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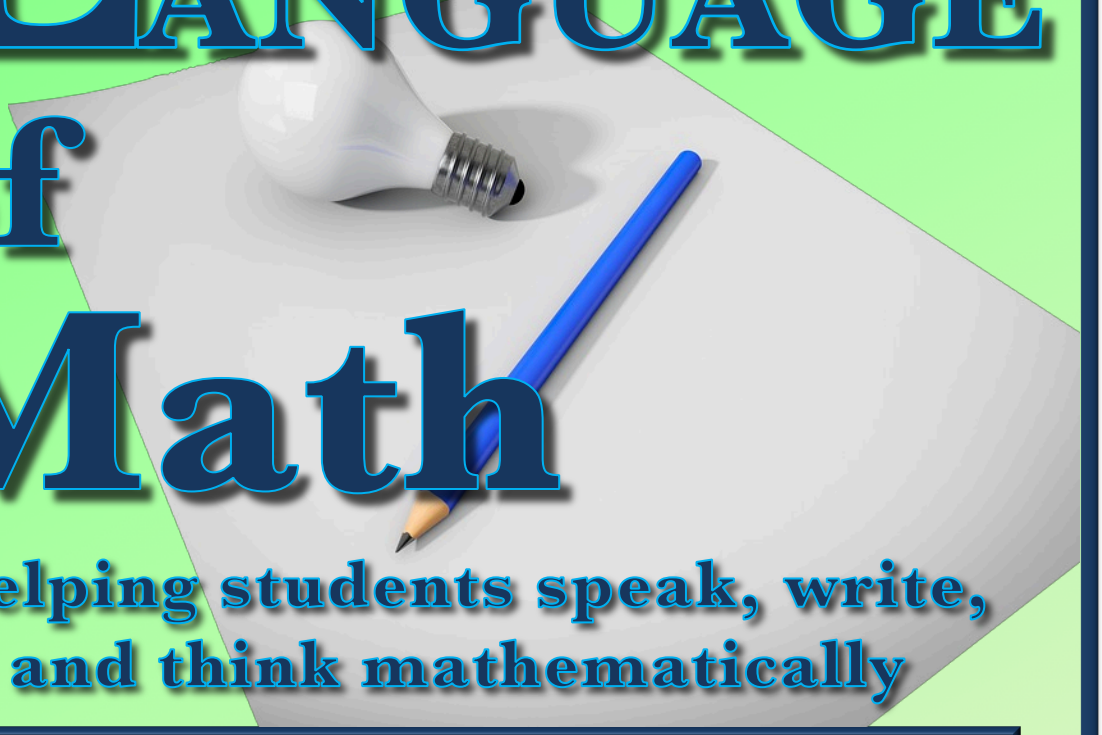
The Language of Math



Helping students speak, write, and think mathematically

By Brad Fulton
Educator of the Year, 2005
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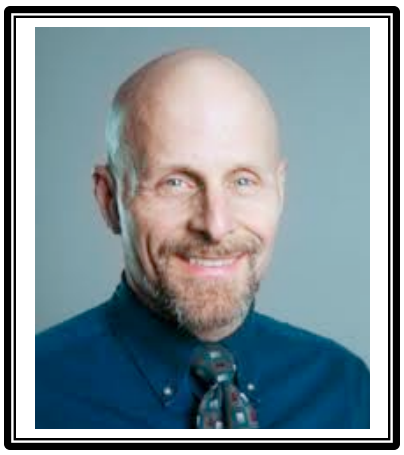

Brad Fulton

Educator of the Year

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- ♦ Educator
- ♦ Author
- ♦ Keynote presenter
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Known throughout the country for motivating and engaging teachers and students, Brad has co-authored over a dozen books that provide easy-to-teach yet mathematically rich activities for busy teachers while teaching full time for over 30 years. In addition, he has co-authored over 40 teacher training manuals full of activities and ideas that help teachers who believe mathematics must be both meaningful and powerful.

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- ♦ California Math Council and NCTM national featured presenter
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The Language of Math

Helping Students Speak, Write, and Think Mathematically

"Building mathematical thinking on a foundation of understanding."

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Brad Fulton and Bill Lombard are mathematics teachers in Redding, California.
They are contributors to the California Math Communicator and are frequent presenters at math conferences throughout the United States.

They have authored and co-authored over a dozen books on the teaching of mathematics. For ordering information, visit us online at:

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Brad and Bill wish to dedicate this book to the many teachers of our nation who love math *almost* as much as they love their students. You are the foundation of our work.

A publication of Teacher to Teacher Press

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Preface

More and more we hear that teachers are discovering the connection between language and mathematics. This is an empowering connection that makes the educational process easier for both the student and the teacher. This book is designed to be a resource for teachers who wish to incorporate more language into the classroom. It is written for elementary, middle school, and high school teachers in regular, gifted, or special education classrooms. This book will serve as a guide to those who want to promote rich mathematical discussions, incorporate math journals, or both.

It is important to take a moment to read the few pages between this preface and the journal prompts. This will ensure that your efforts are successful for both you and the learner. Because we know how valuable your time is, we have kept the pages of instruction to a minimum while maximizing the pages of journal prompts. Try to avoid the temptation to rush into incorporating language without first familiarizing yourself with the advantages of written or oral language, the methods for generating powerful mathematical language, and the strategies for managing written work and class discussion.

Our experience has shown that your efforts will be rewarded if you follow the simple guidelines we present. We have tested the ideas presented in this book, as have many other teachers at various grade levels and teaching assignments. Even though we have incorporated language-based instruction using the strategies shown in this book, we encourage you to be creative and free in modifying these suggestions to suit your needs and goals. Don't be afraid to experiment.

In the margins of the book we have often inserted quotes from research and articles about mathematics. Quotes by Larry Bushman, Margaret E. McIntosh, Karen S. Norwood, and Glenda Carter were taken from *Activities for Junior High School and Middle School Mathematics*, published by the National Council of the Teachers of Mathematics. The quote by Renate Nummela Caine and Geoffrey Caine is taken from *Making Connections: Teaching and the Human Brain*, published by Addison Wesley Innovative Learning Publications. All other quotations were taken from the internet.

We wish to thank all the teachers we have met through the years who have encouraged us to write this book. Your long hours in the classroom and your dedication to your job inspire us each time we meet you. It would be very easy to just stick to the textbook and disregard the benefits of using language with your math students, but teachers tend to do what is best, not what is easiest. We know your students will learn to speak, write, and think mathematically because of your efforts.

Happy teaching,
Bill and Brad

Why Language Matters in the Math Classroom

1 Aside from the fact that the English department will appreciate it, there are numerous good reasons why we should encourage more use of language in our math classrooms. The first is that written and oral language allow us to know what a student is thinking. Quite often when a student misses a math problem, we may not understand what it is that he or she does not understand. In fact, the student may understand the concept perfectly, but has made a casual error. One example would be if we asked a child to find the value of 2^4. The child may write:

$$2^4 = 8$$

Before reading further, take a moment to list what you believe the student may or may not understand about exponents.

At first it may seem that the child does not understand exponents at all. The student may believe that you are supposed to multiply the base by the exponent. Although this is a common misconception, the incorrect answer only tells you one thing—the child wrote the wrong answer. It tells us nothing about the child's level of understanding. However, if we ask the child, "Explain the meaning of 2^4." The child could write:

> *2^4 is an example of an exponent. The two is called the base, and the four is the exponent. It means two multiplied four times. That is 2 x 2 x 2 which is eight.*

We can see that the student has an excellent understanding of what exponents are and how they work along with a familiarity of the vocabulary involved. In fact the only error the child made was a simple miscounting. Had we not asked for a written or oral explanation to this problem, we would have assumed the child needed much more instruction in this concept. Language is the most accurate and reliable assessment.

> *"Answers alone often fail to reveal the nature of a student's thinking, the strategies used in the problem-solving process, or the level of understanding."*
> *Larry Buschman*

Language also takes a student to deeper levels of understanding. We often hear teachers say, "I really understood algebra when I had to teach it." This is true of many concepts in mathematics and other curricular areas. This occurs because using language to explain mathematics to another person requires us to both formalize and refine our understanding of it. The younger the learner or the more the learner struggles in math, the more sophisticated and detailed our teaching and consequently our understanding must be. While in college, I watched a Chinese man tutor students in mathematics. When he tutored calculus, he had no problem getting his point across to the student for they were both fluent in the language of mathematics. When a student needed help

in more basic arithmetic, however, the man's mastery of the English language was not sufficient for the two to communicate.

That is why I often ask my students, "Assume I really don't understand this concept. Pretend I just moved here from another school and math is difficult for me. How would you explain this concept to me so I can understand it?" When I do this, I can see the sophistication of the students' understanding develop. Both oral and written language are effective in increasing depth of understanding. Because it is more formal, written language is more effective than speech, but both are valuable tools for the teacher. If oral language is being used, frequently ask the student for clarification. When the student refers to a quotient as a "thing," ask him or her to be more specific.

"Brain-based education involves ensuring that students process experiences in such a way as to increase the extraction of meaning."
Renate Nummela Caine and Geoffrey Caine

If we do not ask students to use language to verify their understanding, we will be unable to differentiate between those who truly get it, and those who have simply memorized the steps. Research has shown, and our own good intuition as teachers verifies, that if a student lacks conceptual understanding of a subject, all they can do is memorize information. However, memorization of information that lacks meaning is very short term.

It has been said there are three levels of understanding. The first is when you are taught something. The second comes when you have to teach it to another. The deepest level of understanding occurs when you have to try to get the point across to a computer. Computers are the most reluctant of learners in that they don't make any assumptions but do exactly what they are told. Math journals and mathematical discussions provide students with the forum to begin to move through these deeper levels of understanding.

This leads us to the foremost reason for incorporating language in a mathematics class. Whether your brain is in an English class, a history class, an art class, or a math class, it uses language to process the information. Just as computers use an operating system to function, language is the operating system of our brains. Simply stated, to speak or write well is to think well. A prime example can be found in the famous story of Helen Keller. Her thinking was rudimentary and undeveloped until her teacher, Annie Sullivan, put into her hand that first word. In that moment, she had handed Helen language and the ability to think effectively using symbols. Although your brain can do many things well, its primary mode of operation is through language. Language is the DOS of the brain.

"Reading makes a full man. Speaking makes a ready man. Writing makes an exact man."
Francis Bacon

Interestingly, the history of algebra moved through three distinct stages. The first stage could be called the linguistic stage. During this time

period, algebra began to appear in the form of essays by mathematicians. Letters were used to make words, not as symbols for numbers. For example, a mathematician might write a paper explaining why the sum of two odd numbers always had to result in an even number. It might look something like this:

> *All odd numbers follow even numbers. Thus it can be said that an odd number is an even number plus one. If we are to add two odd numbers, we are adding two even numbers and two ones. Since all even numbers represent sets of numbers that can be formed into pairs, both even numbers can be used to create pairs. The two ones can also form a pair. Thus the sum of the two odd numbers will form a set of pairs and is an even number.*

Much later, as in hundreds of years, letters were used to temporarily hold the place of an unknown number. It was always the purpose of the task to find the value of this mysterious letter as when we solve equations.

$$\begin{aligned} 3x + 23 &= 80 \\ 3x + 23 - 23 &= 80 - 23 \\ 3x &= 57 \\ 3x/3 &= 57/3 \\ x &= 19 \end{aligned}$$

It was much later again that letters began to represent variables. Here a letter could be taken to be *any* value. An odd number could be defined by the formula $2n + 1$ where n is any integer.

There is research that suggests that students learn algebra in a sequence that reflects this historical *development*. Notice that the first stage involved the preeminent use of language.

There are other reasons to encourage the use of language in the classroom. One reason is simply to allow students the chance to talk. I have heard many times that the one doing the talking is the one doing the learning. Sometimes I ask the students, to write a note completing this idea: "Something I have wanted to talk to you about for some time is…"

This writing prompt has helped students communicate problems with the curriculum, with the classroom or fellow classmates, or even with myself. Although I don't promise them I can fix all the problems, I believe they were as glad to be listened to as I was to listen. This is not

> *"The development of a student's power to use mathematics…is best accomplished in problem situations in which students have an opportunity to read, write, and discuss ideas in which the use of the language of mathematics becomes natural."*
>
> Margaret E. McIntosh

a mathematical prompt, but it does improve the classroom climate and student management, making my teaching of math go a little easier.

Consider this fact too: many of us put a great deal of emphasis upon assessing homework. Yet how accurately do the answers to a homework assignment reflect what a child knows? Some students use calculators on their homework and some do not. Some parents help their children with the assignment while other students don't seek such help. And of course, some students copy homework. Is this to say we should not grade homework? Not at all. It is worthwhile to give students credit for *completing* homework assignments as this fosters a work ethic. Homework is an opportunity to practice; coaches don't keep score during practice. It may not be a good use of your time to invest hours in correcting the answers under the assumption that it is an accurate assessment. It is probably a much better investment of a teacher's time to look at a writing sample than to look at a homework paper. A subsequent section will deal with ways to do this without creating an additional workload for the teacher.

2 To Write or To Speak?

One of the questions that must be asked is whether to focus on written language or to encourage discussion instead. What are the benefits of each? Should both mediums be used? These are important questions, and the answers will vary from classroom to classroom and from teacher to teacher depending upon your goals. However, let's consider some of the advantages and disadvantages of each.

Because written language is more formal and requires more thought, it fosters deeper understanding than oral language, and if that were the only factor, the choice would be easy. But oral language is easier for the teacher to manage than written language. This is not an insurmountable problem, and a future section will be dedicated to simple ways to read, score, and record written work.

One of the advantages of oral language is that during a discussion, the whole class becomes the audience and can engage in the thinking of the speaker. This is a significant benefit over written work in which the only audience is the teacher. However, even written work can be shared orally. Interestingly, many students who are asked to share their writing with the class will paraphrase their writing. They do this because they see that their written work may not have fully captured their thinking or may have errors. Asking them to read their work word for word will encourage them to edit and improve their writing. Another effective option is to tell them that someone else will read their writing aloud. This will foster much better written work.

