

Neptune  
Grade 7

## Acknowledgments

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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.

A copy of the complete set of revised materials, grades K-8, has been sent to the district office for use by all of the schools. School districts in Florida have permission to reproduce this document for use in their schools for non-profit educational purposes.

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.

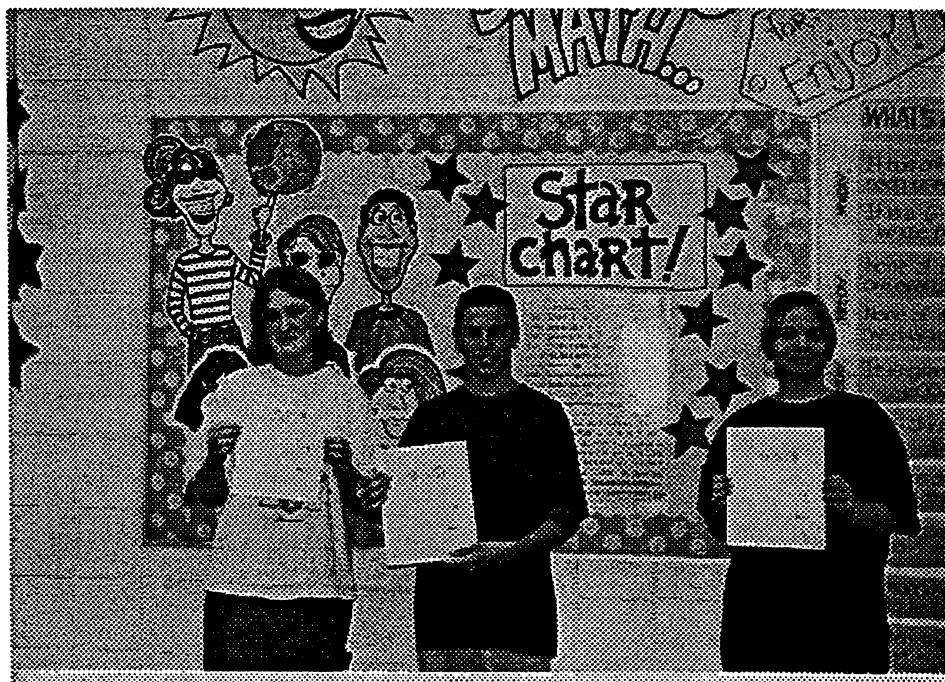
## **ORGANIZATION OF THESE MATERIALS**

### **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*.

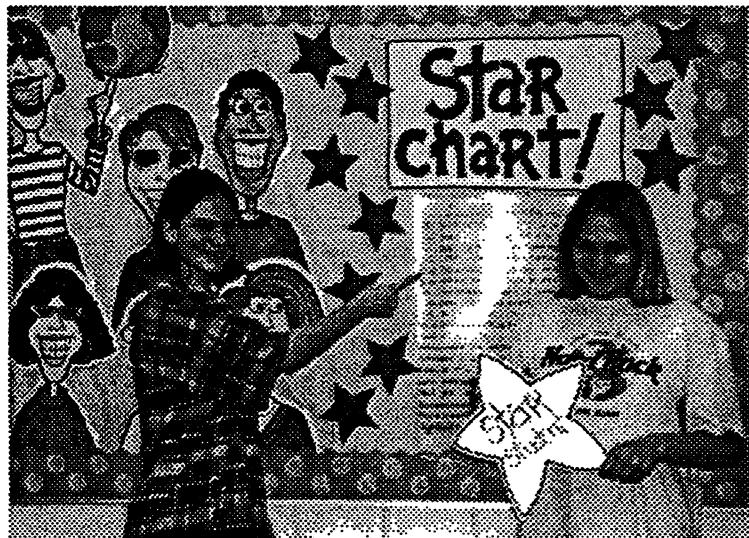
## Variations of the Basic Model

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**

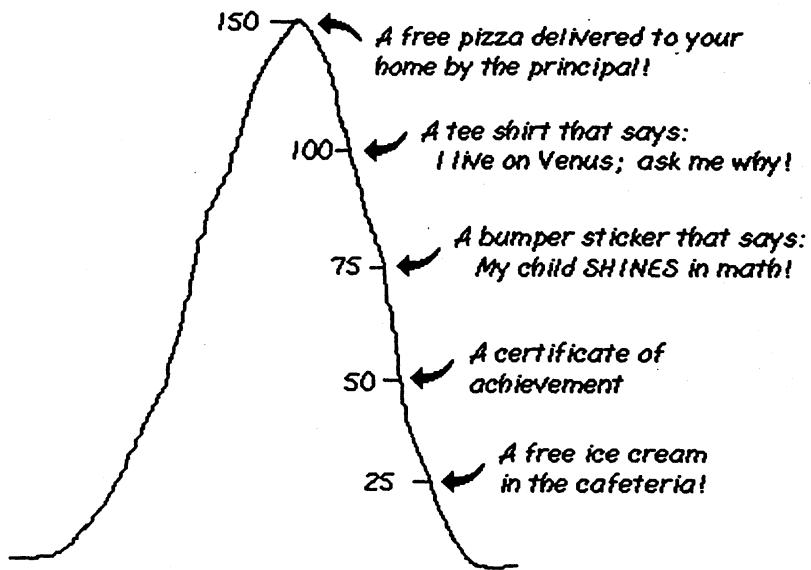
**Sunshine Math** is a K-8 enrichment package for mathematics, designed to be managed by volunteer assisting adults with coordinated support from the classroom teacher and school administrators. The purpose of the program is to give self-motivated students of all ability levels a chance to extend themselves 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.

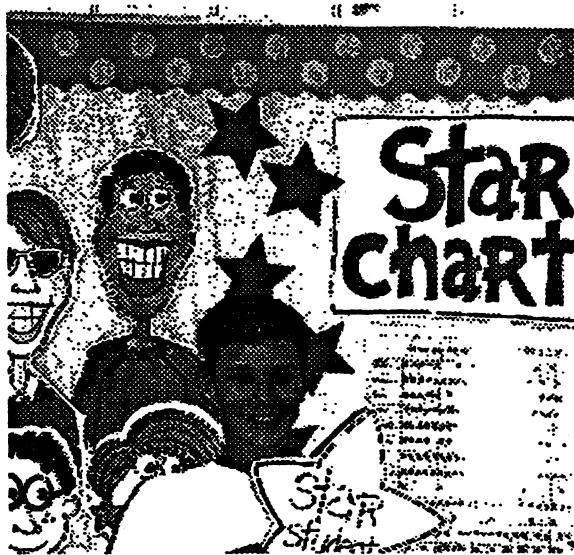
Visual reminders help children see that mathematics is challenging and rewarding. Some ideas are presented below, merely to start your creative juices flowing:



***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.



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!

*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.



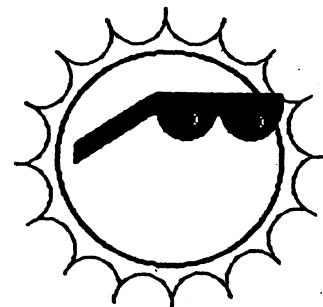
Checklist for assisting adults:

- 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 student's 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* choose 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 go 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



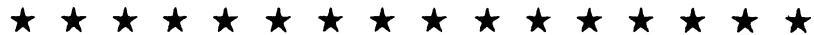
Welcome to *SUNSHINE MATH*, a program designed to enhance your journey through math. Be prepared to face challenging problems which require *thinking!* As you work through the system, you will address many types of problems, stretching and expanding that gray matter of yours in exciting ways!

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...

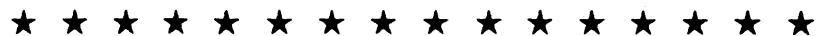
Good luck as you embark upon this mathematical adventure! The rewards will last a lifetime!



\_\_\_\_\_  
\_\_\_\_\_  

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(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!

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(parent's signature)

# WORKSHEETS

# SUNSHINE MATH - 7

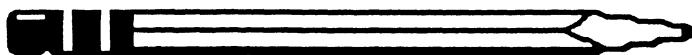
## Neptune, I

Name: \_\_\_\_\_  
*(This shows my own thinking.)*

- ★ 1. A student scores 85, 79, 92 and 100 on her math quizzes. What was her average grade?

Answer: \_\_\_\_\_

- ★★ 2. Stella bought 4 pencils at the school bookstore. She gave the clerk \$2 and received 16¢ in change. How much did she pay for each pencil?

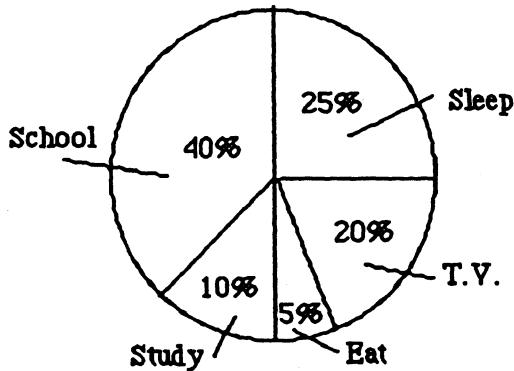


Answer: \_\_\_\_\_

- ★★ 3. The circle graph shows Tom's daily activities, and the percentage of time he spends on each.

a. Which two activities together take up half Tom's time?

b. Which activity takes twice as much time as studying?



Answer: a. \_\_\_\_\_ and \_\_\_\_\_

b. \_\_\_\_\_

- ★★★★ 4. Russell, a seventh grader, finds out the winner of the school talent show at 4:00 P.M. on Friday. He calls two seventh grade friends at 4:15 P.M. to tell them. By 4:30 P.M. they each call two 7th grade friends. If each person who is called calls two more 7th graders every fifteen minutes, when will all 176 seventh grade students know the winner?

Answer: \_\_\_\_\_

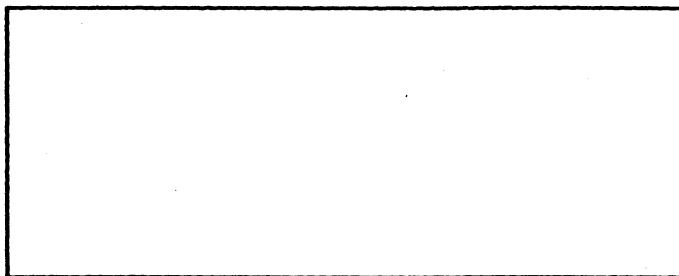
- ★ 5. One number is 7 less than another. Their product is 60. What are the two numbers?

Answer: \_\_\_\_\_ and \_\_\_\_\_

- ★★★ 6. How many different whole numbers can be made with the digits 1, 2, and 3? Any number you make can have 1, 2, or 3 digits in it but you may not repeat a digit in any one number.

Answer: \_\_\_\_\_

- ★★ 7. A rectangular yard 80 feet by 60 feet has a fence with a post on every corner and another post every five feet. How many posts are needed for the entire fence? Use the drawing below if it helps.



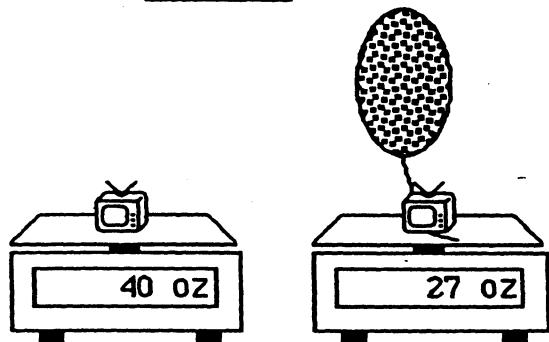
Answer: \_\_\_\_\_

- ★★ 8. The blueprint for landscaping a yard has a scale of  $1/2"$  to 1 foot. If the blueprint is a rectangle 18 inches by 22 inches, what are the dimensions of the yard?

Answer: \_\_\_\_\_

- ★★★ 9. A miniature television is placed on a scale as shown to the right. Then a helium balloon is added. The helium balloon has negative weight since it pulls up on the scale. What is the weight of the helium balloon?

Answer: \_\_\_\_\_



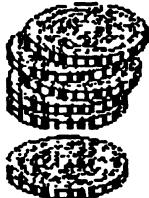
# SUNSHINE MATH - 7

## Neptune, II

Name: \_\_\_\_\_

(This shows my own thinking.)

- ★★ 1. How many different ways can \$0.50 be made with fewer than 8 coins?



Answer : \_\_\_\_\_

- ★★ 2. What integer between 10 and 20 is a solution to  $(x - 4) + (x + 8) = 36$ ?

Answer : \_\_\_\_\_

- ★★ 3. A punch recipe calls for 2 quarts of orange juice,  $1\frac{1}{2}$  quarts of apple juice, and  $1\frac{1}{2}$  quarts of soda water. How many cups of punch will this recipe make?

Answer: \_\_\_\_\_

- ★★ 4. Find a pattern and then write the next two terms according to your pattern.

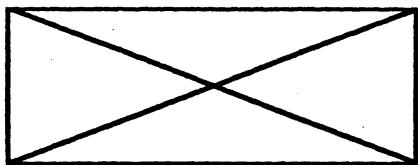
5, 6, 8, 9, 11, 12, 14, 15, 17, 18, .....

Answer: \_\_\_\_ and \_\_\_\_

- ★★ 5. In the pattern above, what two numbers would come before 5?

Answer: \_\_\_\_ and \_\_\_\_

- ★ 6. Two diagonals are drawn in the rectangle. How many acute angles are there altogether?



Answer: \_\_\_\_\_

- ★★ 7. Lisa, Drew, David and Kelly are 11, 12, 13 and 14 years old. David is older than Kelly and younger than Lisa. Drew is younger than David and older than Kelly. How old is each? Use the chart if it helps you.

	11	12	13	14
Lisa				
Drew				
David				
Kelly				

Answer: Lisa is \_\_\_\_, Drew is \_\_\_\_, David is \_\_\_\_, and Kelly is \_\_\_\_.

- ★★★ 8. Cindy and Bill spend part of their summer vacation at the cottage at the lake. Their mom and dad are very busy in the city, but the children would like to stay at the cottage longer and longer every summer. A new pizza restaurant opened at the lake that served pizzas with different toppings. Mom said that they could stay as many days as the number of different orders of two topping pizzas. With the following toppings, how long can they stay?

Pepperoni  
Mushroom  
Bacon

Sausage  
Onion  
Avocado

Meatball  
Green Pepper  
Tuna Fish

Salami  
Tomato  
Ham

Garlic  
Pineapple

Answer: \_\_\_\_\_

- ★★★ 9. You won the lottery! You have so much money that you decide to give \$2,000,000 away. If you give \$50 away every hour, how long will it take you in years?

Answer: \_\_\_\_\_

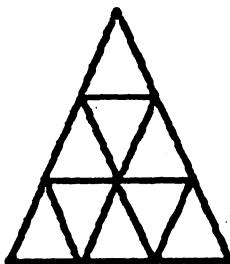
# SUNSHINE MATH - 7

## Neptune, III

Name: \_\_\_\_\_

(This shows my own thinking.)

- ★ 1. How many triangles are in this drawing?



Answer: \_\_\_\_\_

- ★★ 2. Insert parentheses in the following sentence to make it true.

$$40 - 6 \times 6 - 2 - 6 = 10$$

- ★★★ 3. The telephone company has 25 computer-controlled switching systems. Each system handles 700,000 calls an hour. The system works with 95% accuracy. How many calls would not be accurately handled in one day?

Answer: \_\_\_\_\_

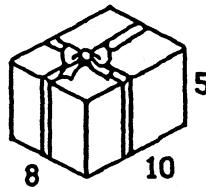
- ★ 4. You stop for lunch with your family on the way to the football game. The total bill for lunch is \$15.00. The service is good so you would like to leave the server approximately 20% as a tip. The game is ready to begin, so you quickly figure about how much you should leave! How much is it?

Answer: \_\_\_\_\_

- ★★ 5. Spaghetti costs 99¢ a pound. A jar of sauce costs \$2.59 and garlic bread is 2 loaves for \$1.39. You have invited friends for dinner and you need 2 pounds of spaghetti, 2 jars of sauce and 3 loaves of bread. To the nearest dollar, how much will it cost?

Answer: \_\_\_\_\_

- ★★★ 6. Ricardo wants to cover this 8" by 10" by 5" box with contact paper. How many square inches of contact paper will he need? How much ribbon will he need if the bow itself adds 15 inches?



