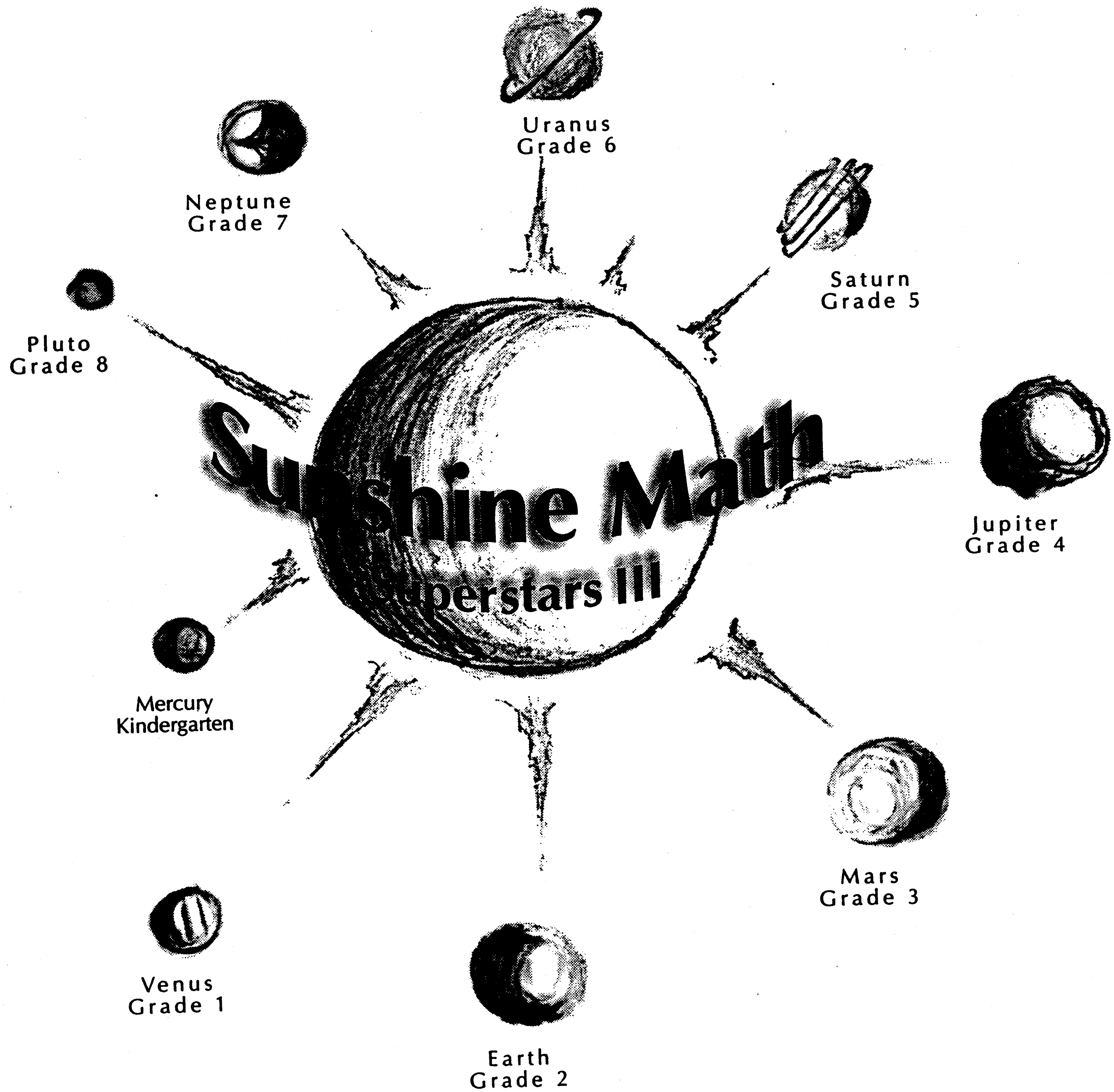

Uranus
Grade 6

Acknowledgments

This project was conceived of and coordinated by the Florida Department of Education. In addition, it was supported financially through a grant to the School Board of Polk County. The rich history of these materials and the predecessor programs *Superstars* and *Superstars II*, goes back to the early 1980's. Dr. Andy Reeves initiated the program at the Department of Education, and many Florida teachers have been involved in developing and using these materials over the years.

The following Florida educators were primarily responsible for developing, field testing, and publishing *Sunshine Math*:

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Revisions were made to *Sunshine Math* by Sandy Berger, Frankie Mack and Linda Fisher with input from Andy Reeves and from volunteers and district staff in Broward, Duval, and Volusia school districts.

Under the provisions governing Eisenhower funds, it is the responsibility of the districts to furnish copies to public and private schools and to ensure that home schools have access to the materials. Questions regarding these responsibilities should be directed to the district contact persons for Eisenhower Funds and for Home Schools.

Additional copies of *Sunshine Math* may be purchased at cost from the Panhandle Area Educational Consortium (PAEC), 753 West Boulevard, Chipley, Florida 32428, or by calling the PAEC Clearinghouse, (850) 638-6131, Suncom 769-6131, FAX (850) 638-6336. Out-of-state schools that purchase copies have permission to reproduce the document for use with their students for non-profit educational purposes.

Preface

Sunshine Math and its predecessor programs, *Superstars* and *Superstars II,* dwell on the positive aspects of students, parents, teachers, and administrators working together. This program assumes that children, even young children, are capable of and interested in learning; that teachers want to help them learn to think for themselves; that administrators see their jobs as clearing the path so that quality education is delivered effectively in their schools; and that parents care about their child's learning and are willing to work with the school system toward that goal. Each of these four groups has a vital role to play in implementing *Sunshine Math.*

The program's initiators believed that elementary students are capable of much more than we normally ask of them, and the subsequent success of *Superstars* indicates that many children are on the path to becoming independent learners. A number of children in *any* classroom are bright, energetic, and willing to accept extra challenges.

The basic purpose of the *Superstars* program is to provide the extra challenge that self-motivated students need in mathematics, and to do so in a structured, long-term program that does not impinge on the normal classroom routine or the time of the teacher. The system is not meant to replace any aspect of the school curriculum -- it is offered as a peripheral opportunity to students who identify with challenges and who want to be rewarded for their extra effort. Participation in the program is always optional -- only those students who voluntarily choose to participate will, in the long run, benefit from this program. Any student, regardless of prior academic performance, should be encouraged to participate as long their interest is maintained.

The predecessor programs for *Sunshine Math* - the Florida Department of Education's *Superstars II* and *Superstars*-- have demonstrated that this concept can be extremely successful. What is required are several dedicated adults who devote a few hours each week to operate the system effectively in the school; an administrator who provides highly visible support; teachers who welcome a supplementary experience for their students to engage in higher-order thinking; and a typical classroom of students. If all of those ingredients are present, *Sunshine Math* will become an integral part of the school fabric.

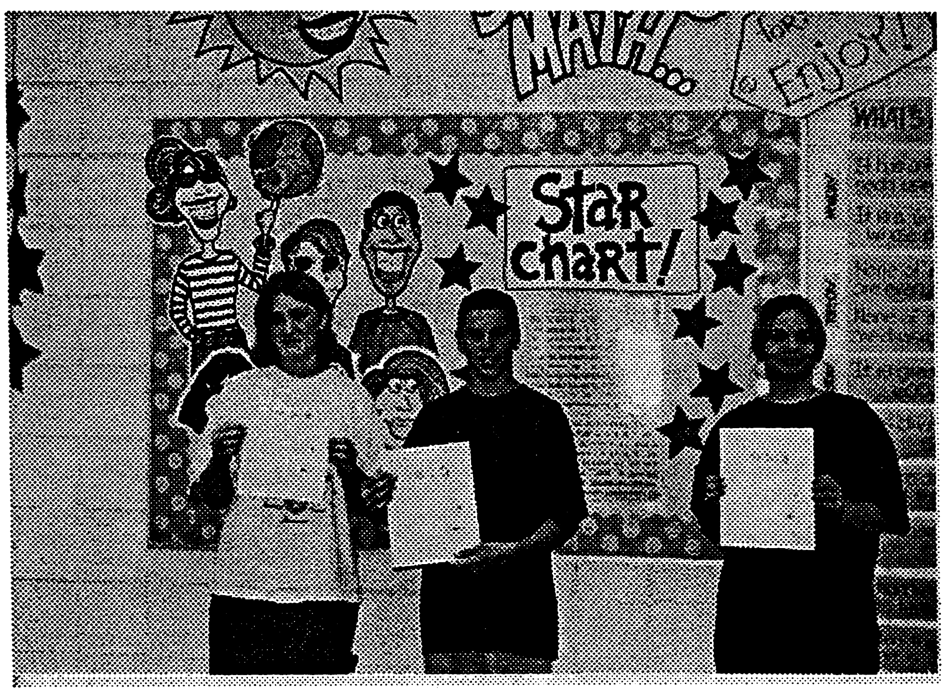
ORGANIZATION OF THESE MATERIALS

Section I **Description of the *Sunshine Math* Program**

1. General Information
2. Information/ checklist for principals
3. Information/checklist for assisting adults
4. Information for teachers
5. Letter to participating students and their parents

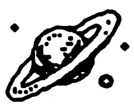
Section II **Student worksheets for *Sunshine Math***

Section III **Commentary for student worksheets for *Sunshine Math***



Sunshine Math General Information

Sunshine Math is a K-8 program designed as an enrichment opportunity for self-directed learners in mathematics. The levels of the program are named after the planets of our solar system:



Kindergarten	Mercury	Fifth Grade	Saturn
First Grade	Venus	Sixth Grade	Uranus
Second Grade	Earth	Seventh Grade	Neptune
Third Grade	Mars	Eighth Grade	Pluto
Fourth Grade	Jupiter		

Students of all ability levels choose on their own to participate in *Sunshine Math.* The visual reinforcement of seeing their names displayed in a prominent place in the school, with a string of stars indicating their success, is the reward a student receives for the extra work. In many cases, the school decides to enhance the basic reward system by awarding certificates or other forms of recognition for achieving certain levels of success in *Sunshine Math.*

Sunshine Math can function in a school in a number of different ways. The "tried and true" way is for assisting adults (volunteers, aides, etc.) to manage the program for the entire school, with support provided by school administrators and classroom teachers. This system has been modified at the school level, with varying degrees of success, over the years. The basic model for running *Sunshine Math* is discussed below, with variations described on the next page.

The Basic Model

The basic model for *Sunshine Math* is for a school to establish a weekly cycle early in the fall, according to these guidelines:

> On Monday of each week, student worksheets are distributed by the assisting adults to those in the program. Students have until Friday to complete the problems, working entirely on their own. On Friday, the classroom teacher hosts a brief problem-solving session for the students in the program. The more difficult problems on the worksheet for that week are discussed, with students describing their thinking about how to approach and solve the problems. They do not give their answers for the problems, only their strategies.
>
> Students get double-credit for problems they complete prior to the problem-solving session, and regular credit for those they complete successfully over the weekend. On Monday, all papers are handed in, checked by the assisting adult, and stars are posted for problems successfully worked. This completes the cycle for the preceding week, allows for the new worksheets to be passed out, and the cycle begins again.

Sunshine Math is not for every child -- it's only for those who are self-motivated and who are not easily frustrated by challenging situations. This does not diminish the value of the program, but rather makes us realize that there are children of all ability and socio-economic levels who are self-directed learners and who need challenges beyond those of the regular school day. These children will shine in *Sunshine Math.*

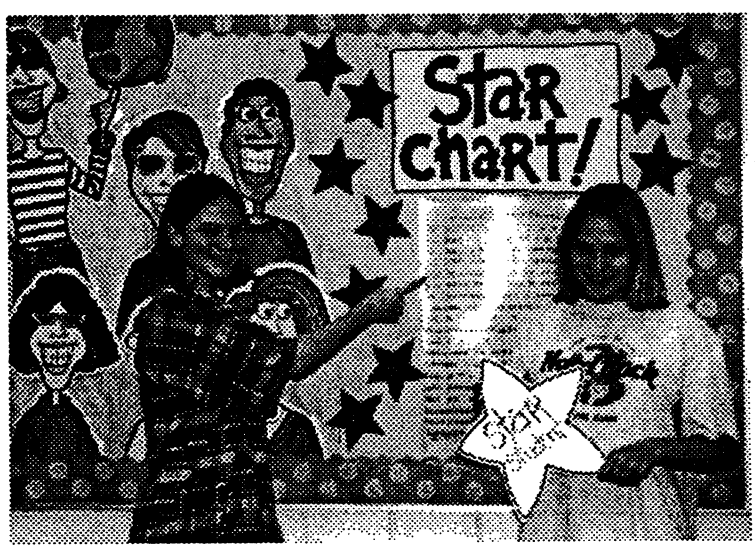
Variations of the Basic Model

The first variation that has been used successfully retains the weekly cycle and assisting adult role as in the basic model. However, the teacher involves the entire class in the problem-solving discussions. For example, the teacher might pick the four hardest problems on the worksheet for that week, and do a "parallel problem" with the entire class to open the mathematics class on Tuesday through Friday. Using this variation, all students are exposed to the problem-solving strategies, but only those who are in *Sunshine Math* exhibit that they have learned the material by completing the worksheet over the weekend.

A second variation is for the assisting adults to run the entire program, including the problem-solving session for students. This method has been used in situations in which some teachers in a school lacked commitment to the program, and thus it was being implemented inconsistently. In such cases, the assisting adults must have a progressive view of what constitutes problem solving in elementary mathematics. They must also be given extra assistance from the principal to ensure students are released from class and that the process works smoothly in general.

Yet another variation is for a parent to run *Sunshine Math* at home, for their own child. The basic rules are the same -- a child gets the worksheet once a week and time to work the problems alone. The parent has a pre-established night to listen to the way the child thought about each problem, interjecting her or his own methods only when the child seems stuck. The reward system is basically the same -- stars on a chart -- but is usually enhanced by doing something special for the child, such as a trip to the movies or to the skating rink, when the child reaches certain levels of success. If this method is adopted, the parent must be sure not to try to "teach the child." *Sunshine Math* is a program designed to stimulate discussion of problem-solving strategies; it is not a program designed for adults to "teach children how to think."

Other variations abound. The basic model on the previous page is the approach that reaches more children in a consistent fashion than any of the other methods. However, individual schools, teachers, or parents are encouraged to get some version started, even if it's not one of the above. Some sunshine is better than none at all!



Sunshine Math: Information for Principals

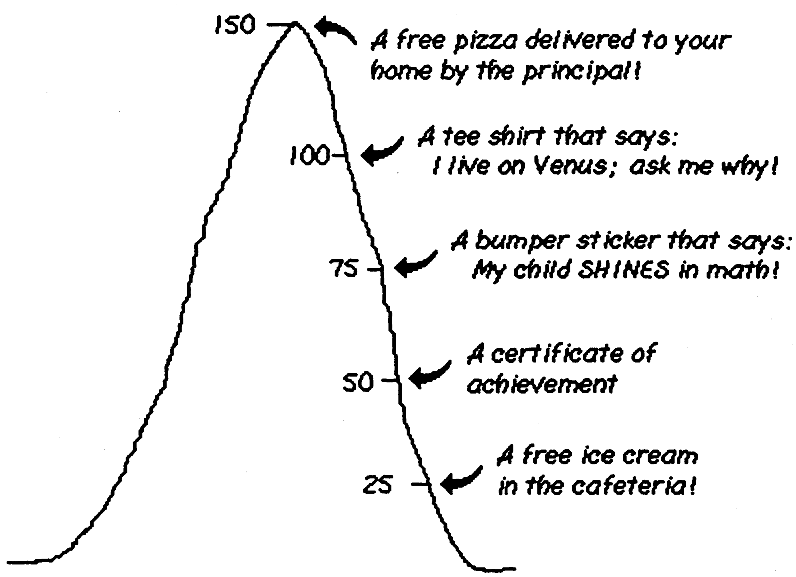
Sunshine Math is a K-8 enrichment package for mathematics, designed to be managed by volunteer assisting adults with coordinated support from the classroom teacher and school administrators. The purpose of the program is to give self-motivated students of all ability levels a chance to extend themselves beyond the normal mathematics curriculum. The complete set of materials comes in nine packages, one for each K-8 grade. The grade levels are named for the planets in the solar system, in order starting from the sun: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto.

Your support is vital if this program is to succeed. As the school administrator, you need to stay in close touch with *Sunshine Math*. A "checklist for success" follows:

- ❑ Become familiar with the philosophy and component parts of the program.
- ❑ Introduce *Sunshine Math* to the faculty early in the school year. Ensure that each teacher understands the philosophy of the program and has a copy of the student worksheets and commentary for that grade level.
- ❑ Speak to parents at your school's first "open house" of the year, explaining the purpose of *Sunshine Math* and the long-term value of children working independently on the worksheets.
- ❑ Recruit several assisting adults (PTA members, aides, senior citizens, business partners, churches, and so on) who are enthusiastic, dependable people to manage the program. Early in the year, meet with these assisting adults to plan such details as:
    - ✔ A prominent place and format for the STAR CHART.
    - ✔ A designated time each Monday and Friday for the assisting adult to be in the school to receive and distribute papers from students, and post stars.
    - ✔ A system for the activity sheets to be duplicated each week.
    - ✔ A plan for extra incentives for accumulating stars. ("World records" to be kept from year-to-year; a celebration day planned for the end of school; students earning prizes for attaining certain levels of success -- see the reverse side of this page for examples.)
    - ✔ A schedule for when the program will begin, and whether or not there should be a "start over" point at some time in the school year. Review a school calendar, and use only weeks that have at least four school days in them. If there isn't time in the school year to cover all the activity sheets under these conditions, decide which sheets to eliminate or when to "double up."
    - ✔ If possible provide volunteers with a *Sunshine Math* cap, name tag, tee-shirt, or other identifying feature.
- ❑ Monitor the program every two weeks to clear up any unforeseen problems. Administrators need to be highly visible for *Sunshine Math* to succeed.

Sunshine Math is an optional program for students. It should be available to any student who wants to participate, regardless of prior success in mathematics. A large number of students will usually begin the program, but a majority of them will lose interest. However, a significant number of students will continue their interest over the life of the program. This is normal and simply means that *Sunshine Math* is successfully addressing the needs of the self-directed learner.

Visual reminders help children see that mathematics is challenging and rewarding. Some ideas are presented below, merely to start your creative juices flowing:

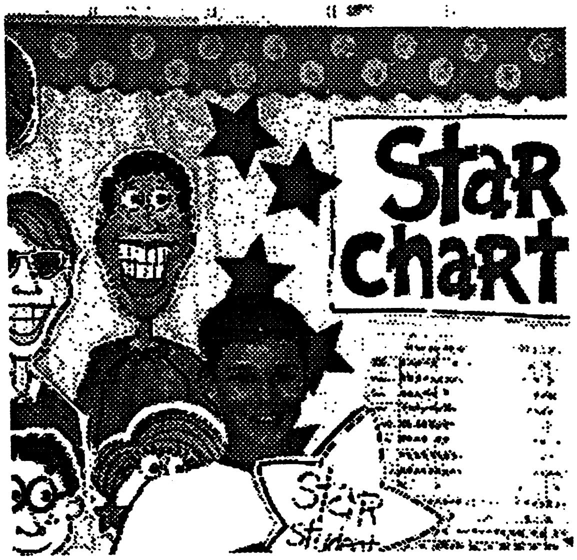


Climb the Mountain this Year!!!

Join the Sunshine Math Club

Sunshine Math: Information for Assisting Adults

Sunshine Math is designed to give assisting adults a well-defined role to play in the school's mathematics program. The success of *Sunshine Math* depends on a team effort among teachers, administrators, parents, and you. Reliability and punctuality are important -- students will rapidly come to depend upon you to be there as scheduled, to check their papers and post their stars, and to listen to alternate ways in which they may have interpreted a problem to arrive at a unique answer. If possible, wear an outfit that fits with the *Sunshine Math* logo; students will quickly begin to identify you as an important person in their school.



Sunshine Math works on a weekly cycle. Each Monday, you collect the worksheets from the previous week and distribute new worksheets to the participating students, all from your *Sunshine Math* area of the school. Allow students to see the answers to the problems, and discuss any for which they arrived at a different answer, giving them credit if their interpretation and reasoning are sound. You then check the worksheets from the previous week, and post the stars earned on the STAR CHART.

Participating students have from Monday until Friday to work the problems entirely on their own -- the only help they can receive during that time is for someone to read the problems to them. On Friday, the teacher hosts a problem-solving session in the classroom, having students describe their approaches to the more difficult problems. Students who have already worked the problems discussed, prior to the problem-solving session, can earn double stars -- you can identify these by looking for the teacher's initials beside certain problems. The students will have the weekend to complete any problems they want to -- for successfully completing these problems, they earn the indicated number of stars.

Be creative when designing a star chart. The basic method of posting stars individually is a good way to begin, but eventually you will want a color-coded system, or perhaps posting only one star each week, with a number in its center. Personalize the chart and the entire *Sunshine Math* center with pictures of students, "smiling faces," and so on. Occasionally bring in a reward for each child -- perhaps a cookie or a hand stamp in the shape of a star -- just for turning in their worksheet. Be creative and enjoy your role -- you are helping enthusiastic students develop higher-level thinking skills!

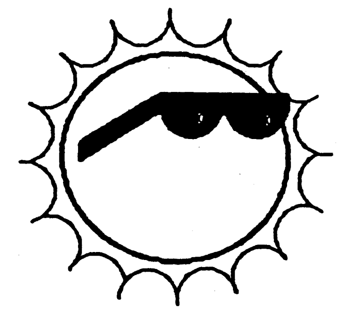
Checklist for assisting adults:

- ❑ Plan with the principal the following:
  - ✔ A prominent place and format for the STAR CHART.
  - ✔ The time and place for you to take up and check papers, and distribute new worksheets.
  - ✔ The system for duplicating worksheets each week, ensuring legible copies.
  - ✔ Any extra incentives ("world records," stickers, coupons, pencils, tee shirts, etc.) that will be part of the system for rewarding levels of achievement in *Sunshine Math.*
- ❑ Make the *Sunshine Math* center a happy place. Use bright colors, smiles, and cheerful words. Show confidence, friendliness, and encouragement to students.
- ❑ Collect the letters which are sent home prior to the first worksheet and signed by each student and parent . If in the future you have evidence that the work turned in does not represent the thinking of the student, discuss the situation with the classroom teacher. These situations are best handled individually in a firm, consistent manner.
- ❑ Check the worksheets from the previous week consistently. If you give partial credit for a problem with several parts, do so in a fair way that can be explained to students. Do not award partial credit for problems with only one answer.
- ❑ Have answer sheets available and encourage students to look at the answers when they hand in their worksheets. Allow them to explain their thinking if they arrived at a different answer. Award them full credit if they show a unique interpretation of the problem, and logical reasoning in obtaining an answer.
- ❑ Leave extra worksheets with the classroom teacher for participating students who were absent on Monday. Accept a late-arriving worksheet only if the student was absent on Monday. If a students' name is missing, or on the wrong place on a worksheet, check the paper but award the stars to "no name" on the STAR CHART. Adhering strictly to these rules will rapidly teach responsibility to the students, and keep your work load manageable.
- ❑ Keep all returned worksheets. As the same worksheets are used year-after-year, and many participating students have siblings who will later be in *Sunshine Math*, it is important that the students not be allowed to keep their worksheets.
- ❑ On weeks when *Sunshine Math* will not be available, post a sign such as "No star problems this week, but please come back after the vacation for more!"

Sunshine Math: Information for Teachers

Sunshine Math is a program designed to complement your regular classroom mathematics curriculum. It offers a peripheral opportunity for students to practice mathematics skills appropriate for their grade level and, at the same time, to participate in problem-solving experiences. It offers a challenge to those students who are self-directed learners by giving them something worthwhile to do outside of class.

Your involvement is strictly as a teacher. *Sunshine Math* will remain special to students if it's managed by someone outside the classroom, and if the teacher is viewed as a facilitator in the system, rather than as the authority figure. Your primary role is to monitor the system in your own classroom and host a brief problem-solving session for *Sunshine Math* students on Friday of each week. You will also need to release the participating students from your class at a set time on Monday to turn in their worksheet and obtain a new one. You might make yourself a special pin like that shown to the right, to wear on Monday and Friday to remind students that those days are special.



