3$. I'll substitute these values into the choices and see how this will turn out.

I have to keep in mind that distance must be positive. It makes no sense for me to be a -9 feet from the wall.

Oh, look at these choices: **A**, **C** and **D** have vertical bars. I remember doing problems with those bars and we called it absolute value. No matter what the value between the bars (positive or negative), when the bars were eliminated, the value was always positive. Let me think about this with examples.

$$|7| = 7$$

$$|-5 + 2| = |-3| = 3$$

$$|-4| = 4$$

$$|5 - 3| = |2| = 2$$

$$|-6 - 3| = |-9| = 9$$

OK, now I am ready to substitute values for x .

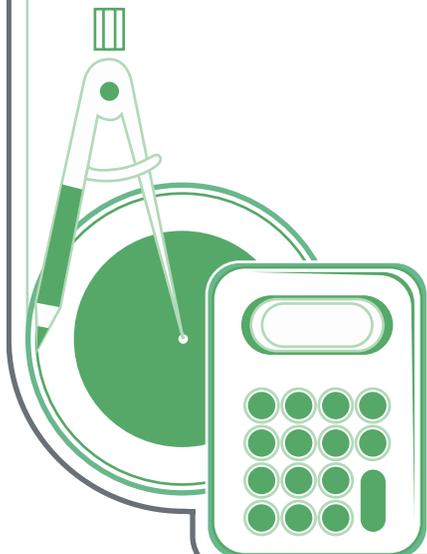
If $x = -1$ then I can see on the number line that the distance from 3 to -1 is 4 units.

If $x = 5$ is the distance from 3 to 5 is 2 units.

If $x = 3$ is the distance from 3 is 0 units, since they are the same number.

That means that when $x = -1$ the distance is 4.
And when $x = 5$ the distance is 2.
And when $x = 3$ the distance is 0.

1



NEXT PAGE

Choice A

$x = -1$ $|-1| = 1$
I'm looking for 4, so this is not it.

$x = 5$ $|5| = 5$
I'm looking for 2; not it.

$x = 3$ $|3| = 3$
I'm looking for 0; not it.

2

That means that
Choice A is not
correct.

Choice B

$x = -1$ $-1 - 3 = -4$
I got -4 and I needed a positive 4.
Distance cannot be negative, so that's
not it for two reasons.

3

The small number
did not work, but the
big number did
work. I don't think
that Choice B is
correct, because ALL
THREE numbers
need to work.

$x = 5$ $5 - 3 = 2$
That works because I got 2.

$x = 3$ $3 - 3 = 0$
That works because I got 0.

4

Choice C

$x = -1$ $|-1| - 3$ $1 - 3 = -2$
No way! Not a 4.

$x = 5$ $|5| - 3$ $5 - 3 = 2$
That's true.

$x = 3$ $|3| - 3$ $3 - 3 = 0$
This is true also.

This is just like
choice B. Choice C is
not correct because
only 2 of the
possibilities are true.

5

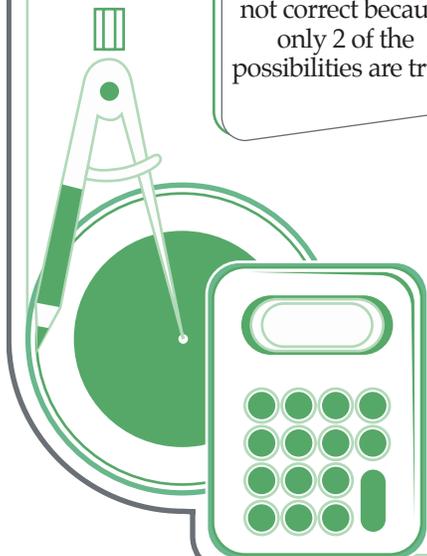
Choice D

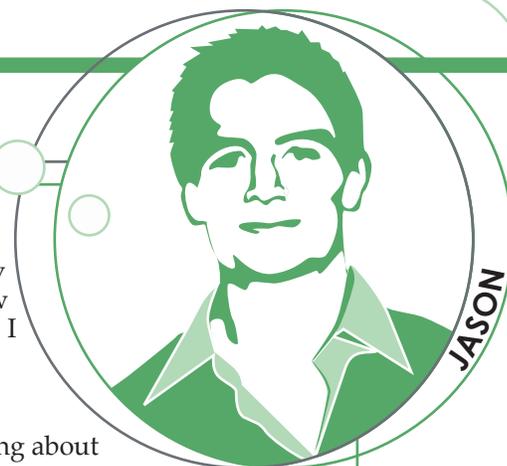
$x = -1$ $|-1 - 3|$ $|-4| = 4$
Yes! The distance is 4, the correct distance.

$x = 5$ $|5 - 3|$ $|2| = 2$
Wow! This one works, too.

$x = 3$ $|3 - 3|$ $|0| = 0$
Three in a row!

So choice D is the
correct solution!





Oh, good. I have been waiting for a box-and-whisker plot! This was one of my favorite things in math class. Let me review what I know about box-and-whiskers before I look at the choices.

There were 100 chickens in the sample. The weight of the chickens is what we are talking about in this problem.

I notice that there are 10 spaces between 0 and 1 therefore each space represents $\frac{1}{10}$ OR 0.1 pound. I'll start at the left and work right on the plot with the endpoint. The smallest chicken weighed about 0.4 pounds.