Answer: \_\_\_\_\_ sq. in. of contact paper and \_\_\_\_\_ inches of ribbon

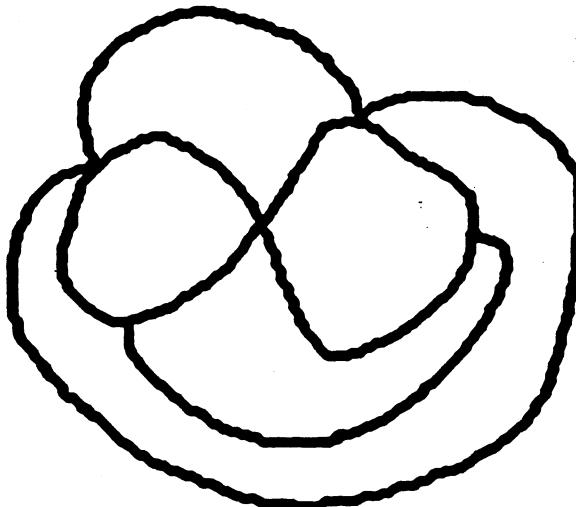
- ★★ 7. On the same day in early June, the temperature in Miami, Florida, was  $88^{\circ}\text{F}$  and the temperature in Nome, Alaska was  $-6^{\circ}\text{ F}$ . How much warmer was it in Miami?

Answer: \_\_\_\_\_

- ★★ 8. Fabian bought 6 notebooks at the school bookstore. He gave the clerk \$6. If two notebooks cost \$1.77, and the sales tax was 6%, how much change should he receive?

Answer: \_\_\_\_\_

- ★★ 9. If you start in the right place on this figure, you can trace the whole path without lifting your pencil and without retracing any path. Circle a place to start to do this. You get two stars if you can circle both places where you can start and accomplish this task.



# SUNSHINE MATH - 7

## Neptune, IV

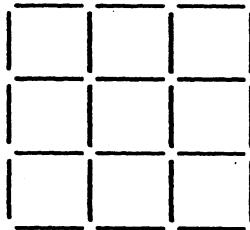
Name: \_\_\_\_\_

(This shows my own thinking.)

- ★ 1. Sam has to be at work at 6 P.M. He leaves his house at 4:10 P.M. and it takes him 20 minutes to drive to the library. It takes him 25 minutes to drive from the library to work. How much time can he spend at the library?

Answer: \_\_\_\_\_

- ★★ 2. Remove 8 toothpicks and leave 2 squares. Show the ones to remove by making an X through them.



- ★★★ 3. Stamps come in large sheets with perforations in between. How many different ways can you buy 4 attached square stamps? (Two ways to put them together are considered *the same* if one way can be turned or flipped so that its outline looks like the other way.)

Answer: \_\_\_\_\_ ways

- ★★★ 4. A video arcade offers 6 free games to first time customers. Each game costs \$.75 with a free game for every four you buy. How many games could you play for \$3.00 the first time you are a customer?

Answer: \_\_\_\_\_ games

- ★★ 5. Apples sell for \$1.29 a pound, and there is an average of 3 apples per pound. About how many apples would you expect to get for \$5.00?

Answer: \_\_\_\_\_ ⚬s

- ★★ 6. A number  $x$  is increased by 27 and the result is multiplied by 6, giving 372 as the result.

What was the original number  $x$ ? \_\_\_\_\_

- ★★★★ 7. A gymnast received the following scores from 5 judges in the state competition:

floor:	8.8, 9.3, 8.1, 8.9, 9.5
bars:	7.6, 8.2, 8.5, 8.2, 8.9
vault:	9.5, 8.9, 9.4, 9.5, 9.0
beam:	8.4, 8.5, 8.4, 7.9, 8.7

Her score for each event is found by computing the average *after* the high and low score is thrown out and rounding to the nearest hundredth.

- ✓ What was her score on each event?

floor: \_\_\_\_\_ bars: \_\_\_\_\_ vault: \_\_\_\_\_ beam: \_\_\_\_\_

- ✓ What was her worst event? \_\_\_\_\_

- ✓ What was her best event? \_\_\_\_\_

- ✓ What was her total score for the day, all 4 events combined? \_\_\_\_\_

- ★★★ 8. How many 22 centimeter pieces of string can be cut from a 4.2 meter piece of string? How many centimeters are left over?

Answer: \_\_\_\_\_ pieces with \_\_\_\_\_ cm left over.

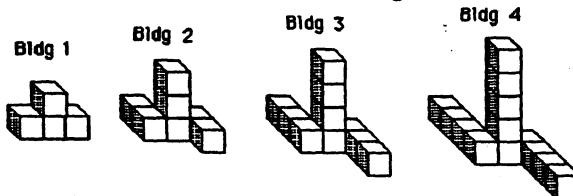
- ★★★★ 9. Some buildings are shown below. If the builder continues this same pattern:

How tall will the tower be in Building 100? \_\_\_\_\_ blocks high

How long will each of the two wings be in Building 500? \_\_\_\_\_ blocks long

How many blocks will it take to make Building 1000? \_\_\_\_\_ blocks

How many blocks will it take to make Building  $n$ , where  $n$  can be any whole number? \_\_\_\_\_



# SUNSHINE MATH - 7

## Neptune, V

Name: \_\_\_\_\_

(This shows my own thinking.)

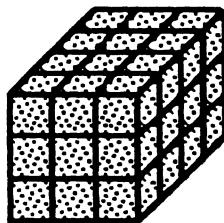
- ★★ 1. What is 10% of 20% of 30% of 100?

Answer: \_\_\_\_\_

- ★ 2. The hundreds digit of a three digit number is  $\frac{1}{3}$  of the ones digit and twice the tens digit.  
What is the number?

Answer: \_\_\_\_\_

- ★★ 3. How many small cubes are used to make this solid prism?



Answer: \_\_\_\_\_

- ★★★ 4. If the above prism was dipped in green paint, how many small cubes would not have any paint on them?

Answer: \_\_\_\_\_

- ★★★ 5. A snail starts at the bottom of a 20-foot well. Each day he climbs up  $4\frac{1}{2}$  feet, but at night slips back 2 feet. How many days will it take to reach the top of the well?

Answer: \_\_\_\_\_

- ★★ 6. The highest point in Florida is in Walton county. It is 345 ft. *above* sea level. Sombrero Key is 30 ft *below* sea level. What is the difference, in feet, between these two points?

Answer: \_\_\_\_\_

- ★★★ 7. A jar contains 48 marbles, identical except for color. There are twice as many yellow as red marbles and twice as many blue as white marbles. There are 6 more white marbles than red marbles. What is the probability of drawing at random a yellow marble from the jar?

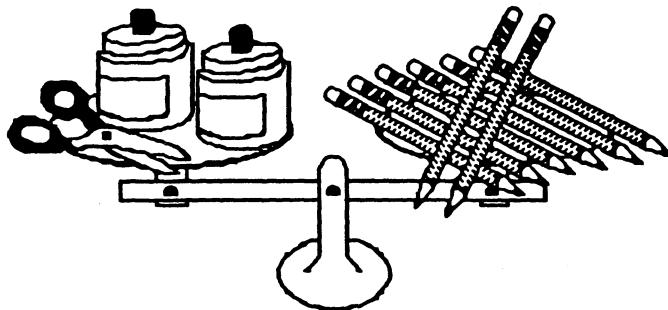
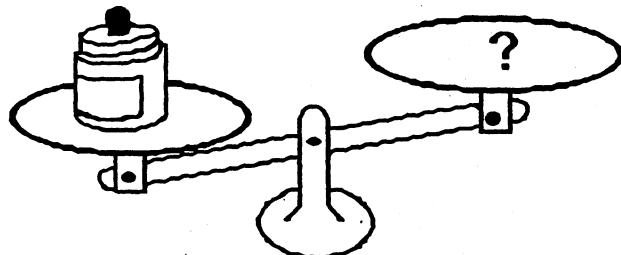
Answer: \_\_\_\_\_

- ★ 8. Add one operation sign (+, -, ×, or ÷) to make this mathematics statement true.

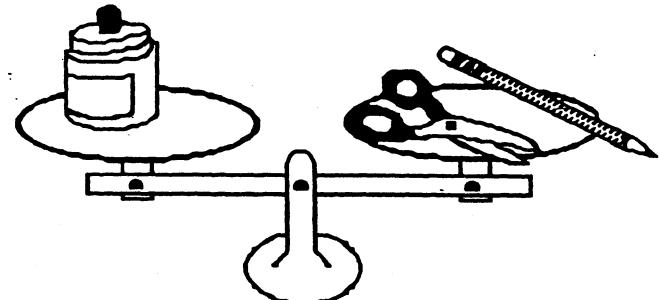
$$7 \ 0 \ 4 \ 3 \ 8 \ 4 = 7 \ 1 \ 2 \ 7$$

- ★★★ 9. How many pencils does it take to balance the jar of paste, given the information below?

Answer: It takes \_\_\_\_\_ pencils to balance the paste.



1 pair of scissors and 2 jars of paste balance 8 pencils.



1 jar of paste balances 1 pair of scissors and 1 pencil.

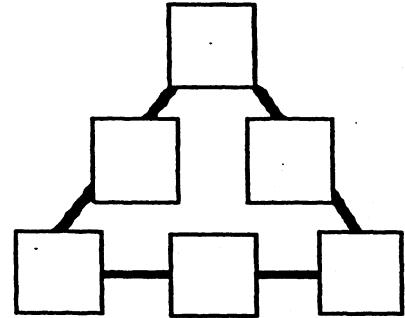
# SUNSHINE MATH - 7

## Neptune, VI

Name: \_\_\_\_\_

(This shows my own thinking.)

- ★ 1. Use the fractions  $\frac{5}{6}$ ,  $\frac{1}{3}$ ,  $\frac{1}{2}$ ,  $\frac{1}{6}$ ,  $\frac{2}{3}$ , and 1 so the sum of each side of the triangle is 2.



- ★ 2. The football team played fifteen games this season and won three more games than it lost. How many games did the team lose?

Answer: \_\_\_\_\_

- ★★★ 3. Look for a pattern. Use the pattern to predict the value of  $999,999,999 \times 9$ .

$$222,222,222 \times 9 = 1,999,999,998$$

$$333,333,333 \times 9 = 2,999,999,997$$

$$444,444,444 \times 9 = 3,999,999,996$$

Answer:  $999,999,999 \times 9 =$  \_\_\_\_\_

- ★★ 4. If three math students do 3 math problems in 3 minutes, how long will it take 33 students to do 33 problems? (The students are splitting the task.)

Answer: \_\_\_\_\_

- ★ 5. You are ordering pizza for 10 people. Each pizza has 8 slices. What is the fewest number of pizzas to order so that everyone gets the same number of whole slices?

Answer: \_\_\_\_\_

- ★★ 6. Add only one arithmetic sign (+, -, x, +) to make the mathematics sentence true.

$$9 \ 3 \ 4 \ 4 \ 6 \ 3 = 4 \ 3 \ 2 \ 4 \ 4 \ 2$$

- ★★★ 7. What three consecutive numbers have a sum which is  $\frac{1}{5}$  of their product?

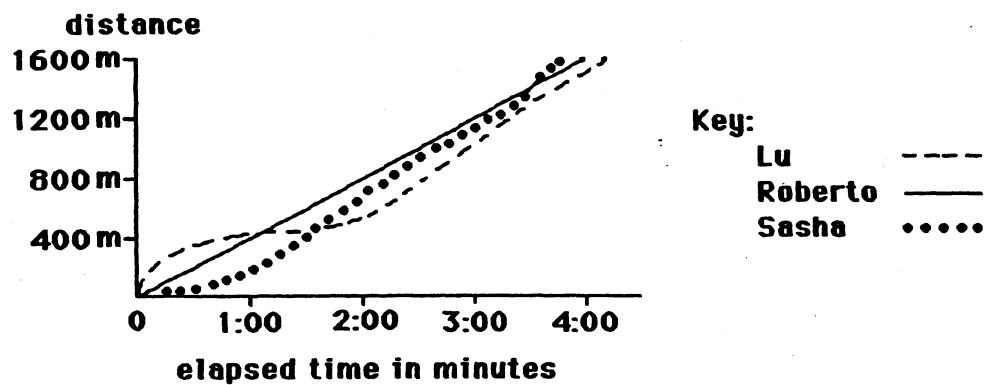
Answer: \_\_\_\_\_

- ★★★★ 8. Rose bought some donuts. She gave  $\frac{1}{2}$  of her donuts and  $\frac{1}{2}$  of a donut to her mom. Then she gave  $\frac{1}{2}$  her remaining donuts and  $\frac{1}{2}$  of a donut to her brother. Then she gave  $\frac{1}{2}$  her remaining donuts and  $\frac{1}{2}$  of a donut to her sister. This left her with  $\frac{1}{4}$  dozen donuts. How many donuts did Rose originally buy?

Answer: \_\_\_\_\_

- ★★★★ 9. Lu, Roberto, and Sasha had a 1600-meter rollerblading race. A recording device was attached to each one. The graph of the race was plotted on the same axis system, as shown below.

- What was the order in which they finished, 1st to 3rd? \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
- Who started off the slowest? \_\_\_\_\_ The fastest? \_\_\_\_\_
- At about what time after the race started did Sasha pass Lu? \_\_\_\_\_
- Who raced at the same pace, all the way through? \_\_\_\_\_



# SUNSHINE MATH - 7

## Neptune, VII

Name: \_\_\_\_\_

(This shows my own thinking.)

- ★★★ 1. What common fraction is equivalent to  $0.\overline{325}$  ?

Answer: \_\_\_\_\_

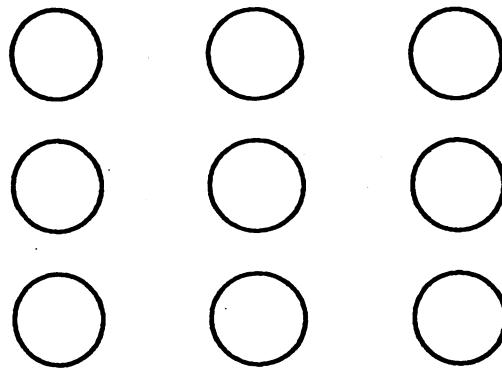
- ★ 2. What five consecutive odd numbers total 95?

Answer: \_\_\_\_\_

- ★★ 3. Lisa had some money. She gave half to her brother and spent half of what she had left. Then she lost 25¢ and only had 50¢ left. How much money did she have to begin with?

Answer: \_\_\_\_\_

- ★★★ 4. Arrange the digits one through nine in the circles in such a way that each row across and down has the same total.



- ★ 5. Find a year between 1970 and 1980 where the sum of the digits in the hundreds place and the thousands place equals the sum of the digits in the ones place and the tens place.

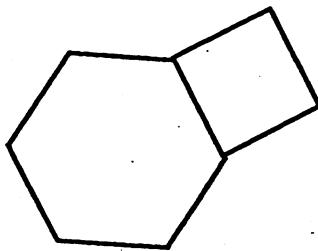
Answer: \_\_\_\_\_

- ★★ 6. Andy takes a 30 question test. How many questions can he miss and still make a 75%?

Answer: \_\_\_\_\_

- ★★★★ 7. If a regular hexagon shares a side with a square, and the perimeter of the hexagon is 72 cm, what is the area of the square?

Answer: \_\_\_\_\_



- ★★★★ 8. Put the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 into each square, using each digit only once.

Make the *sum* of the 2 five-digit numbers as large as possible:

Make the *difference* the smallest possible positive integer:

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+

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-

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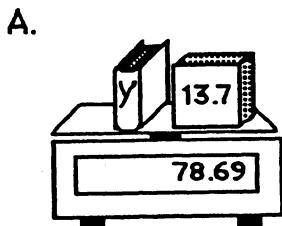
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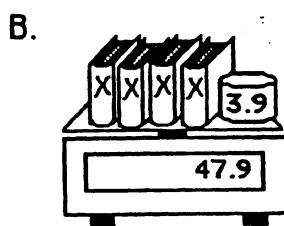
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- ★★★ 9. Write and solve an equation to show each situation below.



Equation A: \_\_\_\_\_

solution:  $y =$  \_\_\_\_\_



Equation B: \_\_\_\_\_

solution:  $x =$  \_\_\_\_\_



Equation C: \_\_\_\_\_

solution:  $n =$  \_\_\_\_\_

# SUNSHINE MATH - 7

## Neptune, VIII

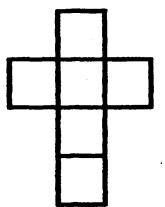
Name: \_\_\_\_\_

(This shows my own thinking.)