Each student worksheet has an accompanying commentary page. This sheet provides hints on parallel problems which you might use in the Friday problem-solving session. It is important that students participate actively in this session, and that you solicit from them their unique approaches to the problem discussed. Only after students present their ideas should you provide guidance on the problems, and then only when necessary. Even though there is a comment provided for each problem, you will have to decide which 3 or 4 problems you will cover during this brief session. Concentrate on those whose solution requires a strategy. The problem-solving session should last no more than 15 minutes.

Do not be disappointed if a large number of your students begin *Sunshine Math*, but many drop out after a few weeks. This is normal; problem solving requires a great deal of effort, and only certain students are ready for this challenge. On the other hand, you will also note that certain students *do* chose to stay in *Sunshine Math* week after week, even though they aren't as successful as other students at earning stars. Their participation should be encouraged, as they are certainly learning from the experience. Under no circumstances should *Sunshine Math* be reserved for only the advanced students in your class.

As a purely practical consideration, students are not allowed to discuss the problems with other students or their parents prior to the Friday "cooperative group" problem-solving session. This allows the "think time" necessary for students to develop into independent thinkers; it also prevents students from earning stars for work that is basically someone else's, which is the surest way to disrupt the entire *Sunshine Math* program. As the teacher, you must monitor this in your classroom and ensure that students abide by the established rule.

It is important that you understand and support the overall philosophy of *Sunshine Math.* Do not worry if students encounter problems for which they have not been prepared in class -- such is the nature of true problem solving. Do not provide remedial instruction to ensure that students master certain types of problems -- they will meet these same problem types repeatedly in the program, and likely will learn them on their own and from listening to other students at the problem-solving session. You should enjoy what the students *can* do, and not worry about what they can't do. You should also read over the general information about the program, to see how your role fits into the entire system.

Here are some hints that you might find useful in your support role for Sunshine Math:

✔ Allow your students to leave the classroom at the designated time on Monday to turn in their worksheets and pick up a new one.

✔ Read each week's worksheet yourself, and feel free to structure classroom activities that parallel those on the *Sunshine Math* worksheet.

✔ During the school week, students should be allowed to work on their *Sunshine Math* problems during their spare time, but the only help they can receive is for someone to read the problems to them. Give the students one warning if you observe them discussing the worksheets, and take away their papers for the next violation. If it happens another time, dismiss them from *Sunshine Math* for a month.

✔ At the problem-solving session on Friday, remember these points:

→ Students come to this session with their worksheets, but without pencils.

→ The session must be brief -- 15 minutes at most. Discuss only the 3 or 4 most difficult problems on the worksheet.

→ Help students summarize their own approaches to the problems, in a non-judgmental fashion. Offer your own approach last, and only when it's different from the student strategies. Do not allow answers to be given to the problems.

→ End the session by encouraging students to complete the problems over the weekend. Put your initials beside any problem discussed in class which a student has already completed successfully. The assisting adult will award double stars for these.

✔ Remember that part of the *Sunshine Math* philosophy is that students learn responsibility by following the rules of the system, if participation is important to them. *Sunshine Math* becomes very important to certain students, so they will adhere to rules about where their names goes on each paper, no credit if they forget their paper on Monday, no talking about the problems prior to the problem-solving session, etc., if *you* enforce the rules.

✔ Enjoy *Sunshine Math.* Students will impress you with their ability to think, and their creative ways to solve problems that appear to be above their level.

Here's a song for your students -- to the tune of "When you wish upon a star":

When you get your SUPERSTARS .....
It won't matter who you are ....
Try a few ....
See what you can do ....
.... and ....
Success will come to you!!!

Sandy Parker, Lake Weir Middle School, Ocala, FL

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Welcome to *SUNSHINE MATH,* a program designed to enhance your journey through math. Be prepared to face challenging problems which require *thinking!* As you work through the system, you will address many types of problems, stretching and expanding that gray matter of yours in exciting ways!

Expect to receive one worksheet at the beginning of the week with the rest of the week to think about each problem. Do not expect to be able to solve each problem on every worksheet. The thinking must be YOUR VERY OWN!!! Once a week, you will attend a "help session" to discuss the most challenging problems of the week.

Your journey will be recorded by charting the stars you achieve. Each problem is ranked according to its level of difficulty. The more stars you see beside the problem, the higher the level of difficulty, and, of course, the more stars you will earn for solving it. You can earn double stars for solving a problem prior to the weekly "help session". You may rework each problem before your paper is collected during the following "help session".

Your signature is just the beginning...

Good luck as you embark upon this mathematical adventure! The rewards will last a lifetime!

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

________________________________ (your name) I am ready to begin the

SUNSHINE MATH Program. All of the answers I submit represent my

own thinking.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Dear Parents,

Welcome to *SUNSHINE MATH*, a program designed to enhance your middle schooler's journey through mathematics. By expressing an interest in more challenging problem solving, your daughter or son has taken the first step toward becoming an independent learner who is able to address many types of problems.

On Monday, a *SUNSHINE MATH* worksheet will be distributed. Each problem on the worksheet is ranked according to its level of difficulty. As the number of stars beside a problem increases, so does the level of difficulty of that problem and the number of stars to be earned for solving it.

Each Friday, a "help session" will be conducted to discuss the most challenging problems of the week. Any problem solved prior to the session will be given double stars, or double credit. After the session, problems may be reworked before the sheets are collected on the following Monday.

Your role in *SUNSHINE MATH* is to **encourage** and **facilitate** problem solving. Feel free to offer guidance toward certain strategies, but please **DO NOT GIVE THE ANSWERS**. In order for this program to be effective, the thinking must be done by the students.

It is normal for a middle school student NOT to be able to complete every problem on a worksheet. The process of reading, understanding and approaching the problems is a valuable step in solving many types of problems. No student is expected to know the answers to every problem.

Thank you for allowing your daughter or son to embark on this mathematical adventure. We hope that the rewards will last a lifetime!

____

(parent's signature)

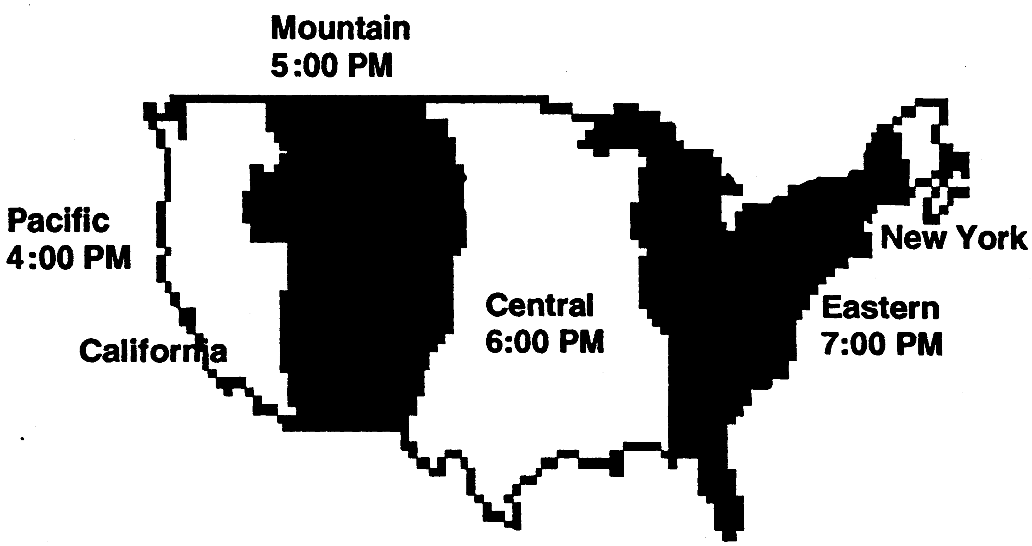
WORKSHEETS

SUNSHINE MATH - 6
Uranus, I

Name: ____________________________

(This shows my own thinking.)

★★ 1. The map below shows the four time zones in the United States. Use the map to help you answer the following questions.



a. If it is 11:00 A.M. in California, what time is it in New York?

Answer: ____

b. If you left San Francisco, California, at 10:30 P.M. on a six hour flight to Miami, what time would it be in Miami when you landed?

Answer: _____

★ 2. Rusty can cut a log into 3 pieces in 20 minutes. At that rate, how long will it take him to cut another such log into 6 pieces?

Answer:_______________

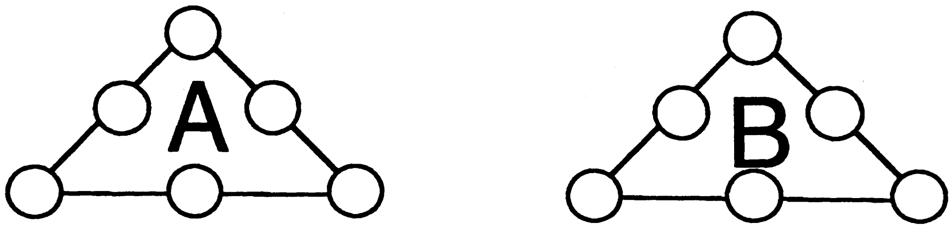
★★★ 3. Find three prime numbers, all less than 30, whose product is 1955.

Answer:_________, _________, and _________

★★ 4. One way to write 99 using four nines is $(9 \times 9) + (9 + 9)$; another way is $99 \div (9{+}9)$. Write 100 using four nines.

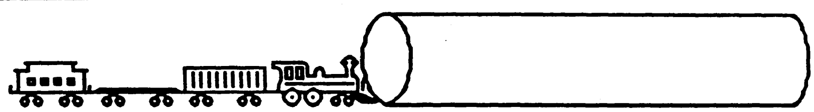
Answer:___________________________

★★ 5. Put the numbers 1, 2, 3, 4, 5, and 6 in the circles below so that the sum "along a line" is 11 in figure A, and 12 in figure B.



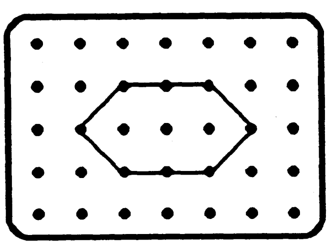
★★★★ 6. A train that is 1 mile long starts through a tunnel that is also 1 mile long. The train is traveling 15 miles per hour. How long does it take for the train to get completely out of the tunnel?

Answer: ______



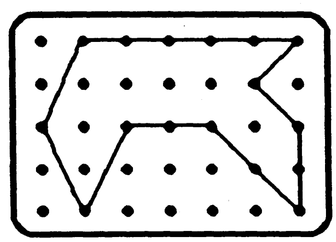
★★★ 7. Find the area of each polygon.

a.



Answer: _____square units

b.



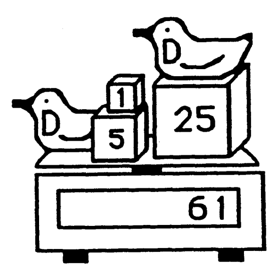
Answer: ______square units

★★ 8. An equation for the situation to the right is:

$2D + 25 + 5 + 1 = 61.$

Solve the equation by finding how much one duck weighs.

Answer: $D =$ _____

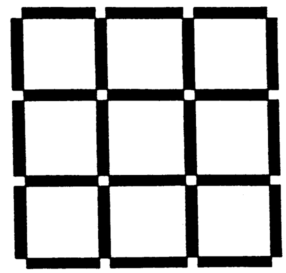


SUNSHINE MATH - 6
Uranus, II

Name: ______________________________

(This shows my own thinking.)

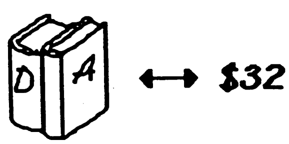
★★★ 1. Make an ✗ on each of four toothpicks you could remove so that exactly 7 squares, all the same size, would be left.

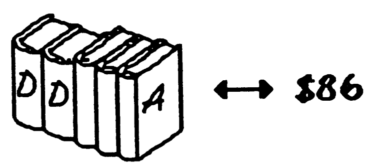


★★ 2. Joe keeps all his socks in one drawer. He has 7 blue socks and 9 brown socks. If he reaches in the drawer without looking, what is the least number of socks he can take out to be sure of getting a pair of the same color?

Answer: ___________ socks

★★★ 3. The total price of a dictionary and an almanac is $32. The total price of 2 dictionaries and 3 almanacs is $86. What is the price of each book?

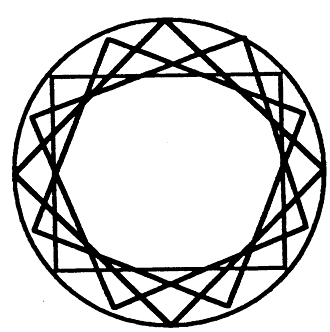




Answer: The cost of a dictionary is ____. The cost of an almanac is ____.

★ 4. How many squares are there in the circle?

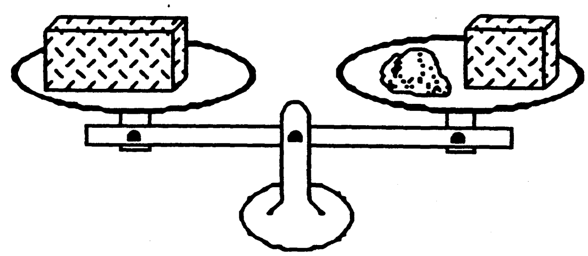
Answer: _____ squares



★★ 5. 5 years, 21 days, 4 hours, 32 minutes, 17 seconds
\- <u>2 years, 93 days, 7 hours, 47 minutes, 24 seconds</u>

★★★ 6. If a brick weighs exactly as much as a 9-pound rock plus half of another brick, what does a brick and a half weigh?

Answer: _____ pounds



★★ 7. Write a number in the △ that will give the answer 39.

$$\triangle \rightarrow (\times 4) \rightarrow (+6) \rightarrow (\div 2) \rightarrow (-4) = \boxed{39}$$

★ 8. How many of the 28 students in Andy's class are boys, if $\frac{4}{7}$ are girls?

Answer: __________ boys

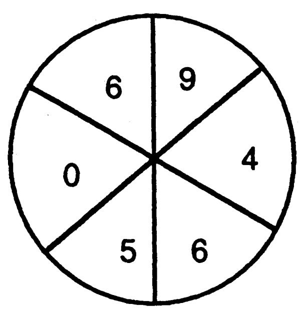
★★★★ 9. If you made a spinner out of the circle below for a game you invented, what is the probability that the arrow would land on:

a. zero? ________

b. an odd number? ________

c. a number greater than 9? ________

d. either an odd number or 0? ________



SUNSHINE MATH - 6
Uranus, III

Name: ____________________________

(This shows my own thinking.)

★ 1. The Adrians were going to grandmother's house for Thanksgiving. They traveled 283 miles in 6 hours. Did they average more or less than 50 miles per hour?

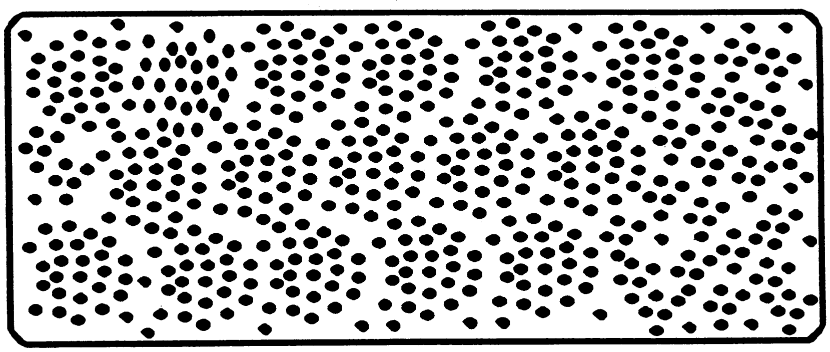
Answer: __________

★★★★ 2. Martha bought a $60 skirt at 40% off and a $40 blouse at 20% off. What percent discount did she receive on the total purchase?

Answer: ___________

★ 3. Count the dots.

Answer: _____ dots



★★★ 4. When 3 times a certain number *n* is added to 6, the sum is 20 more than the original number. What is the number *n*?

Answer: *n* = ______

★★ 5. On February 19, the temperature in Orlando was 78° Fahrenheit. In Fairbanks, Alaska, the temperature was ⁻49° F. What was the difference in these temperature readings?

Answer: _______ ° F

★★★ 6. Mrs. Gonzales has three children whose names are Javier, Juan, and Rosa. Their mean age is 11. Their median age is 10. Rosa is 15 years old. What is the age of the youngest child?

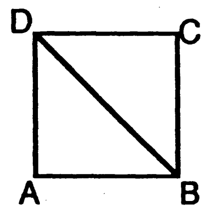
Answer: ___________

★★★ 7. These values were used to find the total score for the figures in the examples below:

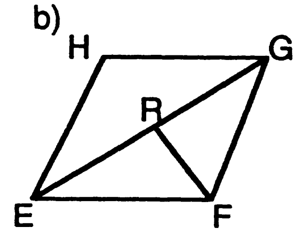
Triangle = 3 points
Quadrilateral = 4 points
Pentagon = 5 points
Hexagon = 6 points

Examples:

a)



b)



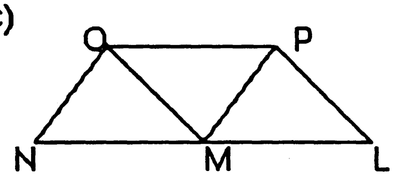
2 triangles
1 quadrilateral

4 triangles
1 quadrilateral
2 pentagons

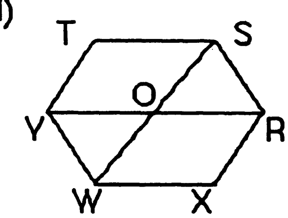
Score = 10 | Score = 26 | Total Score = 36

Now you do these. Find the total score for figures c and d. Add the scores for c and d and give the total score.

c)



d)



Score ________ Score ________ Total Score: _____

★ 8. Write what goes in the $\square$ if $a = 4$.

$$3 + a + 7 - 5 + 10 + a - a = \square$$

★★★ 9. If two prime numbers differ by 2, they are called TWIN PRIMES. List all the twin primes less than 50.

Answer: 3 & 5.

SUNSHINE MATH - 6
Uranus, IV

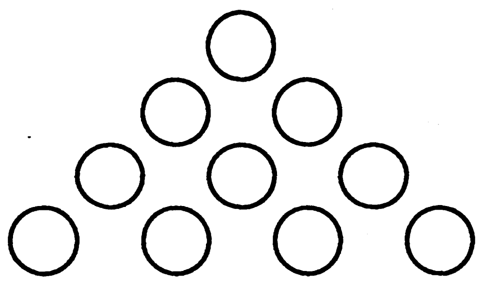
Name: ___________________________

(This shows my own thinking.)

★ 1. In one 7-day week, how often does a clock show 3 o'clock?

Answer:________

★★★ 2. Here is a triangle made of discs. Move only 3 discs and turn the triangle upside down. Draw arrows to show how you would move them. Practice with pennies if it will help you.



★★ 3. A furniture shop makes only tables and stools. Each table has four legs and each stool has three legs. The legs for both the tables and stools are the same. How many tables and how many stools can be made from 32 legs if some of each are made?

Answer: _______ tables and _______ stools

★ 4. If a regular octahedron has a surface area of 48 square inches, what is the surface area of each face?

Answer:________

★★ 5. The thousands digit of a 4-digit number is 4 greater than the hundreds digit. The tens digit is 2 times the thousands digit. The ones digit is one-half the thousands digit. What is the number?

Answer: _________

★★ 6. If you put a million sheets of 30-cm long paper end-to-end, how many kilometers long would the paper be from beginning to end?

Answer: __________

★★★★ 7. Amy, Betty, David and Ed have last names of Gonzales, Jackson, Keller, and Perez, though not in that order. They recently participated in a 1500-meter race and they all finished the race in a different position. From the clues below match the first and last names and determine in what order they finished the race.

a) Jackson said she would have finished higher if she had not slipped at the start of the race.
b) Ed finished ahead of Perez, but behind Betty.
c) Amy finished directly behind Gonzales.
d) Neither David nor Ed finished third.

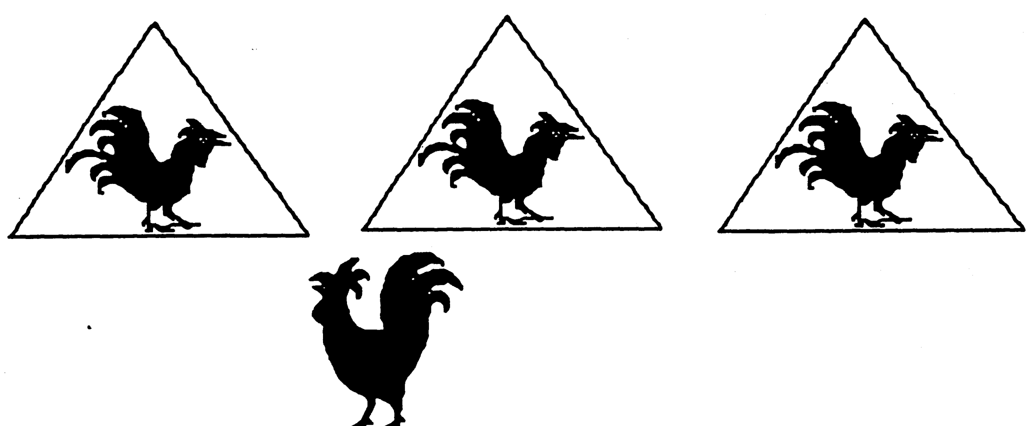
Answer: Amy _____________finished ____; Betty_____________finished ____;

David ____________finished _____; Ed_______________ finished ____.

★★ 8. The newspaper used rounded off numbers to report that about 70,000 people attended the University of Florida vs. Florida State University football game last year. What is the greatest number of people that could have attended that game?

Answer: ______________

★★★ 9. A farmer has three roosters. She keeps them in three pens like the ones shown below. She sold a cow and bought another rooster, but did not have enough money to build another pen. How can she rearrange the three pens she has to make a fourth pen? All the pens should be the same size and shape. Draw a picture below to show your solution.



SUNSHINE MATH - 6
Uranus, V

Name: ____________________________

(This shows my own thinking.)

★★★★ 1. Assign values to each letter so that the message becomes a meaningful addition example. Write your answer as an addition example beside the one below.

```
  CROSS
+ ROADS
 DANGER
```

Answer:

★★★★ 2. Every hour, on the hour, a train leaves Tallahassee for Jacksonville, while another train leaves Jacksonville for Tallahassee. The trip between the two cities takes exactly two hours. How many of the trains going in the opposite direction will a Tallahassee train to Jacksonville meet?

Answer: _______ trains

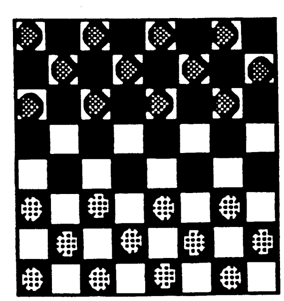
★★ 3. James purchased 3 hamburgers, 1 hot dog, 4 orders of French fries, and 4 soft drinks. The sales tax is 6%. How much change will he get from his $20?

MENU			
Hamburger	95 ¢	Milk	65 ¢
Hot dog	85 ¢	Soft drink	79 ¢
Grilled cheese	75 ¢	Milk shake	99 ¢
French fries	89 ¢	Ice cream	69 ¢

Answer: __________ as change

★★ 4. At the beginning of a game of checkers, what percent of the squares are not covered by checker pieces?

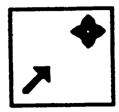
Answer: ________ %



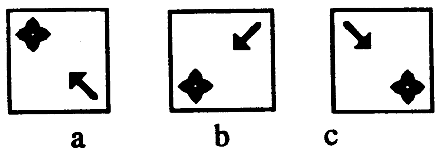
★ 5. On his way to school, Skip counted 17 trees on the right side of the street. On the way home he counted 17 trees on the left side of the street. How many different trees did he count in all?

Answer: _______ trees

★★ 6. Look at this figure:



What is the correct order for these three figures to show the one above being turned 90°, another 90° and another 90°, all in the clockwise direction?