> *"Using oral or written communication as a tool with which students can reflect their understanding of mathematics helps them make connections and personalize mathematics concepts."*
>
> *Larry Buschman*

There are other ways to increase the audience of written work. You can ask students to share their writing in small groups. Another option is to have students exchange papers and write a commentary on the first student's writing. A noticeable advantage of the oral language model is that the thinking of one student will often spur another student. This may not happen with written work unless it is shared.

As you can see, both formats have their advantages: oral language boasts a larger audience; written work promotes more sophisticated thinking. You may wish to incorporate both mediums in your classroom, emphasizing one more than the other. Keep in mind the advantages of each by first considering your goals. Do you wish to help students really cement their understanding? A journal write might be the best choice. Are you trying to get students to look at new ways of considering a concept? A discussion would serve the purpose best here. Remember that using oral and written language is like painting a room. Sometimes a roller is used to cover a wider area, and at other times a

fine brush is used for detail work. Oral language addresses a wider audience than the finer quality we get from written work.

Promoting Good Discussions

3

The strategies that a teacher employs to encourage students to *speak* mathematically will do more for improving the quality of mathematical *thinking* than any other single factor. The elements that make this happen are simple habits any teacher can develop. There are a few strategies and a few specific questions that can be easily learned and quickly applied.

Often we teachers have developed the habit of calling a student's name and then asking that student the question. This is the opposite of what is most effective. When a student's name is called, other students can relax since they realize the thinking task does not involve them. We want every student engaged in the thinking process. The best way to do this is to first state the question. Then pause for five seconds. Mentally count these seconds to give every student a chance to begin thinking. During this time, which will seem like an eternity, many hands will go up. Ignore them for now. Then call on a student of your choice (even if that student's hand is not raised) for the answer. After that student has responded, feel free to call on others who had raised their hand. If we get in the habit of calling on only students who raise their hands, we know that discussions will engage only five or six eager students, and those who need to participate in discussions the most will fade quietly into obscurity.

Create a climate that fosters discussion by giving students this valuable think time before calling on a respondent. For more intensive questions, more than five seconds of wait time may be required. I have sometimes told students, "I'm going to give you 60 seconds to think about this question. Don't discuss it with anyone else until the time is up. Then you can discuss it with a partner or with the class." Sometimes I find that after five seconds a student is still not ready. I ask them if they want more time to think about the question. If they do, I simply tell them I'll check back with them, then I pose a different question for the class to consider and provide wait time for it. After that question has been handled, I go back to the original student. My students have learned that it's okay to say, "I don't know. I need more time," but it isn't okay to say, "Um…huh?…What's the question?"

> *"A better understanding of students' thinking in mathematics is needed if mathematics education is to be improved."*
> *Karen S. Norwood and Glenda Carter*

When a student responds, there are some rules to follow which will help develop the climate of mathematical discussion you want to create. Try to avoid repeating what the student says. This inadvertently communicates to other students that it's not necessary to listen to the student—the teacher will repeat it if it is important. A better plan is to ask another student to paraphrase the idea of the first student. This is a

difficult task for most students, but their skill will improve with practice. Also, this request helps other students realize the need to listen attentively to classmates just as they would for the teacher.

I try to call on every student every day in no particular order. My students know that being called upon once does not mean you are finished answering questions. As nearly as possible, I try to make my selections randomly. It is important to do everything possible to ensure that a student is capable of answering the question. For this reason, I try to avoid calling on students merely for the purpose of pointing out that they aren't paying attention. If the question is one that many students may find difficult, I make sure to say something like, "I'm going to ask a difficult question, and I'm interested to know your thoughts about this. Make sure you listen carefully, and ask me for clarification if you need it."

There are a couple of related strategies that are helpful. After a student has offered a suggestion, such as a method of solving a problem, refer to it by the student's name. Then ask if anyone else had a similar idea. For example, you might say, "Did anyone else solve the problem Sarah's way?" This validates Sarah's thinking and also shows who did and did not use such a strategy. Then ask, "Who found a different way to solve the problem?" Suggesting the importance of other ways to solve problems encourages the divergence of thinking that will enhance good discussion and good mathematics. These solutions also can be labeled with the name of the student who offers them. Soon you will notice students referring to Ray's method, or Rashawn's procedure.

> *"Mathematics is the science which uses easy words for hard ideas."*
> *Edward Kasner and James Newman*

To summarize, here are strategies that will foster mathematical discussions in the classroom. This is not an exhaustive list, and you will likely discover more tricks that help your students.

- Use wait time of at least five seconds.
- Call on as many students as possible.
- Avoid repeating a student's words
- Ask fellow students to paraphrase.
- Encourage students to respond to one another instead of only to the teacher.
- Ask for alternate ways to solve problems.
- Label thinking with the name of the student.

Overall the goal is simple: we are trying to communicate respect for a child's thinking in all we say and do. Accomplish this, and students will see that you value their ideas and will feel safe in expressing them.

Quick Questions That Promote Good Discussions

4

If a discussion seems to be bogging down, try these sure-fire questions:

- How did you solve the problem?
- Did anyone else solve the problem this way?
- Can you solve the problem a different way?
- Who solved it a different way?
- Is this problem similar to another you solved?
- Can you write a rule or formula for your problem?
- What patterns do you notice?
- Does that always work?
- How did you know that?
- Why does that work?
- Why is that true?
- Can you think of a situation in which that wouldn't work?
- Why did you decide to do it that way?
- What pattern(s) do you see?
- Do you agree or disagree with what that student said? Why?
- How would you convince me that you are right?
- Does that seem like a reasonable answer?
- Can you paraphrase what that student said?
  - What information is important in this problem?

> *"Mathematics is the only universal language there is, Senator."*
> *Jodie Foster in the film* Contact

Promoting Good Writing

5 Few strategies will do more for eliciting good thinking from students than asking a question in the right way. If a student is told, "Tell me what you know about fractions," the teacher will get vague and disjointed writing that offers little insight to what the student truly knows. Rephrasing the question will result in greatly detailed and high-level thought. Asking such questions is not a difficult task. We simply have to remember the four key elements of a good question. First of all, students are usually not told who their audience is. Most simply think they are writing this for the teacher. No great writer picks up a pen without first considering the **audience**. Thus one of the important elements of a well worded writing prompt is that it offers a unique audience.

Great novels never start with, "Hi. I'm an author and I have something to say." Instead, the writer creates a character or **voice** from which to speak. Although the need for this may not seem apparent at first, it separates creative and stimulating writing from the mundane. Even though the setting of the writing is a mathematics classroom, our goal is to stimulate rich thinking.

Every good writer also chooses an appropriate **format**. Will the writing be a letter? …a note? …an essay? …a paragraph?...a poem? …a list? …an argument? The example used above, "Tell me what you know about fractions," could be improved by saying, "Make two lists, one list of the skills you understand about fractions and one list of the things you want to study more." The teacher will get much more usable information with this type of question.

Lastly, to write well, a writer needs a narrowly focused, **specific topic**. The difference in the responses between general and specific writing prompts is phenomenal. "Tell me what you know about fractions," will never generate the valuable thinking we would receive if we were to say, "Explain how to add two fractions when one is thirds and the other is fourths."

Thus the four components of a good writing prompt are **audience, voice, format, and specific topic**. Simply including these elements in your question is all that is needed to promote effective responses. Look at the following examples and see if you can identify the four elements.

- As a worker bee, write a letter to the queen explaining why the hexagon is the best shape for the hive cells.

"What humans do with the language of mathematics is to describe patterns. Mathematics is an exploratory science that seeks to understand every kind of pattern – patterns that occur in nature, patterns invented by the human mind, and even patterns created by other patterns."

Lynn Steen

- Pretend you are the teacher and write a note to a parent explaining what we are covering in class this week.
- Write a dialog between two students one of whom was absent explaining what we learned in class today.
- Write an instruction manual for young children telling them how to draw a parallelogram.
- Write directions for a blind person telling them how to walk in the shape of an isosceles right triangle.

> *"When students communicate mathematical information, they remember it, understand it, and use it to uncover and find even more information. (Perkins 1992)"*
> *Larry Buschman*

In fact, writing good prompts can be as simple as filling in the blanks. Use the following sentence as a template and substitute items from the list below to create effective prompts. Remember that for the topic, you will simply use whatever you are studying currently, but keep it focused. Ask the student to summarize a specific skill or concept but not the entire unit of study.

Write a (format) from (voice) to (audience) about (specific topic)

Format	Voice	Audience
note	teacher	younger student
paragraph	younger student	sibling
song	older student	the President
list	alien	employee
award	architect	customer
dialogue	parent	boss
speech	principal	teacher
poem	news reporter	the PTA

Obviously these lists could go on and on and the combinations are extensive.

Managing Written Work

6 For many mathematics teachers the biggest hurdle in initiating writing in the classroom is the fear of being buried alive in papers that must be read and scored. Although educators in elementary classrooms may be familiar with the teaching of writing, teachers with more specialized credentials in mathematics are probably not used to this. This section will make the teaching and management of written work simple and easy.

In order for students to take the writing process seriously, they must believe that the teacher takes it seriously. This means they need to know you care about what they have to say. Therefore, it must be monitored. There are various ways to do this.

One way is to have a student share his or her work with the class by reading it aloud. Either the teacher or student can do this. If you have students read, it is important to encourage them to read exactly what they have written instead of paraphrasing it. To do this, you may ask them to read the work to another student first and make any necessary corrections. You also might ask other students to comment on the first student's writing after it has been read. This helps all students to see that writing is valued and will foster attentiveness when other students read aloud. If you choose to have students read their work aloud, make sure you call on a variety of students each day. Especially encourage those who are not likely to volunteer their work. This oral method frees you as the teacher from having to read and grade a stack of papers.

The most important mode for students' writing about mathematics is…as a follow-up to a lesson. Writing is especially effective when it follows hands-on activities, since in those exercises the most active learning takes place.

Learning to write about mathematics
Arithmetic Teacher,
S. Wilde

Obviously another option is that the teacher reads the work of each student. This is more time-consuming for you, but it allows you to hear from every student. The problem is how to get this done in a reasonable amount of time. The problem is compounded if you are a middle school or high school educator who teaches many sections of math. Fortunately there are tricks that will let you get the job done.

When I taught multiple subjects, I found that I was able to read every student's math journal each week. I did this during their reading time. I told them that this was my reading time too. Instead of entering a grade, I read all the week's entries and wrote a comment or two. These comments showed the students that I was interested in their writing. Later when I taught five sections of math each day, I did not have the luxury of that free reading time. Instead I had the *students* reread their week's entries and put a star next to the one that represented their best mathematical thinking. Then I collected their journals and read that

entry. I scored their entry on a one to four scale. Then I multiplied that by the number of entries they had that week. If they wrote in their math journal all five days and the score on their selected work was a four, they got a perfect score of twenty that week. (I also glanced at one other entry. That prevented a student from only taking the writing seriously on one day each week. If I felt they were trying to get by with minimal effort on other days, I graded one of those entries instead of the selected one.) Another option would be to tell the students you will randomly read one of the entries each week. This way, they must write well each day since they don't know which entry you will score.

Sometimes a student is absent and misses an entry. I told my students that they should make up their own journal topics when they are absent. Journals accounted for 20 points out of the 100 points possible in my class each week. You can increase or decrease this total by making each entry worth more or fewer points or by varying the amount of entries each week.

"Clearly explain your expectations to your students, and give them details concerning how their writing will be evaluated. Respond to the students' writing on a frequent basis. Join the students in writing. Address the topic from a teacher's point of view. Share your writing with your students."
Karen S. Norwood and Glenda Carter

Where should the students enter their writing? Some teachers prefer to have students use a spiral notebook. I provided identical writing journals for each student. Since they were all alike, this made them easier to collect and carry around to home or any place I could find a few minutes to grade them. You may want to have students make their own journals. A pair of copy masters for this can be found on pages 111 and 112. Simply make a copy of the cover (page 111) on heavy paper and insert copies of the lined paper (page 112) inside. Students can then decorate the covers as they wish. Younger students seem to take their writing more seriously when they make their own journals. When I used this format, I gave each student a paper clip to use as a marker. This saved me the hassle of searching through page after page to find that week's entries. An option for older students is to run a double-sided copy of pages 113 and 114. Monday's writing goes on the top half of the front; Tuesday's goes on the bottom; Wednesday's goes on the back on top, and Thursday's goes on the bottom of the back. On Friday you can collect them. This way, the entire week's writing is on a single sheet of paper. This is an especially good idea for those of us who teach multiple sections of math. If each day's entry is worth five points, and you multiply that by the four entries, you get a 20-point grade. When I used this method, I found that I could grade a journal in less than a minute. This included writing a comment on each one. I had over 150 students, but I could grade all the journals in about an hour and a half. This was less time than I typically spent correcting homework papers. I believe I can learn more about a student's mathematical thinking and his or her problems by reading a journal than by correcting homework as mentioned earlier. To compensate for the additional workload of reading journals, I quit *correcting* homework. I still gave them a grade for *finishing* it, but I didn't check each answer. As they wrote in their

journals, I circulated around the class to verify that they had completed their homework and had shown the work, and then I gave them a grade for it. My overall time investment was equal to or less than it had been, and I was now incorporating math journals into my curriculum.

Sometimes I read the journals after school in my classroom. Sometimes I read them during the commercials of a movie or a football game. You might make each class turn in their journals on a different day of the week so you are not inundated with the entire set on one day. If the students keep their journals in the classroom, you could read a few each day while they are working. That way you would have fewer to read after school.

The important thing is to find a system that works for you. Feel free to customize these suggestions to fit your goals and your situation. If you have multiple classes, you may wish to begin by trying journals with one class instead of all of them at once. Another option is to commit to using them for a period of time. At the end of that trial period, decide how you can customize the management of journals so they are more effective or manageable. There is no "right" way to do this. The only important factor to keep in mind is that students need to know their writing matters and that you are reading it.