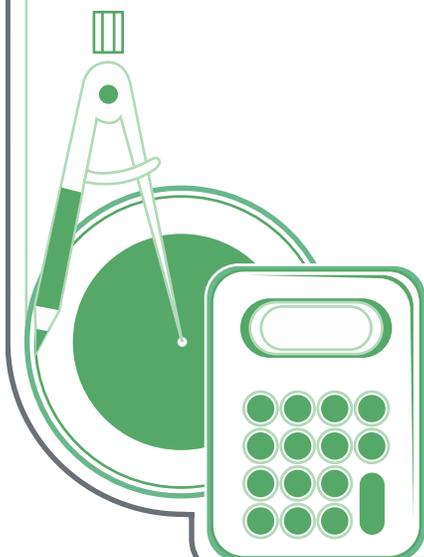
The plot divides the chickens into 4 equal parts. For this plot that means that 25% are represented in the whisker on the left, 25% are in the left side of the box, 25% are in the right side of the box and 25% are in the whisker on the right.

25 % or 25 chickens weigh between 0.4 and 1.2 pounds.
25 % or 25 chickens weigh between 1.2 and 1.9 pounds.
25 % or 25 chickens weigh between 1.9 and 2.3 pounds.
25 % or 25 chickens weigh between 2.3 and 2.4 pounds.

The endpoint of the right side shows that the heaviest chicken weighs 2.4 pounds.

I think I am ready to look at the choices now.

1



NEXT PAGE

Choice A

The range is 3 pounds. Range is the difference between the largest value and the smallest value. I found the largest was 2.4 and the smallest 0.4. The difference is $2.4 - 0.4$ which is 2 pounds.

2

That means that Choice A is not correct.

3

Choice B

The median weight is less than 2 pounds. Median is the middle value. On a box-and-whisker, the middle (median) is marked by the vertical bar in the box. From the graph it looks like the median is 1.9.

Yes!
1.9 is less than 2.
So Choice B looks like a good possibility.

4

Choice C

Twenty-five percent of the chickens weigh less than 1 pound. That left whisker represents 25% of the chickens. Maybe they are all less than one pound, but there might be some that are 1.0 or 1.1 or 1.2 pounds.

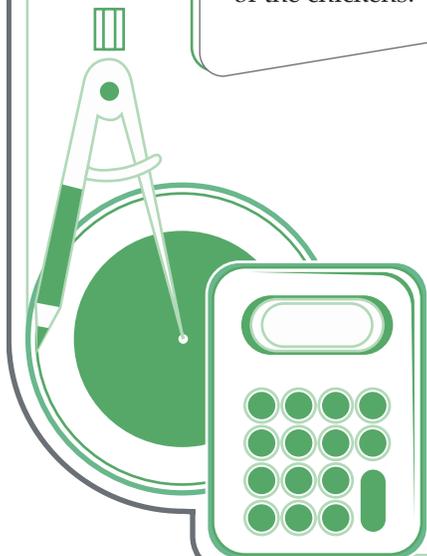
Choice C is not correct; this plot does not tell me the exact weight of each of the chickens.

5

Choice D

Fifty percent of the chickens weigh more than 2 pounds. The top 50% of the chickens are shown in the plot on the right side (the whisker and the right part of the box). The plot shows that 50% of the chickens weigh 1.9 pounds or more.

The winner is ...
Choice B!





I like graphs. Let me see what they say about this graph in the reading.

Quadrilateral. I think "quad" means "4" so I think they are talking about the figure drawn in the upper right hand section of the graph. I see it is marked STUW.

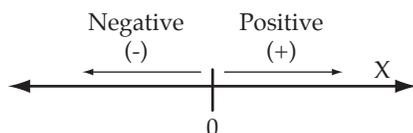
1

It now mentions vertices. I know that is where the sides of the figure meet. These vertices are marked with capital letters and named with "coordinates."

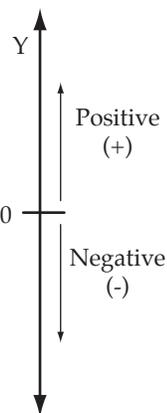
2

The sign of the coordinate tells the direction to move from the origin.

A positive x -coordinate means to go right.
A negative x -coordinate means go left.



A positive y -coordinate means to go up.
A negative y -coordinate means go down.

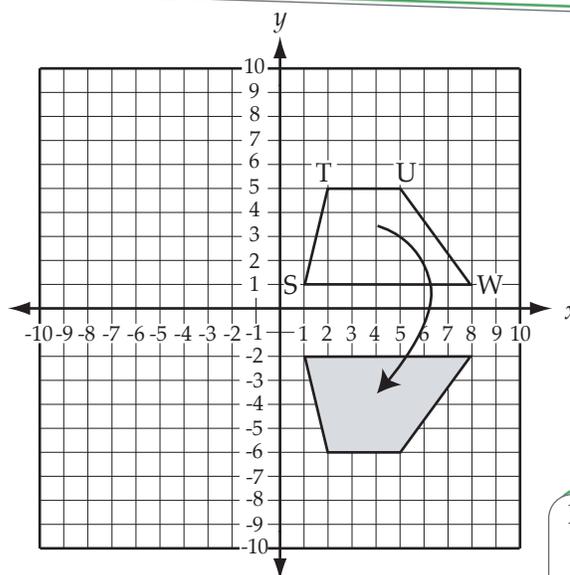


NEXT PAGE

Back to the question, “What are the coordinates of the vertices of quadrilateral STUW when it is reflected over the x -axis?” The x -axis must be the horizontal line marked x . When I think of reflect, I think of a mirror. If the mirror is the x -axis, then the figure will reflect or fold over to the bottom right section of the graph.