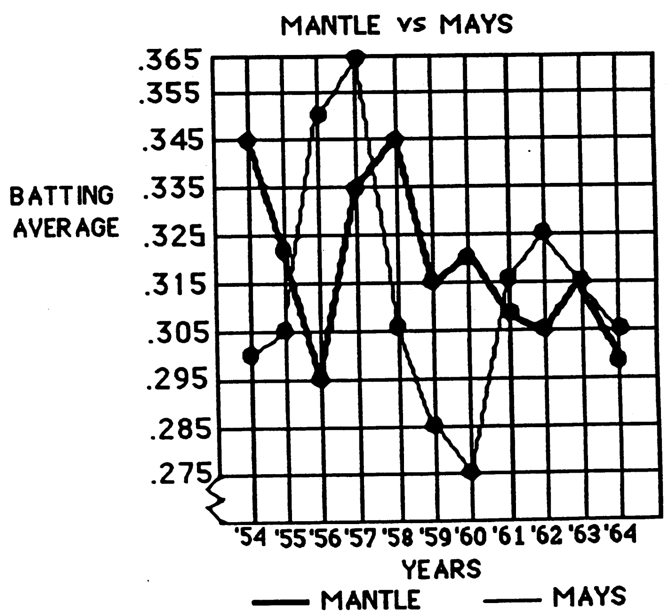


Answer: The order is ____, ____, and ____.

★★ 7. Pluto is about 5,900,000,000 kilometers from the sun. Scientists use a shortcut for recording large numbers called *scientific notation.* Write the distance from Pluto to the sun using this shortcut.

Answer: _____________ km

★★★ 8. Two of the great baseball players of this century are Willie Mays and Mickey Mantle. The graph below shows their end of year batting averages over the years from 1954 to 1964.



a. In which year did they both have the same average?

______

b. In which year did they both average more than 1 hit in every 3 at bats? _____

c. Which hitter had the smallest range between his best year and his worst year, batting-wise? ____________

SUNSHINE MATH - 6
Uranus, VI

Name: ______________________

(This shows my own thinking.)

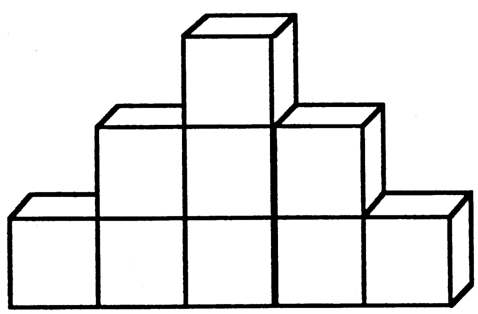
★★ 1. The world record for limbo dancing under a flaming bar is $6\frac{1}{8}$ inches. The record for roller skating under a limbo bar is $5\frac{1}{4}$ inches. How much lower is the record on roller skates, than without roller skates?

Answer: __________ inches

★★ 2. Fill in the squares using non-zero digits. Also, place the decimal point correctly in the answer.

$$\begin{array}{rrrr} & & .2 & 5 \\ \times & & 3. & \square \\ \hline & 1 & 7 & \square \\ \square & & 5 & 0 \\ \hline \square & & 2 & 5 \end{array}$$

★★★ 3. The edge of each of the cubes in the picture below has a measure of 1 inch. What is the total surface area of the figure, including the bottom?



Answer: ____________ square inches

★★ 4. If the moon takes an average of $27\frac{1}{3}$ days to revolve around the Earth, which is the closest estimate for the number of hours it will take? Circle your answer.

a) 400 hours b) 650 hours c) 1025 hours d) 900 hours

★★ 5. Find the number of letters in America's first President's last name. Multiply it by the number of letters that differ between the last names of America's second President and sixth President. What is your answer?

Answer: ____________

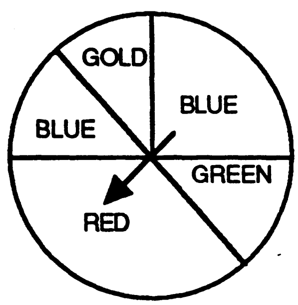
★ 6. Scientists predict that by the year 2080, the Earth and its manned space stations will be inhabited by 4,327,650,189,012 people. Round this number to the nearest billion.

Answer: ______________________________

★★ 7. Solve the following problem using Roman numerals. Be sure to give you answer as a Roman numeral.

(XL ÷ X) + XVI - XIX = __________

★★★★ 8. The picture below represents a spinner. Find the probability of hitting each of the following colors. Give your answers as lowest term fractions.



a) red: _______ b) blue: _______ c) gold or green: _______ d) orange:______

★★ 9. A sandwich shop sells hamburgers and hot dogs. They offer French fries, chips and pretzels as side orders. They also have soda, milk or juice to drink. How many different combinations of a sandwich, a side order, and a drink are possible from their menu?

Answer: ______ combinations

★★ 10. There are 24 students in Mrs. Perimeter's class. If $87\frac{1}{2}\%$ of them passed their mathematics test, how many students did not pass?

Answer: __________ students did not pass

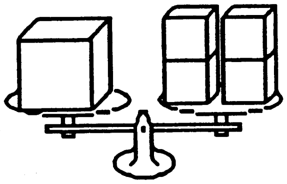
SUNSHINE MATH - 6
Uranus, VII

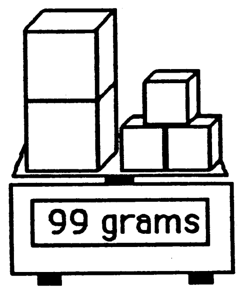
Name: ____________________________
(This shows my own thinking.)

★★ 1. A winning basketball team earned 336 points in the first 4 games last season. One-eighth of their points were made on 3-point shots. How many 3-point baskets had they made after four games?

Answer: _____ baskets

★★★ 2. Each large block below weighs the same amount. Each small block weighs the same amount. From looking at the pictures, find the weight of both the small and large blocks.





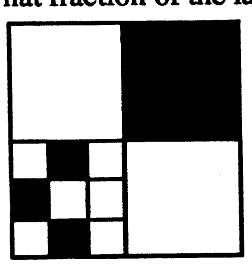
Answer: A small block weighs ______ grams.

A large block weighs ______ grams.

★★★ 3. What is the probability that you will roll a sum of 7 on one roll of a standard pair of dice?

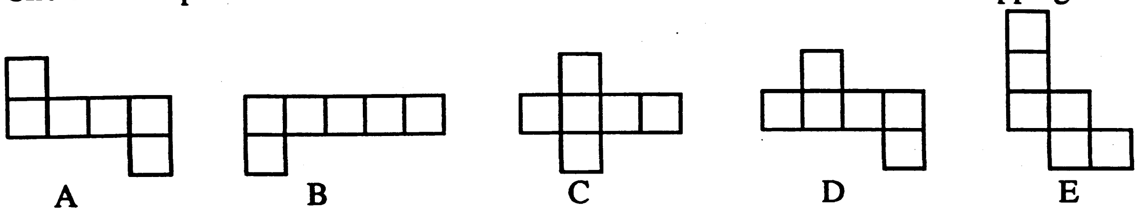
Answer:____________

★★ 4. In lowest terms, what fraction of the large square is shaded?



Answer: _______

★★ 5. Circle the shapes below that can be folded to form a closed box with no overlapping sides.

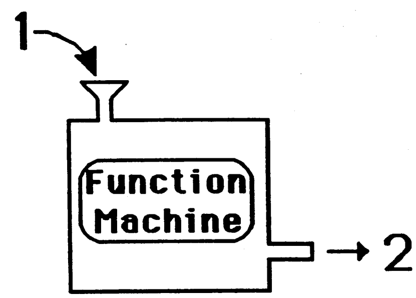


★ 6. Alfonso took a 40 question test. How many can he miss and still make an 85%?

Answer:________ questions can be missed.

★★★ 7. A function machine is set up so that when an ***input number*** is dropped into the machine, a predictable ***output number*** comes out. When 1 is dropped in, for example, 2 comes out. Study the pattern of input and output numbers in the chart below, and fill in the missing numbers.

INPUT	OUTPUT
1	2
2	5
3	10
4	17
5	
6	
7	



★★★ 8. a. For the function machine in problem 7, what number was the ***input*** number for the ***output*** number 101? ________

b. If the input number is called ***n***, what would the *output* number be?____

★ 9. Beth, Michael, Gale, Maria, and Dot are all different ages. Gale is older than Beth and younger than Michael. Maria is older than Michael. Dot is older than Beth and younger than Gale. List the names of the 5 people from the oldest to the youngest.

Answer:____

SUNSHINE MATH - 6
Uranus, VIII

Name: ____________________________

(This shows my own thinking.)

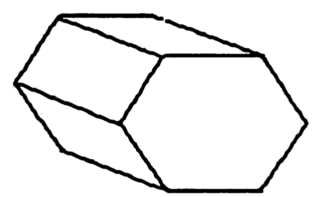
★ 1. What fraction is equivalent to $\frac{4}{5}$ and has a denominator that is 4 more than its numerator?

Answer:____________

★★★★ 2. A man weighing 80 kg. and his two children, each weighing 40 kg., want to cross a river. Each can row the boat they must use. The boat can carry only 80 kg. What is the least number of crossings that can be made to get from one side of the river to the other? (A crossing means going from one side of the river to the other side -- not a round trip.)

Answer: _______ crossings

★★★ 3. A hexagonal prism looks like the picture to the right. What is the total number of:



a. *faces* on the shape? ____

b. *edges* on the shape? ____

c. *vertices* on the shape? ____

★★★ 4. Sarah's age is three times Anthony's age. Four years from now, Sarah will be twice as old as Anthony. How old is Sarah now?

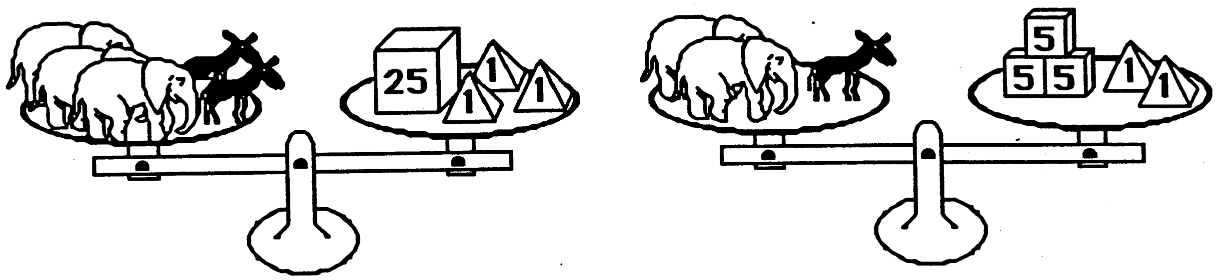
Answer: ______

★★★ 5. Diane counted 28 geese and horses on the farm. Altogether, there were 78 legs on all of the animals. How many were geese?

Answer:________ geese

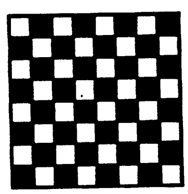
★ 6. In the space below, show how to combine six 1's so that their sum is 123.

★★ 7. Maria likes to weigh her toy animals. She found that the animals below balanced the gram weights in her science kit. Three elephants and 2 donkeys balanced 28 grams; two elephants and 1 donkey balanced 17 grams. Maria says she can now tell how much both animals weigh. Are you as clever as Maria?



Answer: An elephant is _____ grams; a donkey is ___ grams.

★★★★ 8. A checkerboard is made from a number of small squares. Four of the small squares can be grouped so that a larger square is formed. Nine of the small squares can be grouped so that even a larger square is formed. This process can be continued, up to all 64 small squares making one huge squares. How many squares altogether can be formed on a checkerboard?



Answer: _______ squares

★★★ 9. Thomas works for his dad. He was given the choice of:
(a) working for 25 days at $15.00 per day, or
(b) working for 25 days and doubling his wages every day, beginning with 1¢ the first day, 2¢ the second day, 4¢ the third day, 8¢ the fourth day, etc.

Which choice, (a) or (b), will give Thomas the greater pay and how much more pay than the other choice?

Answer: Choice ____ will give him $_______________more.

SUNSHINE MATH - 6
Uranus, IX

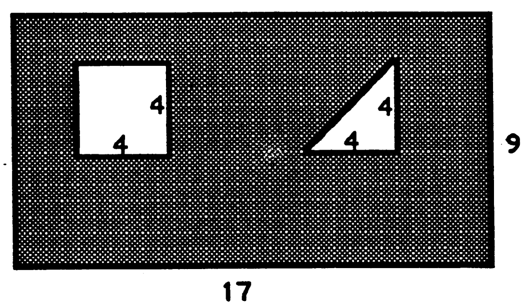
Name: ____________________________

(This shows my own thinking.)

★ 1. Look at the pattern. Fill in the next two numbers.

1, 1, 2, 3, 5, 8, 13, _____, _____

★★★★ 2. The 17-inch-by-9-inch piece of cardboard below has two holes that were cut from it. What is the area, in square inches, of the remaining cardboard?



Answer: ___________square units

★★ 3. Susan challenged a friend with this problem:

Multiply the square root of 49 by 10 and subtract 50.
Then multiply that number by 7.
Now find 1/5 of the product.

What is the answer to Susan's problem? ___________

★★★ 4. Here's a number trick:

Chose a number from 1 to 9. *Double it.* *Add 5.* *Multiply your result by 5.* *Subtract 25.* *Remove the ones digit.* *Viola! You have your original number back.*

Does this number trick always work? Answer: __________ (yes or no)

★★★ 5. A high school track record that remained unbroken for over thirty years is Jim Ryun's 1965 mile run of 3 minutes, 58.3 seconds. Essentially he ran 1 mile in 4 minutes. What was his average speed, to the nearest whole number, in miles per hour?

Answer: _____ miles per hour

★★ 6. If Andy's average pulse rate is 72 beats per minute, about how many times will his heart beat in a day? Give your answer rounded to the nearest thousand beats.

Answer: _______________ beats

★★★ 7. Jim's Sport Shop sells four pairs of roller blades for every three skateboards. Last week he sold sixteen pairs of roller blades. How many more pairs of roller blades did Jim sell than skateboards?

Answer: __________

★★ 8. Tamika took five math tests. Her teacher reported she had an average score of 91, but had lost one of Tamika's tests. The four the teacher had showed scores of 86, 92, 88, and 96. What was her score on the lost test?

Answer: ________

★★ 9. A real estate broker sold a house for $120,000. Her commission was 8% of the selling price.

a. How much money did she earn in commission?

Answer: ________

b. If she had to pay 28% of her commission in income tax, how much did she have left to spend?

Answer: ________

SUNSHINE MATH - 6
Uranus, X

Name: ______________________

(This shows my own thinking.)

★ 1. Multiply 37 by 3. Now multiply 37 by 6. What would you have to multiply 37 by to get all fives?

Answer: ________

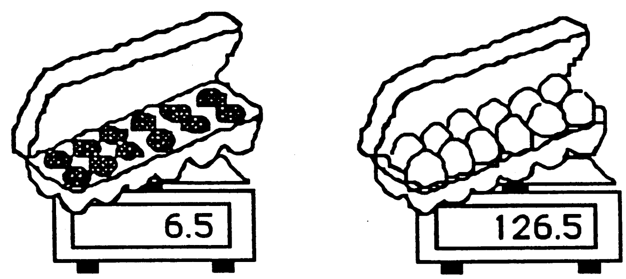
★★★★ 2. Solve each problem.

a. A 12-pak of colas cost \$4.48, including tax of \$0.28. How much would each cola cost, without tax? ________

b. Maria put 5 pups in a cage to send them on an airplane. The total weight was 90 pounds. The cage by itself was 25 pounds. On average, how much did each pup weigh? ______

c. Garth gets to watch 15 hours of TV each week. There are only 5 hour- long shows he watches each week. How many half-hour shows can he watch? _____

d. The scale shows grams. How much does one egg weigh? ______ grams



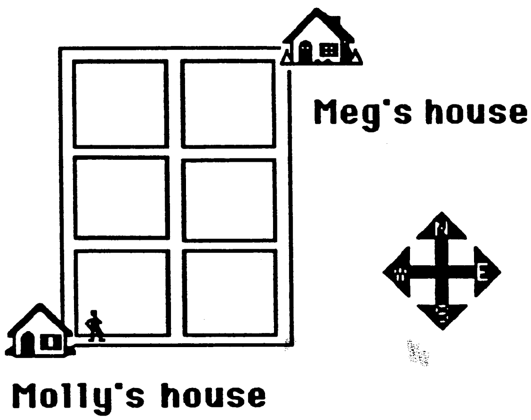
★★★ 3. Place the numbers 1 to 16 in the grid so that each row, column and diagonal will have a sum of 34. Some numbers have been placed for you.

		3	
	11	10	
9			12
		15	1

★★ 4. If a 27 in^3 jar of peanut butter holds 16 ounces, how much peanut butter is in a jar that is 67.5 in^3 in volume?

Answer: ___________ ounces

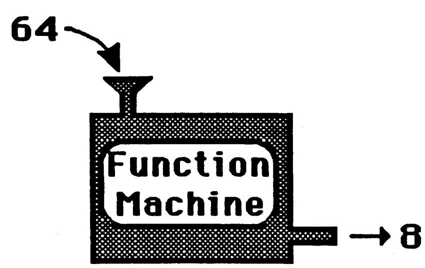
★★★ 5. Molly and Meg are good friends who like to visit each other often. The map below shows the location of the two girls' houses. Molly decided to find all the different ways to get to Meg's house from hers. She can move only in the direction of east and north. How many different routes are there for Meg to use?



Answer: __________ routes

★★ 6. The function machine below shows what happens to a number dropped in the input place. Fill in the two missing output numbers, when 49 and 81 are dropped in.

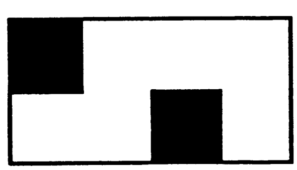
INPUT	OUTPUT
64	8
36	6
4	2
100	10
49	
81	



★★★ 7. In sixteen more minutes it will be as many minutes before 3 P.M. as it was after 2 P.M. ten minutes ago. What time is it?

Answer: __________

★ 8. Estimate the percent of the figure that is shaded.



Answer: __________

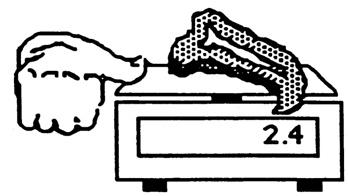
SUNSHINE MATH - 6
Uranus, XI

Name: ____________________________
(This shows my own thinking.)

★★★★ 1. Harry the Hog is a disgrace to butchers everywhere! He's known for keeping his thumb on the scale for a little extra weight and therefore money. The T-bone sells for $2.99 a pound, but Harry's thumb has added 0.3 lb. to the scale.

a. What will you pay for the steak if you don't notice his thumb? ________

b. What will you pay for the steak if you make him remove his thumb? ________

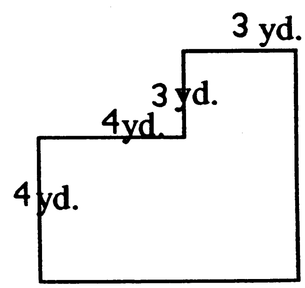


★★ 2. A notebook costs $1 more than a pencil. Together they cost $1.50. How much does each item cost?

Answer: a) The notebook costs _________.

b) The pencil costs ____________.

★★★ 3. One of the classrooms at the middle school is shaped like the picture to the right. What is the area of the entire room?



Answer: _________

★ 4. Arrange the fractions $\frac{2}{3}$, $\frac{1}{2}$, $\frac{5}{6}$, $\frac{7}{12}$, and $\frac{3}{4}$ in order from smallest to largest.

Answer: _____ _____ _____ _____ _____

★★ 5. Johnny had a raise in pay that moved him from \$4.00 an hour to \$4.60 an hour. What was his percentage of increase in pay for one hour?

Answer: The percentage raise was __________% per hour.

★★★★ 6. In the array below, the middle entry in each *odd* row is the square of the row number itself. So in the third row, the middle entry is nine, and 3 x 3 = 9.

a) What is the middle entry of the 23rd row going to be?

Answer: ________

1		→ row 1
3 5		→ row 2
7 9 11		→ row 3
13 15 17 19		→ row 4
21 23 25 27 29		→ row 5

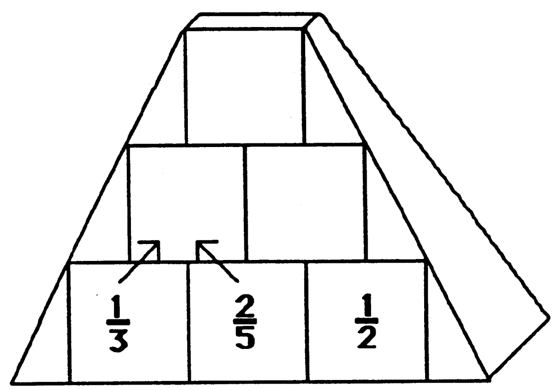
b) What will be the sum of the numbers in the 10th row?

Answer: ________

★ 7. A digit in the fifth place to the left of the decimal point has what place value?

Answer: ______________________________

★★ 8. Complete the pyramid by adding adjacent fractions and placing the sum above the two numbers being added. Put your answers in lowest terms in the three squares.



★★ 9. To make four servings of cream of wheat, you bring to a boil 4 cups of water, and then mix in $\frac{2}{3}$ of a cup of cream of wheat. But a family of three doesn't want to make four servings.

a. How much water would be required for three servings of cream of wheat? _____

b. How much cream of wheat would be required for a serving of three? _______

SUNSHINE MATH - 6
Uranus, XII

Name: ______________________________

(This shows my own thinking.)

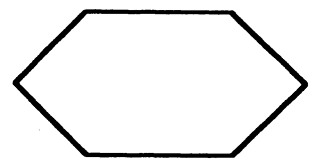
★★ 1. Goldbach, a Russian mathematician, conjectured that every even counting number greater than 2 can be written as the sum of two different prime numbers. For example, $10 = 3 + 7$.

Write each of these as a sum of two different primes:

a) 26 = ___________ b) 82 = ___________

★ 2. How many diagonals does a hexagon have?

Answer: _____



★★ 3. Mrs. Searcy's class is entering a riddle writing contest sponsored by *MATH WIZZ* magazine. Leila wrote this riddle:

Find 3 integers whose product is $^{-}36$ *and whose sum is 5.*

What is the answer to Leila's riddle?

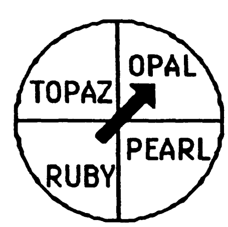
Answer: ___________

★★ 4. Compute the following: $2^4 + 3^3 + 4^0$

Answer: ___________

★★★ 5. Mark had to hit the same area of the spinner twice in a row to win his girlfriend a bracelet at the fair. What are his chances of hitting the same area two times in only two spins?

Answer: ______

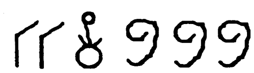


★ 6. Circle the greatest decimal number below.

2.05 2.5 2.005

★★ 7. Use the Egyptian Symbol Chart below to write the Egyptian numeral as a decimal numeral.

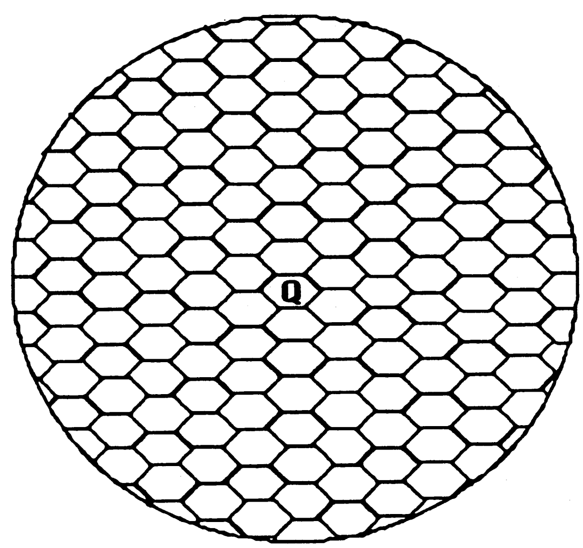
Egyptian Symbol	Decimal Numeral
(stroke)	1
(ox yoke)	10
(coil of rope)	100
(lotus plant)	1000
(bent finger)	10,000
(tadpole)	100,000
(astonished man)	1,000,000

 = ________

★★★ 8. How can you make change for a dollar using exactly 50 coins and only the coins listed below?

__________ dimes __________nickels __________pennies

★★★★ 9. The picture shows a peek at a honeycomb. The queen's nest is shown in the center.



a. How many nests touch the queen's nest?