"Mathematics is a language."
Josiah Willard Gibbs

Journal Prompts

7

On the following pages you will find a multitude of journal topics. There are over 200 of these–enough for every day of the school year. Some of these may be more appropriate for your grade level than others, but all of them can serve as a springboard or template for topics you create for your students. Keep in mind that section five showed you how to write effective writing prompts. The journal questions are in two sections: written prompts and more visual questions.

The first section offers prompts in four formats. The first set is composed of prompts about classroom management issues. The second set includes prompts that reflect self-esteem issues. Although these two sets do not pertain strictly to mathematics, they are included here because I have found they keep my classroom healthy and make my teaching job much easier.

The next set of prompts includes questions about math in general, and the third set is made up of questions about specific mathematics concepts.

Although no answer key can be provided for such prompts, I would highly suggest that you try a few of my favorites:

Classroom Management:

1 It's always good to remind students of the rules, and you may be surprised that some students aren't as familiar with the rules as you wish.
7 This prompt gives the students a chance to ask something that has been on their mind for some time.
30 This will help students learn to make thoughtful and courteous suggestions.
31 Of course it also helps them to analyze their own behaviors too.

Self Esteem

1 This is a real eye-opener. Many middle school students have very low perceptions of your feelings for them.
31 Knowing how to *get* an F can help a student avoid one.
35 Everyone needs a compliment now and then.

The second set of prompts is presented as copy masters since they tend to be more visual in nature. They can also be displayed on an interactive board Space is left at the bottom of each master for students to show their work. Prompts of similar math topics are presented consecutively. The first prompt of each group is an introductory prompt and the

"Mathematics is not playing with numbers and doing accounting. Mathematics is dealing with ideas in a creative and yet very precise way."

Przemyslaw Prusinkiewicz, computer scientist

subsequent ones extend the concept to a deeper or more advanced level. Of course the teacher could continue to create similar prompts. Some of these prompts do have specific answers, so a key is provided on pages 109 and 110.

Class Management

1. List ten rules you think are important in this class.
2. How can we help this school?
3. What makes a good class?
4. How do you feel when we have a sub?
5. What makes a good sub?
6. How do you act differently when you have a sub?
7. What question would you like to ask your teacher? Why?
8. What was your most surprising grade in this class? Why?
9. Have you ever been mad at a teacher? What happened?
10. What could parents do to get their child to study more?
11. Why do you think we have "Back to School Night"?
12. From this room of students, who would be in your ideal group of four? Why?
13. What do you think your grade is? Why?
14. Are you satisfied with your grade? Why?
15. What did you do to earn your grade?
16. What one thing could you do to improve your grade the most?
17. How do sports and activities help the school?
18. What do you think is the appropriate attire for teachers and for students?
19. What is a suitable consequence for being tardy in your opinion?
20. What advice would you give to someone new to this class?
21. How is this math class different from others?
22. Which do you prefer, tables or desks? Why?
23. Which do you prefer, to work alone or in groups?
24. What is your favorite activity in this class?
25. What makes a lesson hard?
26. How would you answer a student who says "I don't get it?"
27. What makes a classroom or subject interesting?
28. How important are grades?
29. What did you think of the test? How do you think you did? Why?
30. What qualities are important in a teacher?
31. What qualities are important in a student?
32. Why do I have you write in a math journal?
33. When do you feel you need a calculator?

"One merit of mathematics few will deny: it says more in fewer words than any other science."

David Eugene Smith

Self Esteem/General

1. What do you think I think of you?
2. How will you change your study habits this grading period?
3. How can you help someone in this class?
4. How can you help your school?
5. How can you help yourself be a better student?
6. What do you like most about this class?
7. What is your number one suggestion for this class?
8. Has a lie ever helped you? How?
9. Why are you thankful?
10. If you can have anyone at your Thanksgiving table, who would you have and why?
11. What is one thing you want to do for your family?
12. What is the Christmas Spirit?
13. If you could listen to any speaker, who would it be, and why?
14. What does it mean to be smart?
15. Which is more important in school, to be smart or to be a hard worker?
16. How do you control your temper?
17. How can you tell if a teacher likes you?
18. How have you grown this year?
19. When do you consider yourself "grown-up"?
20. What is your favorite subject? Why?
21. What is most difficult about being your age?
22. Name ten things you did over the holidays and rank them from least favorite to most favorite.
23. Rank ten events from your life that were very important to you. Begin with the most important.
24. What will you be when you are out of school?
25. How much math will you use when you are out of school?
26. What classes will you take next year? Why?
27. Pretend you are a pencil and tell me about your day.
28. What is the title of your favorite book?
29. How was your weekend?
30. What is the difference between a job and a profession?
31. What does an "F" mean? How could I earn one in this class?
32. What words do your friends use when they describe you?
33. What are you good at?
34. What do you like about yourself? What do you think others like about you?
35. Give yourself a sincere compliment. Now give a sincere compliment to the person on your left.

"The process by which a student arrives at the answer to a problem becomes as important as the answer itself."
Larry Buschman

"As we move into the era of an information-based world, the value of mathematics as a former of our culture is going to become greater and greater."
Kevin Kelly

Curriculum: General

1. What did you learn today that you didn't know yesterday?
2. What would you say was the main idea of today's lesson? What one question would you like to ask about today's lesson?
3. How would you explain how to do today's lesson to somebody who was absent?
4. How would you explain today's lesson to somebody younger?
5. What went on in class yesterday?
6. Give an example of a real world application of what we studied in class today. Write a math problem for it and solve it.
7. Write a quick news story about a situation that involves today's concept.
8. Does having a test make you study harder? Why or why not?
9. What is math?
10. What would you compare math to? Math is like…
11. How is math represented in nature?
12. When have you learned enough math?
13. What makes a lesson hard or easy?
14. What is your favorite number? Why?
15. What do you think of today's math test?
16. Why do you think we take proficiency tests?
17. Name ten things you have done that required math but were not part of this class. Choose things that happened as recently as possible.
18. Name times in which the order you do things is important. Give examples.
19. List as many mathematical uses of a shoelace as you can.
20. Which would take more energy, to run up a short, steep hill, or to run up a long gradual hill?
21. If it starts to rain, will you stay drier by running to your destination or by walking? Explain your reasoning.
22. "Are we ever really gonna use this?"
23. Of what we have studied so far this year, what will be the most important to you in getting a job?
24. What might mathematicians do if they worked for McDonalds?
25. Explain if you agree or disagree with this statement, "The more math you know, the more money you will earn."
26. How is math in the news today?
27. Write a challenging word problem on today's topic, then solve it.
28. Write a word problem about today's concept. Include information that is not needed to solve the problem. Exchange problems with a classmate and solve.
29. Give an example of a math problem that will be used by an adult, then solve it.
30. If "M.A.T.H." were an acronym, what might it stand for?

"The process by which a student arrives at the answer to a problem becomes as important as the answer itself."
Larry Buschman

Curriculum: Specific

1. Why do you use a variable?
2. What does "fair" mean in a contest? Give an example of something that is fair.
3. What would you do if you were 5 cm tall?
4. What would you do if you were 5 meters tall?
5. Why is a common denominator necessary?
6. What are surveys? Why do we have them?
7. Give examples in life of how positives cancel out negatives.
8. How are percents, fractions, and decimals similar?
9. How are percents, fractions, and decimals different?
10. Tell how you would direct a visually-impaired person from this class to the cafeteria.
11. When would coordinate (x, y) graphing be used outside of school?
12. How is graphing helpful?
13. What does "numerator" mean?
14. What does "denominator" mean?
15. What does "percent" mean?
16. What does "divide" mean?
17. What does "formula" mean?
18. What does "slope" mean?
19. What does "fraction" mean?
20. Why do we need a decimal point?
21. Why is an exponent like a shortcut?
22. If you had to count the feathers on a turkey, how would you go about it?
23. What do the roof of a house, a downhill ski run, and the side of a mountain have in common?
24. When somebody is being irrational, what does it mean?
25. Jaime Escalante said, "Math is the great equalizer." What do you think he meant?
26. Why do we really need to study algebra?
27. When will today's lesson be useful to you in later life?
28. If everything in the world were suddenly twice as big, how would you know?
29. How could you prove the earth was round if you never took your feet off the ground?
30. Which will be greater: twice your age in four years, or three times your age in two years?
31. Write a "real-life" problem on today's subject and solve it.
32. Why did I teach what I taught you today?
33. How would you measure the distance to a planet or to the sun?

"If a pendulum's swinging quite free,
Then it's always a marvel to me,
That each tick plus each tock,
Of the grandfather clock,
Is 2π root L over g."
π Limerick

"The infinitude of the primes,
Is the subject of plenty of rhymes,
But we can't begin
To prove there's a twin,
An infinite number of times."
Peter Rosenthal, American mathematician

1. Mr. Infinity's math class is so popular everyone is trying to get in. Here is his seating chart. If you were student 100, explain how you could find the row and column of your seat.

Column	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Row 1	1	2	3	4	5	6	7	8
Row 2	9	10	11	12	13	14	15	16
Row 3	17	18	19	20	21	22	23	24
Row 4	25	26	27	28	29	30	31	32

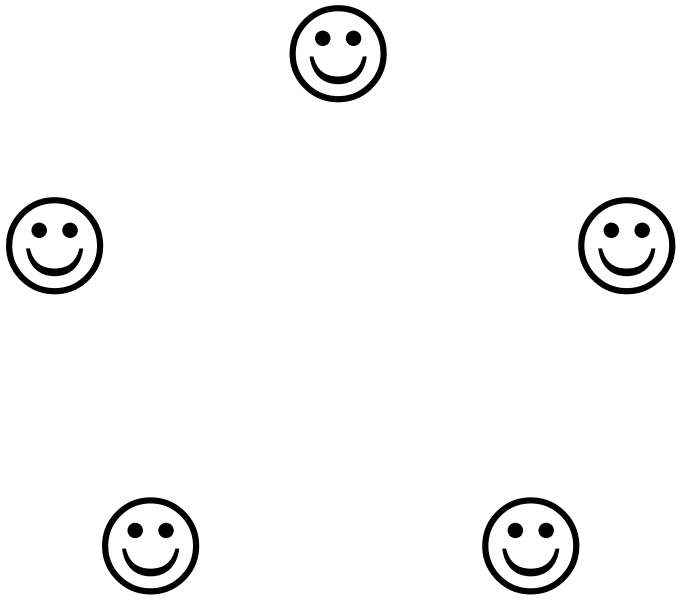
2. Mr. Infinity has changed his seating chart. Explain in what row and column student 100 would sit.

Column	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Row 1	1	2	3	4	5	6	7
Row 2	8	9	10	11	12	13	14
Row 3	15	16	17	18	19	20	21
Row 4	22	23	24	25	26	27	28

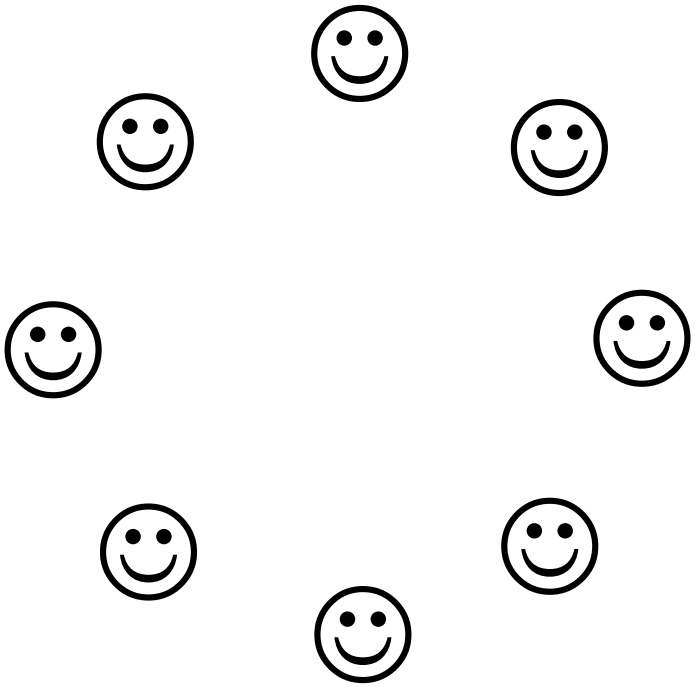
3. Mr. Infinity has gotten creative. Here is the seating chart for his popular math class. Explain in what row and seat student 100 would sit.

Row 1	1	2	3	4	5	6	7	8
Row 2	15	14	13	12	11	10	9	
Row 3	16	17	18	19	20	21	22	23
Row 4	30	29	28	27	26	25	24	

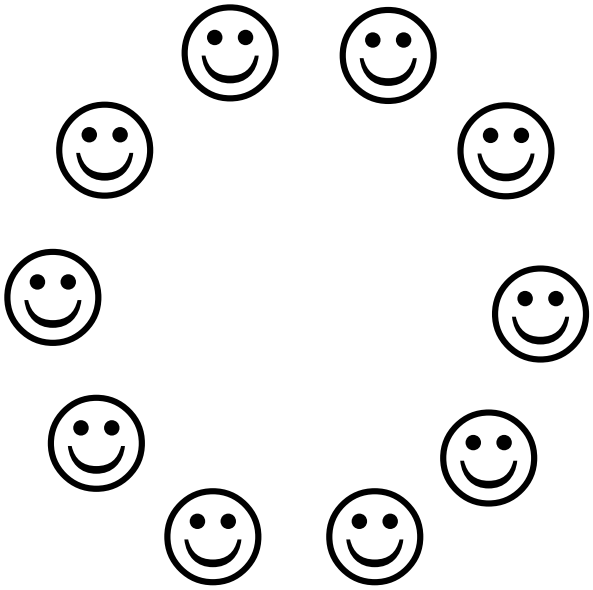
4. Five friends meet on the street and shake hands. How many handshakes will be required? Explain how you got your answer.