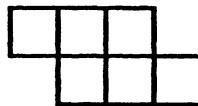
- ★★★ 1. On a farm there were 36 heads and 104 legs when counting the cows and chickens. How many chickens were on the farm? How many cows were on the farm?

Answer: \_\_\_\_\_ chickens and \_\_\_\_\_ cows

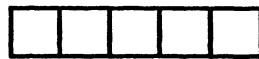
- ★★ 2. Circle the figures that can be folded to make a closed cube.



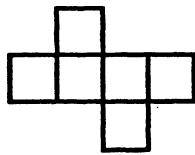
A



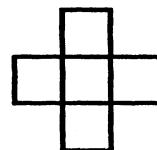
B



C

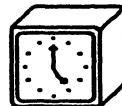


D



E

- ★★★ 3. Give the exact number of degrees in the smaller angle formed by the hands of the clock at 5 o'clock. The picture is not accurate enough to be measured with a protractor.



Answer: \_\_\_\_\_

- ★★★ 4. Your sock drawer has 10 blue socks, 16 red socks and 12 white socks.

- a) In the dark, what is the probability that you will pull out a white sock? \_\_\_\_\_
- b) If you pull a white sock and put it on, what is the probability that the next sock you pull out will also be white? \_\_\_\_\_

- ★★ 5. Place the next three numbers in the pattern:

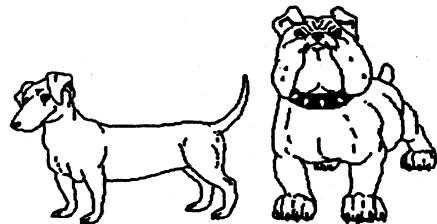
1, 3, 6, 10, 15, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, . . .

- ★★ 6. A student has the following grades on a math test: 65%, 90%, and 85%. What is the highest possible average the student can receive if there will be one more test, and all four tests count equally?

Answer: \_\_\_\_\_

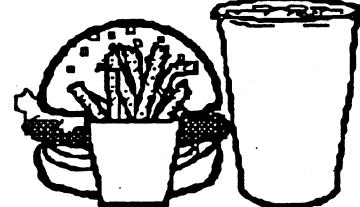
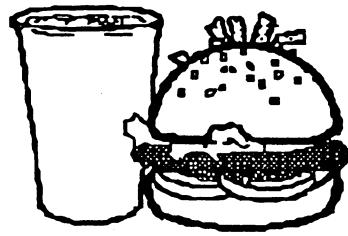
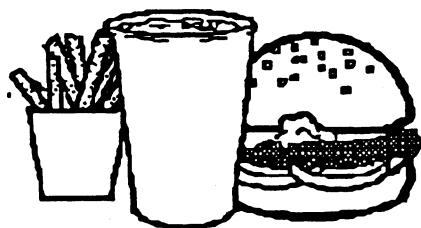
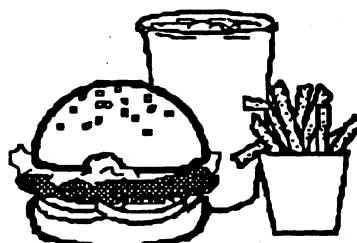
- ★★★ 7. If it takes 2 dogs 2 minutes to eat 4 bones, how long will it take 4 dogs to eat 24 bones?

Answer: \_\_\_\_\_



- ★★ 8. Insert parentheses to make the sentence true:  $28 - 20 - 3 - 4 = 7$

- ★★★ 9. Walter saw this view of his hamburger, fries, and cola when he looked straight at the counter. Tell which view each of the pictures below show, the view from the right, from the left, or the view from the back of the counter. Write "right," "left," or "back" in the correct blank.



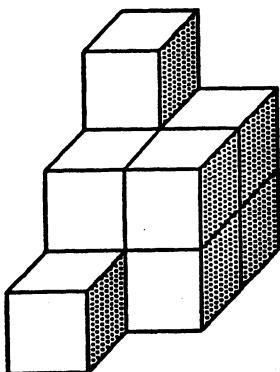
# SUNSHINE MATH - 7

## Neptune, IX

Name: \_\_\_\_\_

(This shows my own thinking.)

- ★ 1. How many cubes were glued together to create this solid figure?



Answer: \_\_\_\_\_

- ★★★ 2. A CD costs \$14.76, including tax. You give the clerk a twenty dollar bill and a penny.

- a) Why would you give the clerk the extra penny?

Answer: \_\_\_\_\_

- b) How much change will you receive?

Answer: \_\_\_\_\_

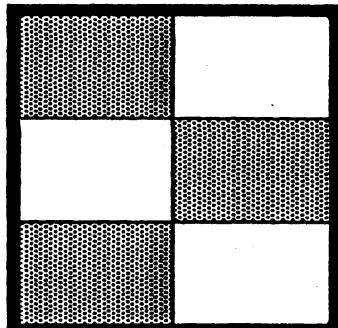
- ★★ 3. Estimate a 15% tip for a \$15.32 restaurant bill. About how much money should you leave as a tip?

Answer: \_\_\_\_\_

- ★★★ 4. Mary calls every three days, Nicole calls every 4 days and Cindy calls every 6 days.

Once in every \_\_\_\_\_ days, all three will call on the same day.

- ★ 5. What percent of the rectangle is shaded?

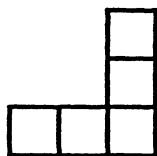


Answer: \_\_\_\_\_

- ★★ 6. Estimate to the nearest half hour the time it will take to travel 870 miles at an average speed of 50 miles per hour.

Answer: \_\_\_\_\_

- ★★★ 7. The figure below consists of 5 squares of the same size. The area of the figure is 180 square units. What is the perimeter?



Answer: \_\_\_\_\_

- ★★★★ 8. You've heard "Two wrongs don't make a right." But in the puzzle below, two wrongs do make a right! Solve the puzzle by finding the values of the letters W, R, N, G, T, and I.

$$\begin{array}{r} \text{W} \ \text{R} \ \text{O} \ \text{N} \ \text{G} \\ + \underline{\text{W} \ \text{R} \ \text{O} \ \text{N} \ \text{G}} \\ \hline \text{R} \ \text{I} \ \text{G} \ \text{H} \ \text{T} \end{array}$$

Letter O = 0 (zero)  
Letter H = 8

$$\text{W} = \underline{\quad} \quad \text{R} = \underline{\quad} \quad \text{N} = \underline{\quad} \quad \text{G} = \underline{\quad} \quad \text{T} = \underline{\quad} \quad \text{I} = \underline{\quad}$$

# SUNSHINE MATH - 7

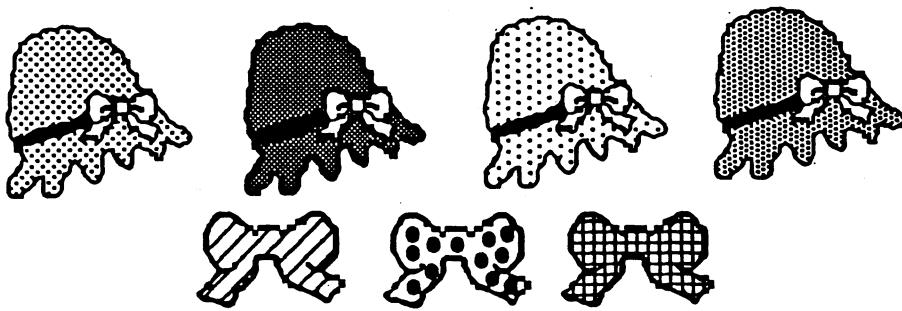
## Neptune, X

Name: \_\_\_\_\_  
*(This shows my own thinking.)*

- ★★ 1. At Super Star Middle School, sixty of eighty teachers are female. What percent of the teachers are male?

Answer: \_\_\_\_\_ %

- ★★★ 2. Aurelia has 4 hats; one green, one yellow, one blue and one purple. She has 3 pretty bows for them; one with stripes, one with polka-dots and one with checks. If she must use one bow per hat, how many different hats can she possibly make, assuming she can put any bow on any hat and change them whenever she chooses?



Answer: \_\_\_\_\_ hats

- ★★ 3. Sam wants to have a Halloween party for 30 of his friends. Jumbo subs cost \$15.99 and can feed 8 people. How much will Sam spend to feed himself and thirty friends, after sales tax of 7% is added?

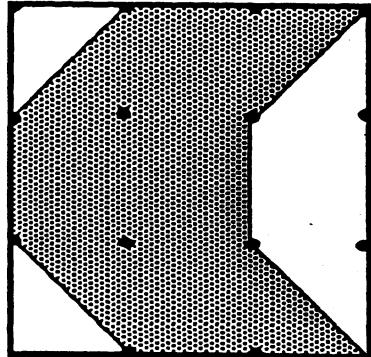
Answer: \$ \_\_\_\_\_

- ★★★ 4. In her first 20 free-throw attempts, Suzie sunk 9 baskets. How many baskets must she sink in her next 30 attempts to have an overall average of 70%?

Answer: \_\_\_\_\_ baskets

- ★★★ 5. The area of the large square made on a wooden geoboard is 81 sq. in. What is the area of the shaded portion?

Answer: \_\_\_\_\_ sq. in.

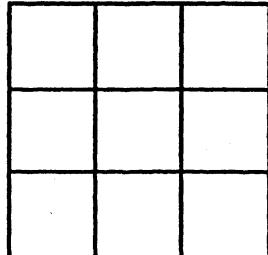


- ★★★ 6. How many terms does the following arithmetic sequence have?

**2.5, 4, 5.5, 7, ..... , 17.5**

Answer: \_\_\_\_\_

- ★★ 7. How many squares are shown in the picture below?



Answer: \_\_\_\_\_ squares

- ★ 8. Miguel's family wants to go to Disney World. Admission is \$38.00 each. His dad has saved \$75.00. How much more does he need to save for Miguel, his dad, his mother and his sister to go to Disney World?

Answer: \$ \_\_\_\_\_

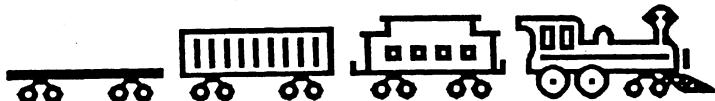


# SUNSHINE MATH - 7

## Neptune, XI

Name: \_\_\_\_\_  
*(This shows my own thinking.)*

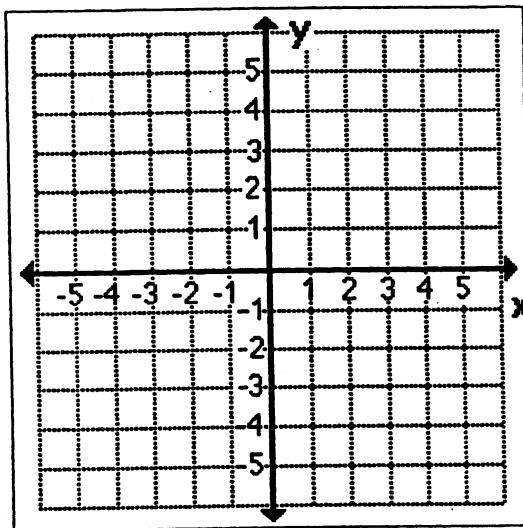
- ★★ 1. If a train has 1 engine and 3 other cars, and the engine must always be in front, how many different ways can the 4 cars in the train be arranged?



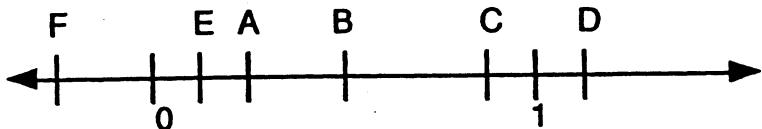
Answer: \_\_\_\_\_

- ★ 2. Plot these points on the grid below and connect them in order. You should get a familiar picture.

- a. (-3,0)      b. (-1,-1)      c. (-2,-4)      d. (0,-2)  
e. (2,-4)      f. (1,-1)      g. (3,0)      h. (1,0)  
i. (0,3)      j. (-1,0)      k. (-3,0)



- ★★★ 3. If point A is multiplied by point B the answer will be point \_\_\_\_\_.  
F      E      A      B      C      D



- ★★★ 4. Mike's birthday was 100 days ago. Today is Wednesday. On what day of the week did his birthday fall?

Answer: \_\_\_\_\_

- ★★★ 5. David signed a contract that says he must build 10 dog houses for the S.P.C.A. The organization wants them ready within one month. For every dog house David completes he will receive \$40 and for every one he fails to complete he will be fined \$10. At the end of the month David received \$150. How many dog houses did he build?

Answer: \_\_\_\_\_

- ★★★ 6. Mary starts a project at the library at 9:00 A.M. She estimates that her work will take her about 4 hours. She plans to take a 15 minute break and a 30 minute lunch. Her walk home is about 20 minutes. About what time would she expect to return home?

Answer: \_\_\_\_\_

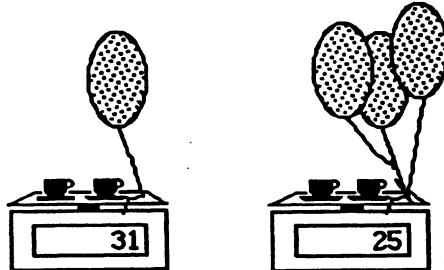
- ★★ 7. In 1977, Florida started keeping records on the number of manatees that died each year. The results through 1980 are shown below. What is the average number of manatees that died per year from 1977 to 1980? Round your answer to the nearest whole number.

<u>YEAR</u>	<u>NUMBER DEAD</u>
1977	112
1978	88
1979	80
1980	65

Answer: \_\_\_\_\_

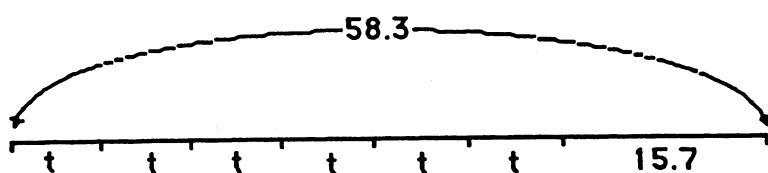
- ★★★ 8. The scale shows weight in grams. How much does each cup of coffee weigh? Remember that a balloon can have negative weight, if filled with helium.

Answer: \_\_\_\_\_ grams



- ★★★ 9. Write an equation for the situation below. Solve the equation by finding the value for  $t$ .

Answer: An equation is: \_\_\_\_\_. The solution is  $t =$  \_\_\_\_\_



# SUNSHINE MATH - 7

## Neptune, XII

Name: \_\_\_\_\_

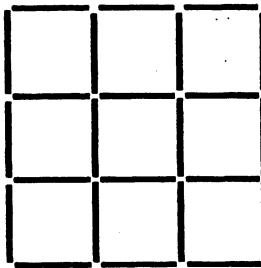
(This shows my own thinking.)

- ★★ 1. Using 4 fours with any operations or grouping symbols, write an expression that has a value of 9.

4    4    4    4

Answer: \_\_\_\_\_

- ★★ 2. This figure is made of 24 toothpicks arranged to form 9 small squares. Show how to remove 4 toothpicks, by putting an X on them, to leave 5 small squares.



- ★★★ 3. Give an example of 4 different test scores whose median equals the mean.

Answer: \_\_\_\_\_

- ★ 4. There are 5 students on the bowling team, 8 students on the track team and 4 students on the tennis team. The only students on more than one team are the two students on both the bowling and tennis teams. How many students are participating in these three sports?

Answer: \_\_\_\_\_ people

- ★★ 5. Before the big flag football game between 7th and 8th grade girls, the ten 7th graders on the team all shake hands with each other. How many handshakes are exchanged?

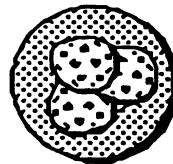
Answer: \_\_\_\_\_

- ★★★ 6. A new lottery game has 8 scratch-off spots. The numbers from 1 through 8 have been randomly placed on the spots. To win, you have to scratch off 3 *even numbers* with only 3 scratches allowed. What are your chances of winning?