____

b. How many nests touch a nest that touches the queen's nest? ______

c. The two sets of nests above could be called neighborhoods 1 and 2. How many nests in neighborhood 3? _____

Neighborhood 4? _____

Neighborhood 5? ______

d. What is an expression for the number of nests in Neighborhood *n*? ______

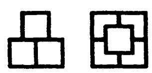
SUNSHINE MATH - 6
Uranus, XIII

Name: ______________________________

(This shows my own thinking.)

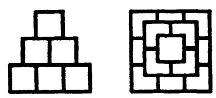
★★★★ 1. Below you can see the side view and top view of three buildings in a pattern of buildings made from sugar cubes. Study the pattern until you can visualize how Building 5 would look.

Building 2



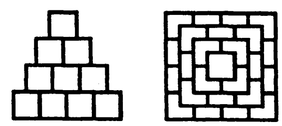
side view top view

Building 3



side view top view

Building 4



side view top view

a. Draw the side view and top view of building 5 below.

side view top view

b. How many cubes would it take to make Building 5? ______

c. How many cubes would it take to make Building 10 in the pattern? ______

★★ 2. A friend tells you she made 96, 83, and 87 on the past three math tests. What must she make on the next test to attain an average of 90?

Answer: ____________________

★★ 3. Compute:

a) $3.7 + 4.78 + 9\frac{3}{5} - 4.09 + 6 =$ ______

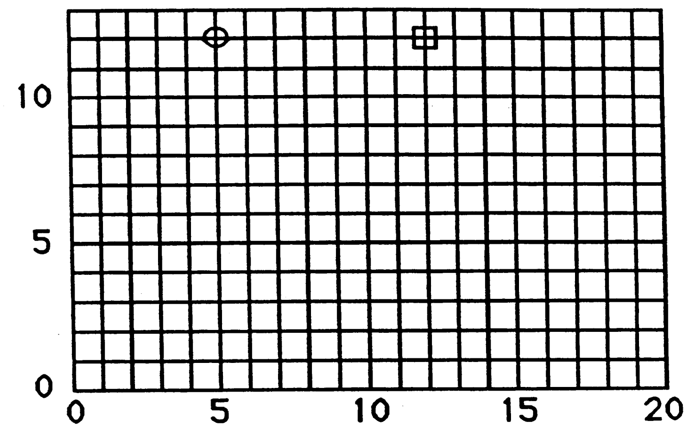
b) $\frac{5}{12} + \frac{7}{8} - \frac{2}{3} + 1\frac{1}{2} - 2\frac{3}{24} =$ ______

★ 4. A patch of water lilies doubles itself in size each day. From the time the first leaf appeared to the time when the pond was completely covered took 40 days. How long did it take for the pond to be half covered in lily pads?

Answer: ____________

★★ 5. Look at the graph below. The point (5, 12) has a circle around it, and the point (12, 12) has a box around it. The first number in parenthesis shows how far horizontally to go to find the point, and the second number shows how far vertically to go to find the point. Follow these directions exactly and you should have a word spelled out. Make your lines very heavy, or use a different color, so the lines will stand out against the grid.

Put a big dot at (3, 3).
Connect (16, 7) to (16, 3).
Connect (14, 7) to (14, 3).
Connect (16, 5) to (14, 5).
Connect (7, 3) to (7, 7)to(5, 7)to(5, 5)to(7, 5).
Connect (3, 7) to (3, 4).
Connect (8, 3) to (10, 3) to (10, 7).
Connect (11, 7) to (13, 7) to (13, 3) to (11, 3).
Connect (12, 5) to (13, 5).



★★ 6. Bob and Alex live in Pensacola, and they want to visit their aunt who lives in Miami. On the way, they want to stop and visit their cousins in Jacksonville. They need to calculate the distance they will travel from Pensacola to Miami, stopping in Jacksonville. On a map, the scale of miles shows that 1 cm represents 50 miles. Pensacola to Jacksonville is 7 cm, and Jacksonville to Miami is 6.5 cm. How many miles will they travel?

Answer: ________ miles

★★★★ 7. Name a ten-digit number such that:

The first digit on the left tells how many *zeros* are in the number.
The second digit from the left tells how many *ones* are in the number.
The third digit from the left tells how many *twos* are in the number.
The fourth digit from the left tells how many *threes* are in the number.
The fifth digit from the left tells how many *fours* are in the number.
The sixth digit from the left tells how many *fives* are in the number.
The seventh digit from the left tells how many *sixes* are in the number.
The eighth digit from the left tells how many *sevens* are in the number.
The ninth digit from the left tells how many *eights* are in the number.
The tenth digit from the left tells how many *nines* are in the number.

Answer: ________________________________

SUNSHINE MATH - 6
Uranus, XIV

Name: ____________________

(This shows my own thinking.)

★★★ 1. Carla sold lemonade at the school fair. She had only two sizes of cups: 5 oz. and 8 oz. Her friend Josie wanted to buy exactly 2 oz. How did Carla measure out 2 oz. of lemonade?

For the correct answer, arrange these steps in proper order by writing lst, 2nd, 3rd, 4th, or 5th in the blanks beside the statements.

_____ Pour its contents into the 8 oz. cup.

_____ 2 oz. will remain in the 5 oz. cup.

_____ Fill the 5 oz. cup.

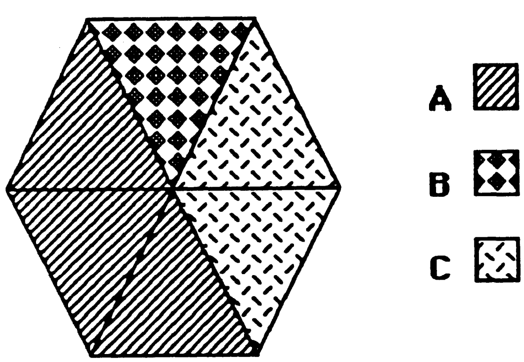
_____ Pour its contents into the 8 oz. cup until the large cup is filled.

_____ Re-fill the 5 oz. cup.

★★ 2. Alison needs to add a liquid vitamin to her horse Bobo's food. The directions on the bottle say to add 7 mL per 25 pounds of the animal body weight. If Bobo weighs 750 pounds, how much vitamin supplement should she add?

Answer: ______ mL

★★★ 3. Rounded to the nearest whole percent, what percent of the hexagon is each of the lettered parts?



Answer: A = _________

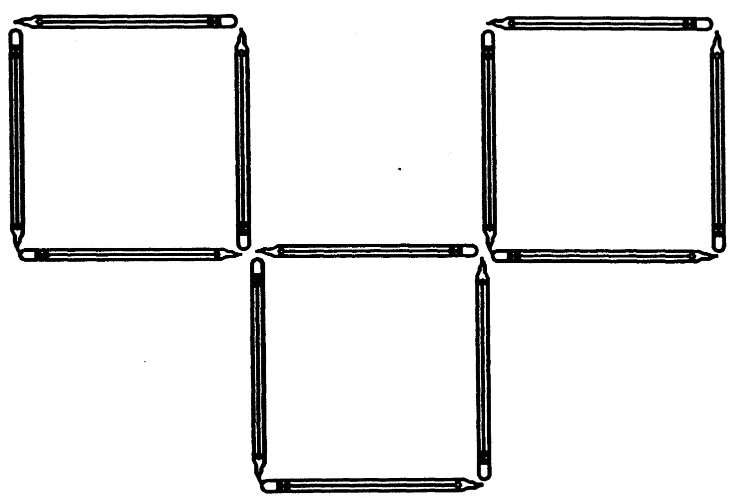
B = _________

C = _________

★★ 4. Eight girls are sitting at a table. Five are wearing sweaters, three are wearing coats, and two are wearing both sweaters and coats. How many girls are not wearing a coat or a sweater?

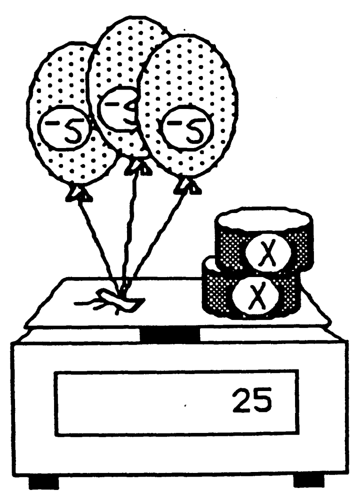
Answer: ____________________

★★★ 5. Three squares have been made from 12 pencils below. Show how to move only three of the pencils, and make four squares this same size.



★★★★ 6. The scale below shows three helium balloons attached to a scale, with two cans of unknown weight x. The helium balloons pull *up* on the scale, and so have a negative weight which has previously been measured as -5 because each one exactly balances a 5 gram weight. The cans push *down* on the scale and so have a positive unknown weight. Use your ingenuity to find the weight of one can.

Answer: $x =$ _____ grams



★★ 7. One gum ball costs 2 cents. The gum balls come in six different colors. What is the most money you would need to spend to ensure you get 3 gum balls of the same color?

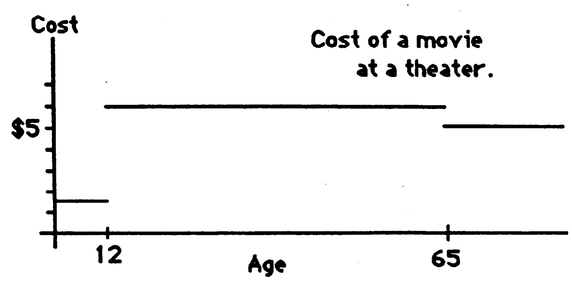
Answer: $________

SUNSHINE MATH - 6
Uranus, XV

Name: ____________________________

(This shows my own thinking.)

★★★ 1. Answer these questions about the graph.



a. How much does it cost for a 5-year old to go to a movie? ______

b. How much does it cost a 15-year old to go to a movie? _______

c. How much does it cost a senior citizen to go to a movie? _____

d. How much would it cost a father in his 40's and his 8-year old twins to go to a movie? ______

★★ 2. Karen has 20 coins worth $1.35. The coins are all nickels and dimes. How many of each coin does she have?

Answer: ________ nickels

________ dimes

★★★ 3. Five campers agreed to "share the lookout" one night. They divided the time between bedtime (9:00 PM) and sunrise (5:30 AM) into five equal time intervals. Give the resulting times below.

1st watch: 9:00 PM until ________ 4th watch: _______until _________

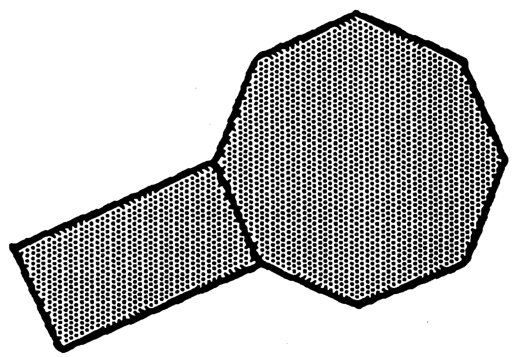
2nd watch: ______until ________ 5th watch: _______until _________

3rd watch: ______until ________

★ 4. The students at Harry's school are going to take a field trip. There are 487 students and 45 can ride on each bus. How many buses are needed for the field trip? Circle your answer.

a) 12 buses b) 10 buses c) 11 buses

★★★★ 5. A rectangle and a regular octagon share a common side. If the length of the rectangle is twice its width and the perimeter is 36 cm, what is the perimeter of the octagon?



Answer: _____ cm

★★ 6. Marcus has 3 red marbles, 9 white marbles, and 4 green marbles. He wants to divide all the marbles evenly into two jars, but he only wants two colors in each jar. How can they be divided?

Answer: ____

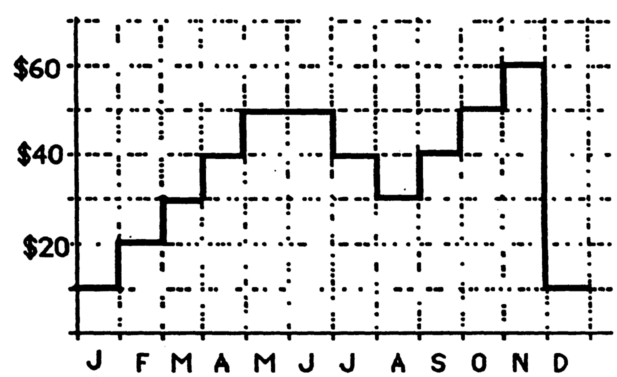
★★★ 7. The graph shows the balance in Jeremy's savings account for 1995.

a. What happened to Jeremy's account during the spring months?

answer: ____________________

b. When did the savings drop by $10 at the end of the month?

answer: ________ and ________



c. Between what two months did the biggest change occur? __________ and __________

★★ 8. Larry's ice cream shop has chocolate macadamia nut ice cream, rocky road ice cream, and strawberry cheesecake ice cream. They also have sugar cones and waffle cones. How many different double-dip ice cream cone combinations (using two different flavors of ice cream) can they make from these selections? The order of the ice cream does not matter, for example, chocolate macadamia on top of strawberry is the same as strawberry on top of chocolate macadamia.

Answer: _________

SUNSHINE MATH - 6
Uranus, XVI

Name: ______________________
(This shows my own thinking.)

★ 1. The number described by these clues can be found in the grid below. Circle the number.

a) It is greater than 588 ÷ 3.
b) It is odd.
c) It has a ones digit and tens digit whose sum is 6.

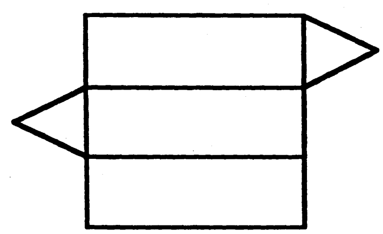
144	324	214
304	233	323
151	342	123

★★★ 2. Mrs. Circle has a class of 30 students. For every three girls in the class there are 2 boys. How many boys are in the class?

Answer: ______ boys

★★ 3. The picture shows a pattern for making a polyhedron. If you could cut this out and fold it up, what is the name of the polyhedron you would make?

Answer: ______________________

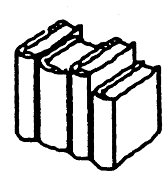


★★ 4. The cheerleaders are making lapel ribbons to sell at the Friday night football game. Each lapel ribbon requires 1/4 yard of ribbon. They have 60 yards of ribbon with which to make new lapel ribbons. In addition, they have 10 ribbons left from last week's game that they did not sell. All together, how many ribbons will they have to sell at this Friday's game?

Answer: ________

★★ 5. In how many different ways can 4 books be arranged on a shelf?

Answer: ________ ways



★ 6. Examine this set of numbers to see what they have in common. Then write the next 3 numbers in the set.

2, 3, 5, 7, 11, 13, 17, ______, ______, ______, ...

★★★ 7. Dorothy, Jake, Vicky, Otis, and Nick wore red, blue, yellow, purple, and green jackets. They collected spiders, marbles, hammers, fish, and watches. No two people wore the same color or had the same collection. Use these clues to match the people to the color of their jackets and their collections.

a) The boy in the green jacket collects spiders.
b) A girl who collects marbles has a yellow jacket.
c) Nick's favorite color is red and he always knows what time it is.
d) Jake's mother is always picking up rocks and putting them in fish bowls.
e) Dorothy collects hammers and hates the color blue.

NAME	JACKET	COLLECTION
DOROTHY		
JAKE		
VICKY		
OTIS		
NICK		

★★ 8. The letters S, T, and U have been left out of the sequence of letters below. Write each in its correct place above or below the line.

A EF HI KLMN VWXYZ
BCD G J OPQR

★★★★ 9. You have three bottles -- a 10-liter, a 4-liter and a 3-liter. All of the bottles are unmarked and there is no other supply of water available. The 10-liter bottle is full. You want to divide the water in such a way as to have one liter of water in the 3-liter bottle, four liters in the 4-liter bottle and five liters in the 10-liter bottle. You can do this by pouring the water from one bottle to another. What is the fewest number of pourings that will achieve this division of the water?

Answer: ______ pourings

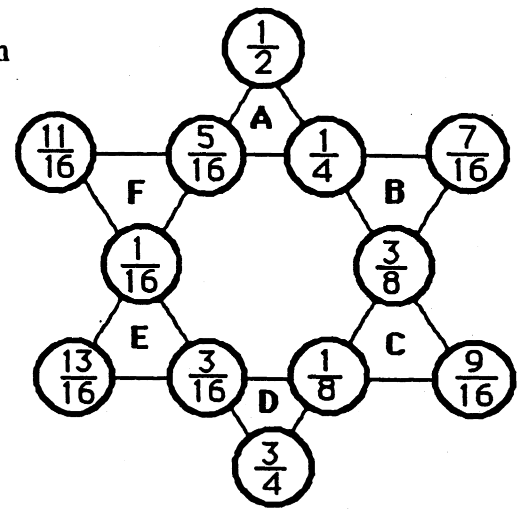
SUNSHINE MATH - 6
Uranus, XVII

Name: ______________________________

(This shows my own thinking.)

★ 1. The star at the right is a "magic star." All fractions in each straight line have the sam sum. What is the magic sum?

Answer: __________



★ 2. Add the fractions at the corners of the two large triangles. First, add the fractions $\frac{1}{2} + \frac{13}{16} + \frac{9}{16}$. Next, add $\frac{11}{16} + \frac{7}{16} + \frac{3}{4}$. What is the magic sum?

Answer: _________

★ 3. Finally, add the fractions at the corners of small triangle A: $\frac{1}{2} + \frac{5}{16} + \frac{1}{4}$. Then add the fractions at the corners of each of the triangles marked B, C, D, E, and F. What is the sum of each small triangle?

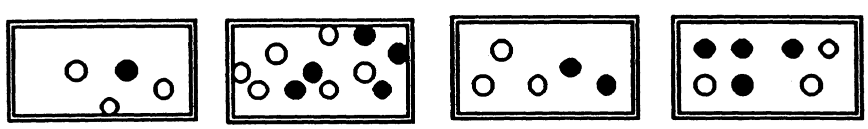
Answer:_________

★★★★ 4. Replace the letters *a* - *j* with the digits 0 - 9 to make each of these equations true. You may use each digit only one time.

a) $a + 2 + 5 = 8$	b) $6\ (b - 8) = 6$	c) $8 + (c + 4) = d$
d) $6 + e \times f = 30$	e) $2\ (g - h) = 10$	f) $3\,i + j = 15$

a = ___; b = ___; c = ___; d = ___; e = ___; f = ___; g = ___; h = ___; i = ___; j = ___

★★★ 5. Rhonda went to a party where they were drawing marbles out of a box for prizes. The player wins if she draws out a black marble on the first draw. Circle the box below that would give Rhonda the best chance of winning.



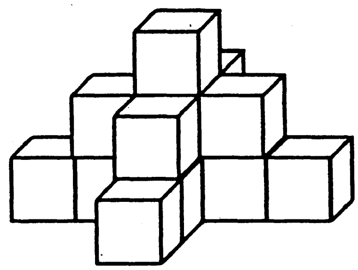
A B C D

★ 6. Mrs. Walker bought a board 30 inches long for a class project. She needs to cut it into 1-inch pieces so that each student in her class will have a piece. How many cuts are required?

Answer: ___________ cuts

★ 7. Joaquin made the figure below by stacking up centimeter cubes. The figure looks this same way when viewed from the back side. What is the volume of the figure?

Answer: ____ cubic centimeters



★ 8. Fill in the blanks in the numbers below with the largest digit possible to make each statement true.

a) 4, __ 2 3 is divisible by 3. b) 2 __, 9 3 6 is divisible by 9.

★★★ 9. The "unit fractions" are those whose numerator is 1, such as $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$ and so on. Find three different unit fractions whose sum is a whole number.

Answer: _____________

★ 10. Jessie's total score after 3 games of bowling was 456. If she scored 132 in the fourth and final game, what was her average score per game?

Answer: _____________

SUNSHINE MATH - 6
Uranus, XVIII

Name: ______________________________

(This shows my own thinking.)

★★ 1. Hickory, dickory, dock
The mouse ran up the clock.
The clock struck four
The mouse ran down.
Hickory, dickory, dock.

If the clock strikes only on the hour, how many times will the clock strike before it strikes only four times again?

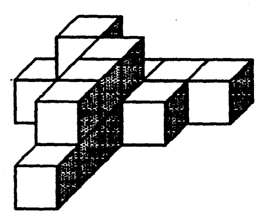
Answer: __________

★ 2. What is the prime factorization of the number 30?

Answer: ___________

★★ 3. How many blocks are in the picture if each block sits on another and there are no hidden spaces?

Answer: _____ blocks



★★ 4. Dan is painting letters on the side of a model truck. The letters on the real truck are 40 inches high. The model is $\frac{1}{20}$ the size of the truck. How high should Dan make the letters on the model?

Answer: ____________

★★ 5. According to the *Guinness Book of World Records*, Michel Lotito is the world champion eater of metal and glass. Since 1966, he has eaten 10 bicycles, 7 TV sets, a Cessna airplane, and a metal coffin, among other things.

His doctors say he can eat up to 2 pounds of metal a day. At this rate, how long would it take him to eat a small car, which weighs about 1 ton?

Answer: _____ years and _______ days

★★★ 6. Draw the 100th figure for the pattern below:

♣♥♥♣♣♥♥♣♣♣♥♥♣♣♣♣♥♥♣♣♣♣♣♥....

Answer: ________

★★ 7. Write the number of things in a dozen. Multiply it by the number of inches in a foot. Multiply that by the number of months in a calendar year. Multiply that by the number of items in the set of numbers on a clock. Write your answer below.

Answer: ________

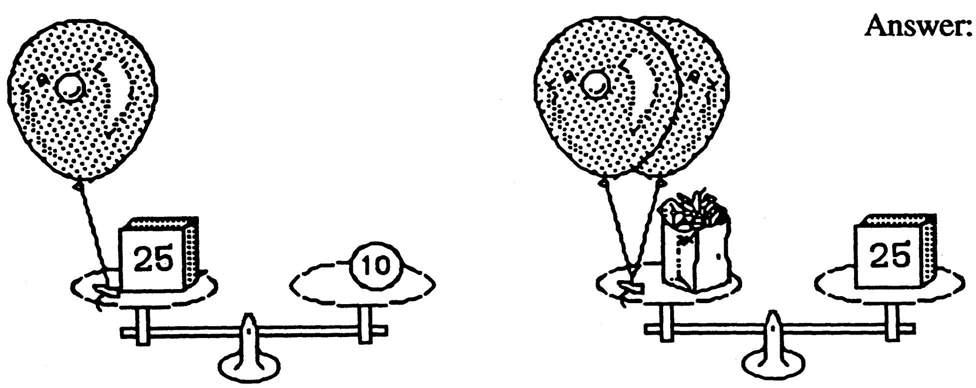
★★ 8. One day Jimmy's teacher gave the class the correct answers to their math examples but she failed to put in the decimal points. Help Jimmy decide where to place the decimals by rounding off the numbers involved, and estimating. Place the decimal points in the proper place.

a) 7.436 x 3.89 = 2 8 9 2 6 0 4

b) 3.773 ÷ 0.98 = 3 8 5

★★★★ 9. Sheila bought a couple of identical helium balloons at the mall. She was testing out their "pull power" with her science kit, and found that one balloon and a 25-gram weight exactly balanced a 10-gram weight. Then she tested a bag of groceries, and found that the two balloons and bag of groceries exactly balanced the same 25-gram weight. Sheila said "Aha -- I know how much the groceries weigh." How much *do* the groceries weigh?

Answer: _____ grams



★★ 10. What would the next set of letters in this pattern be?

AN, bo, DQ, gt, _____, ...

SUNSHINE MATH - 6
Uranus, XIX

Name: ______________________
(This shows my own thinking.)

★ 1. A football player ran from his own 38-yard line to the other team's 40 yard line. How long was his run?

Answer: _________ yards

★★ 2. Ryan can walk to school in $\frac{6}{15}$ of an hour. When he rides his bike, he can get there in 8 minutes. Can Ryan get to school quicker by walking or by riding his bike? How many times faster?

Answer: a) Ryan can get to school faster by ___________.

b) _________ times faster.

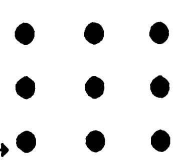
★★★★ 3. Look at the equations to the right: A, B, C, and D are whole numbers.