5. How many handshakes would be required for all these friends to introduce themselves to one another?

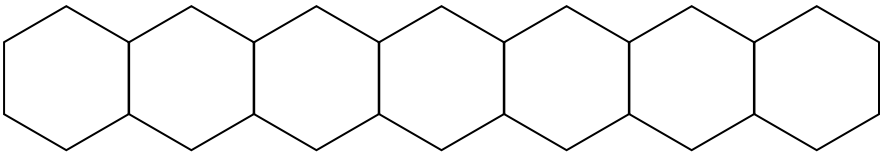


6. How many handshakes would be required for all these friends to introduce themselves to one another?

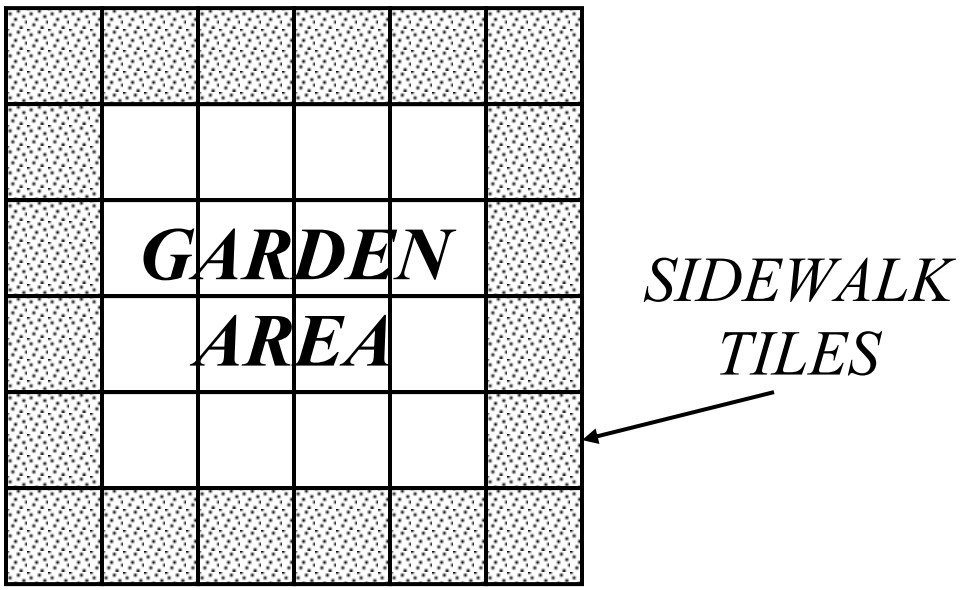


7. How many people can be seated at this arrangement of tables? People can sit on each side and both ends. What if eleven tables were used. What if 100 tables were used?

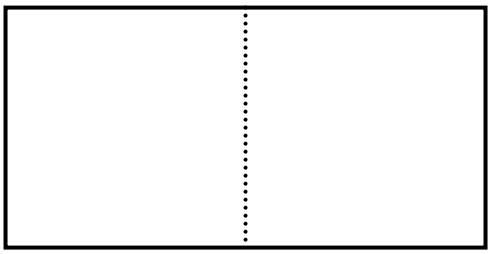
8. How many people can be seated at this arrangement of tables? People sit on each side and both ends. What if 17 tables were used? What if a total of 100 tables were used?



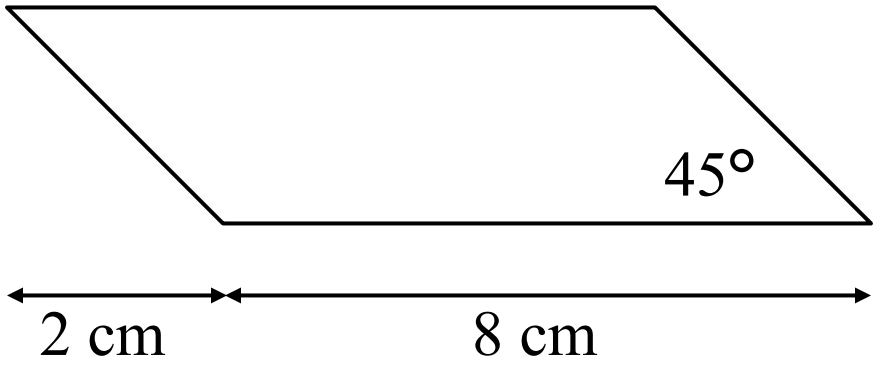
9. How many gray sidewalk tiles does it take to surround this garden? If the garden remains in a square shape but each side of the *white* garden area has a side length of seven, how many *gray* tiles are needed to surround it? What if the garden measures 100 by 100 squares?



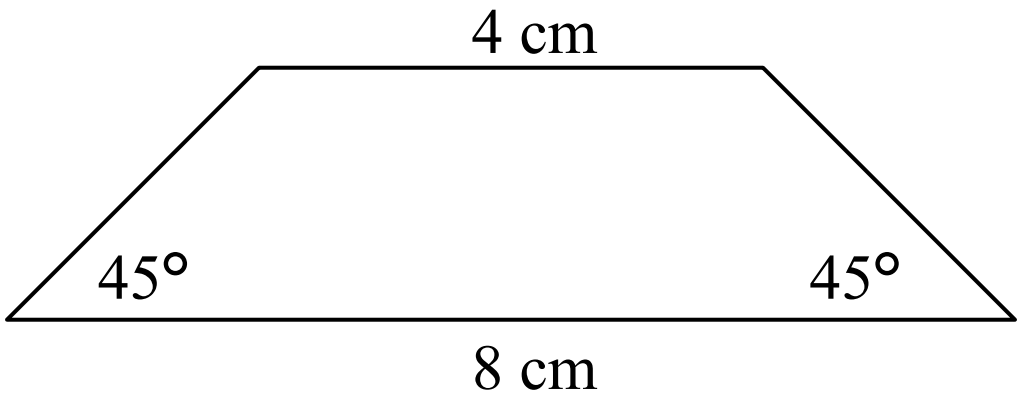
10. Write instructions to a friend explaining how to draw the *solid* line of this shape exactly.



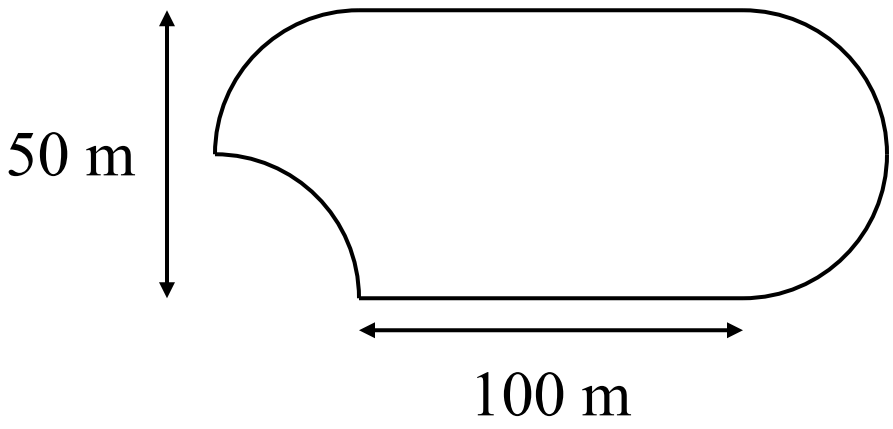
11. Write instructions to a friend explaining how to draw this exact shape.



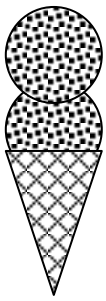
12. Write instructions to a friend explaining how to draw this exact shape.



13. Write instructions to a friend explaining how to draw this exact shape.



14. An ice cream shop sells five different flavors of ice cream. How many different types of double scoop cones can they create? It is acceptable to use the same flavor in a cone, but switching two flavors is not a new type.



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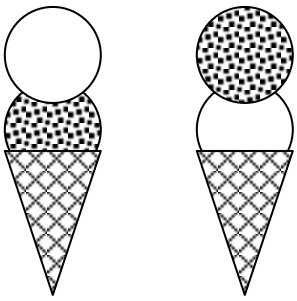
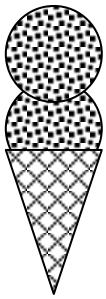
These are the same type.



15. An ice cream shop sells six different flavors of ice cream. How many different types of double scoop cones can they create? It is acceptable to use the same flavor in a cone, but switching two flavors is not a new type.



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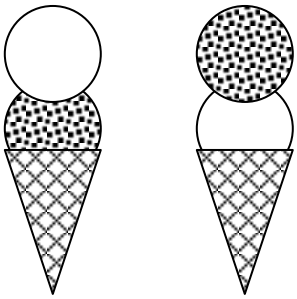
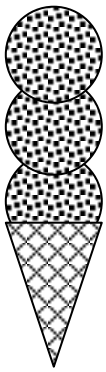


16. An ice cream shop sells three different flavors of ice cream. How many different types of triple scoop cones can they create? It is acceptable to use the same flavor in a cone, but switching two flavors is not a new type.



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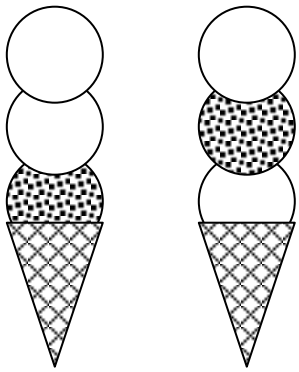
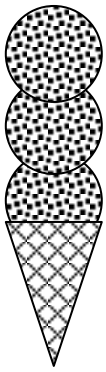


17. An ice cream shop sells four different flavors of ice cream. How many different types of triple scoop cones can they create? It is acceptable to use the same flavor in a cone, but switching two flavors is not a new type.



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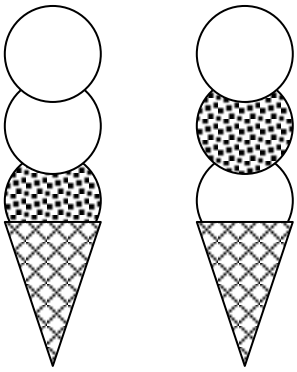
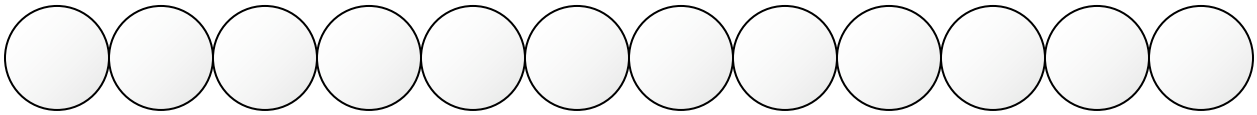
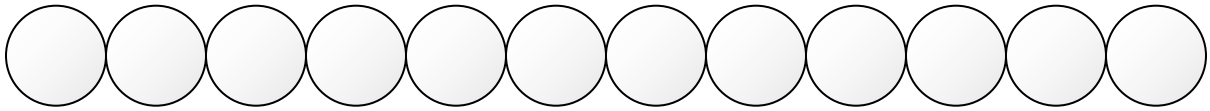


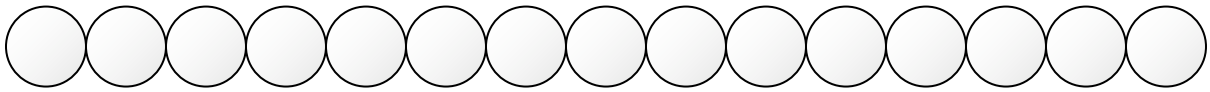
18. Twelve marbles are in a row. One third of them are yellow. There are an equal amount of red and blue. There are two less green marbles than yellow. Explain how to find out how many of each color of marble are in the row.



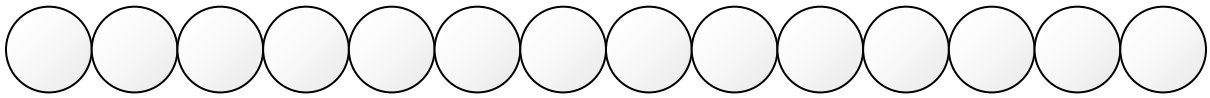
19. Twelve marbles are in a row. 25% of them are blue. There is one more red marble than green. One sixth of the marbles are yellow. Explain how to find out how many of each color of marble are in the row.



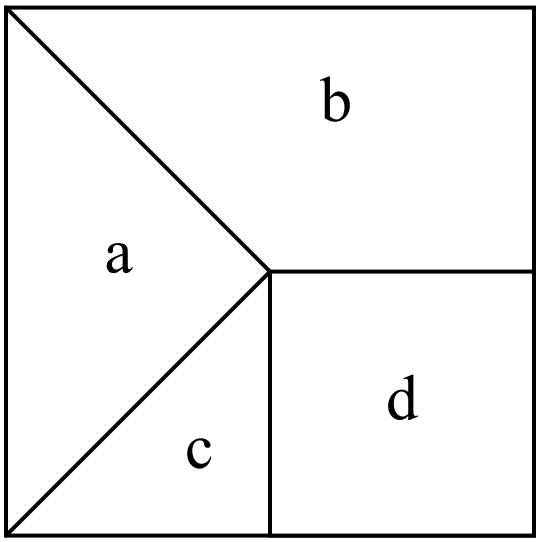
20. Fifteen marbles are in a row. 20% are blue. One third are green. Yellow marbles account for 0.2 of the row. The remaining marbles are red. Explain how to find out how many of each color of marble are in the row.