I'll just draw the picture of the reflections of each point and see which points match the choices. Now I need to find the names or coordinates of the reflected vertex points. I see that the reflection of point S is 1 unit right and 1 unit down. That would be (1,-1).

3



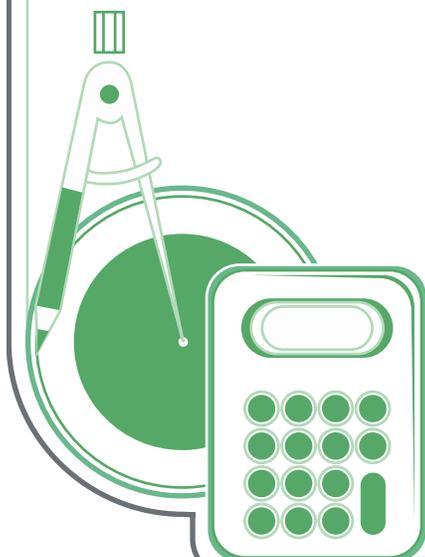
It looks like Choice **D** is correct, but to make sure I'll try another point.

4

The reflection of point T is 2 to the right and 5 down: (2,-5). Again choice **D** is the only choice that has that point. Now I feel more confident.

The reflection of point U is 5 to the right and 5 down (5,-5) and the reflection of point W is 8 right and 1 down (8,-1).

Now I am positive that Choice **D** is the correct answer.





Finally, a problem about shopping. This is something I know something about. I always see the sale signs in the windows at the mall. And I know that tax always adds to the cost of the item.

1

Now, 15% off the regular price means that the \$135 price will get smaller by 15%. I know I have to multiply \$135 by 15%, but I need to put in the decimal 0.15 in the calculator to get the discount.

2

$$\$135 \times 0.15 = \$20.25$$

\$20.25 is the discount.

3

To find the sale price, I need to subtract the discount from the regular price.

$$\$135 - \$20.25 = \$114.75$$

\$114.75 is the sale price.

4

Wow, look at these choices: when I add the tax, the total must be more than \$114.75.

C and D cannot be correct.

5

It looks like Choice A is too big. It is even more than the regular price.

Choice A cannot be correct.

6

I'll calculate the tax to make sure that Choice B is the correct one.
5% of \$114.75 can be calculated by $\$114.75 \times 0.05 = \5.74 tax.
The final price is the sale price plus tax.
 $\$114.75 + \$5.74 = \$120.49$

I was right! Choice B is the correct answer.





I see that in the table the x -value is first and the y -value is second, but in the equations given as possible answers, the y is first and the x is second.

I think I'll just try Choice A and see if it works. Good thing I have a calculator to help me with this.

1

Choice A

$y = x - 1$
 $-1 = 0 - 1$ That works!
 $0 = 1 - 1$ That works!
 $3 = 2 - 1$ That does not work.

Try one more just to make sure.
 $8 = 3 - 1$ NO!

Good thing I did not stop after one try. I could have thought this was the correct choice.

Choice A is not correct.

2

Choice B

$y = x + 19$
 $-1 = 0 + 19$
 Not even close!

I don't need to try another one because I already found one that does not work.

Choice B is not correct.

3

Choice C

$y = x^2 - 1$
 $-1 = 0^2 - 1$
 Maybe this is it!
 $0 = 1^2 - 1$
 Yes, I might be onto something.
 $3 = 2^2 - 1$
 Lookin' good.
 $8 = 3^2 - 1$
 Yes!
 $15 = 4^2 - 1$
 This is it!

Choice C is correct.

4

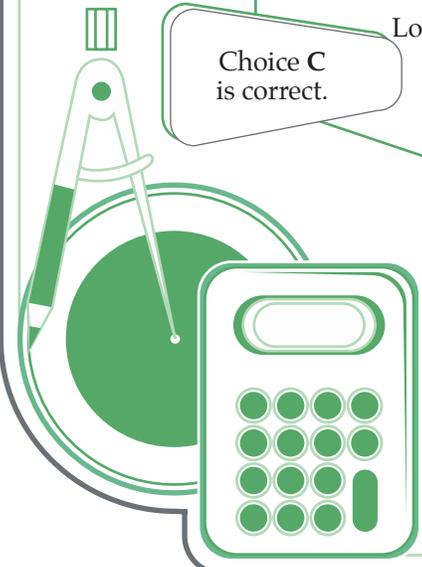
Choice D

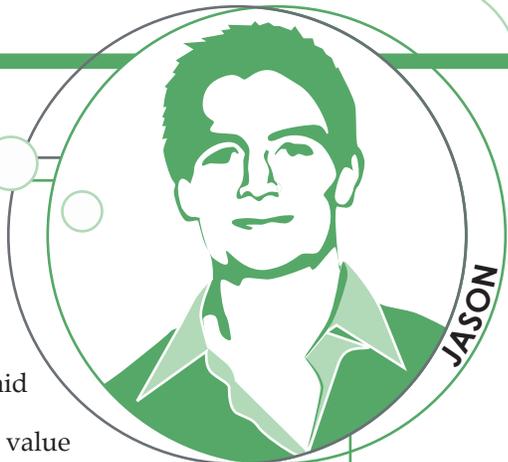
Maybe I should check Choice D, just to be sure. When I look at Choice D it reminds me that I must do powers (exponents) first (I'll use parentheses) and then multiplication and finally the subtraction.

$y = 2x^2 - 5$
 $-1 = 2(0^2) - 5$
 No, this is not it!

OK, I'm satisfied with Choice C. The mapping has convinced me!