Answer: \_\_\_\_\_

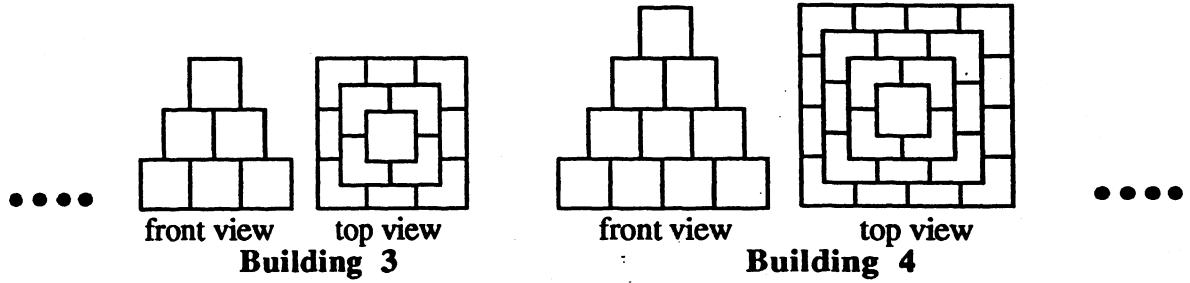


- ★★★★ 7. To make money for the 7th grade end-of-year party, baked goods were to be sold. Herbert was assigned to correctly price the cookies. A small cookie was to sell for 25¢. A giant cookie, whose diameter was 4 times that of the small cookie, was also to be made. Herbert priced the giant cookie based on its area as compared to the area of the small cookie. How much did it sell for?



Answer: \_\_\_\_\_

- ★★★ 8. Shown below are the front view and top view of two buildings made according to a pattern.
- How many blocks would it take to build the 5th building in the pattern? \_\_\_\_\_
  - How many blocks would it take to build the 10th building in the pattern? \_\_\_\_\_
  - If you had 1000 blocks, what the largest building number you could build? \_\_\_\_\_



- ★★ 9. How much larger is the sum of the even numbers from 1 to 100, than the odd numbers from 1 to 100?

Answer: \_\_\_\_\_

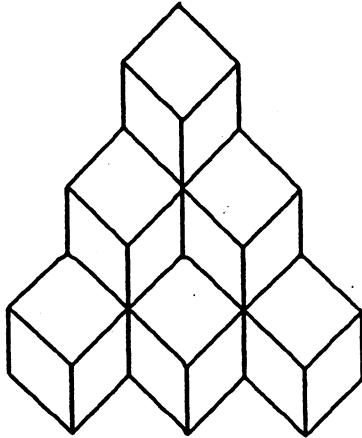
# SUNSHINE MATH - 7

## Neptune, XIII

Name: \_\_\_\_\_

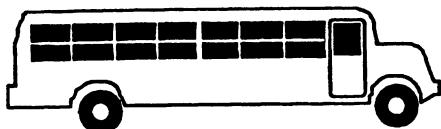
(This shows my own thinking.)

- ★ 1. How many cubes were needed to create the solid figure below?



Answer: \_\_\_\_\_ cubes

- ★★★★ 2. One bus arrives at Mathematics Mall every 16 minutes, while another bus arrives every 20 minutes. If they both arrive at 3:00 P.M. what is the next time they will both arrive at the mall at the same time?



Answer: \_\_\_\_\_

- ★★★★ 3. A basketball team has players with the following heights:

6'1", 6'3", 6', 5'11"

If the average height of this 5-player team is 6'1", how tall is the fifth player?

Answer: \_\_\_\_ ft. \_\_\_\_ in.

- ★ 4. The sum of the ages of Amy and her sister is 19 and the difference is 5. What is the product of their ages?

Answer: \_\_\_\_\_

- ★ 5. A battery in a portable T.V. has an expected life of 1000 hours. If you watch such a T.V. every day from 4 P.M. until 10 P.M., about how many months can you expect your T.V. to play using the original battery?



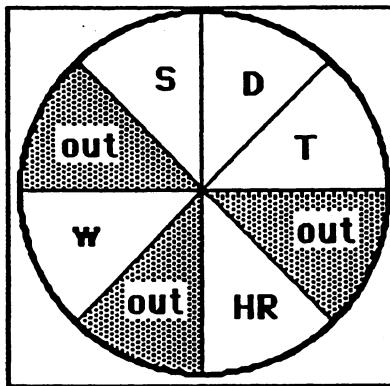
Answer: \_\_\_\_\_ months

- ★★★ 6. The estimated cost of sending a person to Mars is \$45 billion. This amount is to be shared equally by the 250 million people in the United States. What is each person's share?

Answer: \$\_\_\_\_\_ per person

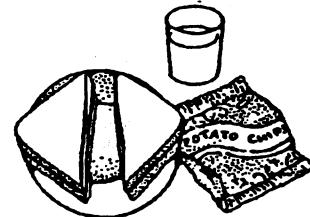
- ★★★ 7. Dante made a dart board "baseball game" for his house. As the batter, he would either get a walk (w), a single (s), a double (d), a triple (t), a homerun (hr), or make an out. If his darts land randomly on the board,

- What percent of the time will he be successful in getting on base? (Hint: A home run is counted as getting on base) \_\_\_\_\_
- What percent of the time will he make an out? \_\_\_\_\_
- What is the chance that he will make 3 outs in a row? \_\_\_\_\_



- ★★ 8. Three out of every five students who eat lunch in the cafeteria have chocolate milk. How many students can you expect to drink chocolate milk if 250 students eat lunch in the cafeteria on Friday?

Answer: \_\_\_\_\_ students



# SUNSHINE MATH - 7

## Neptune, XIV

Name: \_\_\_\_\_

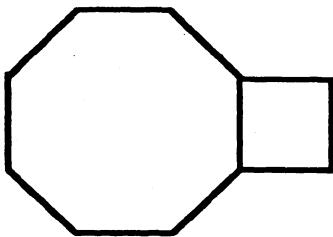
(This shows my own thinking.)

- ★★ 1. On the average, human beings breathe 980 times each hour. Assume you are average.
- About how many breaths per week do you take? \_\_\_\_\_
  - About how long would it take you to breathe a million times? \_\_\_\_\_

- ★ 2. John has 20 dimes and 30 pennies. Ken has the same amount of money in nickels and quarters. If Ken has 8 quarters, how many nickels does he have?

Answer: \_\_\_\_\_ nickels

- ★★ 3. If the perimeter of a regular octagon is 48 cm., what is the area of the adjacent square?



Answer: \_\_\_\_\_ sq. cm.

- ★ 4. Mark and John drive to work together. They split the cost of parking in a parking garage. How much would each pay to park the car for 7 hours?

PARKING RATES	
FIRST HOUR	\$4.00
EACH ADDITIONAL HOUR	\$1.75

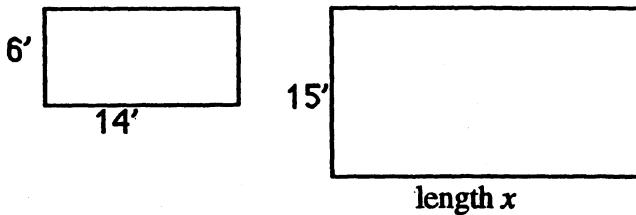
Answer: \$ \_\_\_\_\_

- ★★★★ 5. Mike has a jar filled with 100 jelly beans. Some are green and some are red. When he shook the jar and removed a handful of jelly beans, he got 10 green and 15 red. Using this information, estimate the number of green and red jelly beans in the jar.

Answer: \_\_\_\_\_ green

\_\_\_\_\_ red

- ★★★ 6. Two rectangles below are similar. Find the length  $x$  of rectangle B.

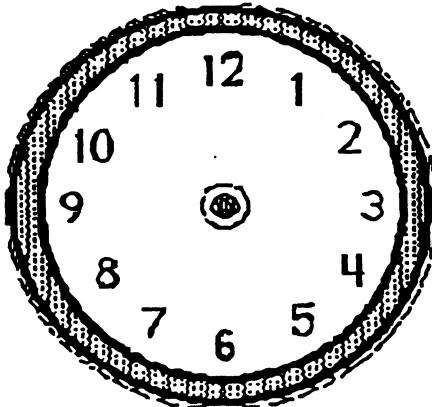


Answer: \_\_\_\_\_ feet

- ★ 7. Sally traveled on an airplane to visit her cousin Sue. She overheard the flight attendant saying that there were 254 people on board, but the plane wasn't full. She noticed that each row seated 6 people. What is the minimum number of rows needed for the 254 passengers?

Answer: \_\_\_\_\_ rows

- ★★★★ 8. From 3 P.M. today until 3 P.M. tomorrow, how many times will the hands on the clock coincide?



Answer: \_\_\_\_\_

# SUNSHINE MATH - 7

## Neptune, XV

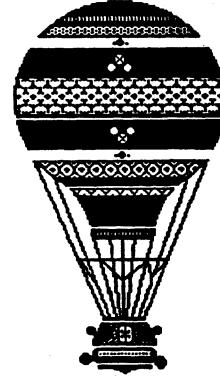
Name: \_\_\_\_\_  
*(This shows my own thinking.)*

- ★ 1. Jeremy started out with 7 pogs. In the first game he lost 2, then he won 4. He continued to play and lost 5, won 3, lost 1, won 2, then lost 1. How many more pogs did he have when he finished, than he started with?

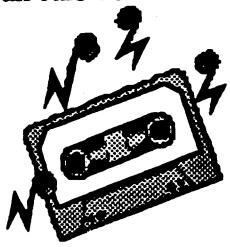
Answer: \_\_\_\_\_ pogs

- ★★ 2. Mrs. Smith had a plaque engraved for the outstanding mathematics student. The engraving cost is 74¢ for the first eight letters and 10¢ for each additional letter.
- How many letters are in a name that has a total engraving cost of \$1.84? \_\_\_\_\_
  - How much would your first and last name cost, on the plaque? \_\_\_\_\_
- ★★ 3. A hot-air balloon race started at 10:30 A.M. The timer started a stop watch and let it run for the entire match. When the race ended, the timer noted that 215 minutes had passed. What time did the race end?

Answer: \_\_\_\_\_

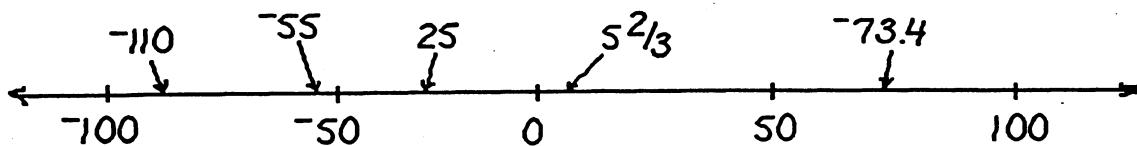


- ★ 4. Four out of five cars in the United States have a tape player and a radio. What percent of American cars do *not* have a tape player or radio?

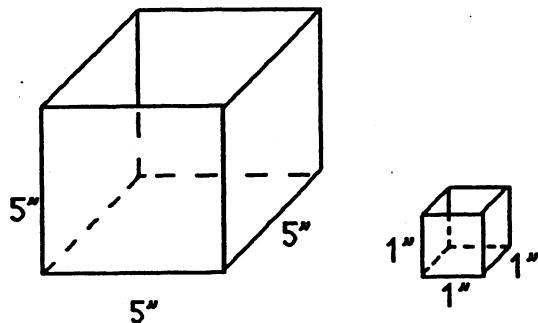


Answer: \_\_\_\_\_ %

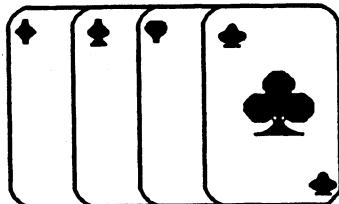
- ★★★ 5. The numbers below the line (-100, -50, 0, 50, and 100) are placed correctly. Three of the numbers above the line are incorrect, but two are about right. Circle the three that are incorrect.



- ★★★★ 6. How many small cubes will fit in the large cube? \_\_\_\_\_ cubes



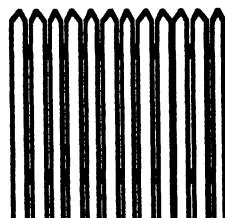
- ★★★★ 7. How many cards must be drawn from a standard deck to be certain that 4 cards of the same suit are drawn? Assume that the cards are not replaced each time.



Answer: \_\_\_\_\_ cards

- ★★ 8. Jim and Rowena spent a total of 28 hours putting up a fence. Rowena worked 4 more hours than Jim. How many hours did each work?

Answer: Rowena: \_\_\_\_\_ hours  
Jim: \_\_\_\_\_ hours



# SUNSHINE MATH - 7

## Neptune, XVI

Name: \_\_\_\_\_  
*(This shows my own thinking.)*

- ★ 1. West Side High School graduated with honors 23 boys and 24 girls. There were 210 students who graduated without honors. What percent of the graduation class were honor students?



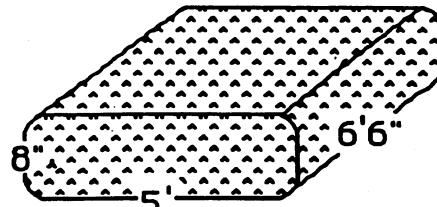
Answer: \_\_\_\_\_ %

- ★ 2. If sixty is divided by one half and added to ten, what is the result?

Answer: \_\_\_\_\_

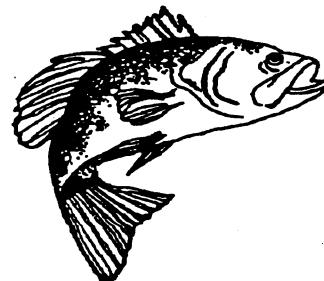
- ★★★ 3. A queen-size water bed mattress measures 5 feet wide by 6 feet 6 inches long by 8 inches thick. Water weighs about 62 pounds per cubic foot. To the nearest 50 pounds, how much does such a mattress weigh, when full of water?

Answer: \_\_\_\_\_ pounds

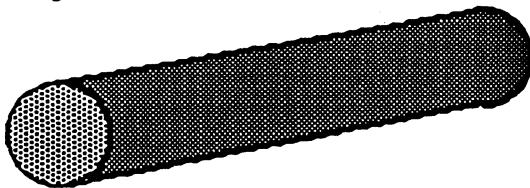


- ★★★ 4. Bob Jones sometimes fishes at the pier. The gulf is 8 feet deep at the pier, but every quarter mile you move away from the pier, the gulf becomes 1 foot deeper. Sometimes Bob takes his boat out to go fishing. When he is 3.25 miles from the pier, how deep is the water?

Answer: \_\_\_\_\_ feet deep



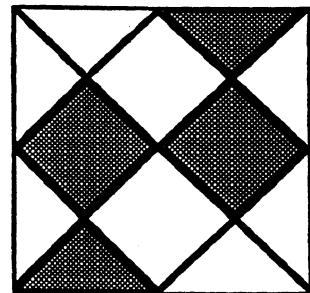
- ★★ 5. If it takes  $5\frac{1}{4}$  minutes to make one cut through a log, how long will it take to cut a five foot log into 5 equal lengths?



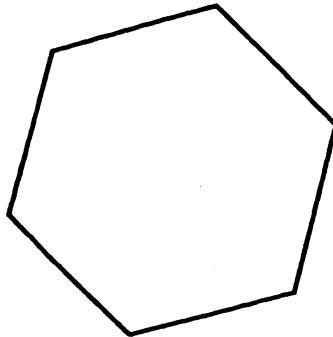
Answer: \_\_\_\_\_ minutes

- ★★ 6. The picture to the right is composed of squares and isosceles triangles. What percentage of the picture is shaded?

Answer: \_\_\_\_\_ %



- ★★★ 7. Change this regular hexagon so that it looks like a cube by drawing only 3 additional line segments.



- ★★★★ 8. A candy bar weighs 4 ounces. If you eat only half of the remaining candy bar with each bite, how many bites have you taken when there is exactly 0.125 ounces left?

Answer: \_\_\_\_\_ bites

# SUNSHINE MATH - 7

## Neptune, XVII

Name: \_\_\_\_\_

(This shows my own thinking.)

- ★★★★ 1. At a drive-in movie there is a fixed charge for the driver and one passenger and an extra charge for each additional passenger. If 6 people are in the car, the total charge is \$8.00. If 3 people are in the car, the total charge is \$4.25. What is the fixed charge for the driver and one passenger?

Answer: \$ \_\_\_\_\_

- ★★★ 2. The owner of a computer company works 7 days a week during the summer when business is booming. He wears a clean shirt to work every day. If he drops off his shirts and picks up the previous week's shirts every Monday after work, how many shirts must he own so that he doesn't run out of clean clothing?