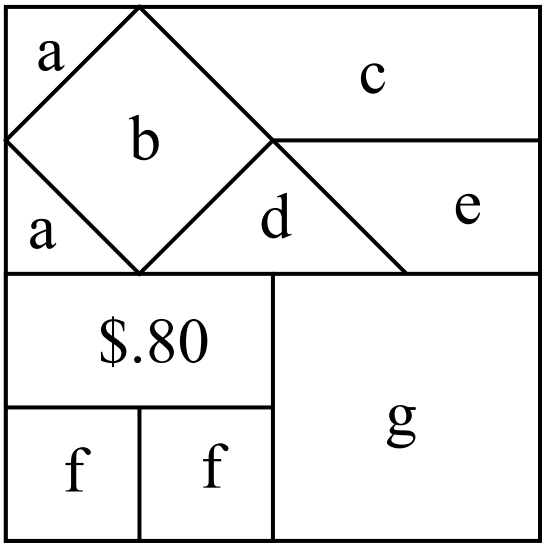
21. There are fourteen marbles in a row. There are twice as many blue marbles as yellow ones. There is one less red marbles than green. There are three times as many green marbles as blue. Explain how to find out how many of each color or marble are in a row.



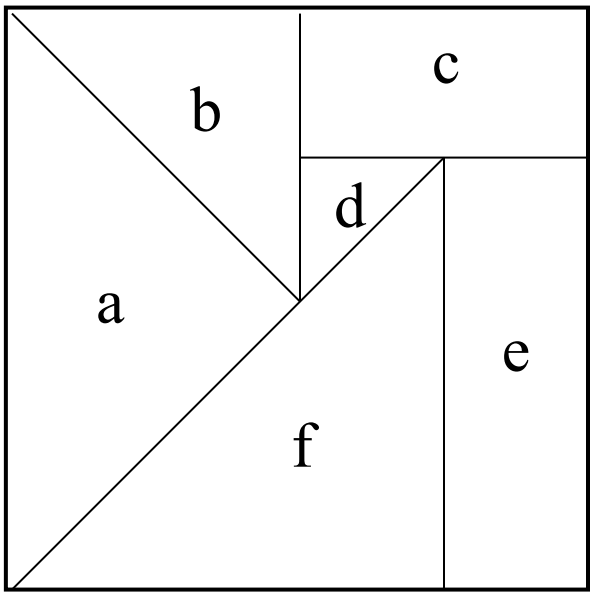
22. This tile costs $2 when it is whole. Explain how to find a reasonable price for each of the pieces.



23. One piece of this tile has a price. Based upon this, find a reasonable price for the other pieces and the whole tile.



24. This tile has a value of 1 unit. Explain how to find the fractional value for each of the pieces.



25. Which of these numbers does not belong? Explain your reasoning. Can you find a reason why a different number might not belong?

2002	2020
2202	0202

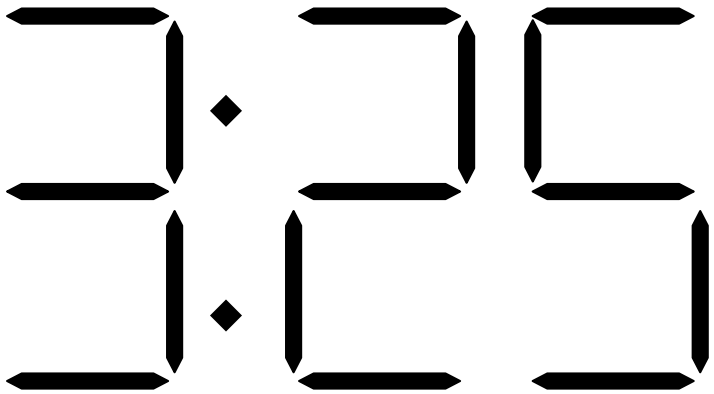
26. Which of these numbers does not belong? Explain your reasoning. Can you find a reason why a different number might not belong?

616	828
111	822

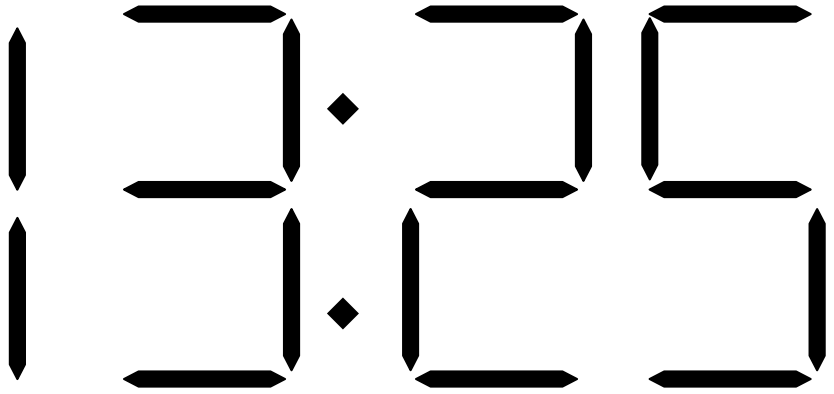
27. Which of these numbers does not belong? Explain your reasoning. Can you find a reason why a different number might not belong?

1904	8060
905	3030

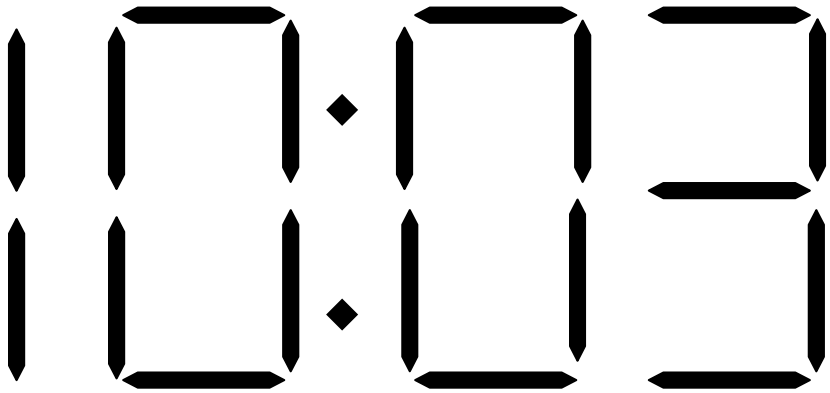
28. The digital clock shown here displays the time by lighting up bars to make the numbers. The more bars needed to make a number, the brighter the time appears. For example, a 3 produces more light than a 1. At what time will the clock produce the most light?



29. The digital clock shown here displays the time by lighting up bars to make the numbers. The more bars needed to make a number, the brighter the time appears. For example, a 3 produces more light than a 1. If the clock is set for 24-hour time, when will it produce the most light?



30. The digital clock shown here displays the time by lighting up bars to make the numbers. Different numbers will produce more or less light. Find another time that uses different numbers but produces the same amount of light. How many solutions can you find?



31. Explain how you could show that this statement is true.

$$\frac{3}{4} > \frac{2}{3}$$

32. Find a number that is between these two fractions. Explain how you know it is between the two numbers.

$$\frac{3}{5} \qquad \frac{4}{5}$$

33. Find a number that is between these two fractions. Explain how you know it is between the two numbers.

$$\frac{4}{7} \qquad \frac{5}{7}$$

34. Arrange these fractions in order from least to greatest. Explain how you know you are correct.

$$\frac{2}{5} \quad \frac{3}{4} \quad \frac{1}{5} \quad \frac{3}{8} \quad \frac{1}{3}$$

35. Arrange these fractions in order from least to greatest. Explain how you know you are correct.

$$\frac{5}{7} \quad \frac{3}{7} \quad \frac{2}{3} \quad \frac{4}{9} \quad \frac{3}{5}$$

36. Arrange these numbers in order from least to greatest. Explain how you know you are correct.

$$\frac{1}{3} \quad 0.2 \quad \frac{1}{4} \quad 0.02 \quad 30\%$$

37. Arrange these numbers in order from least to greatest. Explain how you know you are correct.

$$\frac{3}{5} \quad 0.55 \quad \frac{2}{3} \quad 0.6 \quad 67\%$$

38. Explain a way to solve this problem in your head.

$$52 + 36 + 2 + 18 + 12 =$$

39. Explain a way to solve this problem in your head.

$$5 \times 7 \times 4 \times 3 \times 5 =$$

40. Make a reasonable estimate for this problem and explain how you arrived at it.

$$26 \times 32 =$$

41. Make a reasonable estimate for this problem and explain how you made it.

$$843+21.6+434+81.6+94.3=$$

42. Juan uses this trick to add. "I begin by adding the hundreds, then the tens, and finally the ones. Then I add those answers together." Explain why the method works.

$$\begin{array}{r} 358 \\ 267 \\ +\ 649 \\ \hline 1100 \\ 150 \\ +\ 24 \\ \hline 1274 \end{array}$$

43. Diana uses this trick to subtract sometimes. "I subtract one from both numbers, then I subtract as usual." Explain why her method works. Are there situations where it is not a good method?

$$\begin{array}{r} 6000 \\ -\ 1286 \\ \hline \end{array} \qquad \begin{array}{r} 5999 \\ -\ 1285 \\ \hline 4714 \end{array}$$

44. Lashawna uses this trick to multiply two-digit numbers. Explain how her method works and why it works. Do you think this is a good way to multiply? Why or why not?

$$\begin{array}{r} 42 \\ \times\ 26 \\ \hline 800 \\ 240 \\ 40 \\ +\ 12 \\ \hline 1092 \end{array}$$

45. Here are some number patterns. Create a number pattern of your own and write instructions so a person could understand the pattern and recreate it. Can you write a rule for your pattern or predict the 20th term of the pattern?

11, 15, 19, 23, …

1, 8, 15, 22, …

46. Here are some number patterns. Create a number pattern of your own and write instructions so a person could understand the pattern and recreate it. Can you write a rule for your pattern or predict the 14th term of the pattern?

1, 3, 6, 10, 15, …

83, 77, 71, 65, 59, …

47. Here are some number patterns. Create a number pattern of your own and write instructions so a person could understand the pattern and recreate it. Can you write a rule for your pattern or predict the 25th term of the pattern?

1, 3, 9, 27, 81, …

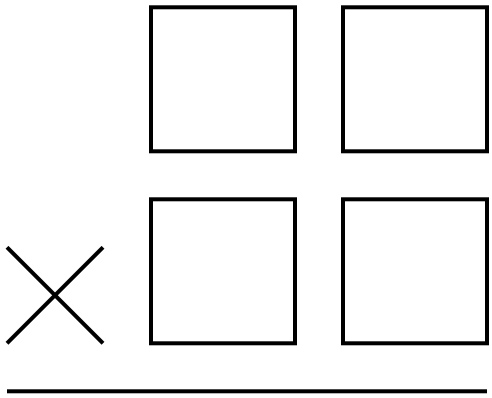
291, 287, 271, 267, 251, …

48. These four digits go in the boxes. Where will you place them to create the greatest possible product? Explain how you know this will yield the greatest product.

5, 3, 2, 8

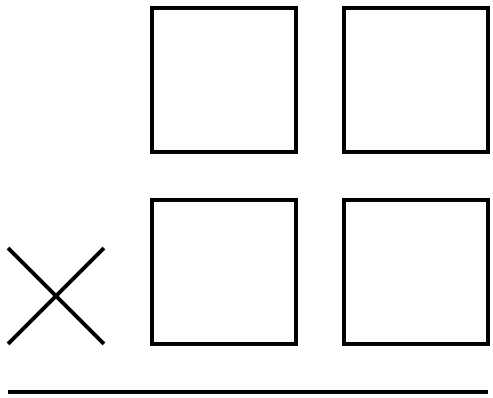
$$\begin{array}{r} \square\,\square \\ \times\ \square\,\square \\ \hline \end{array}$$

49. You are going to put four digits in the boxes to create the greatest possible product. Where would you put the largest digit, second largest, third largest, and smallest? Explain how you know this would yield the greatest product.

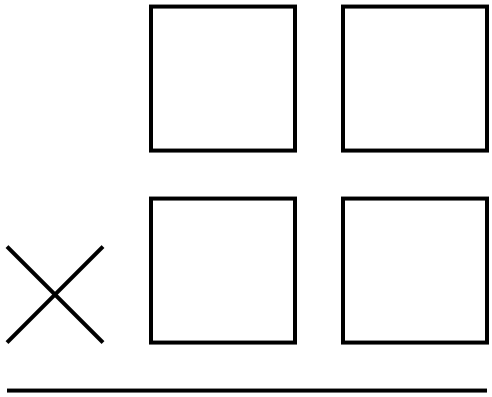


50. These four digits go in the boxes. Where will you place them to create the *least* possible product? Explain how you know this will yield the least product.

8, 6, 2, 7



51. You are going to put four digits in the boxes to create the *least* possible product. Where would you put the largest digit, second largest, third largest, and smallest? Explain how you know this would yield the least product.



52. Here are home prices in a neighborhood. What would be the approximate price of a typical home in this neighborhood?

$236,000
$274,000
$243,500
$304,800
$1,304,000
$278,000
$247,400

53. Here are test scores for Celia. Explain to the student what overall grade you would give to her.

88%, 97%, 52%, 81%, 100%, 85%, 91%, 97%, 93%

54. Here are the test percentages of six students in a math class. As principal, your job is to determine which student will receive a math award. Decide which student should get the award and write a short speech explaining why that students deserves the award.

Test:	1	2	3	4	5	6
Andrea	89	93	91	92	92	89
Bobby	93	82	93	93	86	93
Carlos	76	79	85	91	91	100
David	97	98	96	92	78	85
Elisa	96	98	94	75	96	77
Francisco	95	98	94	93	60	95

55. Here are the points scored by the Atlanta Braves in six games.

3 14 9 1 3 3

Here are the points scored by the Philadelphia Phillies during six games.

4 3 4 2 4 6

Based on this information, which team is better? Explain your reasoning.

56. Here are the scores for six games between the Philadelphia Phillies and the Atlanta Braves. Based on this information, which team is better? Explain your reasoning.