5





I'll have to pay close attention here because this is a short-answer problem and I will have to explain it well. I'll start by reading the problem and underlining the important facts.

In the first sentence I'll underline: Monique paid \$5.50, and the value is now \$17.00.
In the second sentence: Sean paid \$12.00 and the value is now is \$27.00.

It seems that the information that Monique bought the card two years ago and that she is Sean's sister is not important for me to solve this problem.

1

Let's look at the next part: Sean said that his card has increased more than Monique's. Well, I think I can do that. Monique's card increased from \$5.50 to \$17, so $\$17.00 - \$5.50 = \$11.50$.

Sean's card increased from \$12 to \$27, so $\$27 - \12 is \$15.

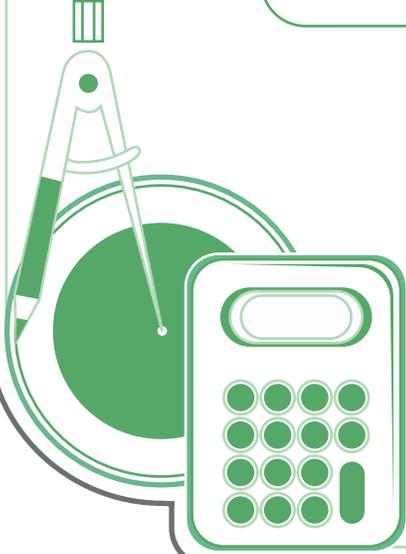
Yes, Sean is correct!

2

What do I have to do next? Monique says that her card has increased more than Sean's card. How can that be? I already used subtraction to compare, what else can I do? If I bought a baseball card I would like it to double in value. I wonder if these doubled.

3

Name	Original Price	Price doubled	Price tripled
Monique	\$5.50	\$11.00	\$16.50
Sean	\$12.00	\$24.00	\$36.00



Wow! Monique's card has more than tripled in value and Sean's card is just a little more than doubled in value. So when I look at the information this way, the value of Monique's baseball card has increased more than Sean's.

I think I am ready to write a pretty good response here! Here goes ...

4

--- NEXT PAGE →

Here's my response. I'm going to double-check to be sure that I have all the important information so I get two points!

Sean's card increased by \$15.00 ($\$27.00 - \12.00) while Monique's card increased by \$11.50 ($\$17.00 - \5.50), supporting Sean's claim.

5

Monique's card more than tripled its value ($\$5.50 \times 3 = \16.50) while Sean's card doubled its value ($\$12.00 \times 2 = \24.00), supporting Monique's claim.

I should get two points on this one!

Here are some other responses written by other students.

Sean's card had increased more in money because he has made \$15 and Monique has only made \$11.50.

6

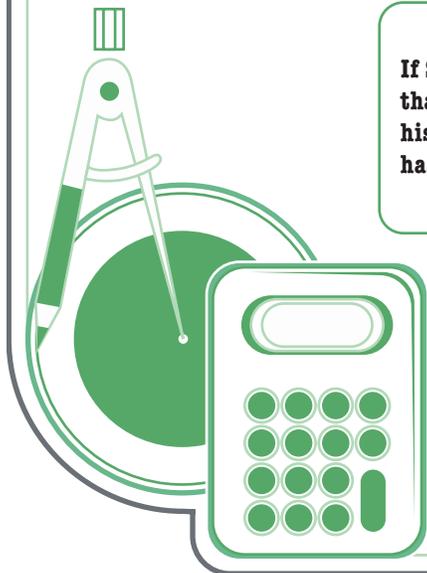
Monique's card has increased more in value because she only spent \$5.50 to buy the card but Sean spent \$20.

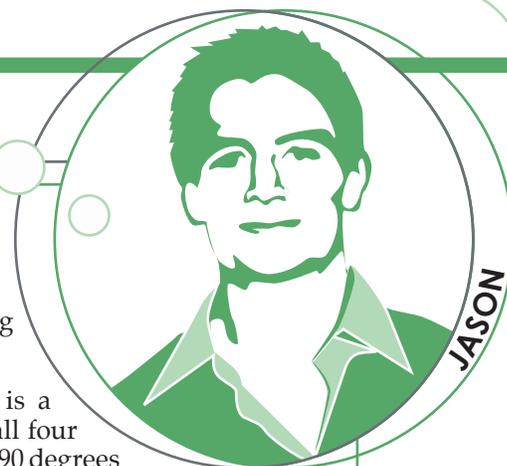
This one got only one point.

If Sean bought his card the same time as Monique, then Sean's card has increased more but if Sean bought his card 1 year before Monique, then Monique's card has increased more.

7

This one got zero points.





I don't know much from this picture.

I'll read the problem until I find something important.

"The floor plan of one room in a bookstore is a **square**..." A square has four congruent sides (all four sides are the same length) and four right angles (90 degrees each).

"... with an **area** ..."

Area means the number of square units that fit in this **square**.

".... of 576 square feet."

So that tells me there are 576 square feet that fit into this **square**.

The second sentence: "Part of this room is taken up by a café."

That's interesting. I can see the cafe in the diagram and it's a triangle.

Finally, "The border of the café runs from the **midpoints** of the 2 **adjacent** walls." **Midpoints** are easy. That is the point that divides the segment into 2 congruent (or equal) segments. I see they marked this on the diagram with little tick marks. I'm not sure what **adjacent** means but they put the tick marks on the bottom and the right side of the square, so it must mean sides that are next to each other.

What do I have to do with this information? Oh there is the question under the diagram! "Find the **area**, in square feet, of the café."