Answer: \_\_\_\_\_

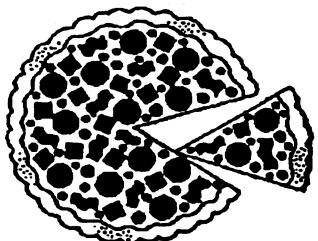


- ★ 3. Juanita and her family leave home for a vacation at 6:00 A.M. During the day, they stop 3 times to eat for an hour each time, and 4 times for gas and a restroom break for 30 minutes each time. They drive a total of 600 miles and arrive at 9:00 P.M. What is their average rate of speed while the car is moving?

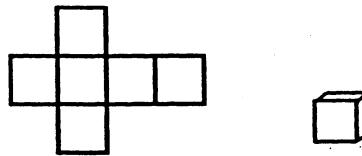
Answer: \_\_\_\_\_ miles per hour

- ★★ 4. A pizza restaurant offers three choices of cheese, two choices for crust, and four choices for toppings. How many different pizzas can be made using exactly one choice of cheese, crust and topping?

Answer: \_\_\_\_\_ different pizzas

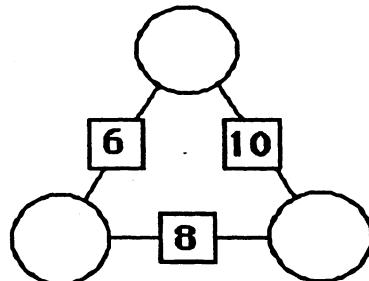


- ★★★ 5. The figure to the left consists of 6 squares the same size. The area of the figure is 294 square units. When folded, it makes a box as shown to the right. What is the volume of the box?



Answer: \_\_\_\_\_ cubic units

- ★★★ 6. Find numbers for the vertices so that the numbers on the sides are the sum of vertices they join. Write each answer in the appropriate circle.



- ★★ 7. A five digit zip code has two identical missing digits  $x$  so that it reads: 69x4x

How many zip codes are possible if the zip code is divisible by 7?

Answer: \_\_\_\_\_ zip codes

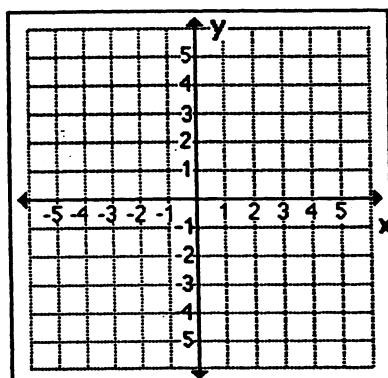
- ★★★ 8. The average of 4 positive whole numbers is 8. If all four numbers are less than 10, what are the five possible sets of numbers?

Answer: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

- ★★★★ 9. Connect these points with a heavy line:

- (a) connect  $(-5, -1)$  to  $(-5, -6)$
- (b) connect  $(-5, -3)$  to  $(-3, -3)$
- (c) connect  $(-3, -6)$  to  $(-3, -1)$
- (d) connect  $(1, -2)$  to  $(1, -6)$
- (e) connect  $(0, -1)$  to  $(-1, -6)$  to  $(-2, -1)$
- (f) connect  $(-1.5, -3)$  to  $(-0.5, -3)$
- (g) draw a big dot at  $(1, -1)$

Draw the reflection of these lines about the  $x$  axis. You should now have a familiar word.



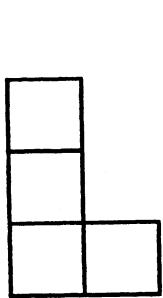
# SUNSHINE MATH - 7

## Neptune, XVIII

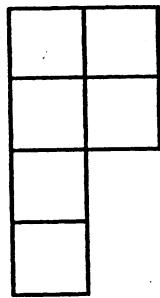
Name: \_\_\_\_\_  
(This shows my own thinking.)

- ★★★★ 1. Three "landscape views" of a building made from cubes are shown below. How many cubes were used to make the building? Make such a building if it helps you.

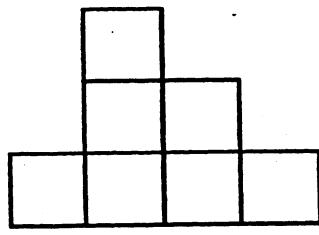
Answer: \_\_\_\_\_ cubes



Front view



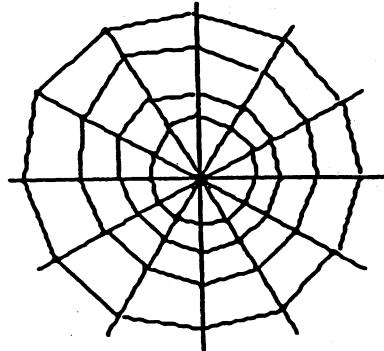
Top-down view



View from the right side

- ★★ 2. A spider made the web shown. How many degrees are in each *central angle* of this web? Note that somehow the spider knows to make all the central angles congruent.

Answer: \_\_\_\_\_ °



- ★★ 3. The length of each side of the military's pentagon building in Washington, DC, is a whole number of feet. Circle the number below which the perimeter could not be, if this is a *regular pentagon*:

a) 1990 feet

c) 2900 feet

b) 1415 feet

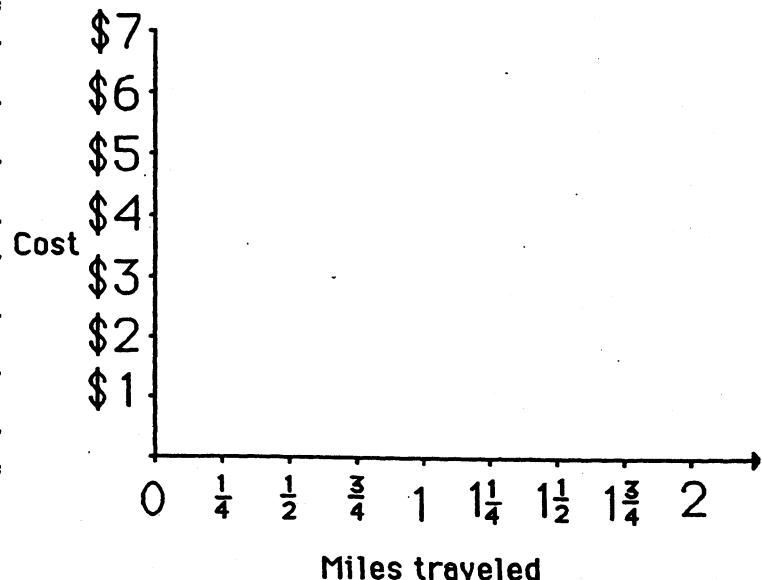
d) 2748 feet

- ★ 4. You bought 12 tickets to a raffle and your sister bought 4. If 100 tickets were sold, what is the probability that you or your sister will win the raffle?

Answer: \_\_\_\_\_

- ★★★ 5. Green Cabs charge \$1.40 for the first quarter mile and \$0.65 for each additional quarter mile. Yellow Cabs charge \$1.00 for the first half mile then a flat rate of \$1.00 for each additional quarter mile. Fill out the chart below to find the cost for each company for a few miles. Graph the rates for both companies. Then answer the questions below the graph.

Cost of:	Green Cab	Yellow Cab
$\frac{1}{4}$ mile		
$\frac{1}{2}$ mile		
$\frac{3}{4}$ mile		
1 mile		
$1\frac{1}{4}$ mile		
$1\frac{1}{2}$ mile		
$1\frac{3}{4}$ mile		
2 miles		



- a. For what trip length are the Green and Yellow Cab fares the same? \_\_\_\_\_
- b. What happens on the graph when the fares are the same for both?
- 

- ★★★ 6. Attendance at Busch Gardens is down. To increase the daily attendance, the daily admission price of \$30 is reduced by 20%. The plan works and attendance increases, but now the park is overcrowded. To reduce the number of people, the admission price is now raised 20%. How does the new price compare to the original price?

Answer: \_\_\_\_\_

- ★★★ 7. An English teacher was asked how many fish she caught. She replied:

*When I tried to place a fish upon each dish, I had a fish without a dish.  
When I tried to place two fish upon each dish, I had a dish without a fish.  
You'll never hear boos and hisses, if you can find how many fishes!*

How many did she catch? \_\_\_\_\_

# SUNSHINE MATH - 7

## Neptune, XIX

Name: \_\_\_\_\_

(This shows my own thinking.)

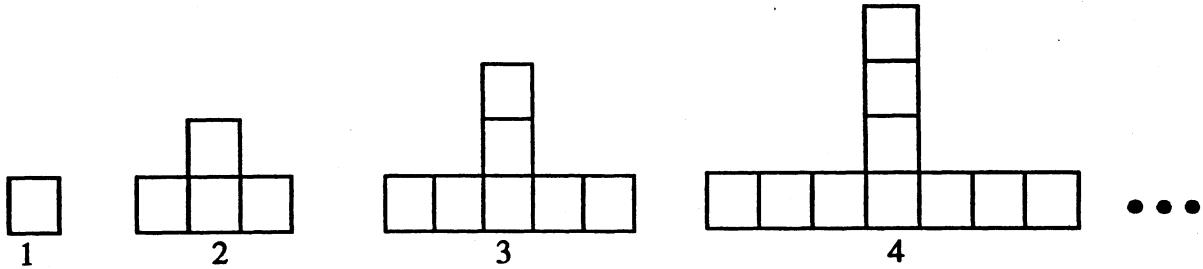
- ★★ 1. Which whole number values make this inequality true? Circle your choice.

$$\frac{X}{2} < 10$$

- a)  $X = 19, 20, \text{ or } 21$       c)  $X = 0, 1, 2, \dots, 19$   
b)  $X = 41, 42, 43$       d)  $X = 21, 22, 23, \dots$

- ★★★ 2. The figures below form a pattern of squares. The *area* of the 1st figure is  $\frac{1}{16}$  inch<sup>2</sup>.

- a. What is the *perimeter* of the 1st figure? \_\_\_\_ inch  
b. What is the *area* of the 3rd figure? \_\_\_\_ inch<sup>2</sup>  
c. What is the *perimeter* of the 3rd figure? \_\_\_\_ inches  
d. What is the *area* of the 10th figure in the pattern? \_\_\_\_ inches<sup>2</sup>



- ★★ 3. The scale on a map is: 1 inch = 16 miles. A National Park is represented on this map by a square whose side is  $1/8$  inch. What is the actual area of the park in square miles.

Answer: \_\_\_\_\_ sq. mi.

- ★★ 4. If  $X + 2 = Y$  and  $Y + 1 = 5$ , then  $X = \underline{\hspace{2cm}}$ .

Answer: \_\_\_\_\_

★★★ 5. If  $280 = N$ , then  $350 = \underline{\hspace{2cm}}$ .

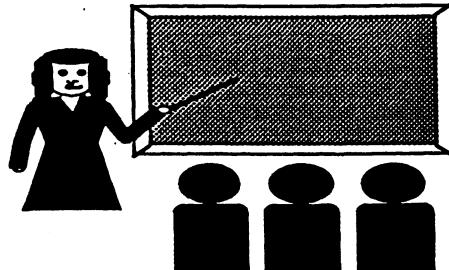
a)  $\frac{N}{4}$   
b)  $\frac{4N}{5}$

c)  $\frac{4N}{3}$   
d)  $\frac{5N}{4}$

Answer:                 

★★ 6. In a class of 30, 12 are boys. If 6 more boys join the class, what percent of the class is then boys?

Answer:        %

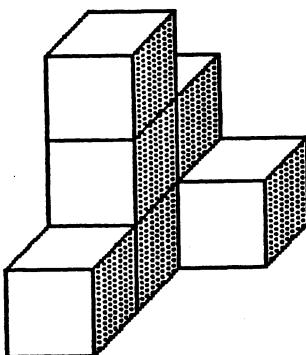


★★★ 7. In the correct addition shown below, A, B, and C are different non-zero digits. What is the value of C?

$$\begin{array}{r} B \quad B \\ + B \quad B \\ \hline A \quad B \quad C \end{array}$$

Answer:                 

★★★ 8. The figure below is made by glueing together 7 cubes. If the figure is dipped in a bucket of red paint and allowed to dry, how many square faces will have paint on them?



Answer:

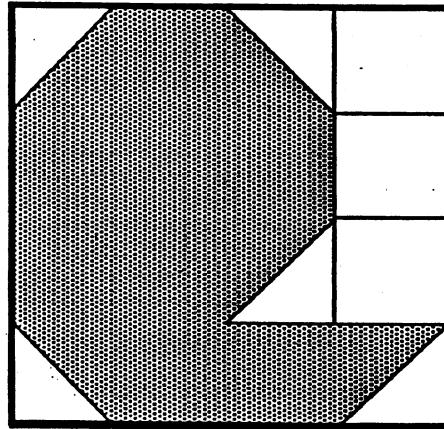
# SUNSHINE MATH - 7

## Neptune, XX

Name: \_\_\_\_\_  
*(This shows my own thinking.)*

- ★★ 1. The city is planning a new park. Each small square is 1 acre. The shaded portion is set aside for softball diamonds, soccer and football fields, and basketball courts. How many acres of the park will be for these sports?

**Answer:**                  acres



- ★ 2. Hector randomly picks an integer between 0 and 9. Which one of the following is the most likely outcome? Circle your choice.

- a) the number is 5
  - b) the number is 9
  - c) the number is odd
  - d) the number is not 1

- ★★★ 3. Write the correct letter from the choices below, to complete the sentence truthfully.

The difference between two prime numbers can never equal \_\_\_\_\_.

- a) 1
  - b) 2
  - c) 7
  - d) 8

- ★★★ 4. Lin's scores on her math tests this period were: 88, 92, 88, 75, 95, 90. Her teacher said she could have her choice of the mean, median, or mode of these scores as her final grade. Which should she pick?

**Answer:**

- ★★ 5. The first term in a sequence (pattern) is 7. Each term in the sequence is 4 more than 2 times the number before. What are the second and third terms in the sequence?

**Answer:** \_\_\_\_\_ ,

- ★★ 6. Under the plates, there are 4 coins in a row; a penny, a nickel, a dime and a quarter. The penny is not next to the dime. The nickel is second (from the left) in the row. The quarter is to the left of the dime. Write which coin is under each plate in order from left to right?



Answer: \_\_\_\_\_

- ★★★ 7. Baseball cards can be ordered in packages of 8, 64, 512 and so on. If the package sizes continue to increase at the same rate, what is the size for the next larger package?

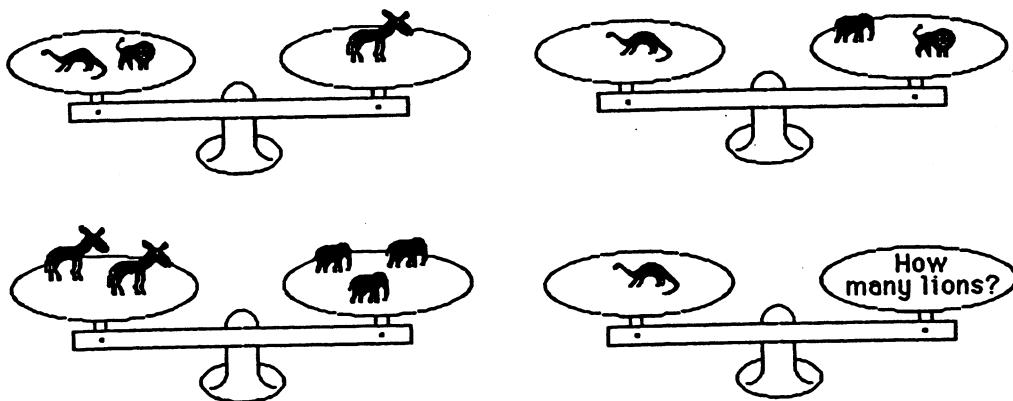
Answer: \_\_\_\_\_

★ 8. Find the missing number:  $\frac{2}{6} + \frac{2}{6} + \frac{2}{6} + \frac{2}{6} = \frac{??}{24}$

Answer: \_\_\_\_\_

- ★★★ 9. A dinosaur and a lion balance a burro. A dinosaur balances an elephant and a lion, and 2 burros balance three elephants. How many lions balance a dinosaur?