	Braves	Phillies
Game 1	3	4
Game 2	14	3
Game 3	9	4
Game 4	1	2
Game 5	3	4
Game 6	3	6

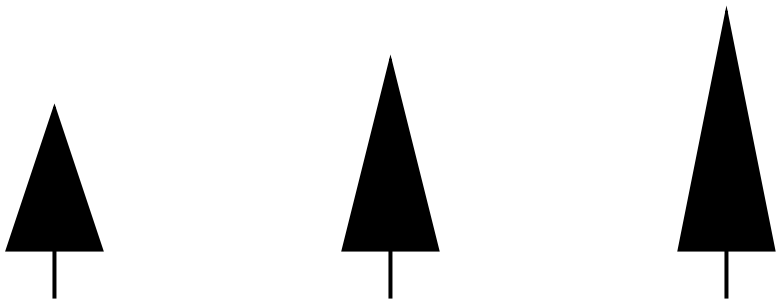
57. Here are the points scored by four football teams. According to this data, explain which team is best.

Express:	7	13	10
Monarchs:	6	14	49
Knights:	10	21	13
Galaxy:	21	20	48

58. Here are the results of the games between four football teams over a three-week period. According to this data, which team is best? How does your answer compare to the previous one?

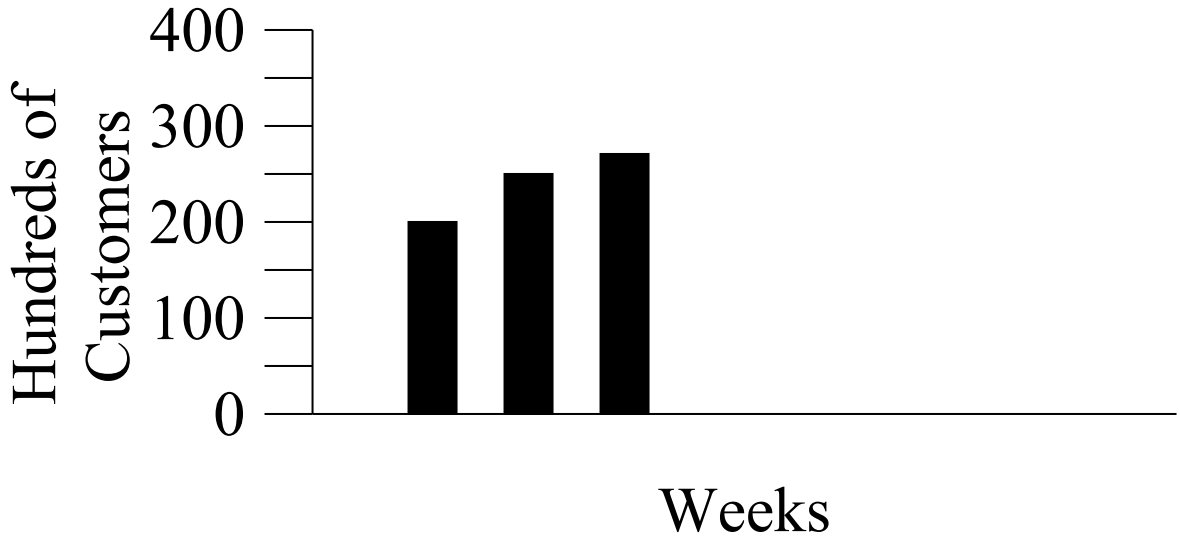
Week:		
1	Monarchs: 6 Knights: 10	Express: 7 Galaxy: 21
2	Monarchs: 14 Express: 13	Knights: 21 Galaxy: 20
3	Monarchs: 49 Galaxy: 48	Knights: 13 Express: 10

59. Here are the heights of a tree over a period of three years. Estimate how tall the tree will be when it is five years old. Explain why you think your estimate is correct.



12’	16’	21’
Year 1	Year 2	Year 3

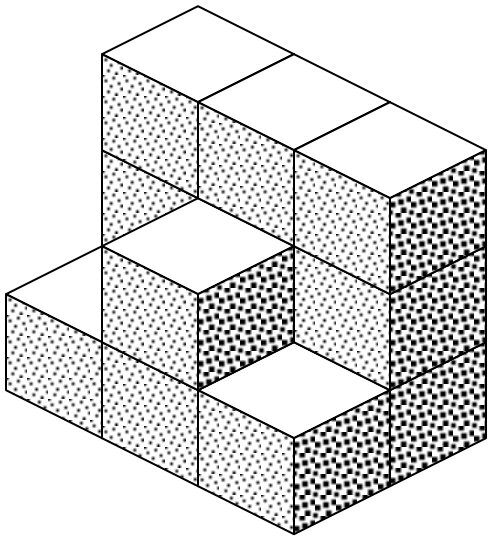
60. This graph shows the number of customers who visited Ana's shop in the first three weeks after it opened. Estimate the number of customers she will have in week 10 and explain your reasoning.

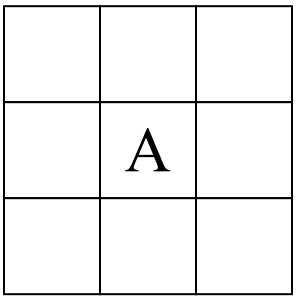


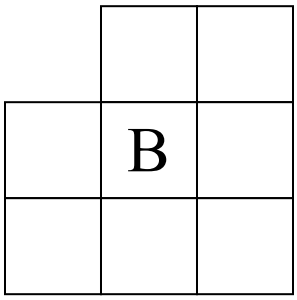
61. Here are the amounts of money Jason earned on sales for four weeks. Estimate his total income after 18 weeks and explain your reasoning.

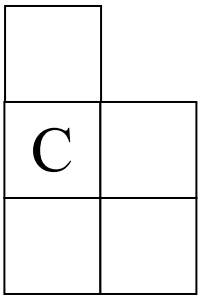
Week:	1	2	3	4
Sales:	$71	$67	$83	$91

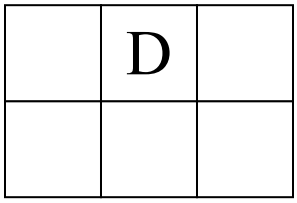
62. Which of these is *not* a view of this building? Explain how you know this.



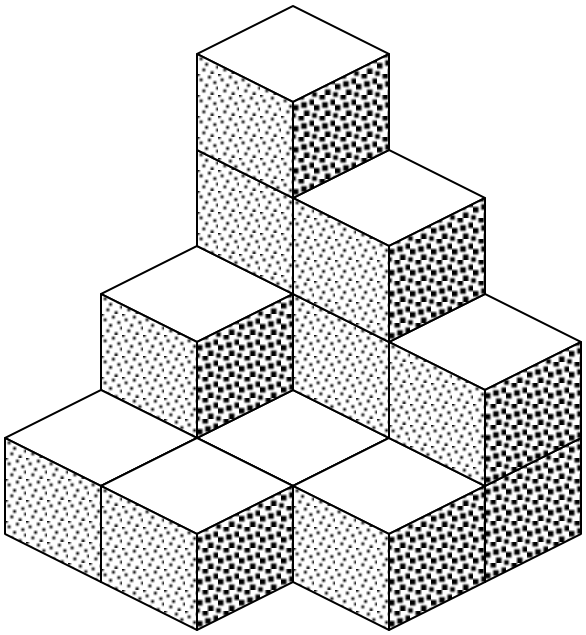


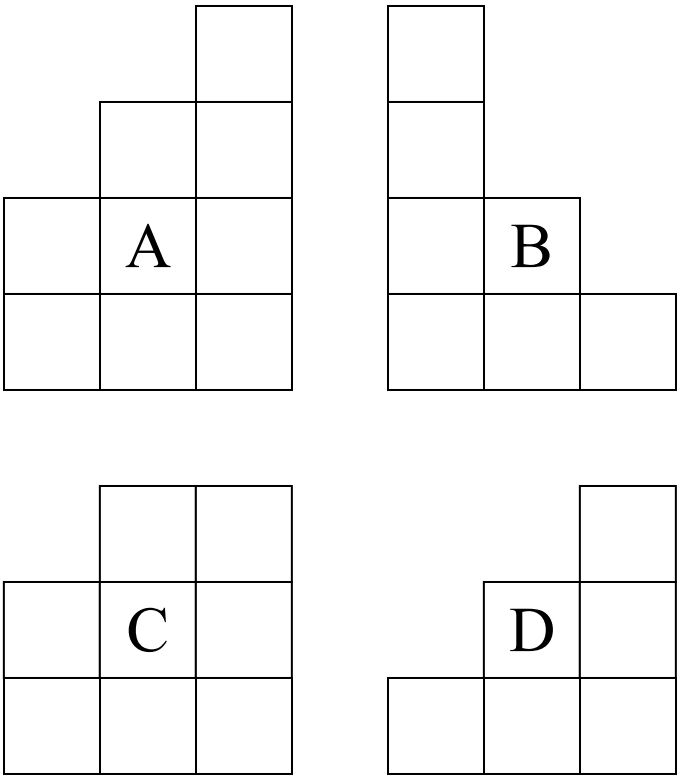




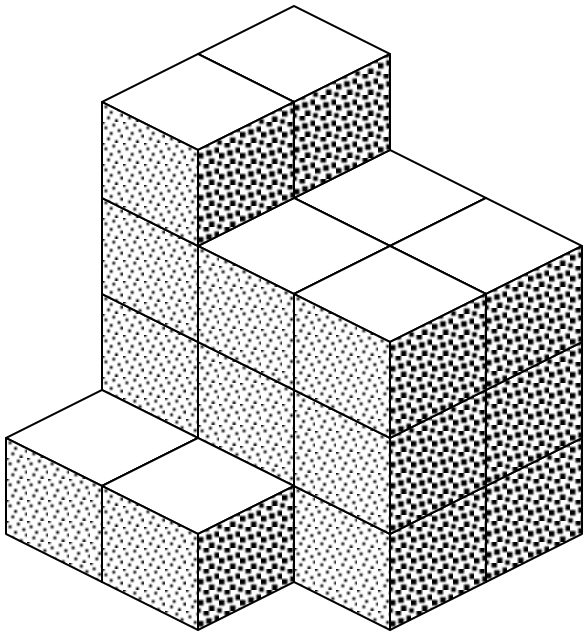


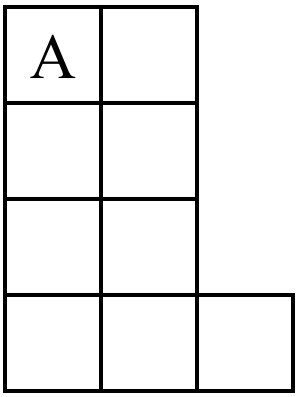
63. Which of these is *not* A view of this building? Explain how you know this.

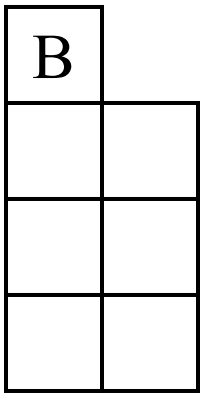


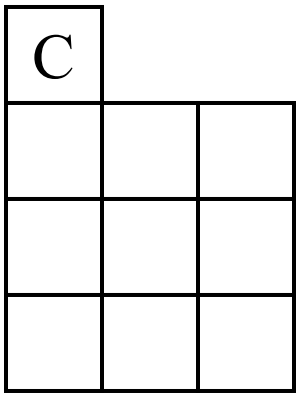


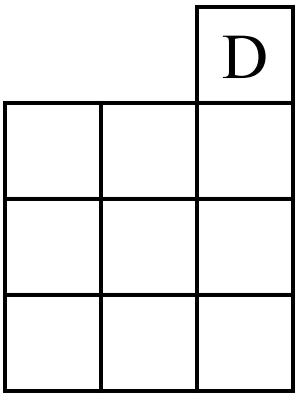
64. Which of these is *not* a view of the building. Explain how you know this.