1

Before I can find the area of the café, I need to know the dimensions of the square and the triangle. I'll have to start with the square because they gave me the area of the square.

2

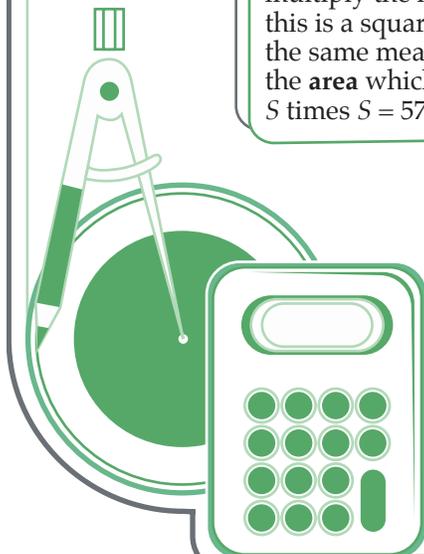
To find the **area of the square** I need to multiply the length times the width (since this is a square, the length and the width are the same measure). So **side times side** equals the **area** which is 576 square feet or $S \text{ times } S = 576$.

3

So I am trying to find a number multiplied by itself which will give me 576.

I know that 10 times 10 is 100 => Too small.
I'll use my calculator to test some more numbers.
20 times 20 is 400 => Still too small.
30 times 30 is 900 => Wow! That is way too big!
25 times 25 is 625 => Pretty close, but too big.
24 times 24 is 576. Bingo!
That means that each side of the big square is 24 feet long. I'll mark that on my diagram.

NEXT PAGE 



REFERENCE Mathematics OGT 2004
Item 26

Now that I have done that I can see that sides marked with the midpoints are divided into two equal parts of 12 feet each. So the café (a right triangle) has a length of 12 feet and a width of 12 feet.

I don't remember the formula for the area of a triangle. Luckily there is a formula paper with this test. Let's see, the area formula is $A = \frac{1}{2}bh$. I remember the b stands for base and the h stands for the height. And both b and h are 12 feet.

4

$$A = \frac{1}{2}bh$$

$$A = \frac{1}{2}(12)(12)$$

$$A = \frac{1}{2}(144)$$

$$A = \frac{1}{2} \text{ square feet}$$

I think I'm ready to write my response to this question.

The area of the bookstore is 576 square feet

The bookstore is square so the length of each side is

$$\sqrt{576} = 24 \text{ feet}$$

$$\frac{24 \text{ feet}}{2} = \text{length of side of café}$$

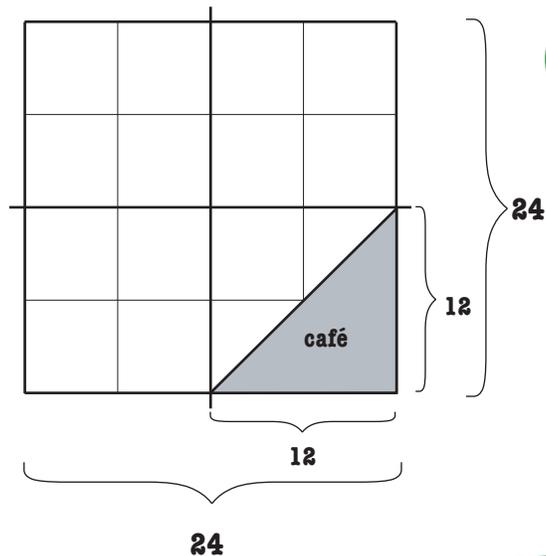
$$12 = \text{length of side of café}$$

$$A = \frac{1}{2}bh$$

$$= \frac{1}{2}(12 \times 12)$$

$$= \frac{1}{2}(144)$$

$$A = 72 \text{ square feet}$$



I got two points on this one!

I'm getting good at these two-pointers. I think it's because I am taking my time to be sure that I have worked through the problem completely, showed my work so that I could refer back to it in writing my response and paid attention to my thinking.

NEXT PAGE

Other students wrote these responses. Can you see the difference in their responses from mine? Be sure to get all the important information into your answer!

The area of the bookstore is 576 square feet, which is 24 X 24.

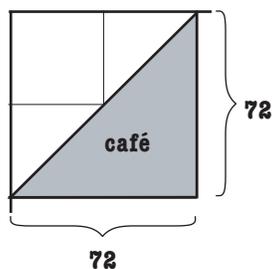
Half of 24 is 12, so the area of the café is 12 X 12, which is 144 square feet.

6

This one got only one point.

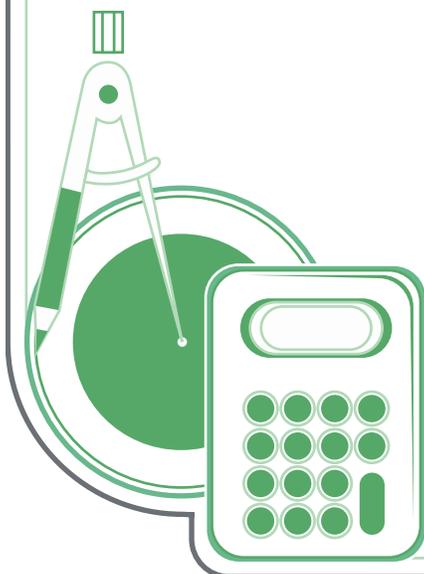
$$\frac{576}{4} = 144$$

area of café is 72 square feet.



7

This one got zero points.





JASON

This problem talks about graphing two equations. I can see the equations above the tables. I notice the y -value is missing in both tables. The first part of the question asks me to copy the table and find those y -values.