$A \times B = 24$
$A + B = 14$
$C \times D = 48$
$A \times D = 192$
$B \times C = 6$

What number is A? ____ What number is B? ____

What number is C? ____ What number is D? ____

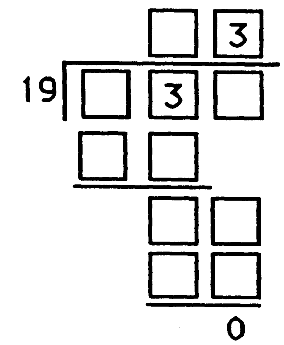
★★★ 4. Start as shown. Draw only 4 straight lines to connect all 9 dots. Do not lift your pencil until all the dots are covered.

Start here →


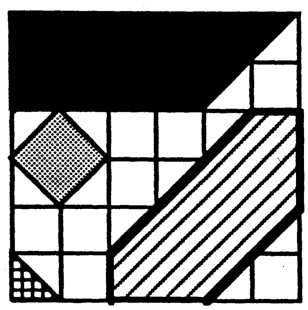
★★★ 5. Maria and Sarah are cutting strips of fabric for streamers to use in the P.E. show. Each strip needs to be $2\frac{1}{4}$ inches wide. How many strips can they cut from 6 feet of fabric if they cut from selvage to selvage?

Answer: _________ strips can be cut.

★★ 6. Write the missing digits in the problem:



★★★★ 7. Assume the area of the big square is 36 cm^2. Name the areas of the parts described.

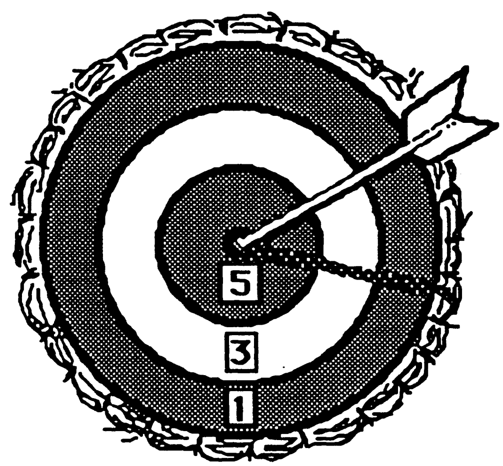


Black region: ________ cm^2
Dotted region: ________ cm^2
Striped region: ________ cm^2
Crossed region: ________ cm^2

★★ 8. If you shot 3 arrows at this target and all 3 arrows hit the bull's eye, you would score 15 points.

If exactly 3 arrows hit this target, how many different total scores are possible?

Answer: _____



SUNSHINE MATH - 6
Uranus, XX

Name: ____________________

(This shows my own thinking.)

★★ 1. I am a four-digit number.
All of my digits are *odd* numbers.
Each of my digits is different.
My *thousands* digit is the smallest counting number.
My *tens* digit is less than my units or hundreds digit.
The sum of my first and last digits is the same as the sum of my two middle digits.

What number am I?

☐ ☐ ☐ ☐

★★★ 2. Karen's company needed to reduce its expenses. Her salary was cut by 10%. Later, her company decided to give her a raise. By what percent must her salary then be raised to bring it back to the original amount?

Answer :__________ percent

★ 3. What math symbol can be placed between the 2 and the 3 in "23" to make a number greater than 2 but less than 3?

Answer: __________

★★ 4. A spaceship launched from Earth was in orbit for $29\frac{1}{2}$ days. What is the closest estimate for the number of hours it was in orbit? Ring your answer.

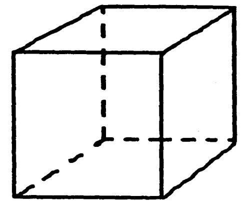
a) 700 hours b) 750 hours c) 650 hours

★ 5. The sixth grade math club gave this problem to its members to solve:

$$\boxed{13.6} + \boxed{2.7} - \boxed{4.8} \times \boxed{1.7} + \boxed{0.11} \Rightarrow \boxed{}$$

Solve the problem for them by writing the correct answer in the box. But don't forget "My Dear Aunt Sally" or you'll miss it!

★★ 6. Number each of the eight corners on the cube from 1 to 8 so that the sum of any four numbers at the corners of each face is 18.



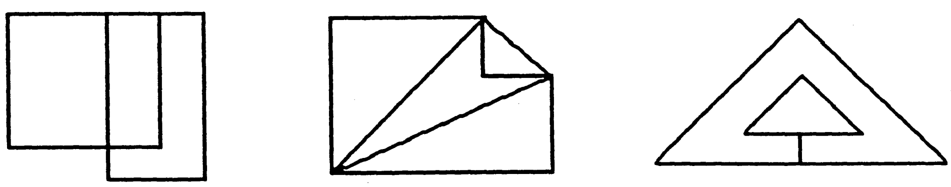
★★★ 7. The telephone company has 16 computer-controlled switching systems. Each system handles 650,000 calls *an hour*. The systems work with 98% accuracy. How many calls would not be accurately answered in *a day*?

Answer: ________________ calls

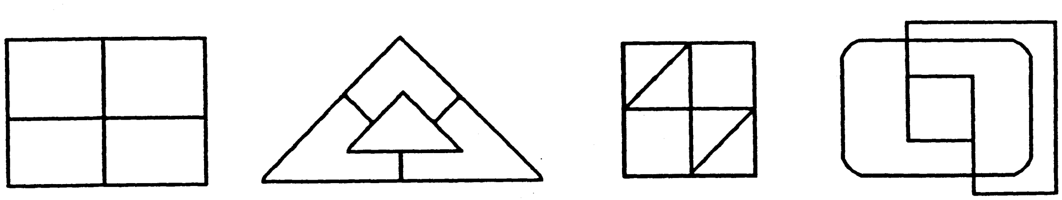
★★ 8. There are two ways you can make change for a dollar bill using exactly 50 coins. How many of each coin would you use for each way? Write your answers in the chart below.

	pennies	nickels	dimes	quarters	half dollars
first way:					
second way:					

★★★ 9. The designs below are called *one-drawable*. This means you can draw them with one continuous line without lifting your pencil or retracing a line, if you start in the right place.



Which of the designs below are *one-drawable*? Circle your answers.



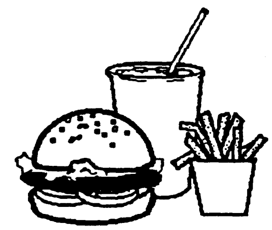
SUNSHINE MATH - 6
Uranus, XXI

Name: ______________________
(This shows my own thinking.)

★★★ 1. How much change will you get back from a $5 bill if you order a cheeseburger platter? Sales tax is 5%, and is always rounded up to the next penny if necessary.

Answer_________

Hamburger	$2.00	fries	.89¢
Cheeseburger	$2.15	cola	.99¢
Tuna melt	$2.45	shake	$1.39
Platter (includes sandwich, fries and cola): add $1.45 to sandwich price			



★ 2. Iris looked at the sign above, asked for a cola, and gave the clerk a penny and told him to "keep the change." Why was she justified for doing this, mathematically speaking?

Answer: ____

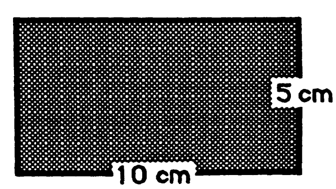
★★ 3. Josie's hobby is learning everything about the Presidents of the United States. Her friend Jacque loves math. Jacque posed the following situation to Josie: Find the number of letters in the last name of the third President of the United States. Add the total number of letters in the last name of the President elected in 1976. Now find the prime factors of this number. What is the correct answer?

Answer: _____________

★★★ 4. The softball team won 70% of its games and won 4 more than it lost. How many games did the team lose?

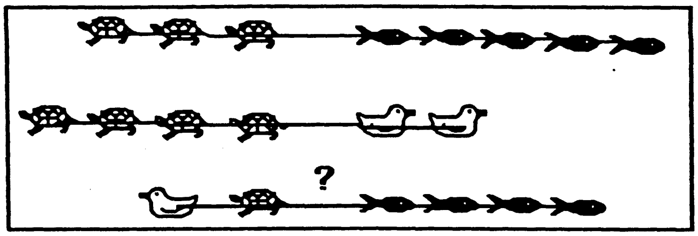
Answer: ___________ games

★★ 5. What happens to the *area* of the piece of cardboard to the right if its length and width are both doubled? Circle the best answer.



a. The area doubles.
b. The area stays the same.
c. The area gets smaller.
d. The area is 4 times as great.

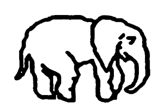
★★ 6. Dirk trained his water babies to have tug of war contests. He found that 3 turtles could tug the same as 5 goldfish, and 4 turtles could tug the same as 2 baby ducks. Which team would win between a baby duck and a turtle matched against 4 goldfish? Circle the winners below.



★★★ 7. In a gymnastics competition, five judges award scores on a 10-point scale for each event. The high and low scores are discarded before an average score is determined. The judges' scores for Terri's vault at a recent competition were 8.3, 9.0, 8.8, 7.5 and 8.4. What was Terri's score for the vault?

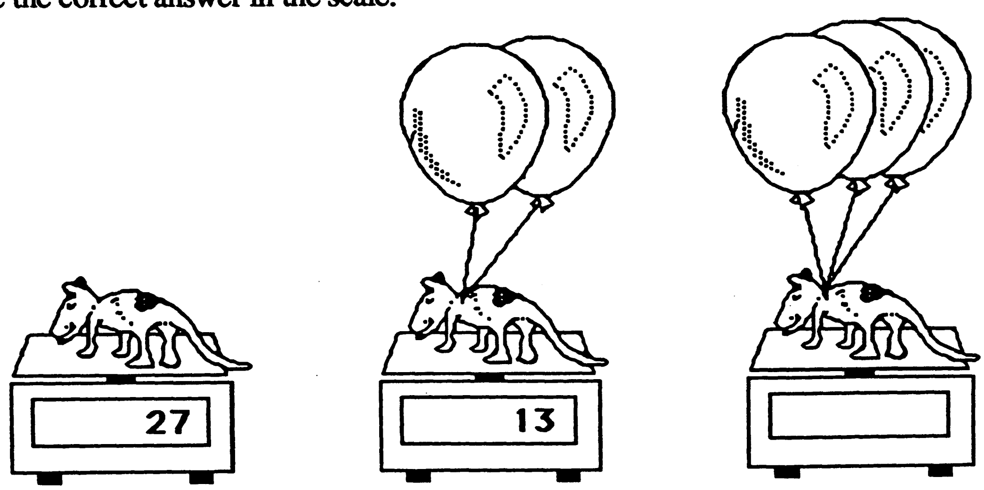
Answer: ______

★★★★ 8. Hannah kept track of the new baby elephant at the zoo. At one month the baby weighed 2 kg. At 2 months, he weighed 5 kg. At 3 months, he weighed 14 kg, and at 4 months he weighed 41 kg. Hannah noticed a pattern -- what was her prediction for his weight at 7 months?



Answer: ______ kg

★★ 9. Andy weighed his dog, then attached two identical helium balloons to his collar and weighed him again. If he attached a third identical balloon to the dog, what would the scale read? Write the correct answer in the scale.



SUNSHINE MATH - 6
Uranus, XXII

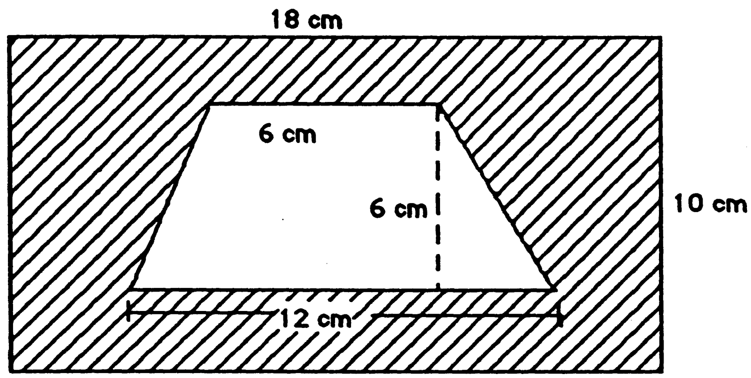
Name: ______________________

(This shows my own thinking.)

★ 1. What is the difference between the sum of twice 50 and twice 7, and twice 57?

Answer: __________

★★★ 2. It costs $1 per cm^2 to add gold plating to a surface. What will it cost to gold plate the shaded region below, which is a rectangle with a hole cut in it?



Answer: $ ________

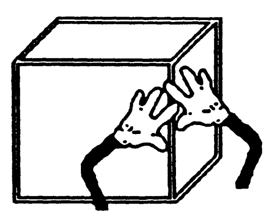
★ 3. A friend tells you that she is thinking of two 2-digit numbers and gives you the following clues. Find the numbers your friend is thinking of.

a. The numbers have the same digits, only reversed in position,
b. The sum of the digits is 8 in each number, and
c. The difference between the two numbers is 36.

Answer: ______ and ______

★★★ 4. A cube has a volume of 64 cubic inches. If you had to attach "string ribbon" to all of the edges of this cube, how many inches of ribbon would you need?

Answer: ________



★ 5. Try adding these numbers mentally. Look for numbers that go together naturally to give 100, and add them first.

$$45 + 25 + 15 + 55 + 75 =$$

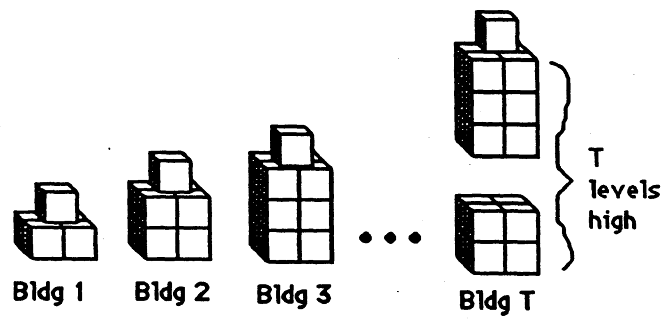
Answer: ___________

★★★ 6. Consider the pattern of buildings below, made from blocks

a. How many blocks would the 4th building require? ______

b. How many blocks would the 5th building require? ______

c. How many blocks would the 25th building require? ______

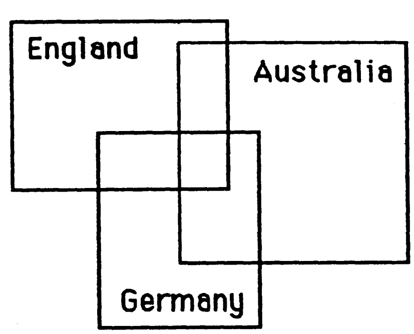


★ 7. How many blocks would it take to make building *T* in the pattern above, where *T* can be any whole number?

Answer: To make building *T*, I need this many blocks: ________________

★★★ 8. In the *Stamps are Beautiful* stamp collecting club, 21 members have stamps from England, 19 members have stamps from Germany, and 11 members have stamps from Australia. Some of these same members have stamps from more than one country. Six have stamps from England and Germany, 4 have stamps from Germany and Australia, and 2 have stamps from England and Australia. No member has stamps from all three countries. How many members are in the *Stamps are Beautiful* stamp club? (HINT: Use the Venn diagram below.)

Answer: _____________



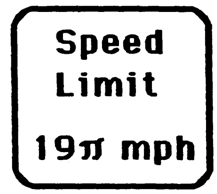
SUNSHINE MATH - 6
Uranus, XXIII

Name: ____________________

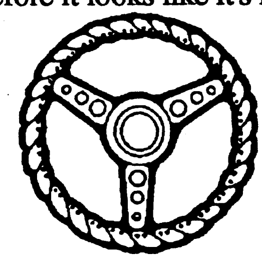
(This shows my own thinking.)

★★★ 1. You've heard of π, and so has the mathematician who designed this new speed limit sign. To the nearest whole number, what is the speed limit here? Circle the best choice below.

a. 25 mph   b. 40 mph
c. 55 mph   d. 60 mph
e. 65 mph   f. 75 mph



★★ 2. A steering wheel is shown below. How many degrees clockwise would you have to rotate this steering wheel before it looks like it's in its original position?



Answer: ______ degrees

★★★ 3. Try this number trick on several friends. What is the answer they always get, if they do it correctly?

Answer: _____

Number Trick:

Take the number of brothers and sisters you have.
Double this number.
Add 4.
Multiply by 5.
Add one.
Subtract 10 times the number of brothers and sisters.

What is your answer?

★★★ 4. If you started counting on April fool's day at 8:00 AM, and counted 1 number a second, non-stop, 24 hours a day, on what day would you get to 1 million?

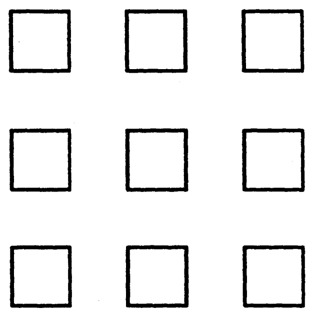
Answer: __________

★★ 5. Wayne wrote the months of the year on twelve identical cards and put them in a bag. He told his younger brother to pull one out without looking. If the brother drew out his birthday month, Wayne would do his chores for that month for his present. If his brother pulled out a summer month, Wayne promised to take him along whenever he went to the pool, as his present.

a. What is the brother's chance of drawing out his birthday month? ____

b. What is his chance of drawing out a summer month of June, July, or August? ____

★★★ 6. Arrange the digits 1 through 9 in the boxes below so that each row across and each column down has the same total.



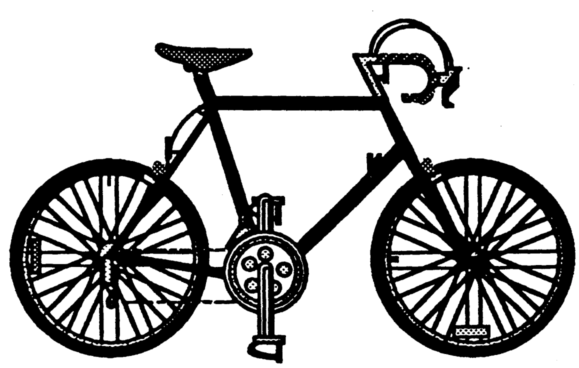
★★ 7. There's only one thing wrong with the problem to the right. What is incorrect?

Answer: ______________________________

____

```
   3.71
  x4.05
    405
  2835
+1215
 1502.55
```

★★★ 8. Mario wanted to get a tune up for his bike before an upcoming road trip with his scout troop. The bike shop charges 25¢ to check and tighten each spoke, \$5.00 to tighten and oil the chain, \$8.00 to adjust the gears, and \$1.50 to inflate the tires properly. How much would this tune up cost him?



Answer: ________

SUNSHINE MATH - 6
Uranus, XXIV

Name: ____________________
(This shows my own thinking.)

★★★ 1. Solve each problem below. The data comes from the *Guinness Book of World Records.* Round your answers to the nearest whole number.

a. The longest distance travelled by a go-kart in a 24-hour race is 1,018 miles. What was its average speed in miles per hour?
Answer: _______

b. The longest distance travelled by a truck riding on 2 side wheels is 2,864 miles. How far did the other two wheels travel on the trip?
Answer: _______

c. The fastest long-distance drive *backwards* in a car went 501 miles in 17.6 hours. What was the average speed for the car?
Answer: _______

★★★ 2. Tamara forgot to buy candles for her older brother's birthday cake, so she used the ones she had left from a previous birthday. She told him "Two candles stand for 6 years." How old was her older brother?

Answer: ______

★★★★ 3. Try this number trick on three people, except for the final step of telling their age and amount of change. Write down the answers each person gives you, together with their age and the amount of pocket change they have. Then decide how you can say how old they are, and how much change they have, ***just from looking at the final answer they give you.***

Age and Pocket Change

by Dr. Wonderful

Step 1. Take your age (years).
Step 2. Double it, then add 5.
Step 3. Multiply by 50.
Step 4. Subtract the number of days in 1 year.
Step 5. Add your pocket change (e.g., 49¢)
Step 6. Add 115. What's your answer?

Aha: You are ___ years old and have ___¢ in your pocket.

Answer: When I hear their final answer, ____________________ tells me how old they are, and ____________ tells me their change.

★★ 4. Find 40% of $(13.5 - 2.08 + 8\frac{58}{100})$:

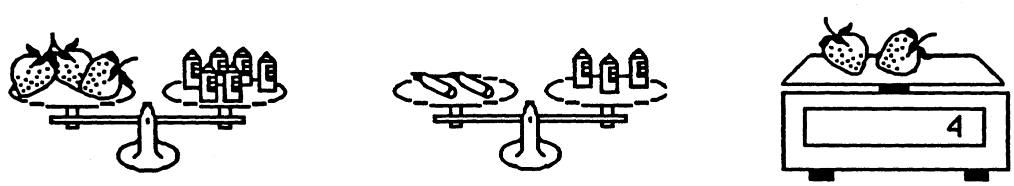
Answer: ________

★★★ 5. If you can read this message, then perhaps you are clever enough to solve this problem:

> If 5 boys and 5 girls were at a party and had to dance, how many different dances must be scheduled so that each boy danced with each girl?
>
> Answer: ________

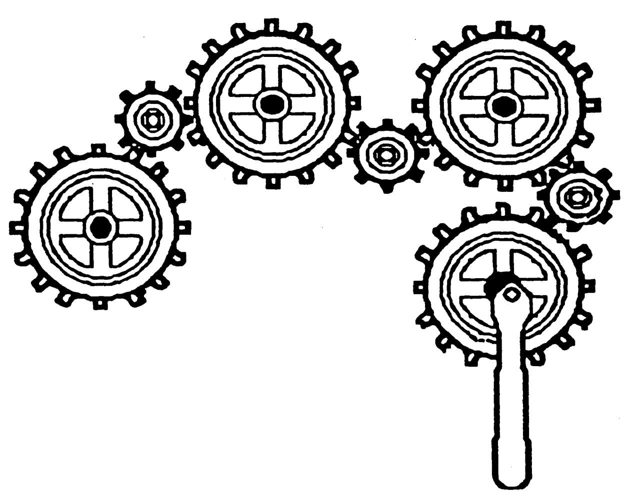
★★ 6. Find the weight of a pencil. The scale is set to measure grams.

Answer: ____ grams



★ 7. The collection of gears below has seven gears in all. If you turn the one with the handle in a clockwise direction, in which direction will the seventh gear turn?

Answer: ______________



SUNSHINE MATH - 6
Uranus, XXV

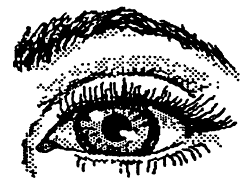
Name: ______________________

(This shows my own thinking.)

★★ 1. A person your age is usually awake about fourteen hours each day. Your eye blinks about 25 times a minute when you're awake.

a. About how many times each day do your eyes blink?

Answer: __________ times



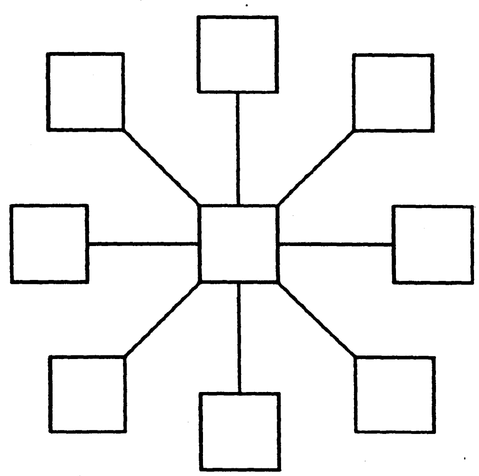
b. About how many times per year do your eyes blink?

Answer: ____________________ times

★★ 2. Sue and Sally were building their own bowling alley. There would be 15 lanes, each needing ten pins. However, due to damage, they needed to keep on hand 20% more pins than were in use at any given time. How many pins did they need to purchase?

Answer: __________ pins

★★★ 3. Put the numbers 10 through 18 in the diagram below in such a way that the sum of the three numbers along any line totals 42.



★★★ 4. A *perfect number* is one that is the sum of its proper divisors. Six is a *perfect number* because 6 = 1 + 2 + 3. In the set of whole numbers, six is the first *perfect number*. What is the second *perfect number*? (Hint: It is less than 30.)

Answer: _________

★ 5. Rebecca bought 3 new cassette tapes on sale. She went into the music store with $27 and came out with $6. What was the average cost for the tapes?