Answer: \_\_\_\_\_



# SUNSHINE MATH - 7

## Neptune, XXI

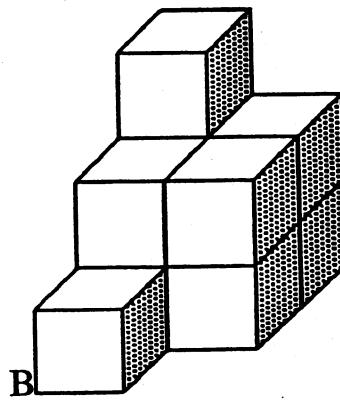
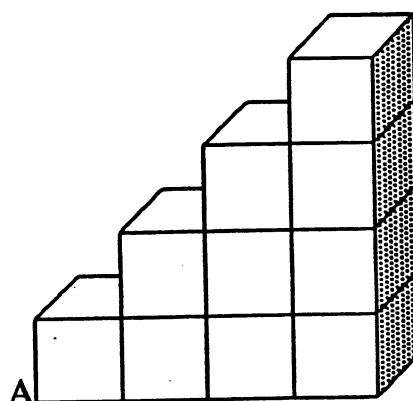
Name: \_\_\_\_\_

*(This shows my own thinking.)*

- ★★ 1. Suzie entered an elevator in a tall building. She rode up three floors, down 5 floors, up 7 floors and then down 9 floors. She found herself on the 23rd floor. On what floor did she enter the elevator?

**Answer:**

- ★★★ 2. The following figures are both made from 10 cubes and so have the same volume. If you had to paint the **outside surfaces** of the cubes, including the bottom surface, which figure would require more paint?



**Answer:** \_\_\_\_\_

- ★ 3. A number  $x$  is divided by 6 and then 3 is subtracted from the result to give 4. What is the original number  $x$ ?

Answer:  $x =$  \_\_\_\_\_

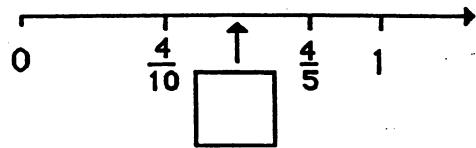
- ★ 4. Fill in the blank from the choices given to make the sentence true:

If the length of each side of a square is a whole number, the perimeter of the square could not be



- ★★ 5. The supplement of an obtuse angle is always a(an) \_\_\_\_\_ angle.

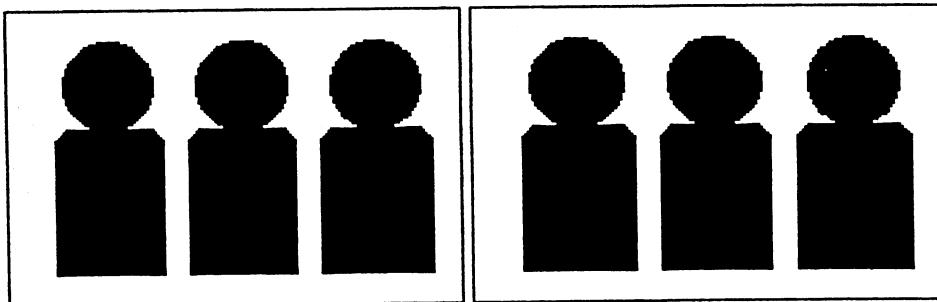
- ★★★ 6. The two points  $\frac{4}{10}$  and  $\frac{4}{5}$  are shown on the number line. Label the mid-point between them as a fraction in lowest terms.



- ★★★ 7. How many 2-inch square tiles are needed to make a square design that is 14 inches on each side, if there are no spaces between tiles?

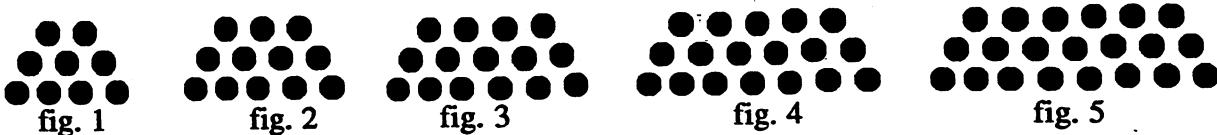
Answer: \_\_\_\_\_

- ★★★ 8. John has 4 more brothers than sisters. How many more brothers than sisters does his sister Mary have?



Answer: \_\_\_\_\_

- ★★★ 9. Consider the pattern of figures below.



- (a) How many dots are needed to make figure 6? \_\_\_\_\_
- (b) How many dots are needed to make figure 7? \_\_\_\_\_
- (c) How many dots are needed to make figure 100? \_\_\_\_\_
- (d) How many dots are needed to make figure  $n$  for any number  $n$ ? \_\_\_\_\_

# SUNSHINE MATH - 7

## Neptune, XXII

Name: \_\_\_\_\_

(This shows my own thinking.)

- ★★ 1. The first four skating judges gave Mario & Maria a 4.2, 4.3, 4.6 and 5.0. What did the fifth judge give Mario & Maria if their average score from five judges was 4.6?

Answer: \_\_\_\_\_



- ★★ 2. Which group is ordered from least to greatest? Use your number sense!

a)  $\frac{7}{3}, \frac{5}{2}, \frac{19}{10}$

c)  $\frac{2}{6}, \frac{2}{8}, \frac{2}{10}$

b)  $\frac{4}{9}, \frac{4}{8}, \frac{4}{7}$

d)  $\frac{3}{5}, \frac{4}{8}, \frac{5}{9}$

Answer: \_\_\_\_\_

- ★★★ 3. Cathy walks 1 mile in 20 minutes. She runs 1 mile in 10 minutes. At a recent 2-hour practice, to warm up and cool down Cathy walked for one-fourth of the 2 hours; she ran for three-fourths of the 2 hours. How many miles did Cathy travel in the practice session?

Answer: \_\_\_\_\_

- ★ 4. If 10% of 10% of a certain number  $x$  is 2, then  $x$  is:

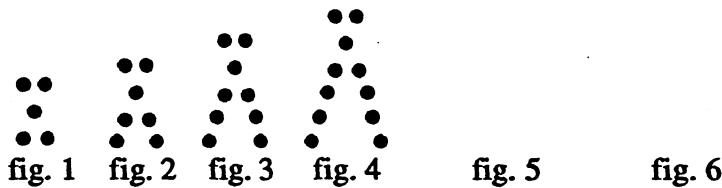
Answer: \_\_\_\_\_

- ★★★ 5. Of 20 students in class, 15 have brown hair, 16 have brown eyes, and 12 have both brown hair and brown eyes. How many students have neither brown hair nor brown eyes?



Answer: \_\_\_\_\_

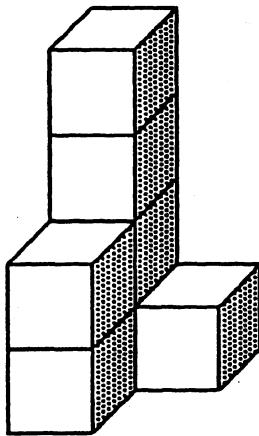
- ★★ 6. Draw the next two figures in the pattern below:



- ★★★ 7. (a) How many dots would it take to make figure 10 in the pattern above? \_\_\_\_\_

(b) How many dots would it take to make figure  $n$  in the pattern above? \_\_\_\_\_

- ★★★★ 8. This figure is made from seven cubes glued together. If the figure was dipped into paint, removed, then separated into cubes, how many square faces would not be painted?



Answer: \_\_\_\_\_

- ★ 9. In an airplane, 6 seats are placed in each row. What is the minimum number of 6-seat rows needed to seat 170 people?

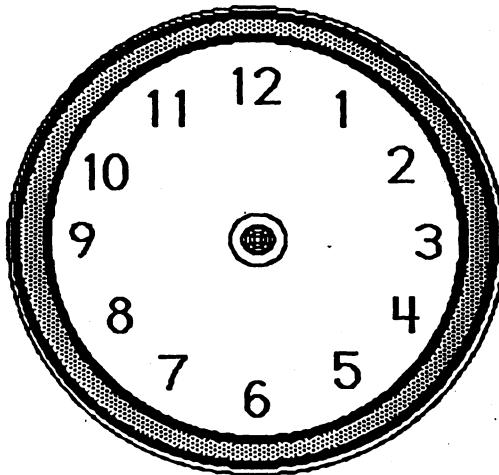
Answer: \_\_\_\_\_

# SUNSHINE MATH - 7

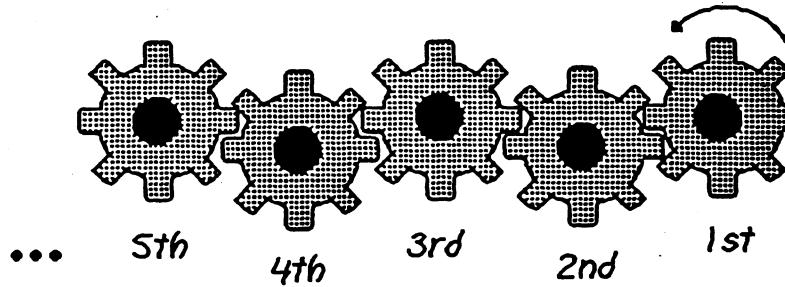
## Neptune, XXIII

Name: \_\_\_\_\_  
*(This shows my own thinking.)*

- ★★ 1. Draw hands on the clock to show 200 minutes before 2:00 P.M.



- ★★★ 2. Think of how the 5 gears below would turn each other—clockwise or counterclockwise—before answering the questions. The 1st gear turns counterclockwise.

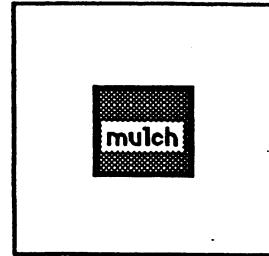


- In what direction would the 2nd gear turn? \_\_\_\_\_
- In what direction would the 3rd gear turn? \_\_\_\_\_
- In what direction would the 4th gear turn? \_\_\_\_\_
- In what direction would the 10th gear turn? \_\_\_\_\_

- ★★ 3. A school offers 2 foreign languages, French and Spanish; 2 computer classes, Logo and BASIC; and 3 physical education classes, volleyball, swimming, and archery. How many different student schedules can be made using exactly one of each of these types of classes?

Answer: \_\_\_\_\_

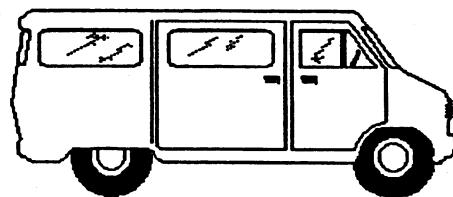
- ★★★★ 4. A man has a 10 meter by 10 meter square garden. In the center is a 4 meter by 4 meter square patch he will use as a mulch pile. He uses the remainder for growing carrots, tomatoes, cucumbers and celery. Show in the drawing how to divide the growing land into 4 congruent rectangles, and tell what length and width each will be.



Answer: The length of each rectangle is \_\_\_\_ m  
and the width is \_\_\_\_ m.

- ★★ 5. What must be the rate in miles per hour of a truck, if it wants to make a 20 mile trip in 40 minutes?

Answer: \_\_\_\_\_

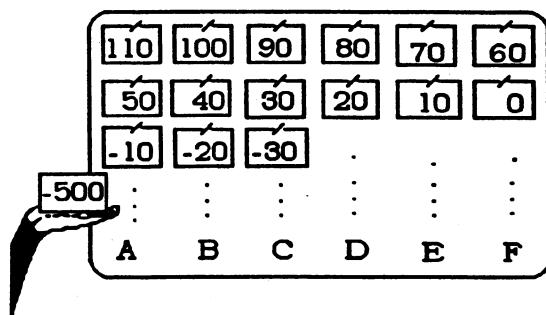


- ★ 6. If  $X = 6 + 4 + 3 + 1 + \frac{1}{2}X$ , then  $X$  must equal:

Answer:  $X =$  \_\_\_\_\_

- ★★★ 7. In which column should -500 go on this chart?

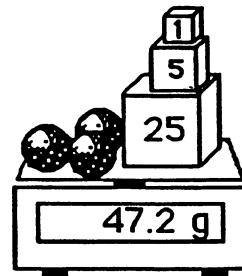
Answer: \_\_\_\_\_



- ★★★★ 8. Write and solve an equation to find the weight of 1 ball  $b$ .

Answer: An equation is: \_\_\_\_\_

The solution is:  $b =$  \_\_\_\_\_



# SUNSHINE MATH - 7

## Neptune, XXIV

Name: \_\_\_\_\_

(This shows my own thinking.)

- ★★★ 1. Bill bought a new Corvette in 1996 for \$42,000. If the car decreases in value 10% each year, in what year will the Corvette be worth less than half of what Bill paid?

Answer: \_\_\_\_\_

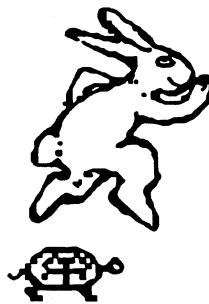


- ★★★ 2. For a science experiment, Denise was asked to take 170 apples that each weighed the same, and put them in paper bags to make the greatest possible number of bags of different weights. What is the greatest number of bags that Denise can use to hold the apples, if each bag must contain at least one apple, but no two bags may contain the same number of apples?

Answer: \_\_\_\_\_ bags

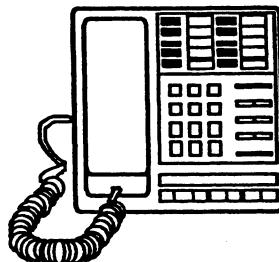
- ★★ 3. The tortoise and the hare had a 3000 meter race. They started at the same time. The hare hops at an average rate of 9 meters per minute while the tortoise averages only 1.5 meters per minute. After one hour, how many meters was the hare ahead of the tortoise?

Answer: \_\_\_\_\_ m

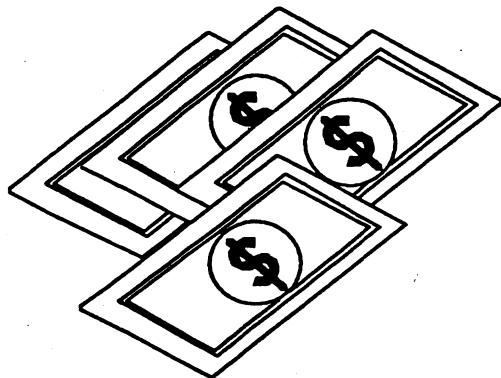


- ★ 4. Al calls me every 3 days, Bob calls me every 4 days and Chris calls me every 6 days. Once in every \_\_\_\_\_ days all three will call on the same day.

Answer: \_\_\_\_\_



- ★★ 5. The Mason family went to an amusement park. They spent exactly \$56.00 for tickets. The tickets cost \$12 for each adult and \$5 for each child. How many adults and how many children went to the park?



Answer: \_\_\_\_\_ adults

Answer: \_\_\_\_\_ children

- ★★ 6. Using 4 fours with any operations or grouping symbols, write an expression that has a value of 3.

4    4    4    4

Answer: \_\_\_\_\_

- ★ 7. Grades can range from 0 to 100 on a test. If you already have tests with scores of 92% and 84%, what is the lowest possible average you can have for three tests? Round to the nearest whole number.

Answer: \_\_\_\_\_ %

- ★★ 8. A standard deck of 52 cards is shuffled and then put in a box. What is the probability that, if a card is drawn randomly from the box, it will have a number on it of which 4 is a factor?

Answer: \_\_\_\_\_

# SUNSHINE MATH - 7

## Neptune, XXV

Name: \_\_\_\_\_

(This shows my own thinking.)

- ★ 1. If you already have scores of 83%, 91% and 86% on your first three math tests, what could your highest possible average be after 4 tests? (Assume no extra credit.)

Answer: \_\_\_\_\_ %

- ★★ 2. Using 4 fours with any operations or grouping symbols, write an expression that has a value of 5.

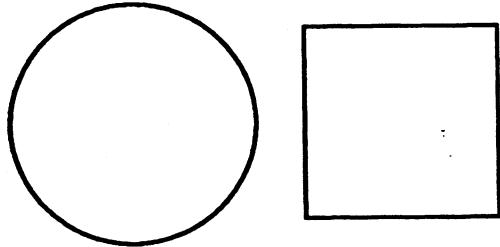
4    4    4    4

Answer: \_\_\_\_\_

- ★ 3. Figure out a rule which was used to determine which letters go above the line and which letters go below the line. Use that rule to place the rest of the letters correctly.

A                  E F    H I    K L M N  
\_\_\_\_\_  
B C D              G       J                      O

- ★★★★ 4. The perimeter of a square is equal to the circumference of a circle.