So I will copy the tables and fill in the values as I compute them.

1

To find the y -values in the first table I know I have to square the x -value. Squaring means to use that number as a factor twice. Example $(-3)^2$ means (-3) times $(-3) = 9$. Therefore the first y -value in the first table is 9. I will have to square each of the x -values to find the y -values. Oh, I could use the x^2 key on my calculator to do this. I would have to push:



2

I got one table finished.

$y = x^2$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

3

Now on to the second table, $y = x^2 + 1$. The only difference from the first table is the "+1". So, after I square the number, I just add 1. The first y -value of this table is $(-3)^2 + 1 = 10$. It's just one more than the first y -value of the first table. That's nice and easy.

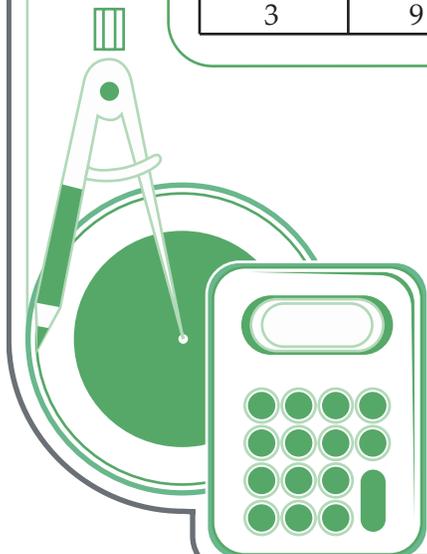
The rest of the y -values will be one more than the respective y -values in the first table.

That takes care of the first part of the problem. At least I can get a point or two by getting this far.

$y = x^2 + 1$

x	y
-3	10
-2	5
-1	2
0	1
1	2
2	5
3	10

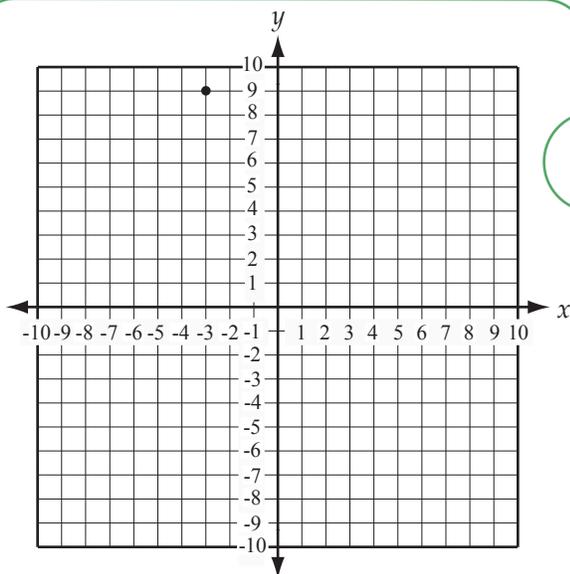
NEXT PAGE



The next part of this asks me to graph both equations. I remember from other graphs that the x -axis is horizontal and the y -axis is vertical. I will draw that on my graph first so I don't forget which is x and y . I have to start at the intersection of the x and y -axes.

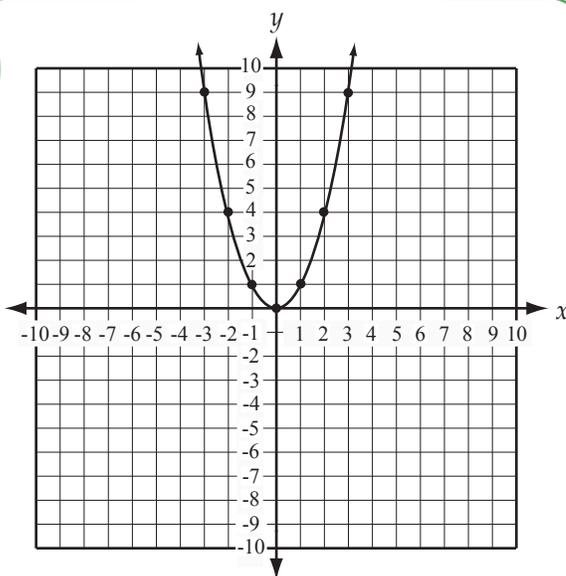
The first point is $(-3,9)$. That means left 3 and up 9.

4

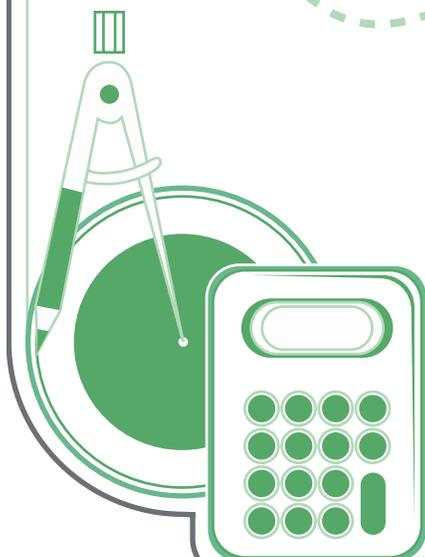


I will do all the points from the first table before I start on the second table. I'll finish the first graph by connecting the points I plotted. My graph looks like a parabola.