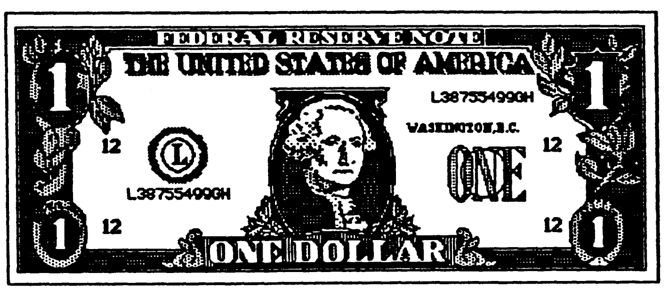
Answer: __________

★★★★ 6. Sam keeps track of several stocks on the stock market. He watched one stock for five consecutive days and recorded the activity. On Monday morning, his favorite stock opened at $12\frac{1}{2}$ and gained $\frac{3}{4}$ points that day. On Tuesday there was a gain of $1\frac{3}{4}$ points. Wednesday the stock lost $5\frac{1}{2}$ points. On Thursday there was a change of $+2\frac{5}{8}$ points. On Friday afternoon the stock closed at $14\frac{1}{4}$. What was the change for Friday over Thursday's standing?

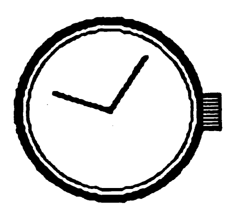
Answer: _________

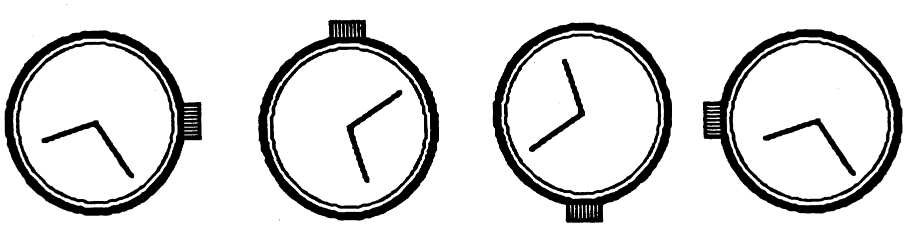
★ 7. How many times does a symbol or word name for the number *one* appear on the dollar bill below?

Answer: _____ times



★ 8. Consider the watch face to the right. Turn it 180°, then flip it over to the left. Circle the figure below that shows what it would look like.



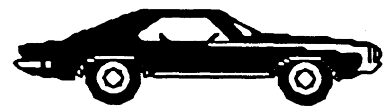


SUNSHINE MATH - 6
Uranus, XXVI

Name: ____________________________

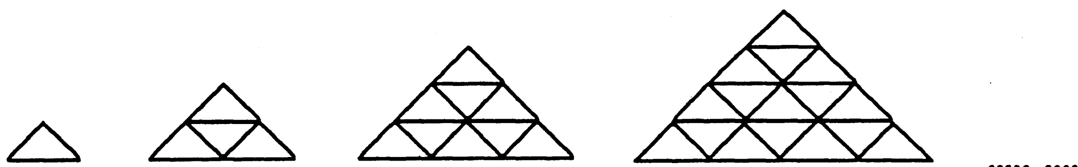
(This shows my own thinking.)

★★ 1. For every new car made, 5 tires and 2 headlights must be made also. If the car manufacturer purchased 400 tires for its new cars one week, how many headlights did they need to purchase for those cars?



Answer: _________ headlights

★★★ 2. The drawing below shows triangles made from toothpicks, in a pattern. Figure 1 requires 3 toothpicks; figure 2 requires 9.



1 2 3 4

a. How many toothpicks would be required for the 5th figure? _____

b. How many toothpicks would be required for the 6th figure? ______

c. How many toothpicks would be required for the 10th figure? ______

★ 3. Ashley is reading her favorite novel a second time and has read $\frac{2}{5}$ of it. The book is 495 pages long. How many more pages does she have to read to finish the book?

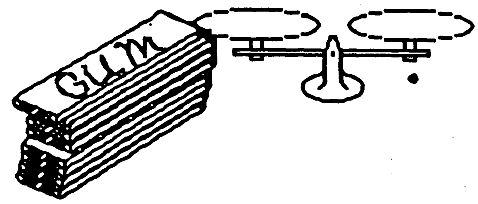
Answer: _________ pages

★★ 4. Daniel is using masking tape to hang pictures around the classroom. Each picture uses 1 ft. 2 in. of tape. How many pictures can he hang if he has a 20-foot roll of tape?

Answer: _________ pictures

★★★★ 5. Your teacher caught you chewing gum and took away the rest of the pack—9 sticks. He removed the wrapping from one stick, replaced the gum with a piece of cardboard the same size and shape but which weighed less. He then re-wrapped it. Now the lighter-weight stick looks and feels like the rest.

You can avoid going to the principal. You must tell him how to find the fake piece by using the balance scale only two times. Explain your reasoning, or go ahead on down the hall.



Answer: *Attach a sheet of paper with your explanation, that starts like this:*

For the first weighing, I would:

For the second weighing, I would:

★ 6. A deep-sea fishing boat is tied to a dock in the harbor. Over its side hangs a rope ladder with its bottom rung almost touching the water. Rungs of the ladder are 1 foot apart. The tide begins rising at the rate of 8 inches per hour. At the end of six hours, how many rungs will be covered by water?

Answer: ___________

★★ 7. A traffic court judge imposed a fine for speeding. The fine was $80, plus $1.75 for every mile per hour the speed limit was exceeded. What was the fine the judge imposed for traveling 57 mph in a 45 mph zone?

Answer: __________

★ 8. A square garden has five fence posts on each side. How many fence posts are there around the garden?

Answer: __________

★★★ 9. If you and four of your friends can stand on a square yard of carpet, how many of you can stand in a classroom that is 27 feet by 36 feet?

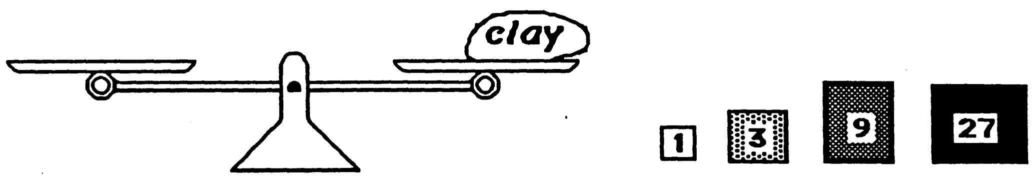
Answer: _____people

SUNSHINE MATH - 6
Uranus, XXVII

Name: ______________________________

(This shows my own thinking.)

★★★★ 1. Mark claims the lump of clay weighs 25 grams, but only has a 1-gram, a 3-gram, a 9-gram, and a 27-gram weight to use for the balance scale. Show where he can place the weights to prove the clay weighs 25 grams.



★★ 2. If your math scores were 76, 76, 83, 85, and 90, which statistic would give you the best final grade -- the *mean*, the *median*, the *mode*, or the *range* of these scores?

Answer: ____________

★★★ 3. How can you arrange 4 pennies, 4 nickels, 4 dimes, and 4 quarters in this grid so that each row, each column, and each diagonal contain exactly one of each type of coin? Write P, N, D, or Q in each square to show your solution.

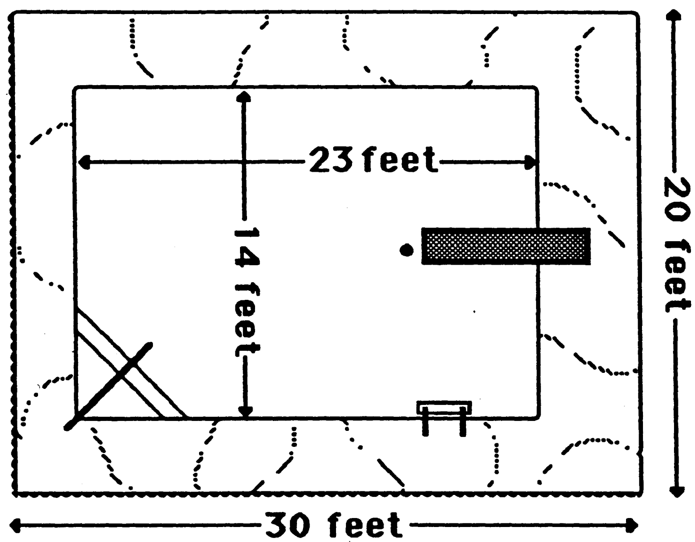
★★ 4. Diana and Felicia want to can 12 quarts of tomatoes from their family's garden. They already have 7 quart jars and 6 pint jars. If only quart and pint jars are available, what is the fewest number of jars they can buy to have enough?

Answer: ______ jars

★ 5. What is the probability of being born in a month with more than 30 days?

Answer: __________

★★★★ 6. The diagram below shows a new swimming pool at the city park. The pool contractor wants to border the pool with ceramic tiles that are 6" squares. If each tile costs $2.75, what is the total cost of the tiles?



Answer: ___________

★★ 7. Timothy received three $20 bills for his birthday. He wants to buy a tennis racquet for $29.95 and two cans of tennis balls for $2.49 each. He also wants to buy a new tennis shirt for $14.95. About how much money should he have left, if his mom agrees to pay the tax? Circle the correct answer.

a) $10 b) $5 c) $15

★★ 8. Tim earned some extra money and bought some new CDs. 50% were rock, 25% were country-western, and the rest were classical. He bought 3 classical CDs. How many CDs did he buy?

Answer: ________

★ 9. Cleopatra was 39 years old when she died in 30 BC. In what year was she born?

Answer: ________

ANSWERS

Commentary

Uranus, I

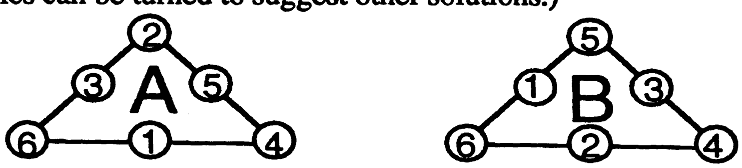
1. **a. (2:00 P.M.)** P.M. must be included.
   b. (7:30 A.M.) A.M. must be included. The time of flight as well as the time differential between time zones is considered in solving the problem.

2. **(50 minutes)** Drawing a picture helps in solving this problem. Students then see that only 2 cuts are needed to cut the log into 3 pieces, so it takes 10 minutes to saw through the log. It always takes one less cut than the number of pieces needed. To get 6 pieces you will make 5 cuts at 10 minutes each.

3. **(5, 17, 23)** *Guess, check, and revise* is a suggested strategy. Students should recognize that the number is divisible by 5 since 1955 ends in 5. 5 x 391 = 1955. They can then choose prime factors to multiply that might equal 391.

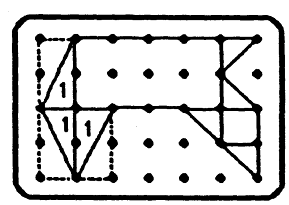
4. **($99\frac{9}{9}$; or 99 + (9÷9); other answers possible)** Students will probably realize that they can put two nines together to get 99, which is 1 away from the goal of 100. Therefore they need to find a way to put the other two nines together, to get 1. 9 ÷ 9 works.

5. (The triangles can be turned to suggest other solutions.)



6. **(8 minutes)** Drawing a diagram helps students see that the train will have to travel 2 miles from where the engine is just entering the tunnel to where its caboose is out of the tunnel. 15 mph means the train is going 1/4 mile per minute. So it would take 8 minutes to travel 2 miles.
   This problem may also be solved with a proportion: $\frac{2}{x} = \frac{15}{60}$

7. **(a. 6; b. 14)** It is helpful to draw in the lines connecting the dots and count the squares and half-squares for part a. For part b, draw in rectangles whose diagonals are the sides of the figure on the left end -- the area of the end triangles is then half of the surrounding rectangle.

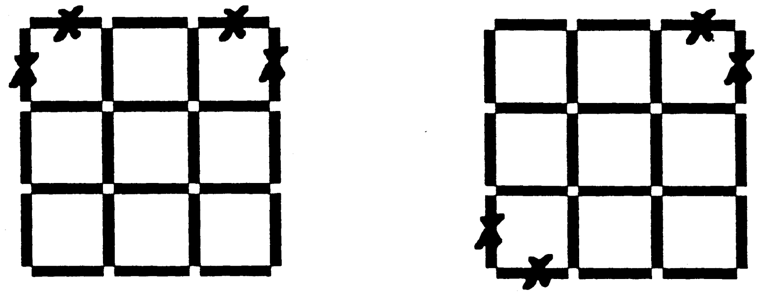


8. **(15)** This problem is a concrete example related to algebraic thinking. Students intuitively know that they can find the weight of 2 ducks by taking the known weights off the scale, and the display will show 61 - 31, or 30. So they divide that result by 2 to obtain the weight of one duck. These steps give concrete meaning to solving this sort of linear equation.

Commentary

Uranus, II

1. Mark out any two of the 4 corners and you will leave 7 squares. Two such cases are shown:



2. **(3 socks)** If the first two socks he draws are a brown and a blue, the next sock drawn has to match one of those.

3. **(dictionary: $10; almanac: $22)** The problem involves the same sort of thinking that students can later use to solve a system of equations in two unknowns, in algebra. In this case, students might reason that since a dictionary and almanac together cost $32, then twice that amount would cost twice as much -- i.e., 2 dictionaries and 2 almanacs would cost $64. But we know 2 dictionaries and 3 almanacs cost $86, so the difference of 1 almanac must be $86 – $64 or $22. Then going back to the first situation, if an almanac costs $22, and a dictionary and almanac cost $32, a dictionary must cost $10. There are other ways to arrive at this same conclusion.

4. **(4)** Students can see that, if they continued adding squares inside the circle, the inner figure would approach becoming a circle itself. This is well known in string designs.

5. **(2 years, 292 days, 20 hours, 44 minutes, 53 seconds)** Students will need to "borrow" in this problem, differently from what they have done in base-ten work. The time on the top line can be rewritten as *4 years, 385 days, 27 hours, 91 minutes, 77 seconds* so that the bottom number can be subtracted, one term at a time.

6. **(27 pounds)** The 9-pound weight must be the same weight as 1/2 brick, so we know that a whole brick weighs 18 pounds. Therefore a brick and a half weighs 18 + 9 or 27 pounds.

7. **(20)** Work backwards is a possible approach. The number must have been 43 prior to subtracting 4 and getting 39. Prior to the next step, it must have been 86; prior to that, 80, and prior to that, 20.

8. **(12)** If 4/7 of the students are girls, then 3/7 are boys. 1/7 of 28 is 4, so 3/7 of 28 is 12.

9. **(a. $\frac{1}{6}$ or 17%; b. $\frac{2}{6}$ or $\frac{1}{3}$ or 67%; c. 0; d. $\frac{3}{6}$ or $\frac{1}{2}$ or 50%)** For (a), since 0 is one of the six equal sections of the circle, the chances are 1 in 6 or 1/6. For (b), the odd numbers are 5 and 9 and represent 2 of the 6 sections, so the chance is 2/6 or 1/3. For (c), there is no section labeled with a number larger than 9, so there is no chance the spinner will give this result. For (d), there are 2 sections with odd numbers and one section labeled with 0, giving three sections of the six. The chances are therefore 3 out of six, or 3/6, or 1/2.

Commentary

Uranus, III

1. **(less than 50)** 283 is less than 300, and 300 miles is how far they would have gone in six hours at 50 miles per hour.

2. **(32%)** The skirt cost $36 and the blouse cost $32 for a total of $68. The original cost was $100. The discount was 32%. Another way to think of the problem is to look at the total saved -- $24 for the skirt and $8 for the blouse. Therefore $32 was saved, out of the original price of $100.

3. **(531)** Students might organize their work by sectioning off parts and counting each part, and total the parts. Some students might make a long "chain" and count; others will count the dots in groups of 25 or 50.

4. **(7)** One approach is simply to *guess-check-revise* until you find a number that works for n. Another is to solve an equation such as $3n + 6 = n + 20$.

5. **(127°)** 78 - (⁻49) = 127. Students might want to make a sketch of a number line, to convince them that the absolute values of the numbers must be added, to find the difference.

6. **(8)** Since the mean age is 11, the total of their three ages is 33. Since the middle child is 10 (the median), the sum of the remaining ages is 23. Rosa is 15, so the age of the youngest is 23-15 = 8.

7. **(c = 21, d = 48, total = 69)** Figure C has three triangles -- MNO, MPL, and OMP. It also has 3 quadrilaterals -- OPLN, OPMN, and OPLM. This totals 9 + 12 or 21 points. Figure D has two triangles (let O be the center point) -- VOW and SOR. It has 6 quadrilaterals -- TSOV, TSWV, XROW, XRSW, XRVW, TSRV. It also has 3 hexagons -- TSRXWV, TSROWV, and XRSOVW. This totals 6 + 24 + 18 or 48 points. The grand total is then 21 + 48 or 69 points. Note -- there are also 2 seven-sided figures. Some students might extend the scoring system, awarding 7 points for these two also, giving a total of 62 for figure D, and a grand total of 83.

8. **(19)** Students can substitute 4 in for *a*, and compute
3 + 4 + 7 -5 + 10 + 4 - 4 = 19.

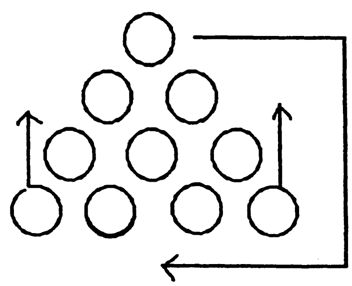
9. **(3 & 5; 5 & 7; 11 & 13; 17 &19; 29 & 31; 41 & 43)** Students might be encouraged to use a calculator to check and see if certain numbers are primes or not.

Commentary

Uranus, IV

1. **(14)** The clock shows 3:00 twice daily. So in 7 days it would show 2 x 7 = 14.

2. The seven discs in the center stay where they are. The 3 corner discs move so that 2 are on the top and the other becomes the bottom of the triangle.



3. **(2 tables, 8 stools OR 5 tables, 4 stools)** *Guess, check and revise* is a possible strategy along with a table to help organize information. Students can begin to guess a number for either the tables or stools, and see if, using that number of legs required, it's possible to make some of the other piece of furniture, using up all the legs.

4. **(6 in^2)** 48 in^2 ÷ 8 faces = 6 in^2. Some students might need help remembering that an octahedron has eight faces, or they might look it up in a dictionary.

5. **(4082)** Since the clues all mention the thousands digit, start guessing what that number might be. It has to be an even number because the ones digit is half of it. It can't be more than 4 because the tens digit is twice that number, and twice an even number more than four would be a 2-digit number. Therefore the first guess might be either 2 or 4.

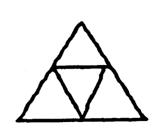
6. **(300 km)** 1,000,000 x 30 cm = 30,000,000 cm, and dividing by 100 gives 300,000 meters. Dividing again by 1000 gives 300 km.

7. **(Amy Jackson–3rd; Betty Keller–1st; David Perez–4th; Ed Gonzales–2nd)** Students might begin by making a chart like the one below, and proceed by eliminating possibilities. From the first clue, David and Ed can't be Jackson. The chart shows these last names eliminated from consideration beside their names. One proceeds in this fashion until the process of elimination shows who has which last name, and where they finish.

FIRST NAME	LAST NAME	POSITION
AMY	G J K P	1 2 3 4
BETTY	G J K P	1 2 3 4
DAVID	G ~~J~~ K P	1 2 3 4
ED	G ~~J~~ K P	1 2 3 4

8. **(74,999)** This is the greatest number that can be rounded to 70,000.

9. The pens are placed together to give another triangle shape in the center:



Commentary

Uranus, V

1. **96233** Students might begin this problem by noting that D = 1, and that there are 3
+ 62513 S's and 3 R's. They might make boxes for all the digits, and fill in the 1
158746 for D and then begin to guess the numbers that S and R might be. Start with a small number for S, perhaps 2, and then R= 4, and proceed to guess the other digits. This doesn't work, so try S = 3 and R= 6. This can be forced to work.

2. **(5)** The train would pass the train that left Jacksonville at 8:00 at the Tallahassee station -- it would pass the 9:00 train 1/4 of the way to Jacksonville. It would pass the train that leaves on the same hour at the half-way mark, and the train that leaves Jacksonville at 11:00 at the 3/4 point. It would also pass the train that leaves Jacksonville at 12:00, at the Jacksonville station.

3. **($8.95)** Three hamburgers cost $2.85; a hot dog cost $0.85; 4 orders of fries cost $3.56; and 4 soft drinks cost $$3.16. This totals $10.42. Multiplying by 1.06 to add the tax gives $11.05 when rounded up. $20.00 - $11.05 = $8.95.

4. **(62.5% or 63%)** 24 out of 64 squares are covered, so 40/64 are not covered. On a calculator, 40 ÷ 64 gives 0.625. Students might also reason that 40/64 = 5/8 in lowest terms, and 5/8 = 62.5%.

5. **(17)** Skip sees the same trees both times. Since he's going in the opposite direction going home, the trees appear on the other side of the street.

6. **(C, B, A)** Students might want to draw the design on a sheet of paper, and actually turn the paper to see if they are correct.

7. **(5.9×10^9)** *Scientific Notation* means that the number is written with one digit to the left of the decimal point, and the corresponding power of ten is used as the multiplier.

8. **(a. 1963; b. 1957; c. Mantle)** For (a), there is only one year in which the dots for the batting averages are the same, although the lines cross "between years" in several places. For (b), 1957 is the year in which both hit more than 0.333. For (c), Mantle's range is from 0.345 to 0.295 while Mays' range is from 0.365 to 0.275. Mantle's range of 50 points is less than Mays' range of 90 points.

Commentary

Uranus, VI

1. **(7/8)** The difference can be found by subtracting 5 1/4 from 6 1/8, or by "counting up" from 5 1/4 to 6 1/8. To do the latter, it's 3/4 of an inch from 5 1/4 inches to 6 inches, and another 1/8 to 6 1/8 inches. So the sum of 3/4 and 1/8, which is 6/8 + 1/8 or 7/8, is the difference.

2.
$$\begin{array}{r} .25 \\ \times\ \underline{3.7} \\ 175 \\ \underline{75} \\ 0.925 \end{array}$$

3. **(34 in^2)** There are 9 faces "facing you," and another 9 on the other side. There are 11 faces that make up the "stair steps" portion, and another 5 on the bottom. This totals 34.

4. **(650 hr)** Multiplying 27 days times 24 hours/day gives 648 hours. Add on 8 hours for the final 1/3 day, and you're at 656 hours. As a rounded number, this is closest to 650 hours.

5. **(0)** Washington has 10 letters. The second and sixth Presidents were both named Adams; so 5 - 5 = 0. 10 x 0 = 0.

6. **(4,328,000,000,000)**

7. **(I)** (40 + 10) + 16 - 19 = 1; 1 is written as I in Roman numerals.

8. **(a. $\frac{3}{8}$; b. $\frac{3}{8}$; c. $\frac{1}{4}$; d. 0)** The red portion is 1/4 plus 1/2 of 1/4 or 1/8, which is 2/8 + 1/8 or 3/8. Blue is the same area as red, although it's made up of two pieces. Gold and green together would be 1/8 + 1/8, or 1/4. Orange isn't pictured, so the chance of getting orange is 0.

9. **(18)** There are two types of sandwiches, three types of side orders, and three types of drinks; therefore 2 x 3 x 3 = 18 gives the number of choices. For students who need a concrete experience to solve this problem, they might try labeling each choice, and combining the labels. For example, let A and B be the sandwich types, C, D, and E the side orders, and F, G, and H the drinks. Then ACF, ACG, ACH, ADF, ADG, ADH, AEF, AEG, and AEH are the combinations with the first type sandwich. There is the same number for the second type of sandwich.

10. **(3)** 100% - 87.5% = 12.5% that did not pass, and 12.5% x 24 = 3.

Commentary
Uranus, VII

1. **(14)** $\frac{1}{8}$ of 336 is 42 points, and 42 points ÷ 3 points/basket is 14 baskets.

2. **(9 and 36)** Students can think of each larger block on the right-hand scale as composed of 4 small blocks. Therefore the right-hand scale shows that 4 + 4 + 3 or 11 small blocks weigh 99 grams. Or, each small block weighs 9 grams. Then a large block is 4 x 9 grams, or 36 grams.