If the diameter of the circle is 8, what is the area of the square?

Answer: \_\_\_\_\_ sq. units

- ★★★ 5. This is the same pattern looked at 2 different ways. Write the next term in the pattern. Find two ways to describe how to find each new term.

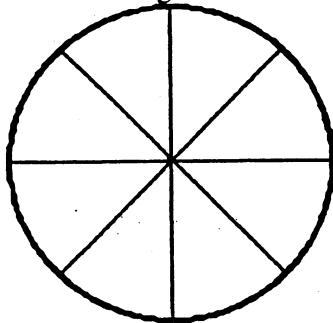
4, 7, 13, 25, 49, \_\_\_, ...

One way to describe the next term is: \_\_\_\_\_

4, 7, 13, 25, 49, \_\_\_, ...

Another way is: \_\_\_\_\_

- ★★★ 6. How many acute central angles are in this figure? Right angles? Obtuse angles?



Answer: \_\_\_\_\_ acute angles

Answer: \_\_\_\_\_ right angles

Answer: \_\_\_\_\_ obtuse angles

- ★★★ 7. Your heart beats approximately 70 times a minute. The life span expectancy of a male is 75 years, and that of a female is 79 years. To the nearest billion, how many times will your heart beat if you live to your life expectancy?

Answer: \_\_\_\_\_ beats

- ★★★ 8. Cookies were missing from the kitchen. They were taken by Sam, Bob, or Sue. Each made a statement to their mother.

Sam said: Bob took the cookies

Bob said: That is true.

Sue said: I did not take the cookies.

If at least one of them lied and at least one told the truth, who took the cookies?

Answer: \_\_\_\_\_

# SUNSHINE MATH - 7

## Neptune, XXVI

Name: \_\_\_\_\_

*This shows my own thinking.)*

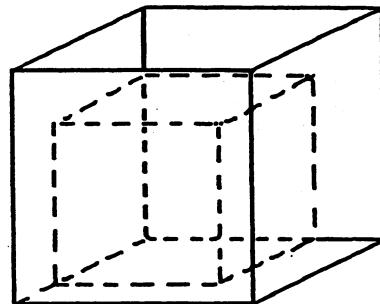
- ★★ 1. Using 4 fours with any operations or grouping symbols, write an expression that has a value of 6.

$$4 \quad 4 \quad 4 \quad 4 = 6$$

Answer: \_\_\_\_\_

- ★★★ 2. If a cube whose edge is 4 inches is placed inside of a cube whose edge is 5 inches, what percent of the space inside the larger cube is filled by the smaller cube?

Answer: \_\_\_\_ %



- ★★ 3. A baseball team won 6 out of 12 games and then won the next 6 games. What percent of their games did they win?

Answer: \_\_\_\_ %

- ★★ 4. On the school track, four laps make a mile. Mark ran 6 laps in 12 minutes. At this rate how long would it take him to run a mile?

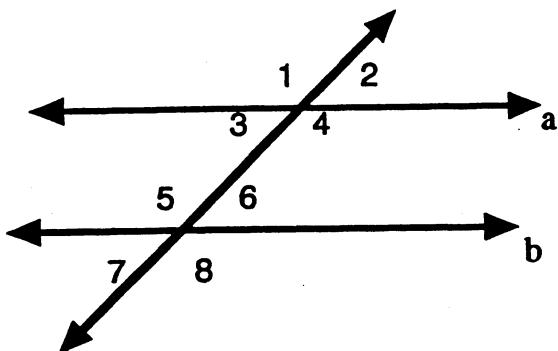
Answer: \_\_\_\_\_ minutes

- ★ 5. If a quart of ice cream is split equally among 4 people, what fraction of a gallon will each person get?

Answer: \_\_\_\_ of a gallon



- ★★★ 6. In the diagram below, lines a and b are parallel. If angle 1 measures  $120^\circ$  find the measures of angles 2, 3, 4, 5, 6, 7, & 8. Record them in the chart below.



Angle	Measure	Angle	Measure

- ★★★★ 7. On a TV game show there are 3 doors. The grand prize is behind one of them. If you appear on the show for 2 days in a row, what is the probability that you will pick the door with the grand prize both days?

Answer: \_\_\_\_\_

- ★★★ 8. Human hair grows at an average rate of 2.5 millimeters per week. Suppose that today is your 13th birthday and you have not cut your hair since you were born. Estimate how long your hair would be in meters today.



Answer: \_\_\_\_\_ meters

- ★★★★ 9. Someone once asked Marilyn vos Savant, who is the smartest person in the world, this question:

*Suppose the earth were smooth, and you could wrap a 25,000-mile-long metal belt snugly around it. Now let's say you lengthen the band by 10 feet, loosening it just a little. What would be the largest thing that could slither under the new band? An amoeba, a worm, a snake, or an alligator?*

What was her answer?

Answer: \_\_\_\_\_

# SUNSHINE MATH - 7

## Neptune, XXVII

Name: \_\_\_\_\_  
*(This shows my own thinking.)*

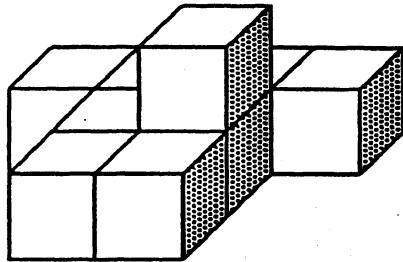
- ★★ 1. Using 4 fours with any operations or grouping symbols, write an expression that has a value of 7.

$$4 \quad 4 \quad 4 \quad 4 = 7$$

Answer: \_\_\_\_\_

- ★★★ 2. To glue these 9 cubes together, how many square surfaces must be joined?

Answer: \_\_\_\_\_



- ★★ 3. It was 3:00 PM when Akita measured the depth of her fish pond to be three and one half feet. It was filling at a rate of 1 inch per minute. When would it be 8 feet deep so she could turn the pump off?

Answer: \_\_\_\_\_ o'clock

- ★★★ 4. In a summer camp, counselors often split the campers into 3, 5 or 6 equal groups but they always ended up with one extra camper. Today they split the campers into 7 equal sized groups and there were no campers left over. What is the smallest number of campers at this camp?

Answer: \_\_\_\_\_ campers

- ★★★ 5. Find the pattern. Use it to write the next 4 terms in the blanks.

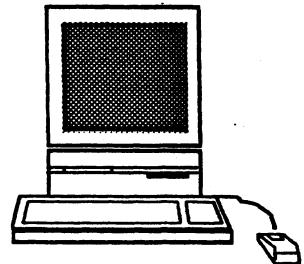
1, 1, 2, 3, 5, 8, 13, 21, \_\_\_, \_\_\_, \_\_\_, \_\_\_, . . .

- ★★★ 6. The sum of 5 different positive integers is 500. What is the largest possible value for one of these integers?

Answer: \_\_\_\_\_

- ★★ 7. Four typists can type a total of 200 letters in 2 days. How many letters can two of these typists type in one day?

Answer: \_\_\_\_\_ letters



- ★★ 8. In how many ways can the Williams family, shown in the picture, arrange themselves in a line? Don't count the dog as a family member!

Answer: \_\_\_\_\_ ways



- ★★ 9. Write an equation and solve it to answer the question in this problem.

Fingernails grow about 1.5 inches per year. How many years  $y$  would it take to grow a world record nail of 37 inches, starting with your present length of about  $1/2$  inch?

Answer: Equation: \_\_\_\_\_

Solution:  $y =$  \_\_\_\_\_

- ★★★ 10. Write an equation and solve it to answer the question in this problem.

Carrie started saving with a \$10 gift from Grandma. She saved half her allowance  $a$  each week. At the end of a year she had \$88. How much per week was her allowance?

Answer: Equation: \_\_\_\_\_

Solution:  $a =$  \_\_\_\_\_

# ANSWERS

## Commentary

*Neptune, I*

1. (89) Add the four scores, then divide by the number of scores.
2. (46¢ each) Begin with the \$2 Stella gave the clerk, subtract 16¢. Since she bought 4 pencils, divide by 4. (They must have been mechanical pencils!!)
3. (School and studying, t.v.) The only two activities that equal half his time are "school" and "studying." The activity that takes twice as much time as studying would have to take 20% of his time. The only activity that takes 20% of his time is "T.V."
4. (between 5:30 and 5:45) Since there are only 176 seventh graders, at some point between 5:30 and 5:45 student number 176 was notified, and the remainder of the students called had already been notified by someone earlier. The work below shows this analysis:

Russell finds out at 4:00 P.M.  
Russell tells 2 others at 4:15 P.M.  
2 each tell 2 more at 4:30 P.M.  
4 each tell 2 more at 4:45 P.M.  
8 each tell 2 more at 5:00 P.M.  
16 each tell 2 more at 5:15 P.M.  
32 each tell 2 more at 5:30 P.M.  
64 each tell 2 more at 5:45 P.M.

one 7th grader knows  
 $1+2 = 3$  (7th graders that know)  
 $3+4 = 7$  (7th graders that know)  
 $7+8 = 15$  (7th graders that know)  
 $15+16 = 31$  (7th graders that know)  
 $31+32 = 63$  (7th graders that know)  
 $63+64 = 127$  (7th graders that know)  
 $127+128 = 255$

5. (5, 12) Trial and error would be one way to solve this problem. Try multiplying numbers together that differ by 7.  $0 \times 7 = 0$ ;  $1 \times 8 = 8$ ;  $2 \times 9 = 18$ ;  $3 \times 10 = 30$ ;  $4 \times 11 = 44$ ;  $5 \times 12 = 60$  Another method would be to assign the first unknown a value of X and the second variable the value of  $X + 7$ . You could then solve the equation  $X(X + 7) = 60$ , to find  $X = 5$ ,  $X + 7 = 12$ .
6. (15) Students will find it helpful to make a list and keep track of combinations. These include one digit only, two-digit combinations and three-digit combinations.

1	1-2	3-1	1-2-3	3-1-2
2	2-1	2-3	2-3-1	2-1-3
3	1-3	3-2	3-2-1	1-3-2

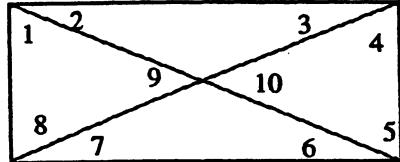
(For a total of 15 combinations.)

7. (56) One way would be to start at one corner of the rectangle and place a dot (fence post) every five feet. If the dots are counted, they will find that 56 fence posts are needed.
8. (36' by 44') The number of  $1/2"$  segments in 18" is 36 so the yard is 36' wide; the number of  $1/2"$  segments in 22" is 44 so the yard is 44' long.
9. (-13 oz) The television by itself is 40 oz; with the balloon it's 27 oz. Therefore the balloon must counterbalance 13 oz. Since weight is considered positive, something that counterbalances it would be assigned a negative value. So the helium balloon would be assigned a weight of -13.

## Commentary

### Neptune, II

1. (8) An organized list would be helpful, such as:  $50, 25 + 25, 25 + 10 + 10 + 5, 25 + 10 + 5 + 5 + 5, 25 + 5 + 5 + 5 + 5, 10 + 10 + 10 + 10 + 10, 10 + 10 + 10 + 10 + 5 + 5, 10 + 10 + 10 + 5 + 5 + 5$ . The total number of ways is 8.
2. (16) *Guess-check-revise* would be a good approach to this problem. Start by guessing a number for  $x$ , and check against the conditions. Sixteen works:  $(16 - 4) + (16 + 8) = 36$
3. (20 cups)  $2 \text{ quarts} + 1\frac{1}{2} \text{ quarts} + \frac{1}{2} \text{ quarts} = 5 \text{ quarts}$ . Since 4 cups=1 quart,  $4 \times 5 = 20 \text{ cups}$ .
4. (20, 21) One pattern begins with 5, then adds 1, then 2, then 1, then 2 alternating. The next number in the pattern would add 2, resulting in 20, then add 1, resulting in 21. Another solution is to notice that these are simply the counting numbers, starting with 5, leaving out every 3rd number.
5. (2, 3) The notion is to extend the pattern above in the other direction, by reversing the action.
6. (10) Draw a rectangle with the two diagonals. Count the acute (less than 90 degrees) angles.



7. (14, 12, 13, 11). One good approach is to make a table, and proceed by eliminating possibilities. From the first clue, we know David isn't 11 and isn't 14, so we place X marks in the chart. That same clue tells us Kelly isn't 14 and Lisa isn't 11. After the first clue, the chart looks like:

	11	12	13	14
Lisa	X			
Drew				
David	X		X	
Kelly			X	

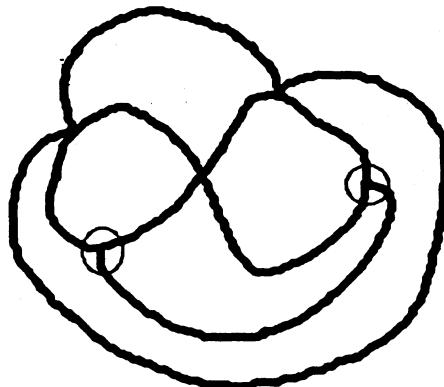
Another approach is just to line up names one on top of the other, and manipulate them according to the rules until you happen upon the solution.

8. (91 days) Make a table for the different combinations. For example: pepperoni can be combined with each of the other 13 items, sausage can be combined with the other 12 items, meatball can be combined with the other 11 items and so on. Total the different combinations,  $13 + 12 + 11 + 10 + 9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 = 91$
9. (about 4.6 or 4 1/2 years) Divide the \$2,000,000 by \$50 to figure how many times you will give away \$50. You need to give away money for 40,000 hours. Divide the 40,000 hours by 24 (the hours in a day) and then by 365 (the days in a year) to get an answer of about 4.6 years.

## Commentary

*Neptune, III*

1. (13) Organize the information. There are 9 small triangles, 3 medium triangles made from four small ones, and one large triangle.
2. (  $40 - 6 \times (6 - 2) - 6 = 10$  ) Students will have to recall the order of operations (multiply and divide first then add and subtract). The solution is then easily found.
3. (21,000,000) The total number of calls that can be handled is  $25 \times 700,000$  or 17,500,000. Only 5% will be inaccurate. Compute 5% of 17,500,000 which equals 875,000 per hour. This number is multiplied by 24 for the number of calls per day, mishandled.
4. (\$3) One way to quickly figure the tip of 20% is to find 10% of \$15, which is \$1.50, and then realize that 20% would be twice as much, or \$3. Another way is that most people know intuitively that  $2 \times 15$  is 30, so  $.2 \times 15$  is 3.0, meaning \$3. Yet another way is that most people realize that 20% of \$10 would be \$2, so \$2 plus half of \$2, or  $\$2 + \$1$ , is the tip for \$15.
5. (\$9) Estimate spaghetti at about \$1 a pound so 2 pounds would cost \$2; sauce at about \$2.50 a jar or 2 jars for \$5; bread is about 70¢ a loaf so three loaves would be about \$2. The total to the nearest dollar is \$9.
6. (340, 71) The two sides that are 10 by 8 have an area of 80 each for a total of 160. Likewise, the two 8 by 5 and the two 10 by 5 sides have total areas of 80 and 100, respectively. The sum of the six sides gives the amount of contact paper needed. The ribbon needed would be two 10 inch pieces, two 8 inch pieces, four 5 inch pieces, and 15 inches for the bow. This totals 71 inches.
7. (94°) The difference between 88° F and -6° F is 94°. So it is warmer by 94 degrees in Miami.
8. (37¢) If notebooks cost \$1.77 for two, then 6 cost \$5.31. Multiply \$5.31 by 1.06 to find the cost after sales tax has been added, which is \$5.63. Subtract \$5.63 from \$6.00 to find the change.
9. The two places where one can start and trace this path, without lifting their pencil, are circled below. This is because these are the only two places with an *odd number* of paths coming into or leaving out of them. So you can start at either place, and you'll finish at the other place.

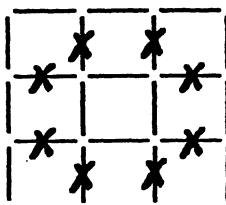


## Commentary

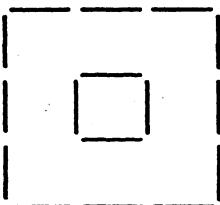
*Neptune, IV*

1. (1 hour, 5 minutes) The difference in 4:10 PM and 6:00 PM is 1 hour and 50 minutes. He spends 45 minutes driving, leaving 1 hour and 5 minutes at the library.