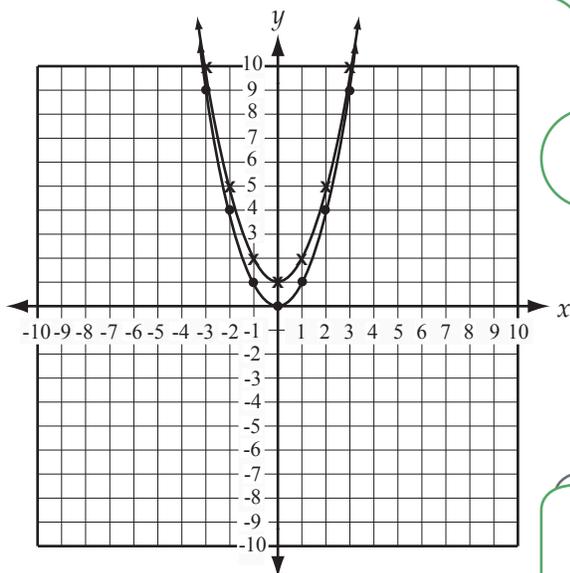
5



NEXT PAGE



Now I need to plot the points from the second table. Somehow I have to mark the points from the second table differently so I don't get confused. Perhaps instead of dots, I'll use a small "x" to show these points.

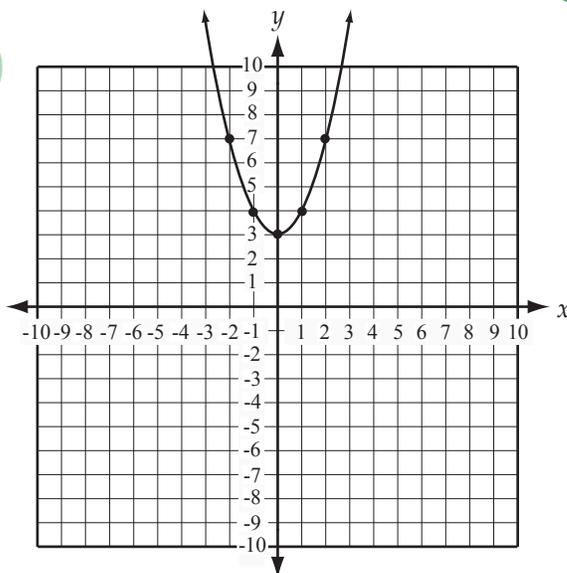


6

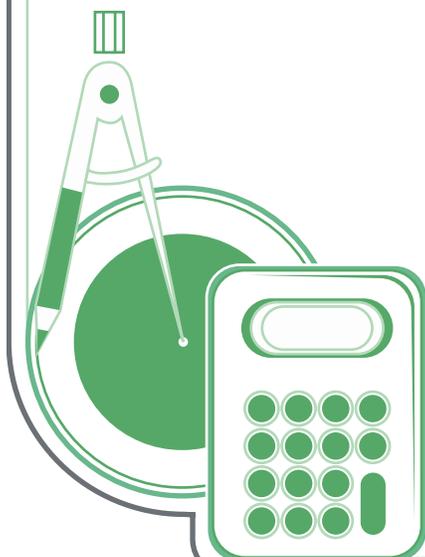
Wow! These graphs look like twins; the second one is always one unit above the first graph for each of the x -values. That makes sense because if I add one to the x^2 it should move the y -value up one.

I wonder what would happen if I added 3 to the x^2 . Oh, I see, the graph would just move up three units. Well that makes me wonder about adding a negative number to x^2 . Then each y -value would decrease and the graph would slide down.

7



NEXT PAGE



So what do I need to do with all this information? They want an hypothesis to describe how adding a number to x^2 changes the graph of x^2 . I see exactly how it changes. When I add a positive number the graph moves up by that number of units and when I add a negative number the graph moves down by the absolute value of that number.

There are three parts that I have to check in my response. First, are my tables correct and complete? Second, did I include everything in my graphs? And lastly, have I explained my hypothesis correctly? Here's what I did. I do believe I have a four-pointer!

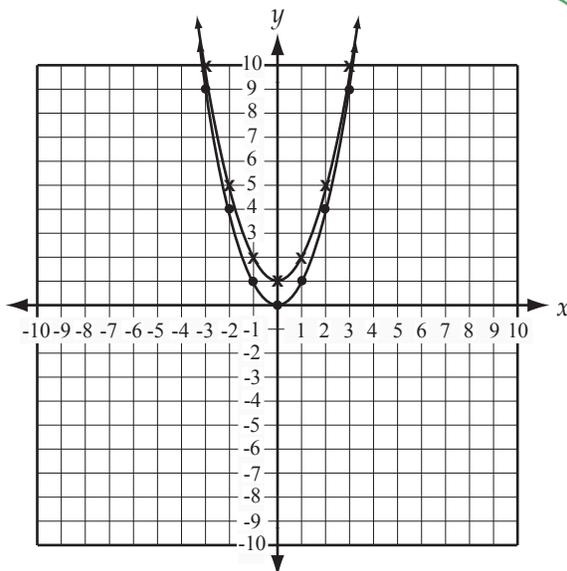
8

$$y = x^2$$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

$$y = x^2 + 1$$

x	y
-3	10
-2	5
-1	2
0	1
1	2
2	5
3	10



The graph of $y = x^2 + 1$ is moved up by 1. It is a vertical change. Adding a number to x^2 makes a vertical shift on the graph.

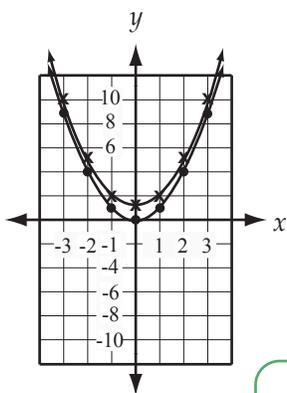
If it was a negative number added, it would have moved down.