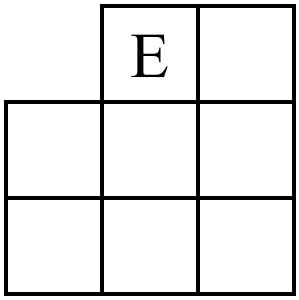




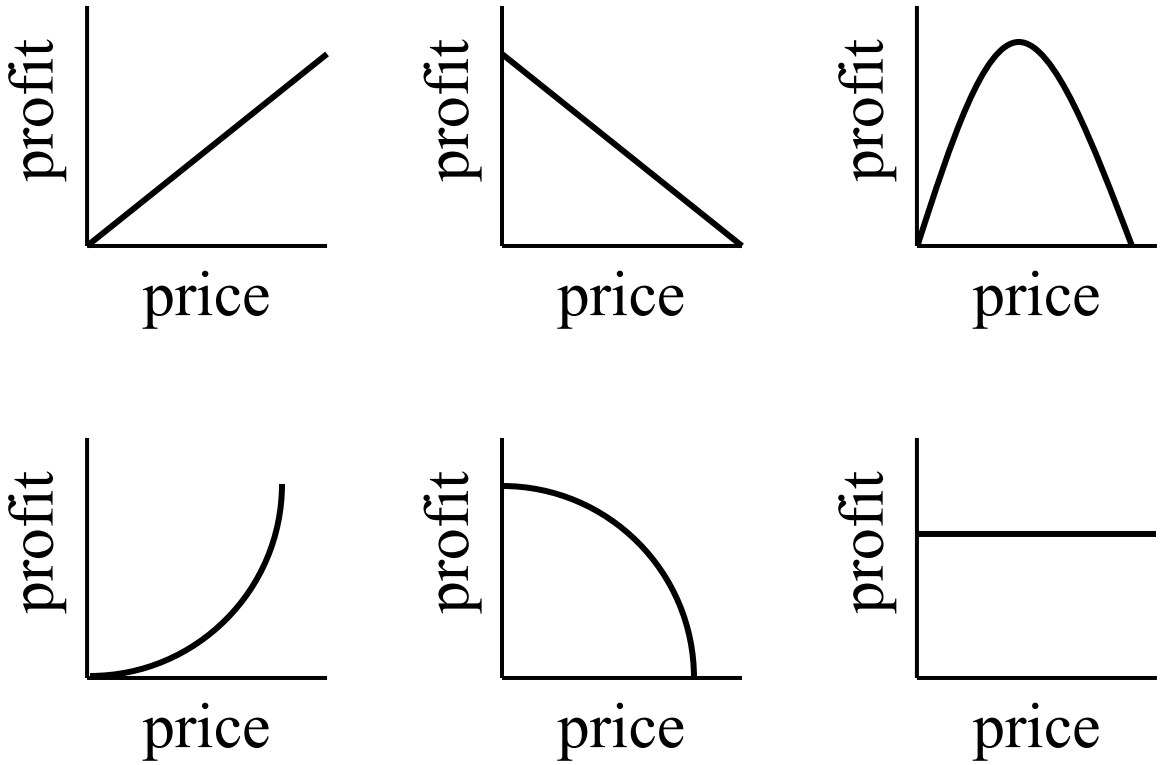




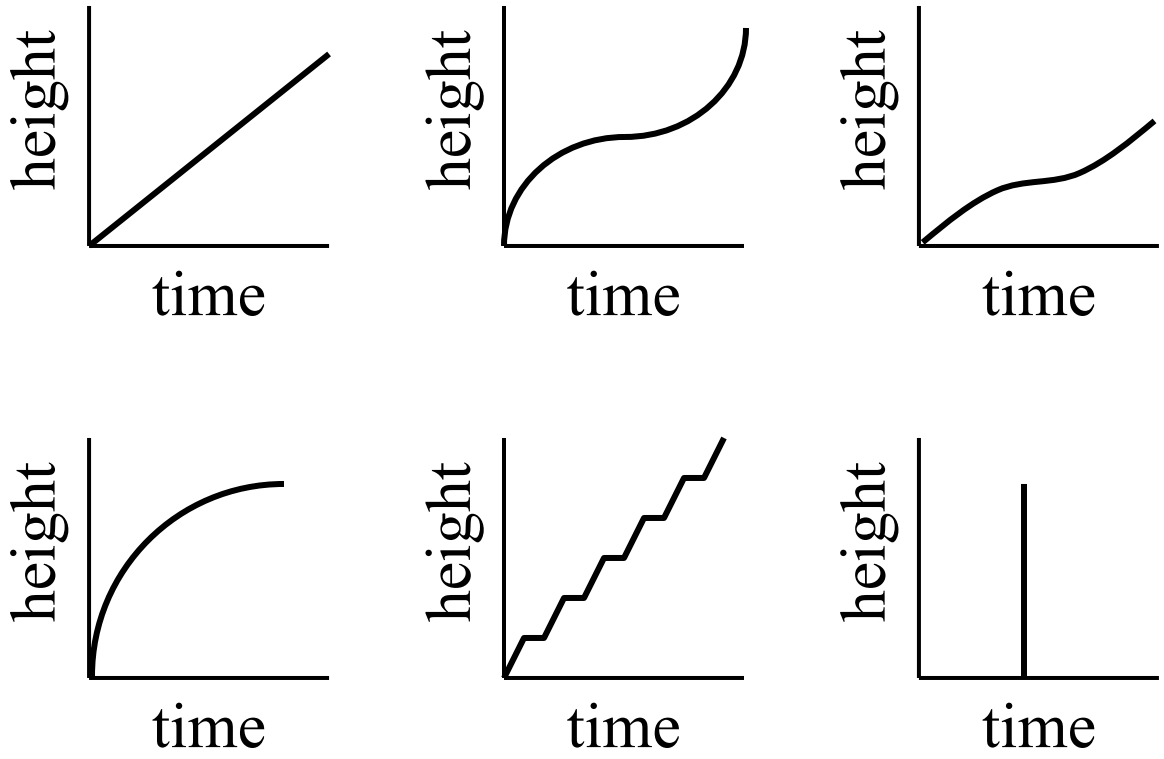




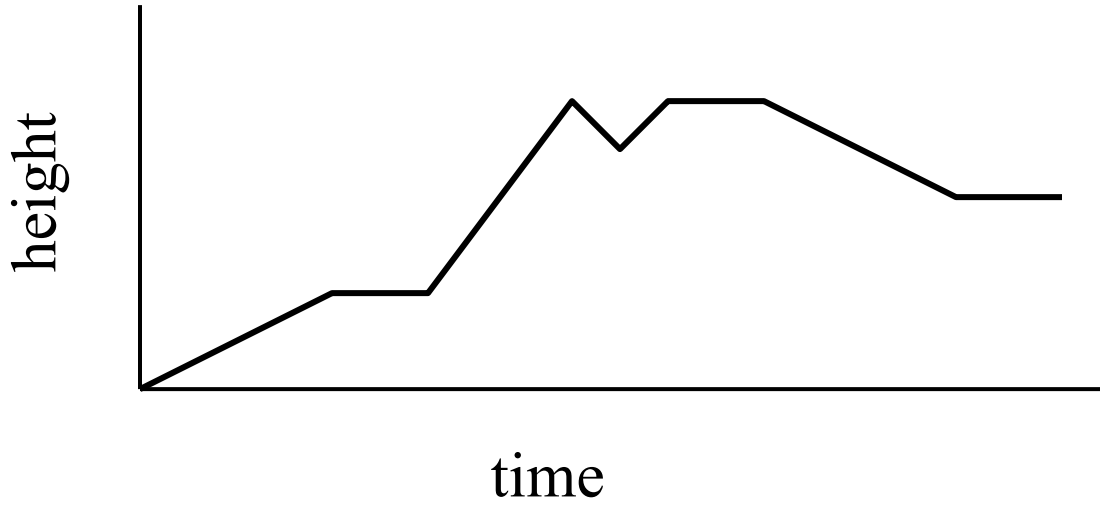
65. Which of these graphs best represents the relationship between the price a store charges for a candy bar and how much profit it makes? Explain your answer.



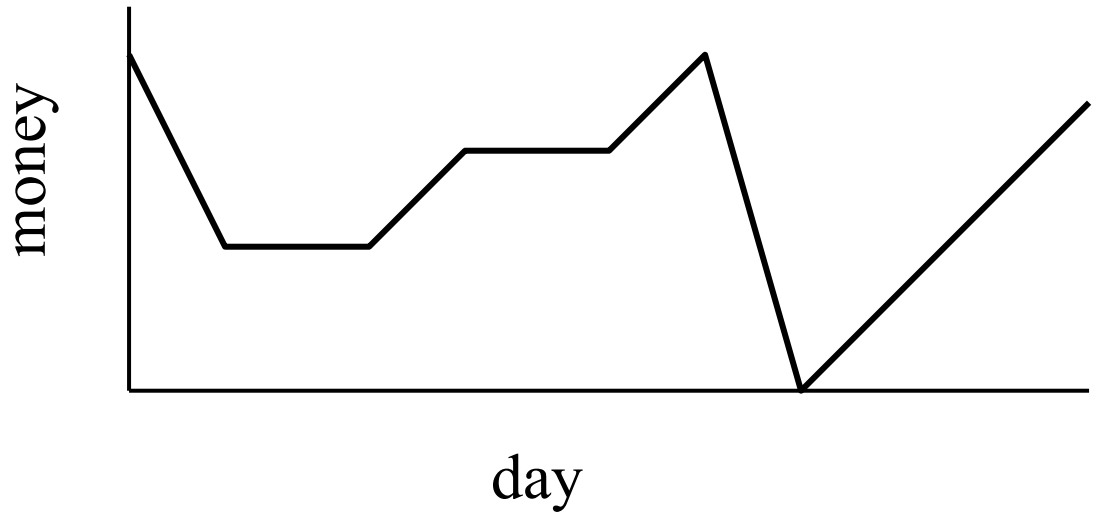
66. Which of these graphs best represents the relationship between time and the height of a monkey as it climbs a palm tree? Explain your reasoning.



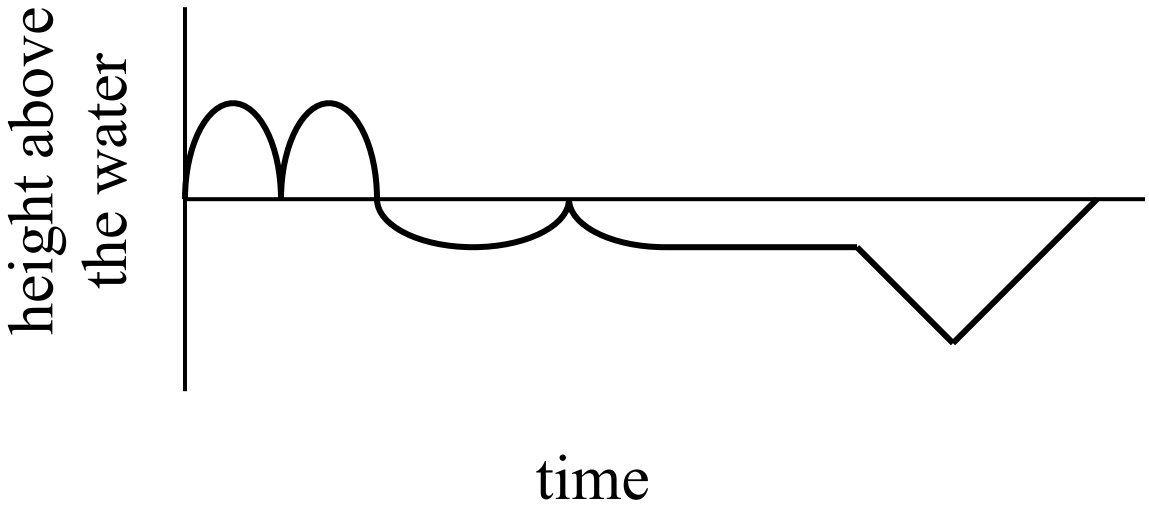
67. Here is the graph for the flight of a bird. Write a story that would reflect this graph.



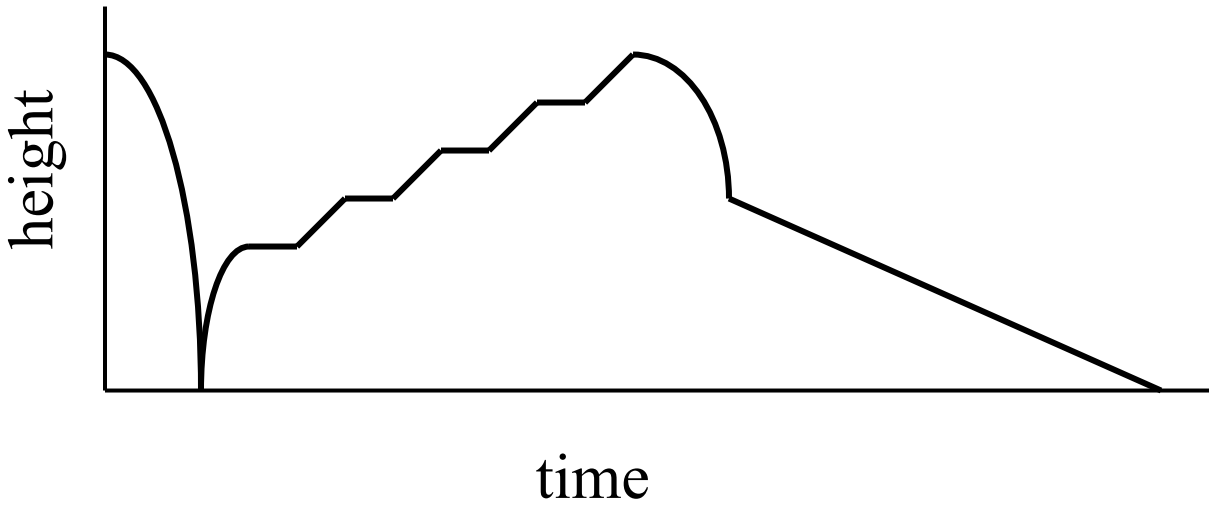
68. Here is a graph of how much money Angelina had during a week. Write a story to fit her graph.



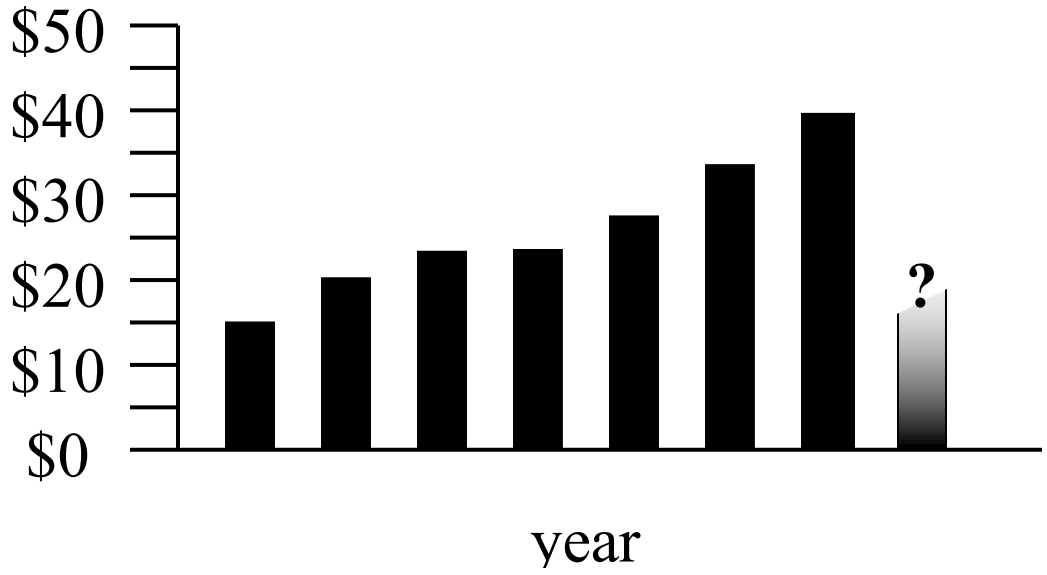
69. Here is a graph of a frog's trip. Write a story about the graph.