3. **(6/36 or 1/6 or 17%)** There are 6 ways to have a sum of 7 on a pair of dice: (1,6), (6,1), (2,5), (5,2), (3,4) and (4,3). There are 36 possible ways that two dice can land "up.' Therefore the chance of getting a sum of 7 is 6/36 or 1/6.

4. **(1/3)** There are a number of ways for students to get this answer. One way is to add the large 1/4 of a square to the smaller pieces, which are 3/36 of the square, getting 9/36 + 3/36 = 12/36 or 1/3.

5. **(Shapes A, C, and D should be circled.)** Students with good visualization skills can do this problem without any physical representations. For other students, they might want to trace the figures, cut them out, and try to fold them along the lines given.

6. **(6)** 85% of 40 is 34, so Alfonso must correctly answer at least 34 questions. This means he can miss up to 6 questions.

7. **(5→26; 6→37; 7→50)** The input number is squared and 1 is added.

8. **(a. 10; b. $n^2 + 1$, or $n \times n + 1$)** The problem encourages students to turn around their thinking from the previous problem. If a number that is squared and then increased by 1 gives 101, subtracting 1 from 101 gives the square of the number, 100. Therefore 10 must be the input number. Part (b) involves writing the function using a variable, if it can be generalized.

9. **(Maria, Michael, Gale, Dot, Beth)** Students might want to simply make a vertical list of the students' names, according to the clues given. Gale would go above Beth but below Michael from the first clue. Maria also goes above Michael, from the second clue. Dot goes above Beth but below Gale. Therefore the order is:

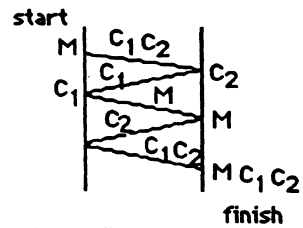
   Maria
   Michael
   Gale
   Dot
   Beth

Commentary

Uranus, VIII

1. **(16/20)** Students might start listing fractions equivalent to 4/5, as 4/5, 8/10, 12/15, 16/20, and so on, until they find one in which the denominator is 4 more than the numerator.

2. **(5)** Students would benefit greatly by drawing a diagram to solve this classic problem. One is shown to the right.



3. **(a. 8; b. 18; c. 12)** Students will have to imagine the parts of the figure they cannot see. This polyhedra and others like it follow Euler's rule that connects vertices, edges, and faces: $F + V - 2 = E$.

4. **(12)** Students might start by guessing ages for Anthony since he's the youngest, multiply that by 3 to get Sarah's age, and then add 4 to both ages and see if Sarah will be twice as old as Anthony in 4 years. Doing so yields Anthony as 4 years old, and Sarah as 12.

5. **(17)** One approach is to notice that giving all 28 animals two legs uses up 56 of the legs. The remaining 22 legs must then be apportioned, in pairs, to make the 4-legged animals. Hence there must be 11 horses. Then 28 - 11 = 17 is the number of geese.

6. **(111 + 11 + 1 or 11 x 11 + 1 + 1)** There may be other solutions.

7. **(6 and 5)** The problem can be approached in a concrete manner that will later be replicated when students begin to solve systems of equations. Notice that doubling what is on both sides of the right-hand scale will give that 4 elephants and 2 donkeys weigh 34 grams. Compared with the left-hand scale which has the same number of donkeys and one less elephant balancing 28 grams, we know that one elephant accounts for the difference between 34 and 28, or one elephant is 6 grams. Then we can use this amount to substitute for the elephant's weight in any of the given scales, and determine that the donkey weighs 5 grams.

8. **(204)** There are 64 small squares, 49 two-by-two squares, 36 three-by-three squares, 25 four-by-four squares, 16 five-by-five squares, 9 six-by-six squares, 4 seven-by-seven squares, and 1 eight-by-eight square. This totals 204 squares.

9. **(b gives $335169.31 more)** This problem is exhausting to do with paper and pencil, but is quite easy with a calculator that has a repeating multiplier concept and a memory key. For such a calculator, pushing either 2 x 0.01 or 0.01 x 2, followed by a sequence of $\boxed{=}$'s, gives the amount he made each of the 25 days. If you also use the $\boxed{M+}$ key to add each new day's pay to what he made previously, at the end of 25 days (or 24 $\boxed{=}$'s being pushed), you should have 335544.31 when you push $\boxed{MR}$. You can then subtract $15 x 25, what he would make at $15 per day for 25 days, to get the answer above.

Commentary

Uranus, IX

1. **(21, 34)** This pattern is the famous Fibonnaci sequence, in which you start with 1, 1, and from there on, each term is the sum of the two preceding terms.

2. **(129)** Students will likely multiply 17 x 9 and get 153, and then subtract the area of the two holes from that. The rectangle has area 4 x 4 or 16, and the triangle is half of that, or 8. Therefore 24 must be subtracted from 153, leaving 129.

3. **(28)** The square root of 49 is 7, and 7 x 10 = 70. Subtracting 50 leaves 20, and 20 x 7 is 140. One-fifth of 140 is 28.

4. **(yes)** Most students will take several numbers and try them out, and since they all work, will conclude the number trick works. If one takes a 1-digit number x, and doubles it to get $2x$, adds 5 to get $2x + 5$, multiplies by 5 to get $10x + 25$, subtracts 25 to get $10x$, then one has the single digit again, but this time in the tens place. Removing the last digit, which is always a zero, gives the original number.

5. **(15)** One mile in four minutes means that every four minutes, he could run a mile at that pace. Since there are 15 groups of four minutes each in 60 minutes or an hour, he could run 15 miles in an hour at that pace. He was therefore running 15 miles per hour.

6. **(104,000)** Using a calculator, multiply 72 x 60 x 24 to get 103,680. Rounded to the nearest thousand, this number is 104,000.

7. **(4)** Four pairs of roller blades for every three skateboards is the ratio 4:3. This is the same ratio as 8:6, 12:9, 16:12, and so on. The ratio 16:12 is the one we're after, as that means 16 roller blades were sold. Then 12 skateboards were sold, and 16 - 12 = 4.

8. **(93)** Students can think of the problem in this way: $(86 + 92 + 88 + 96 + x) \div 5 = 91$. This means that $(86 + 92 + 88 + 96 + x) = 91 \times 5$ or 455. This also means that $x = 455 - (86 + 92 + 88 + 96)$, or $x = 93$. Other students might know that since the average is 91, and the differences between the given scores and 91 are, respectively, -5, +1, -3, and +5, which sums to -2, the remaining test must compensate by scoring +2 over the average, and 91 + 2 is 93.

9. **(a. $9600; b. $6912)** On a calculator, students can multiply $120,000 by 8% or by 0.08. They can then multiply the result by 72%, which is the percent she would have left, after 28% in taxes is removed.

Commentary

Uranus, X

1. **(15)** Multiply 37 by 3 and you get 111, and by 6 and you get 222. The pattern seems to be that multiplying 37 by 3x1 gives all ones, and by 3x2 gives all twos. So you might guess that multiplying 37 by 3x5 would give all fives. Checking it on a calculator proves this is true.

2. **(a. 35¢; b. 13 pounds; c. 20; d. 10)** Each of these problems is set up in the form of what will later be a linear equation to solve. For (a), you can solve $12x + \$0.28 = \$4.48$. For (b) you can solve $5x + 25 = 90$. For (c), $1/2\,x + 5 = 15$. For (d), $12x + 6.5 = 126.5$. At this point, students will not use equations to solve the problems -- they will simply subtract first, and then divide.

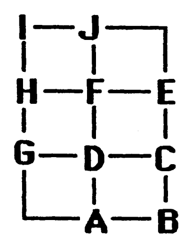
3.

16	**2**	**3**	**13**
5	**11**	**10**	**8**
9	**7**	**6**	**12**
4	**14**	**15**	**1**

The key to solving this problem easily is to start in a column in which you already know three of the four numbers necessary to total 34. You can put 6 under the 10, and then you know the number to the left of 6 must be 7. You also know that 16 must be in the upper left corner. From that point, ***guess-check-revise*** will enable students to solve the problem.

4. **(40)** Use a proportion to solve. $\frac{16}{27} = \frac{x}{67.5}$ $\quad x = 40$

5. **(10)** Students will be helped by placing letters of the alphabet at the corners, and describing each path using these letters. Using the letters placed as below, the ten trips are completely determined by this list:



ABCE; ADCE; ADFE; ADFJ; GDCE; GDFE; GDFJ; GHFE; GHFJ; GHIJ

6. **(7, 9)** The function machine takes the square root of the number dropped in.

7. **(2:27 P.M.)** *Guess, check, and revise* may be the way students approach the problem. For example, guess 2:30 as the time -- in 16 more minutes, it is 2:46, which is 14 minutes before 3:00. But 10 minutes before 2:30 would be 2:20, which is 20 minutes after 2:00. So 2:30 doesn't work -- revise the guess down a little, and check as above. Eventually, 2:27 works as 16 minutes later it is 2:43, which is 17 minutes before 3:00; and 10 minutes before 2:27 was 2:17, which is 17 minutes after 2:00.

8. **(25%)** Students could fill in the grid to see that there are 2 shaded squares of the 8 small squares. $\frac{2}{8} = \frac{1}{4} = 25\%$.

Commentary

Uranus, XI

1. **(a. \$7.18; b. \$6.28)** For (a), students can multiply \$2.99 times 2.4; for part (b), they can multiply \$2.99 times 2.1. In each case, they would round their answer up to the next cent.

2. **(notebook costs \$1.25; pencil costs \$0.25)** Students can solve this by ***guess-check-revise***. They can guess the cost of the notebook first, determine the cost of the pencil as the difference between what is chosen for the notebook and \$1.50, and see if the difference in the two items is \$1. If not, revise the guess.

3. **(37 yd^2 or 37 sq. yd.)** Divide the shape into two rectangles and find the area of each. One rectangle is 3 by 3 or 9 square yards. The second is 4 by 7 or 28 square yards. $28 + 9 =$ 37 square yards. The shape could also be divided into rectangles that are 3 by 7 and 4 by 4. For full credit, students must have the correct label.

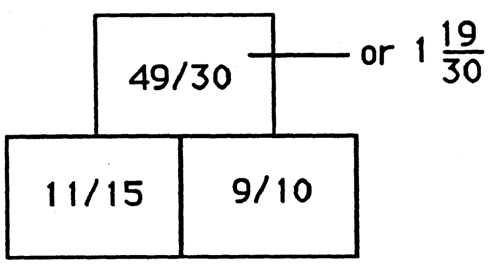
4. **($\frac{1}{2}$, $\frac{7}{12}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$)** Changing all of the fractions so they have the denominator 12 allows one to order them by looking at the numerators.

5. **(15%)** The increase is \$0.60. \$0.60 ÷ \$4 = 0.15 = 15%. Another way to see this result is to take 60/400, reduce it to lowest terms, 3/20, and rename this fraction as 15/100, which is 15%.

6. **(a. 529 or 23^2; b. 1000 or 10^3)** Square the row number to get the middle entry. The sum of the numbers in the row is the cube of the number of the row. $10^3 = 1000$

7. **(ten thousands)**

8.



9. **(a. 3 cups; b. 1/2 cup)** Part (a) involves simple realizing that 3/4 of 4 is 3. Part (b) involves finding 3/4 of 2/3. This can be done by drawing a figure, or mathematically by finding 3/4 x 2/3 or 2/4 or 1/2.

Commentary

Uranus, XII

1. **(a. 26=23+3 or 26=7+19; b. 82=23+59 or 82=11+71 or 82=29+53 or 82=3+79)**

2. **(9)** Three diagonals can be drawn from each of the vertices of a hexagon. There are 6 vertices. 6 x 3 = 18. However, the diagonals will have been counted twice, once at each vertex. So the total is half of 18.

3. **(2,6,-3)** Students will probably have to take the factors of 36, and try them in groups of three, until they find a group in which the product is $^-36$ and the sum is 5. They will be helped by remembering that a negative product and positive sum means that one number is negative.

   $$2 \times 6 \times {}^-3 = {}^-36 \quad \text{and} \quad 2 + 6 + {}^-3 = 5$$

4. **(44)** $2^4 = 16$; $3^3 = 27$; $4^0 = 1$; The sum is 44.

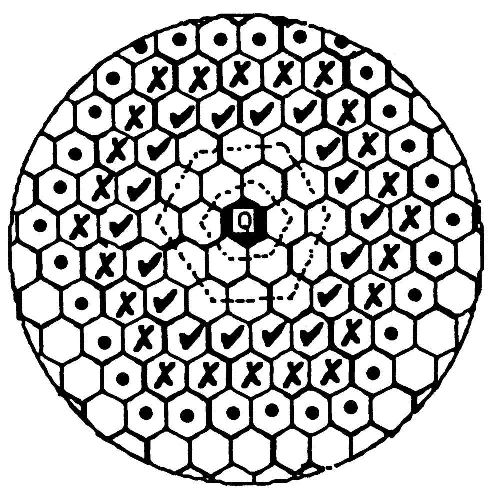
5. **(1/4 or 25% or 0.25)** It doesn't matter what the first spin is. The chance that the second spin will match it is 1/4.

6. **(2.5)** Many students will select one of the other choices because of the number of digits they have.

7. **(21,300)** 10,000 + 10,000 + 1,000 + 100 + 100 + 100 = 21,300

8. **(2 dimes, 8 nickels, 40 pennies)** Students will likely guess-check-revise to solve this problem. A good place to start is with the number of pennies, which has to be most of the 50 coins due to the size of the other coins. There can't be 50 pennies, so try 45. That turns out to be impossible, so drop back to 40. There is a possibility with 40 pennies.

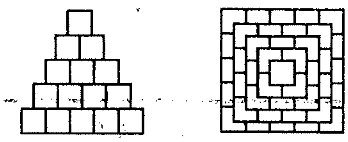
9. **(a. 6; b. 12; c. 18, 24, 30; d. 6*n*)** The first two neighborhoods have dotted lines through them. The next three are marked by ✔, ✗, and ●. After counting the nests in the first five neighborhoods, students will notice that the neighborhood number, times 6, gives the number of nests.



Commentary

Uranus, XIII

1. **(a. see below; b. 55; c. 385)** Each building in the pattern adds on the square of the "building number" of cubes. The 5th building would add 25 more cubes, the 6th would add 36, and so on. The cubes needed for Building 10 would therefore be $10^2 + 9^2 + ... + 1^2 =$ 385.

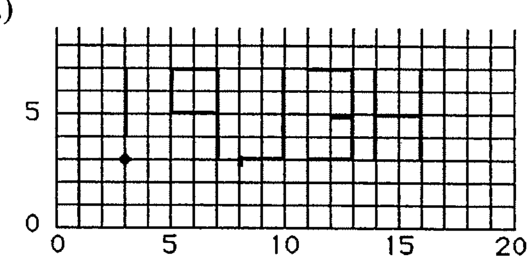


2. **(94)** An average of 90 on 4 tests means the sum of the four was 4(90) or 360. Subtracting the three known tests from 360 leaves 94, the score for the fourth test.

3. **(a. 19.99; b. 0)** For (a), think of 9 3/5 as 9.6 and compute on a calculator. For (b), change all of the fractions to denominator 24, and the numerators will sum to zero.

4. **(39 days)** Students are tempted to take half of 40 days, and report 20 days. However, if the pond was half-covered on day 20, on day 21 it would be completely covered because the water lilies double in size each day.

5. **(HELP! is spelled out backwards.)**



6. **(675)** The trip from Pensacola to Jacksonville is 7 cm or 7 x 50 miles, or 350, miles. The trip from Jacksonville to Miami is 6.5 cm, or 6.5 x 50 miles, which is 325 miles. The sum of the two is 675 miles.

7. **(6,210,001,000)** The way students will solve this problem is to guess-check-revise, likely starting at the left end with the guess 9,000,000,000. But this isn't quite right because it doesn't indicate there's 1 nine. So you alter the number to 8,000,000,001. But this has no 9 now, but it does have an 8, so you adjust again to 8,000,000,010. But, now there's a 1 in the number, which isn't accounted for. You continue to adjust the number in this fashion, working on both the right and left-hand ends, toward the middle. After much erasing, you get the answer above. Students will do much better if they make 10 blanks in ink, and write in numbers they can erase in pencil. It also helps to place below each blank what the digit represents, as below:

____	____	____	____	____	____	____	____	____	____
0's	1's	2's	3's	4's	5's	6's	7's	8's	9's

Commentary

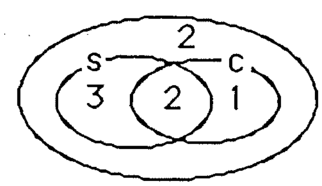
Uranus, XIV

1. **(a. 2nd b. 5th c. 1st d. 4th e. 3rd)** Students can draw a picture to help them think through this problem.

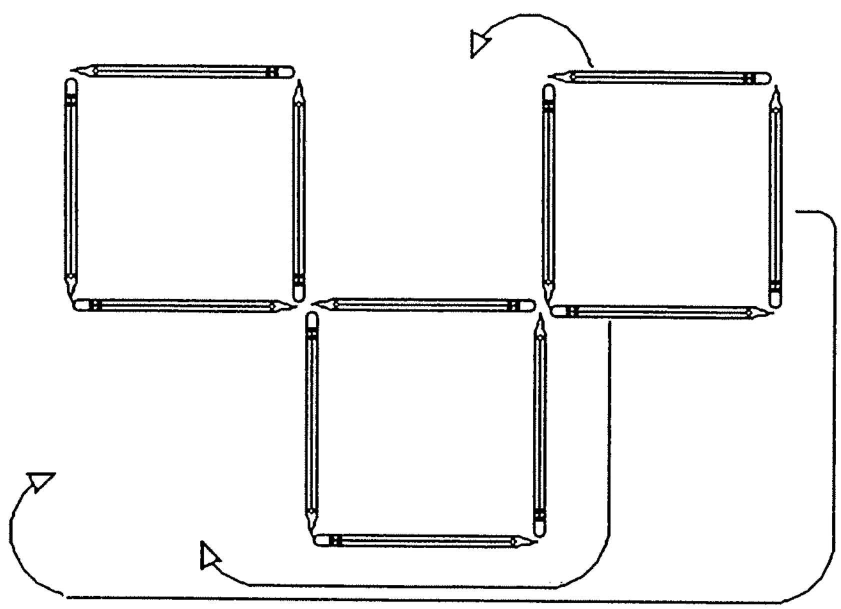
2. **(210)** 750 ÷ 25 = 30, meaning that Bobo weighs 30 times as much as 25 pounds, and so needs 30 times 7 mL of vitamin.

3. **(A = 50%; B = 17%; C = 33%)** Three of the six equal-size regions are shaded like A, giving half or 50%. One region is shaded like B, and 1/6 = 1 ÷ 6 = 0.17 when rounded, or 17%. Two out of six are shaded as C, so 1/3 of the figure is like C -- this is 33 1/3 %, but this is 33% when rounded.

4. **(2)** A Venn diagram helps students see the situation. It's usually helpful to work from the overlap area toward the outside.



5. **(See below.)** Move three of the pencils on either of two ends.



6. **(20)** If the helium balloons are removed from the scale, it will read 15 grams more than it does at present. Therefore the two cans by themselves would have a reading of 25 + 15 or 40 grams. Then each can would weigh half of that, or 20 grams. An equation for this situation is $2x + {}^{-}15 = 25$.

7. **(26¢)** It's possible that the first 12 gumballs you get will result in two gumballs of each of the six colors. However, the next time, you must get a gumball that matches two others.

Commentary

Uranus, XV

1. **(a. $1.50; b. $6.00; c. $5.00; d. $9.00)** The problem involves reading the graph for the different age groups.

2. **(13 nickels and 7 dimes)** Students might make an organized list of the possible number of dimes and nickels to have 20 altogether, and check out which combination totals $1.35. Other students might simply guess-check-revise, perhaps starting with ten of each coin, and revise the guess since the total value would be $1.50, which is too much. More nickels and fewer dimes are called for.

3. **(10:42 PM; 10:42 PM - 12:24 AM; 12:24 AM - 2:06 AM; 2:06 AM - 3:48 AM; 3:48 AM - 5:30)** Most students will count up to see that 8 1/2 hours must be divided, and convert that into 510 minutes. This means each camper will have 102 minutes to stay awake, which is 1 hour, 42 minutes. Students will then add 1:42 to 9:00, then again to the result, and so on.

4. **(11)** Students who divide 487 by 45 will get 10 buses, but with 37 students left over, which takes another bus.

5. **(48 cm)** The perimeter of the rectangle would be given by $w + 2w + w + 2w$. This means that $6w = 36$ cm, implying $w = 6$ cm. If $w = 6$ cm, then the perimeter of the octagon would be 8 times 6 cm, or 48 cm.

6. **(3 red and 5 white in one jar; 4 white and 4 green in the other)**

7. **(a. His savings was increasing. b. June and July; c. November and December)** The problem involves reading the graph carefully, at its critical points where the values change. This is called a "step graph".

8. **(12)** Students might want to label the ice cream A, B, and C, and the cones 1 and 2. There are only three ways to combine A, B, and C two at a time: AB, AC, BC. These three ways can go with either cone 1 or 2, giving six choices altogether.

Commentary

Uranus, XVI

1. **(233)** As you read each clue, mark out those that do not fit the clue. $588 \div 3 = 196$, so mark out 144, 151, 123. Mark out the even numbers 324, 214, 304, 342. Now 233 and 323 remain. In 233 the tens and ones have a sum of 6.

2. **(12)** Girls and boys are in the class in a ratio of 3:2. So, 2 out of every 5 students in the class are boys. 2/5 of 30 = 12.

3. **(triangular prism)**. Some students may top trace over the figure, and cut it out and fold it up to see the triangular prism.

4. **(250)** $60 \div \frac{1}{4} = 60 \times \frac{4}{1} = 240$; $240 + 10 = 250$.

5. **(24)** $4! = 4 \times 3 \times 2 \times 1$. Another approach is to make an organized list. Label the books A, B, C, and D, and list the combinations.

ABCD	BACD	CABD	DABC
ABDC	BADC	CADB	DACB
ACBD	BCAD	CBAD	DBAC
ACDB	BCDA	CBDA	DBCA
ADBC	BDAC	CDAB	DCAB
ADCB	BDCA	CDBA	DCBA

6. **(19, 23, 29)** This is the set of prime numbers.

7. **(Dorothy -- purple, hammers; Jake -- blue, fish; Vicky -- yellow, marbles; Otis -- green, spiders; Nick -- red, watches)** Students may wish to make a logic chart to help them organize info. They could take the given chart, and add in letters to represent the colors and collections, as shown below, and proceed by marking out impossibilities indicated by the clues, and circling things they know. Process of elimination usually comes into play in these problems in that once you know a given fact, such as Nick's jacket being red from clue (c), you can cross out red everywhere else.

	Jacket	Collection
Dorothy	r b y p g	s m h f w

8. **(T)** All letters above the line are made of straight lines. Those below the line have some curved lines.
   S U

9. **(5)**

10 L	4 L	3 L	
10	0	0	start
6	4	0	after filling the 4-liter from the 10-liter
6	1	3	after filling the 3-liter, from the 4-liter
9	1	0	after pouring what's in the 3-liter into the 10-liter
9	0	1	after pouring what's in the 4-liter into the 3-liter
5	4	1	after refilling the 4-liter from the 10-liter

Commentary

Uranus, XVII

1. **($\frac{27}{16}$ or $1\frac{11}{16}$)** Students can choose any line and add the four fractions found there.

2. **($\frac{15}{8}$ or $1\frac{7}{8}$)** Accept alternate answers from students which are not in lowest terms: $\frac{30}{16}$ or $1\frac{14}{16}$

3. **($\frac{17}{16}$ or $1\frac{1}{16}$)** The sum should be the same for each of the six triangles.

4. **(a = 6; b = 9; c = 4; d = 1; e = 3; f = 8; g = 7; h = 2; i = 5; j = 0)** Note that e and f may be switched.

5. **(D)** The probability of getting a black marble in the boxes is:

   a) $\frac{1}{4}$ b) $\frac{5}{11}$ (c) $\frac{2}{5}$ d) $\frac{4}{7}$

   Box D would be the best choice since 4/7 is greater than any of the other fractions. Students can decide this by placing them all over a common denominator, or by using a calculator and diving the numerator by the denominator. Another easy way is to note that 4/7 is the only fraction greater than 1/2, and therefore has to be the largest.

6. **(29)** Drawing a picture helps to solve problems such as this. The last cut produces 2 pieces.