NEXT PAGE

Here are some other responses written by other students. What do you notice about the differences in the responses?

9

$y = x^2$		$y = x^2 + 1$	
x	y	x	y
-3	9	-3	10
-2	4	-2	5
-1	1	-1	2
0	0	0	1
1	1	1	2
2	4	2	5
3	9	3	10



The $x^2 + 1$ graph is one greater in each spot than the x^2 parabola.

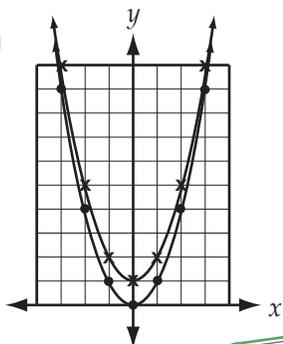
Adding 1 to an x^2 equation makes the parabola rise.

This one got three points.

NEXT PAGE

Adding a number to x^2 will either raise or lower the parabola on the graph.

10



This one got two points.

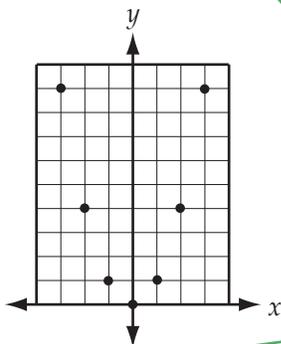
$$y = x^2$$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

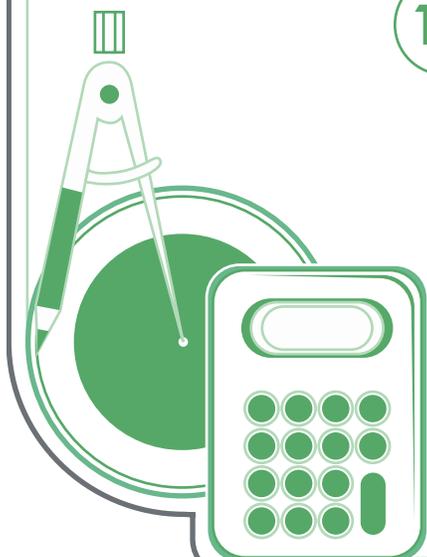
$$y = x^2 + 1$$

x	y
-3	10
-2	5
-1	2
0	1
1	2
2	5
3	10

11



This one got one point.



ADDITIONAL RESOURCES

OGT Resource Web Site for Students Preparing for the OGT

<http://ohio.measinc.com/Content.htm>

This site is designed for students preparing for the OGT. It provides resource materials and practice tests in all five content areas. The student Web site will be periodically updated with additional materials and resources.

OGT Multimedia CD-ROM for Teachers

<http://ohio.measinc.com/teachers/>

Organized by reading, mathematics, writing, science and social studies standards, these CD-ROMs contain information about the OGT, including descriptions of the academic content standards and benchmarks, as well as released OGT multiple-choice test items. The CD-ROMs also contain constructed rubrics for each subject area, dozens of annotated student responses and a practice scoring section where teachers will be able to score constructed responses and compare their scores with the OGT committee scores. All of the standards and benchmarks, multiple-choice and constructed-response items, and annotated constructed response paper will be printable. An additional section of the CD-ROMs will be devoted to instruction, featuring videos of Ohio teachers conducting model lessons with their students. Every year in the fall, ODE plans to distribute updated CD-ROMs with new test items, student responses and model lesson videos to school districts.

ODE Link to Academic Contents Standards

http://www.ode.state.oh.us/families/academic_standards

This site provides a listing of resources available online to families.

ADDITIONAL RESOURCES

A Guide to the New Ohio Graduation Tests for Students and Families

www.ode.state.oh.us/proficiency/PDF/OGTGuide.pdf

The purpose of this guide is to provide students and their families with:

- An overview of what may appear on the OGT in reading, writing, mathematics, science and social studies;
- Sample OGT questions;
- Test-taking tips and activities that will help students prepare for the OGT;
- Frequently asked questions about the OGT;
- A graduation checklist; and
- An OGT Web site.

OGT Sample Tests and Previous OGT Tests

<http://www.ode.state.oh.us/proficiency/OGT>

This site provides both practice tests and previous OGT tests for download. Coaches can use these tests while working to develop their students' skills in mind mapping through questions.

Instructional Management System (IMS)

<http://ims.ode.state.oh.us/ode/ims/>

The Instructional Management System on ODE's Web site is Ohio's Web-based vehicle for communicating the model curricula now aligned with the new academic content standards, to assist Ohio educators in designing and strengthening their lesson plans. With Internet access, educators can view, download and use the content, or customize lesson plans and assessments to meet the needs of individual students.

ADDITIONAL RESOURCES

Books:

Burke, J. (2000). *Reading Reminders, Tools, Tips, and Techniques*. Portsmouth, NH: Boynton/Cook

Cleary, B. A., & Duncan, S. J. (1997). *Tools and Techniques to Inspire Classroom Learning*. Milwaukee, WI: ASQ Quality Press.

Hyerle, D. (2004). *Student Successes with Thinking Maps: School-Based Research, Results, and Models for Achievement Using Visual Tools*. Thousand Oaks, CA: Corwin Press.

Hyerle, D. (1996). *Visual Tools for Constructing Knowledge*. Alexandria, VA: Association for Supervision and Curriculum Development.

Marzano, R.J. (2003). *What Works in Schools: Translating Research into Action*. Alexandria, VA: Association for Supervision and Curriculum Development.