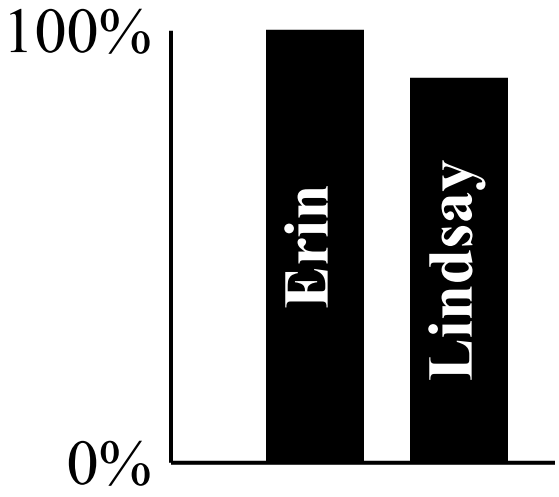
70. Make up a story to fit this graph.

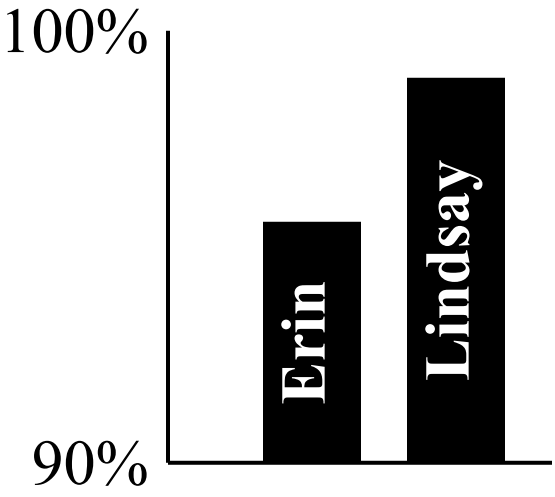


71. Based on this graph, what would you expect the price of widgets to be next year?

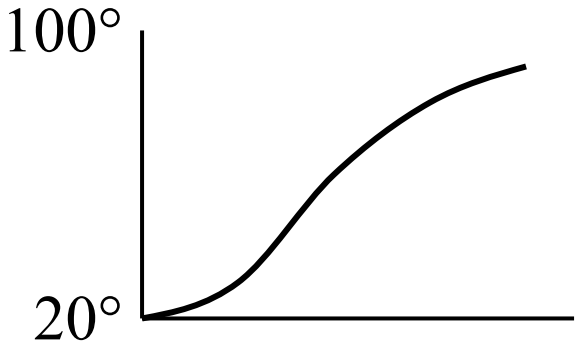


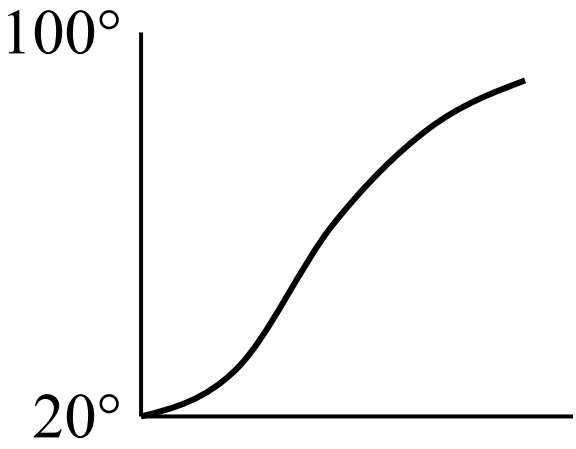
72. “I did better than you on the first test,” said Erin.
“Yes, but I did a *lot* better than you on the second test,” said Lindsay. “I did better overall.”
Explain who is correct and why.



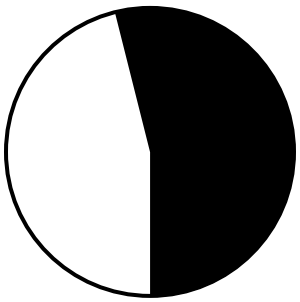


73. Which of these two graphs shows the faster rate of temperature increase and why?



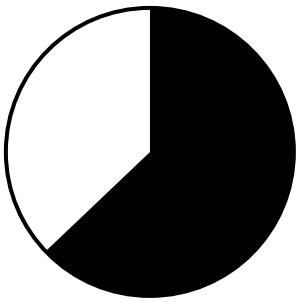


74. Explain which basketball player is better based on these graphs. Which one scored more points? Which one would be most likely to make his or her next shot?



shots made

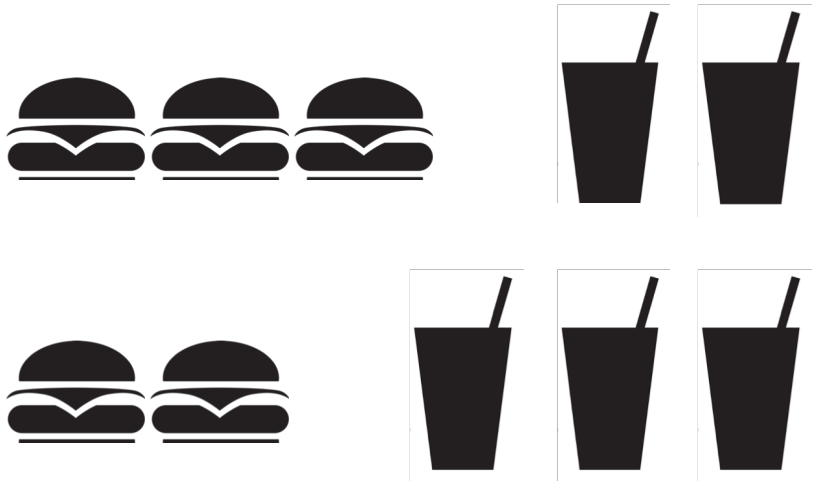
shots missed



Player A

Player B

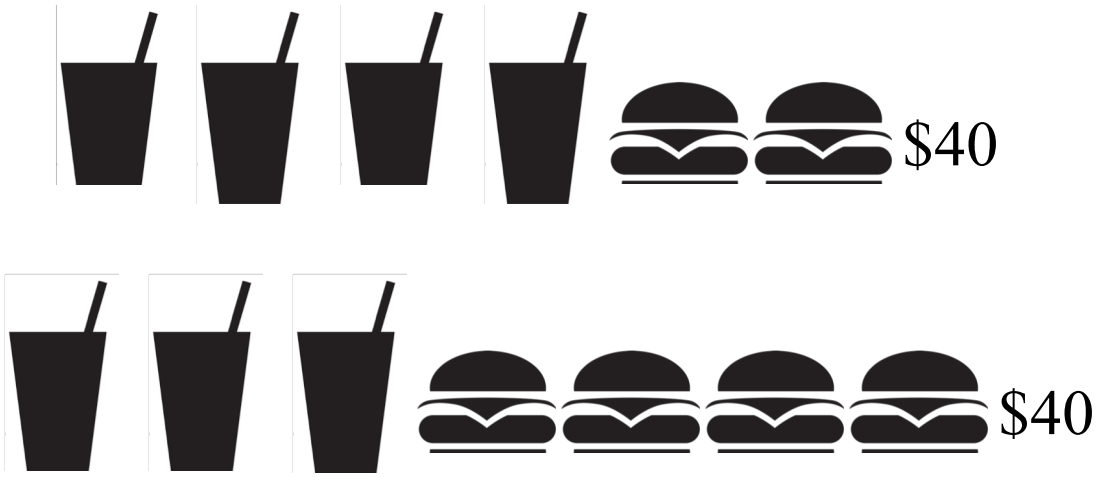
75. Sasha and Josh are at the food court in the mall. They noticed these prices. Explain how to find the price for the burger and for the drink.



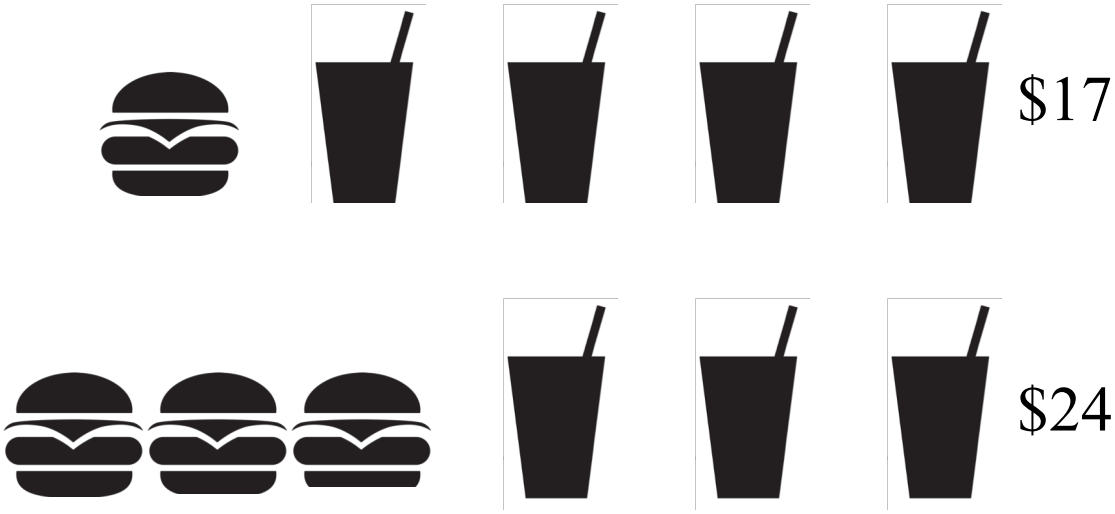
$16

$14

76. Renaldo and Alex are at the food court at the mall and notice these prices. Explain how to find the price for the drink and for the burger.



77. Robin and Steve are at the food court at the mall and notice these prices. Explain how to determine the price for the burger and for the drink.



Answer Key

Answer Key

1. Row 13, Column 4
2. Row 15, Column 2
3. Row 14, 2nd seat from the right
4. 10
5. 28
6. 45
7. 18, 24, 202
8. 30, 70, 402
9. 20, 32, 404
10. Answers will vary.
11. Answers will vary.
12. Answers will vary.
13. Answers will vary.
14. 15
15. 21
16. 10
17. 20
18. 4 yellow, 3 red, 3 blue, 2 green
19. 3 blue, 2 yellow, 4 red, 3 green
20. 3 blue, 5 green, 3 yellow, 4 red
21. 2 blue, 1 yellow, 6 green, 5 red
22. a = \$.50, b = \$.75, c = \$.25, d = \$.50
23. a = \$.20, b = \$.80, c = \$1.00, d = \$.40, e = \$.60, f = \$.40, g = \$1.60
24. a = $^1/_4$, b = $^1/_8$, c = $^1/_8$, d = $^1/_{32}$, e = $^3/_{16}$, f = $^9/_{32}$
25. Answers will vary.
26. Answers will vary.
27. Answers will vary.
28. 10:08
29. 20:08
30. There are many solutions. Three of them are 8:58, 9:08, and 10:30
31. Answers will vary. One solution is that $^9/_{12} > {}^8/_{12}$.
32. Answers will vary. One solution is $^7/_{10}$
33. Answers will vary. One solution is $^9/_{14}$
34. $^1/_5$, $^1/_3$, $^3/_8$, $^2/_5$, $^3/_4$
35. $^3/_7$, $^4/_9$, $^3/_5$, $^2/_3$, $^5/_7$
36. 0.02, 0.2, $^1/_4$, 30%, $^1/_3$
37. 0.55, $^3/_5$ = 0.6, $^2/_3$, 67%
38. Answers will vary.
39. Answers will vary.
40. Answers will vary.
41. Answers will vary.

42. Answers will vary.
43. Answers will vary.
44. Answers will vary.
45. Answers will vary.
46. Answers will vary.
47. Answers will vary.
48. 82 x 53 or 53 x 82
49. Assuming A > B > C > D, AD x BC or BC x AD
50. 27 x 68 or 68 x 27
51. Assuming A > B > C > D, DB x CA
52. Answers will vary. The outlier ($1,304,000) will greatly affect the arithmetic mean but not the median (typical) home price.
53. Answers will vary.
54. Answers will vary.
55. Answers will vary.
56. Answers will vary. The Phillies won that series.
57. Answers will vary.
58. Answers will vary. The Knights are undefeated.
59. Answers will vary.
60. Answers will vary.
61. Answers will vary.
62. B
63. D
64. B
65. The third graph in row one is correct.
66. Answers will vary.
67. Answers will vary.
68. Answers will vary.
69. Answers will vary.
70. Answers will vary.
71. Answers will vary.
72. Erin (Note the two different vertical scales. Erin outscored Lindsay by about 10% on the first test while Lindsay outscored Erin by about 5% on the second.)
73. The two graphs are identical. The second graph has been stretched vertically.
74. It is impossible to tell from the information given. The circle graphs only tell who made a greater *portion* of their shots. We would need to know how many shots each player attempted or made.
75. Burgers = $4, Drinks = $2
76. Drinks = $8, Burgers = $4
77. Burgers= $5, Drinks = $3

Math Journal

Name:

Math Journal Name_____

Monday

Tuesday

Wednesday

Thursday

If you liked this activity, you might also like some of the other lessons available in my TeachersPayTeachers store. Simply search for "**Teacher to Teacher Press**".
You can also find many free and inexpensive resources on my personal website, www.tttpress.com. **Be sure to subscribe to receive monthly newsletters, blogs, and FREE activities.**

Other activities include:

- *Four in a Row* – An engaging and strategic way to practice multiplication of whole numbers, fractions, decimals, integers, monomials, and binomials.
- *Fast Facts and Fractions* – My most popular handout shows how I helped my struggling students master their multiplication facts and all four fraction operations in only 5 minutes a day!
- *Tax Collector* – The engaging game that helps students understand and apply primes and composites as they try to build their bank.
- *Managing the Math Class, volumes 1 & 2* – Stop the paper chase. Here are two proven approaches to minimizing your paperwork so that you can focus on what matters most: your students, your lessons, and coffee!

Feel free to contact me if you have questions or comments or would like to discuss a staff development training or keynote address at your site.

Happy teaching,
Brad