7. **(15)** Students can find this volume by counting, but must realize that there are 3 cubes on the "back side" which they don't see. The clue in the problem says that the figure looks the same from the back.

8. **(a. 9; b. 7)** For part (a), to be divisible by three, the sum of the digits must be a multiple of three. For part (b), to be divisible by nine, the sum of the digits must be a multiple of nine. Another easy way to approach both problems, without using the rules of divisibility, is to use a calculator and begin by inserting 9 into the blank space for (a), and see if you get a whole number answer when dividing by 3. If not, move to the next largest digit 8 in the blank. Proceed in this fashion until you have the largest digit that can be substituted, and results in a whole number answer. The same process works for (b), except you divide by 9.

9. **($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{6}$)** Other answers are possible.

10. **(147)** Adding 132 to 456 gives the total number of points, 588. Divide 588 by four to get the average, 147.

Commentary

Uranus, XVIII

1. **(74)** $5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 + 1 + 2 + 3 = 74$

2. **(2 x 3 x 5)** Students may draw a factor tree to determine the prime factorization. Such a tree is not unique, but gives a unique answer.

3. **(14)** 10 blocks are in the bottom layer and 4 are in the top layer.

4. **(2 inches)** Since the model is 1/20 the size of the truck, the letters should be 1/20 the size of the original letters. Computing 1/20 of 40 gives 2.

5. **(2 years, 270 days)** One ton is 2000 pounds, so eating 2 pounds a day means it takes 2000 ÷ 2 or 1000 days. At 365 days a year, 2 years would be 730 days. 1000 – 730 days = 270 days.

6. **(♣)** The pattern involves a club and a heart. The club appears in this fashion: 1, 2, 3, 4, ... while the heart appears as 2, 2, 2, 2, ... and separates the clubs. The pattern then becomes one of: 1 + 2 + 2 + 2 + 3 + 2 + 4 + 2 + 5 + 2 + ... until you get to or past 100. With a calculator, you get exactly to 100 when you add 12 above; the 12 indicates you are in the club part of the pattern. Therefore the 100th term is a club.

7. **(20,736)** 12 x 12 = 144; 144 x 12 = 1728; 1728 x 12 = 20,736 or $12^4 = 20{,}736$

8. **(a=28.92604 b=3.85)** For (a), round off the numbers mentally to 7 and 4 and multiply. For (b), 0.98 is almost 1. Any number divided by 1 is the same number.

9. **(55)** The helium balloon on the left scale must be "pulling up" with the power of a 15-gram pull, since it and 25 grams balances 10 grams. Therefore we can consider its weight as -15 grams. On the right-hand scale, the two balloons would have a weight of -30; the bag of groceries must then have a weight of 55, so that the groceries and balloons together cancel out 25 grams. These situations are expressed mathematically as:

   $^{-}15 + 25 = 10$ and $^{-}15 + {}^{-}15 + x = 25$, so $x = 55$.

   Note: it's easy for students to see that, when you have a helium balloon that "pulls up" on a scale as -15 grams, the balloons can be replaced on the other side of the scale by a positive weight of that amount. I.e., -15 can be "moved over" to +15, on the other side of the scale.

10. **(KX)** Line up letters of the alphabet and divide them in half. A starts off the first half and N starts off the second half. B and O are next in the two sets; skip 1 letter to get D and Q; skip 2 letters for G and T; skip 3 letters to get K and X. The terms also alternate from upper case pairs to lower case pairs.

Commentary

Uranus, XIX

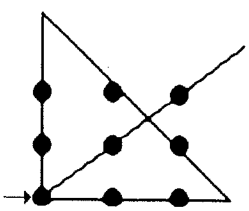
1. **(22 yards)** From the 38 to the 50-yard line is 12 yards, and from the 50 to the 40-yard line is another 10, and 10 + 12 = 22.

2. **(a. bike; b. three times faster)** The 6/15 of an hour Ryan spends walking is 6/15 x 60 minutes, or 24 minutes. Riding his bike takes 8 minutes.

3. **(A = 12; B = 2; C = 3; D = 16)** Students can solve for A, B, C, and D by *guess-check-revise*. They would look at factors of 24, 48, 6 and 192 that "work out" in the equations, when used together. The first and second equations together tell you that A and B should be 12 and 2.

4. **(See right.)** Many students will miss this problem because they fail to go outside the "invisible boundary lines" that the brain places on the figure, because of the dots arranged in a square.

Start here →



5. **(32)** Six feet is 12 x 6 inches, or 72 inches. This amount divided by $2\frac{1}{4}$ inches can be done using fractions ($72 \div 2\frac{1}{4} = 72 \div \frac{9}{4} = 72 \times \frac{4}{9} = 8 \times \frac{4}{1} = 32$). It can also be done by converting $2\frac{1}{4}$ inches to 2.25 inches, and dividing as a decimal or using a calculator.

6. **(See right.)** Successful students will probably start at the bottom of the problem, multiplying 19 x 3 to get 57, and working up to the top of the problem.

$$\begin{array}{r} \boxed{2}\,\boxed{3} \\ 19\overline{)\boxed{4}\,\boxed{3}\,\boxed{7}} \\ \underline{\boxed{3}\,\boxed{8}\phantom{\,\boxed{7}}} \\ \boxed{5}\,\boxed{7} \\ \underline{\boxed{5}\,\boxed{7}} \\ 0 \end{array}$$

7. **(Black -- 10; Dotted -- 2; Striped: $9\frac{1}{2}$; Crossed: $\frac{1}{2}$)** Students might be more successful if they draw in the grid lines, and count squares and half-squares.

8. **(7 scores)** There are 10 possible ways the arrows could land: (1,1,1); (1,1,3); (1,1,5); (1,3,5); (1,3,3); (1,5,5); (3,3,3); (3,3,5); (3,5,5); and (5,5,5). However, these only produce these seven scores: 3, 5, 7, 9, 11, 13, and 15.

Commentary

Uranus, XX

1. **(1537 or 1739)** Start by placing a 1 in the thousands place. They can then *guess-check-revise* to find that the other digits are 5, 3, and 7, or 7, 3, and 9 respectively.

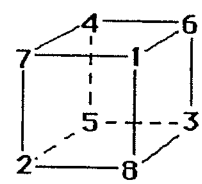
2. **(11.1 %)** Accept 11% also. To solve this problem, students might suppose the original salary was \$100. Then after the decrease of 10%, she's making \$90. To get back to \$100, the salary must increase by \$10 -- the question is -- what percent of \$90 is \$10? \$10 ÷ \$90 = 0.111...., which is 11.1%.

3. **(a decimal point)** A decimal point changes "23" into "2.3" which is between 2 and 3.

4. **(700 hours)** Students might use a calculator to multiply 29.5 x 24. Rounding: 30 x 20 = 600, 30 x 4 = 120, 600 + 120 = 720 - closer to 700.

5. **(8.25)** Students can again use a calculator. "My Dear Aunt Sally" is a way to remember the order of operations in mathematics -- multiply, divide, add, and then subtract. This means that, for this problem, students must compute 4.8 x 1.7 before subtracting this amount, 8.16, from the other numbers.

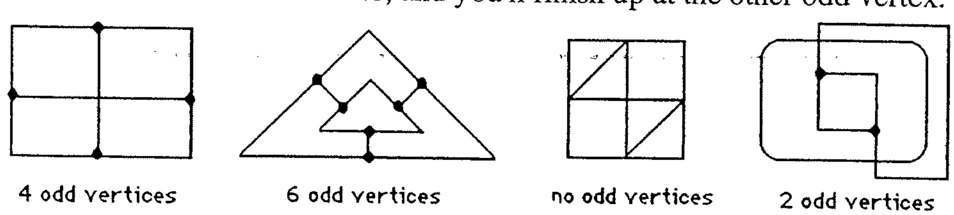
6. **(See one solution to the right.)** Students can guess-check-revise to place the numbers at the corners. They might start by placing 8 and 7 on opposite corners, and 1 and 2 on the same face with 7 and 8, but also on opposite corners. That way they have the two highest balanced off by the two least numbers.



7. **(4,992,000)** The system would incorrectly answer 13,000 calls per hour per system, or 208,000 calls for all 16 systems per hour. Multiply that times 24 hours, and the number of incorrectly answered calls in a day is 4,992,000.

8. **(40 pennies, 8 nickels, 2 dimes or 45 pennies, 2 nickels, 2 dimes, 1 quarter)** One key to solving this problem is to realize that most of the coins must be pennies, so start with large numbers of pennies and see if you can make the other coins "fit." 50 pennies won't work, obviously, so drop back to 45 pennies. After some manipulation, you can see that 2 nickels, 2 dimes, and a quarter give 65¢, which when added to 45¢ gives \$1, and it consists of 10 coins. Try 40 pennies, and again you can gain a solution.

9. **(The two figures to the far right should be ringed.)** A network is *one drawable* if it has 2 *odd vertices* or no *odd vertices*. A vertex is odd if it has an odd number of paths going in or coming out. To trace a network with no odd vertices, start anywhere and you'll finish tracing it back at the same point where you started. If it has 2 odd vertices, you can trace it if you start at one of the odd vertices, and you'll finish up at the other odd vertex.



Commentary

Uranus, XXI

1. **($1.22)** $2.15 + $1.45 = $3.60, and $3.60 x 1.05 = $3.78 gives the price plus tax. This amount subtracted from $5.00 is $1.22.

2. **(The decimal point and ¢ sign together means the sign implied the price was 99 hundredths of a penny, which is less than a penny.)** This mistake is a very common one in society. Students might want to begin looking for such mistakes by store owners, and asking them for their change from a penny, for such purposes. They should keep a sense of humor, however, as most store clerks won't know what they're talking about when they try to explain it.

3. **(3 and 5)** Jefferson has 9 letters and Carter has 6 letters, giving 15 in all. The prime factors of 15 are 3 and 5.

4. **(3)** Students might guess-check-revise on the total number of games played in which they win 70%. A good place to start is with 10 games, since it's easy to find 70% of 10. In this case, this guess is correct as they would win 7 games -- 70% of 10 is 7 -- meaning they lost 3 games, and they won 4 more than they lost.

5. **(d)** Students might calculate both areas. The given area is 5 x 10 or 50 cm^2; after the length and width are doubled, the area is 10 x 20 or 200 cm^2. 200 is 4 times as much as 50. Many students who don't calculate both areas will immediately think the area is doubled.

6. **(duck and turtle)** Students can reason that, from the second tug-of-war, 1 duck equals 2 turtles in pulling power. So in the first tug-of-war, they can substitute a duck for two turtles and know that a duck and a turtle pulls as hard as 5 fish. Then in the bottom tug-of-war, the duck and turtle could outpull 4 fish.

7. **(8.5)** After 7.5 and 9.0 are thrown out, students can find the average of 8.3, 8.8, and 8.4. Some students will add these three numbers and divide by 5, since there were 5 scores to begin. But this gives an unreasonable answer of 5.1.

8. **(1094)** The pattern she noticed is to triple a given weight, then subtract 1,to get the next month's weight. If you triple 41 and subtract 1, you get 122. Triple that and subtract 1 and you get 365. Triple that and subtract 1, and you get 1094.

9. **(6)** Since the dog alone weighs 27 and the dog with two balloons weigh 13, the two balloons must remove 14 from the dog's weight. This means one balloon would remove half of that, or 7. So three balloons would remove 21, leaving 6. This problem can be thought of as using negative numbers in a real-world situation.

Commentary

Uranus, XXII

1. **(0)** Twice 50 and twice 7 is 100 + 14 = 114. Twice 57 is 57 + 57 = 114 also.

2. **($126)** a) The area of the large rectangle is 18 x 10, or 180 cm^2. The area of the trapezoid is $\frac{1}{2}$ x (6 + 12) x 6, or 54 cm^2. The area of the shaded part is then 180 - 54, or 126 cm^2.

3. **(26 and 62)** Students might simply list the 2-digit numbers in which the digits have a sum of 8 and the digits are reversed, and see which of them have a difference of 36. They would try 80 - 08 = 72; 71 -17 = 54; 62 - 26 = 36; 53 -35 = 18; 44 - 44 = 0.

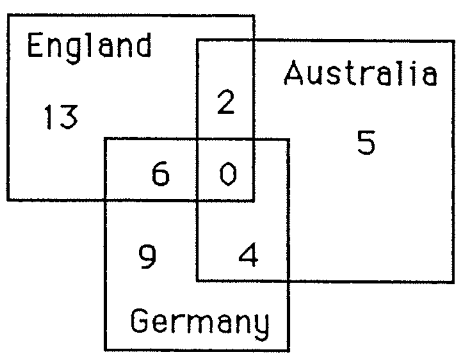
4. **(48)** Each edge of a 64 cubic inch cube is 4 inches long. A cube has 12 edges. 12 x 4 = 48.

5. **(215)** 45 + 55 = 100 25 + 75 = 100 100 + 100 + 15 = 215

6. **(a. 17; b. 21; c. 101)** Students can make the first few buildings out of cubes, and they will notice that they have to add four more cubes to get each one in order from the previous building. Parts (b) and (c) almost force them to generalize beyond the "next term" approach, to finding a formula that does not depend on adding four to the previous building.

7. **(4 x *T* + 1 or 4*T* + 1 or *T* + *T* + *T* + *T* + 1)** Hopefully students will notice the relationship between the building number and the number of blocks required to make it. Accept any equivalent ways to express this number of blocks, using the variable *T*.

8. **(39)** In working with Venn diagrams, it is often helpful to work from the inside out. That is, first fill in the number in the overlap area of all the sets, then move to the overlap area of each pair of sets. Finally, determine the number in each set which does not overlap another set.



Commentary

Uranus, XXIII

1. **(d. 60 mph)** Pi is 3.14, rounded to two decimal places, and 19 π means 19 x π or 19 x 3.14, which is 59.66 or approximately 60. Or rounding: 3 x 20 = 60.

2. **(120°)** The steering wheel has *rotational symmetry*, which means that it can be rotated and will line up with itself. The spokes of the steering wheel partition the circle into 3 congruent parts, so the angles through which it must be rotated to align itself is 360° ÷ 3 = 120°

3. **(21)** Students might be curious as to why this trick works. Let x be the number of brothers or sisters. Doubling x means you have $2x$. Adding 4 gives $2x + 4$. Multiplying by 5 gives $10x + 20$. Adding 1 gives $10x + 21$. Subtracting 10 times the number of brothers and sisters means subtracting $10x$, which gives 21.

4. **(April 12)** It might be helpful to start with how many seconds there are in a 24-hour day, which can be computed as 60 x 60 x 24 = 86,400. Then 1,000,000 ÷ 86,400 = 11.57. Therefore in 11.57 days from 1 April, the counting should be over. This would be 12 April, at around 9:41 PM.

5. **(a. 1/12; b. 3/12 or 1/4)** These chances might also be written as percents or decimals.

6. **(One solution is shown below.)** Other arrangements are possible.

4	9	2
8	1	6
3	5	7

7. **(The decimal point should be between "5" and "0" in the answer.)** The only thing incorrect is that the decimal point is in the wrong place in the answer. Some students will say that the person multiplied incorrectly in that the partial products, 405, 2835, and 1215, are wrong. However, this is a legitimate way to multiply, as can be seen by reversing the positions of 4.05 and 3.71, and multiplying using the normal algorithm. This should point out to students that there are a number of ways to multiply, but all should produce a reasonable answer, and an answer close to 1,502 isn't reasonable when you multiply two numbers that are each close to four.

8. **($30.50)** Every four spokes would cost $1.00, so the tires on the bicycle shown have 8 groups of 4 spokes on each tire, which would cost $8. For two tires, the spokes would run $16. Add to that $5.00, $8.00, and $1.50 and you'll get $30.50.

Commentary

Uranus, XXIV

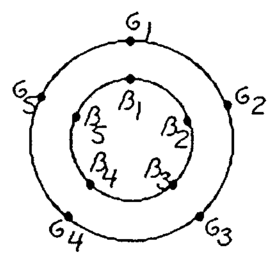
1. **(a. 42; b. 2,864 miles; c. 28 mph)** Students are often quite interested in such strange records as those found in the *Guinness Book of World Records.* For (a), 1018 ÷ 24 = 42.4, which is 42 when rounded to the nearest whole number. For (b), the other two wheels also travelled 2864 miles, as passengers. If students answer "0", give them credit also, as they are interpreting "travel" to mean something different for a tire than a passenger. For (c), 501 ÷ 17.6 = 28.46 which is 28 mph, when rounded. Some students will incorrectly round 28.46 to 28.5 first, and then 28.5 up to 29 mph.

2. **(27)** If two candles stand for 6 years, then each candle is 3 years. 9 candles times 3 is 27 years.

3. **(The first two digits tell me how old they are, and the last two tell me how much change they have.)** The above description works, except that if the person is a single-digit age, then it's the first digit, not the first two, that give the age. This problem also requires that the change be less than $1.00.

4. **(8)** 13.5 - 2.08 = 11.42. Adding 8.58, written as a decimal rather than a mixed number, gives 20. 40% x 20 = 8.

5. **(5)** First, students will need to figure out that the problem is written with a reversed image, which can be reversed again by holding it up in front of a mirror. They might be interested in knowing that Leonardo de Vinci wrote many of his manuscripts in this fashion, to protect them from prying eyes. Students might be fooled into thinking that they add or multiply the two fives in the problem. It is easy to see, however, that if they think of the boys and girls lined up in two concentric circles, it only takes 5 turns of one of the wheels, while the other stays stationery, to match each boy with each girl.



6. **(1.5)** From the right-hand scale, we know that a strawberry weighs 2 grams. Then on the left-most scale, 3 strawberries or 6 grams balancing 6 cans means each can is 1 gram. In the middle scale, 3 cans weighing 3 grams balance 2 pencils, so each pencil must be half of 3 grams, or 1.5 grams.

7. **(clockwise)** Gears that are connected in this fashion alternate in direction. If the first goes clockwise, as it turns, it forces the next to go counterclockwise, which forces the next to go clockwise, and so forth. Every odd number of gears will go in the same direction as wheel number 1; every even numbered wheel will go the opposite way.

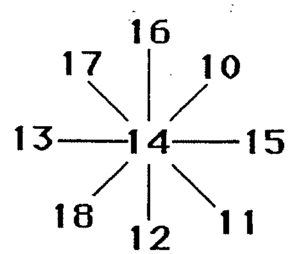
Commentary

Uranus, XXV

1. **(a. 21,000; b. 7,655,000)** The problem involves multiplication. For (a), 25 x 60 x 14 = 21,000; for (b) 21,000 x 365 = 7,655,000.

2. **(180)** Ten pins in each of 15 lanes is 150 pins. Multiplying 150 by 1.2 gives the extra 20% in one step, and 150 x 1.2 = 180. There are many other ways students will find the extra 20% -- one common way is to realize that 10% of 150 is 15 pins, so 20% would be twice that or 30 extra pins.

3. **(One solution is shown to the right.)** Students who start with 14 in the middle square, because it's in the middle of the numbers from one through 18, will have an advantage. From that point, they can work in toward the center of the line of numbers, making pairs that have the same sum.



4. **(28)** 1 + 2 + 4 + 7 + 14 = 28.

5. **($7)** If she went in with $27 and came out with $6, she spent $21. Therefore each tape cost, on the average, $21 ÷ 3 = $7.

6. **($+2\frac{1}{8}$)** The sum of the positive and negative amounts can be combined to find out what the stock was at on Thursday. This can then compared with its closing price on Friday to find how much it gained or lost on Thursday.

$$12\tfrac{1}{2} + \tfrac{3}{4} + 1\tfrac{3}{4} - 5\tfrac{1}{2} + 2\tfrac{5}{8} \text{ would give the closing price on Thursday.}$$

$$= 12\tfrac{4}{8} + \tfrac{6}{8} + 1\tfrac{3}{4} - 5\tfrac{4}{8} + 2\tfrac{5}{8} = 15\tfrac{21}{8} - 5\tfrac{4}{8} = 17\tfrac{5}{8} - 5\tfrac{4}{8} = 12\tfrac{1}{8}$$

This closing price of $12\frac{1}{8}$ is then compared with $14\frac{1}{4} = 14\frac{2}{8}$, and you realize that the stock gained $2\frac{1}{8}$ on Friday.

7. **(10)** There are four 1's in the corners, four more 1's that are part of the 12's that are close to the four corners, and two "ones" printed on the bill.

8. **(Far-left figure should be circled.)** Students might trace the figure using a dark pencil or pen on a sheet of paper or an overhead transparency, and go through the motions described.

Commentary

Uranus, XXVI

1. **(160)** 400 ÷ 5 = 80 cars made. If 2 headlights are needed for each car, then 160 headlights are needed.

2. **(a. 45; b. 63; c. 165)** Most students will draw the next few figures and count the toothpicks. They will likely extend figure 4 down several times, to get each new figure, and just count the new toothpicks added on. A pattern emerges which some students might notice, although they might not be able to express it clearly:

	Figure number:						
	1	2	3	4	5	....	n
Toothpicks required:	3	9	18	30	45	....	$\frac{(3)(n)(n+1)}{2}$

3. **(297)** Since $\frac{2}{5}$ of 495 is 198, Ashley has already read 198 pages, leaving 297 pages.

4. **(17)** A 20-foot roll of tape is 240" long. A 1 ft. 2 in. section of tape is 14" long. 240"÷ 14" = 17.14. There is not enough tape for the 18th picture.

5. **(1st: Weigh three pieces of gum against another three pieces. If the scale balances, you know the light piece is one of the three in your hand. If the scale doesn't balance, you know which group of 3 pieces has the lighter one. 2nd: Weigh two of the three pieces from the lighter group. If the scale balances, the light piece is in your hand. If it doesn't balance, you know which piece is lighter.)**

6. **(0)** The boat also rises as the tide comes in!

7. **($101)** The speed limit was exceeded by 12 mph. $80 + 12 ($1.75) = $101

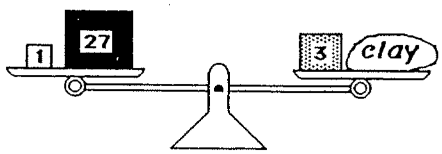
8. **(16)** The students need to remember not to count the corner posts more than once. A drawing will help them see the situation.

9. **(540)** There are 27 x 36 = 972 square feet in the classroom. Since 9 square feet is 1 square yard, 972 square feet ÷ 9 gives 108 square yards. 108 x 5 people = 540 people.

Commentary

Uranus, XXVII

1. **(See below.)** If the scale balances, the clay weighs 25 grams.



2. **(median)** The mean is (76 + 76 + 83 + 85 + 90) ÷ 5 = 82. The median is the middle number when all are lined up in order, and is 83. The mode is the most frequently occuring number, which is 76. The range is the difference in the highest and lowest scores, which is 14.

3. **(See chart to the right.)** This is only one solution. Others are possible:

P	**N**	**D**	**Q**
Q	**D**	**N**	**P**
N	**P**	**Q**	**D**
D	**Q**	**P**	**N**

4. **(2 quart jars)** There are 2 pints in a quart; therefore 7 quarts + 6 pints = 7 quarts + 3 quarts = 10 quarts; therefore 12 quarts - 10 quarts = 2 quarts; the fewest jars would be 2 quart jars.

5. **(7/12)** The months with more than 30 days are January, March, May, July, August, October, and December . This is 7 months out of 12.

6. **($3,058)** The area to be covered can be found by taking the area of the large rectangle and removing the pool area. The area of the 20-by-30 rectangle is 600 square feet; the area of the 23-by-14 pool is 322 square ft. The difference is 600 - 322 = 278 square feet. Each square foot would take 4 of the tiles, therefore 4 x 278 = 1112 tiles needed.1112 tiles x$2.75=$3,058.

7. **($10)** The racquet was about $30, the tennis balls about $5, the shirt about $15. He therefore spent about $50, without counting tax. He should have $10 left from his $60 then, if his mom pays the tax for him.

8. **(12)** The 3 classical CDs must have been 25% of the total also, as that's all that is left from 100% when 50% and 25% are removed. If 25% or 1/4 = 3, then 100% is 4 times 3 or 12.

9. **(69 BC)** The numbers that represent BC years can be thought of as negative number on the number line. The problem becomes finding the number that comes 39 units prior to $^{-}30$, which would be $^{-}69$ - $^{-}69$ BC. As a check mathematically, notice that $^{-}69 + ^{+}39 = ^{-}30$.