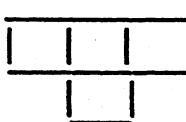
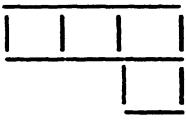
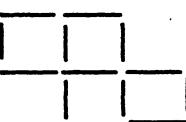
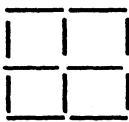
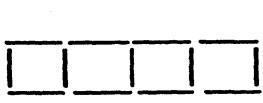
2. (Answer below.)



OR



3. (5) The 5 possible configurations are below:



4. (11) For a first time customer the first 6 games are free. Then you can play 4 more times, costing \$3.00, but get a free game. So the total for only \$3.00 is 11 games.
5. (11 or 12) 3 apples for \$1.29 means that each apple costs about  $\$1.29 \div 3$ , or 43¢ each. Then  $\$5.00 + 43\text{¢}$  is 11.6, so about 11 or 12 apples, on average, can be purchased for \$5.
6. (35) Work backwards:  $372 \div 6 = 62$ , and  $62 - 27 = 35$ . So  $x = 35$ .
7. (9.0, 8.3, 9.3, 8.43; bars; vault; 35.03) To find the mean for each event, add the respective numbers:  
floor: 8.8; 9.3; and 8.9  
bars: 8.2; 8.2; and 8.5  
vault: 9.4; 9.5; and 9.0  
beam: 8.4; 8.4; and 8.5

and divide by 3. Her lowest score (average) is 8.3 for bars, the highest is 9.3 for vault, so those are her worst and best events. Her total is the sum of all four individual event scores.

8. (19 pieces, 2 cm left) 4.2 meters is 420 centimeters.  $420 \div 22 = 19$ , r 20.
9. (101; 500; 3001;  $3n + 1$ ) The number of blocks in the towers is always one more than the building number. The number in each wing is the same as the building number. The total blocks for a building, then, is the number of the building plus 1, plus the number of the building taken 2 times, for a total of 3 times the building number, plus 1.

## Commentary

*Neptune, V*

1. (0.6) 30% of 100 is 30, and 20% of 30 is 6. Then 10% of 6 is 1/10 of 6, or 0.6. Or, change the percents to decimals and solve the mathematical sentence:  
$$0.1 \times 0.2 \times 0.3 \times 100 = 0.6$$
2. (216) If the hundreds digit is 1/3 the ones digit, then the ones digit can only be multiples of 3 -- 3, 6, or 9. This means the hundreds digit can only be 1, 2, or 3. The hundreds digit is also two times the tens digit. The only hundreds digit of that group that is twice another whole number is two. If the hundreds digit is two, the tens digit must be one and the ones digit must be six.
3. (36) There are 12 cubes in each level and three levels for a total of 36 cubes. Students may know that volume = length times width times height.  $3 \times 4 \times 3 = 36$  cubic units
4. (2) The only cubes without paint would be the two single cubes in the center. To see this, each of the 12 cubes in the top and bottom layer have paint on them. In the middle layer, the 3 on each end, and the 2 on each side, in the center of the side, would have paint. This leaves only 2 out of the layer of 12 with no paint.
5. (8) Drawing a diagram will help students solve this problem. A vertical line best represents the well. Many students will realize that the snail is making progress at  $2\frac{1}{2}$  feet per 24-hour period, and can simply start at  $2\frac{1}{2}$  and count by  $2\frac{1}{2}$  until they get to 20.
6. (375) The problem has students find the difference between 345 and -30 on a number line.
7. ( $\frac{10}{48}$  or  $\frac{5}{25}$  or 21%) One approach is to *guess-check-revise*, knowing that once you chose a number for the red marbles, the other marbles can be obtained and you can check to see if they total 48. If not, revise the guess for the red marbles, and check again.

The solution can be obtained algebraically by letting  $X$  be the number of red,  $2X$  the number of yellow,  $X + 6$  the number of white, and  $2X + 12$  the number of blue marbles. The sum of the 4 colors is 48 so  $X + 2X + X + 6 + 2X + 12 = 48$ . Simplifying and solving for  $X$  gives  $X = 5$ . So there are 5 red, 10 yellow, 11 white, 22 blue for a total of 48 marbles. The probability of yellow is then  $10/48$ .

8. (+) 7 0 4 3 + 8 4 = 7 1 2 7

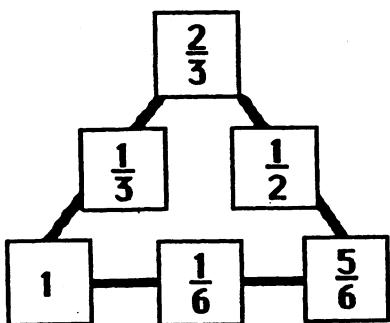
9. (3) This problem will later be solved as a system of equations. At this point, students will reason in a variety of ways to find the answer. One such way is this:

Use the second scale. Double what's on each side, and 2 jars of paste balance 2 scissors and 2 pencils. Substitute 2 scissors and 2 pencils for 2 jars on the left side of the first scale; 2 scissors and 2 pencils and another scissors then balance 8 pencils. Remove 2 pencils from both sides, then 3 scissors balance 6 pencils, or 1 scissors balances 2 pencils. Substituting 2 pencils for the scissors on the right side of the second scale means a jar of paste balances 3 pencils.

## Commentary

*Neptune, VI*

1.



2. (6) The question is what two numbers add to 15, and one is three more than the other. Nine and six fit that description, so the team won 9 and lost 6 games.
3. (8,999,999,991) The way most students will find the product is to know that they must count down 5 more problems like these 3, and fill-in the patterns going down. The first digits are just the counting numbers 1, 2, 3, ..., so 5 more after that would be 8. The middle part of the answer would be 8 nines, consistent with the pattern. The last digit follows the pattern of counting down from 8, resulting in 1. The product is then predicted to be 8,999,999,991. Notice that it hasn't been *proved* that this is the product -- you've simply made a prediction.
4. (3) If 3 math students do 3 math problems in 3 minutes then 1 math student does 1 math problem in 3 minutes. If 33 students are doing 33 problems then each student is doing 1 problem. We know it takes a student 3 minutes to do 1 problem. Therefore, 33 students can do 33 problems in 3 minutes.
5. (5) Find the least common multiple of 10 and 8 which is 40. If each pizza has 8 slices and 40 slices are needed then  $40 \div 8 = 5$  pizzas, allowing each person exactly 4 slices. Or a student might simply ask what is the fewest number of pizzas in which the total number of slices is divisible by ten. One pizza has 8 slices, 2 have 16, 3 have 24, 4 have 32, and 5 pizzas have 40 slices. Since 40 is the first number divisible by 10, five pizzas is the answer.
6. (x)  $9\ 3\ 4 \times 4\ 6\ 3 = 4\ 3\ 2, 4\ 4\ 2$
7. (3, 4, 5) Use mental math to find the sum and product of three consecutive numbers. Keep track of your results until you find that  $3 + 4 + 5 = 12$  and  $3 \times 4 \times 5 = 60$ . The sum is  $1/5$  of the product.
8. (31) Work backwards. She ended with  $1/4$  of a dozen, or 3 donuts. If she gave her sister  $1/2$  of her donuts and half a donut, she had 7. ( $1/2$  of 7 less  $1/2$  = 3) If she gave her brother  $1/2$  of her donuts plus  $1/2$  of a donut she must have had 15. ( $1/2$  of 15 less  $1/2$  = 7) If she gave her mother  $1/2$  of her donuts plus  $1/2$  of a donut she must have had 31 to start. ( $1/2$  of 31 less  $1/2$  = 15)
9. (a. Sasha, Roberto, Lu; b. Sasha, Lu; c. somewhere from 1:30 to 1:45; d. Roberto) The problem involves reading a graph over time, that tells a story. The order of finishing is the one who reached 1600 meters first, timewise. All three stopped at the graph height corresponding to 1600 m; but Sasha's line is to the left of the others, indicating she took less time. Sasha started the slowest because her graph at the beginning doesn't rise as fast as the other two -- she doesn't cover as many meters for any given time as the others, to start. Sasha did pass Lu, however, at about 1 and  $1/2$  to 1 and  $3/4$  minutes. Roberto ran the same pace all the way through, because his line goes in a constant direction -- he covers about 400 m each minute.

## Commentary

### *Neptune, VII*

1. **(325)  
999)** Let  $n$  be the number  $0.\overline{325}$ , and then  $1000n$  "moves the decimal" three places to the right, so  $1000n$  is  $325.\overline{325}$  ... Notice when you then subtract  $n$  from  $1000n$ , you get  $999n = 325$ . Therefore  $n$  is  $325/999$ .
2. **(15, 17, 19, 21, 23)** This problem can be approached through *guess-check-revise*; another method is to notice that since  $95 + 5 = 19$ , the 5 consecutive odd numbers will be centered on 19.

The problem can also be approached algebraically. The first odd number is  $x$ ; the next consecutive odd numbers are  $x + 2$ ,  $x + 4$ ,  $x + 6$ , and  $x + 8$ . They total 95, so  $x + (x + 2) + (x + 4) + (x + 6) + (x + 8) = 95$ . Simplifying and solving the equation gives  $5x + 20 = 95$ , or  $5x = 75$ , so  $x = 15$ . The other numbers are the next four odd numbers in sequence.

3. **(\$3)** Work backwards:  $50\text{¢}$  plus the  $25\text{¢}$  lost gives  $75\text{¢}$ . She had spent half of what she had and was left with  $75\text{¢}$ , so prior to this step she had  $\$1.50$ . If she gave half of what she had to her brother and was left with  $\$1.50$ , then prior to this step she must have had  $\$3.00$ .
4. One solution is shown below. Other solutions are possible.

$$\begin{array}{ccc} 4 & 9 & 2 \\ 8 & 1 & 6 \\ 3 & 5 & 7 \end{array}$$

5. **(1973)** Since all of the years from 1970 to 1980 have the thousands and hundreds digits the same, and their sum is 10, the other two digits must sum to ten. Therefore since a 7 has to be in the tens place to be in the 1970s decade, the units digit is a 3.
6. **(7)**  $75\%$  of 30 is  $0.75 \times 30$  or 22.5. If he misses 8, his score would be 22 which is less than  $75\%$  of 30. So he must miss no more than 7.
7. **(144 cm<sup>2</sup>)** The hexagon has 6 sides;  $72 + 6 = 12$  cm per side of the hexagon and therefore the square. The area of the square is side  $\times$  side or 12 cm  $\times$  12 cm which equals 144 cm<sup>2</sup>.
8. **(See below.)** The digits in the addend on the left can be reversed top and bottom, but the answer is unique. Both the answer and the individual numbers are unique in the subtraction problem.
 

$\begin{array}{r} 97531 \\ 86420 \\ \hline 183951 \end{array}$	$\begin{array}{r} 50123 \\ -49876 \\ \hline 247 \end{array}$
--	--
9. **(a.  $y + 13.7 = 78.69$  and  $y = 64.99$ ; b.  $4x + 3.9 = 47.9$  and  $x = 11$ ; c.  $n - 25 = 50$  and  $n = 75$ )** The equations result from using a variable  $y$ ,  $x$ , or  $n$  to stand for the unknown weight on the scale. In A, a book of unknown weight  $y$ , plus 13.7, weighs 78.69. When the weight 13.7 is removed, the scale would show  $78.69 - 13.7$ , or 64.99. In B, four books and a weight of 3.9 weigh 47.9. When the 3.9 is removed, the four books alone would weigh  $47.9 - 3.9$ , or 44. If four books weigh 44, then each one must weigh  $44 \div 4$  or 11. In C, a helium balloon pulls up on the scale and so has negative weight. Therefore when the helium balloon is removed from the scale, the scale would show  $50 + 25$  or 75. So the book weighs 75.  
 [Note: Some students may write  $x + x + x + x + 3.9 = 47.9$  for B, which is acceptable.]

## Commentary

*Neptune, VIII*

1. **(20 chickens, 16 cows)** Most students will solve this by guess-check-revise. The number of chickens plus the number of cows has to be 36 since there are 36 heads. So students can guess numbers of chickens and cows that total 36, compute the number of legs, and adjust their guess accordingly until they reach the correct number.  
Another clever approach that some students will use is to reason that since there are at least 2 legs on each of the 36 heads, 72 legs are accounted for already. The extras,  $104 - 72$  or 32, must be to make 4-legged animals. That would be 16 pairs of extra legs, so there must be 16 cows. Then the rest,  $36 - 16 = 20$ , are chickens and have only the two legs given initially.
2. **(A, D)** A closed cube must have 6 faces. E has only 5 faces and cannot be a closed cube. B and C will not fold to make a cube, but A and D will.
3. **(150°)** At 5 o'clock, one hand is on the 12 and the other is on the 5. The portion of the clock covered by this angle is  $5/12$  of the clock face, which is a circle of  $360^\circ$ .  $(5/12) \times 360^\circ = 150^\circ$ .
4. **(a. 12/38 or 6/19 or 32%; b. 11/37 or 30%)** On your first pull, you have 12 chances out of 38 of pulling a white sock. If a white sock is pulled first, then there are only 11 white socks left out of a total of 37 left. The chance is then  $11/37$ .
5. **(21; 28; 36)** The most obvious pattern begins with one and first adds two, then adds three, then adds four, then adds five. This pattern is continued by adding six, then seven, then eight. The next three numbers would be  $15 + 6$  or 21,  $21 + 7$  or 28,  $28 + 8$  or 36. Another way to find the answers is to notice that the  $n$ th term is given by  $n(n + 1) + 2$ . If students can justify other answers because they noticed other patterns, give them credit.
6. **(85%)** The average is the total of all the scores divided by the number of tests. The highest possible average would be achieved by scoring a 100% on test number four. The sum would then be  $65 + 90 + 85 + 100 = 340$ . The highest possible average would be  $340/4 = 85\%$ .
7. **(6)** The dogs are eating simultaneously, so it takes each dog 2 minutes to eat 2 bones; that is one bone per minute per dog. So four dogs can eat six bones each, a total of 24 bones, in six minutes.
8. **( 28 - (20 - 3) - 4 = 7 )**
9. **(back, left, right)** Students who can solve this easily have a good sense of space and their visualization skills are high. The visual clues they will use are the figures which are in front of or behind others, or to the left and right of others.  
In the left most picture, the cola is now in front of the other two, whereas it was behind them in the given picture. So this picture is the reverse of the given picture, meaning the view is from the back of the counter. In the center picture, the fries are hidden by the burger -- this would happen only if the view was from the left. In the last picture, the fries are visible in front of the burger -- this implies a view from the right of the original picture. Students might want to experiment with a similar situation, using 3 real objects.

## Commentary

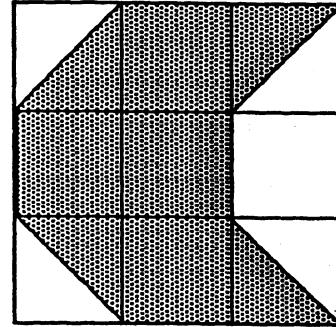
*Neptune, IX*

1. (10) This problem requires visualizing the blocks that are hidden. In the back left, the blocks are stacked 3 high; back right, front left and front right are stacked two high; there is a single block in front.
2. a) You would give the clerk a penny to get fewer coins back in change.  
b) (\$5.25) Your change would be a five-dollar bill and a quarter.
3. (\$2.00 to \$2.50) One way to estimate 15% is to estimate 10% of a number, then add half of that for the other 5%. 10% of \$15.32 would be about \$1.50, and adding half of that would be another 75¢. The total would be about \$2.25. Accept an estimate between \$2.00 and \$2.50.
4. (12) One way to approach the problem is to choose a day to begin counting, and cycle through every 3 days, every 4 days, and every 6 days from that point. Eventually all three counts include a common day, which is 12 days from when you start. You could also solve the problem by finding the least common multiple of 3, 4, and 6, which is 12.
5. (50%) The rectangle is divided into six equal sections, three of which are shaded. This could be expressed as  $\frac{3}{6}$ ,  $\frac{1}{2}$ , 0.5, or 50%.
6. ( $17\frac{1}{2}$  hrs.) A speed of 50 miles per hour means 100 miles every two hours, or 800 miles in 16 hours. Add another hour for the next 50 miles, and you're up to 17 hours for 850 miles. There's 20 more miles to go, which is close to 25 miles that would take almost a half hour at that speed. So add another half hour to the estimated time.
7. (72) The area of 5 squares is 180, so the area of one square is  $180 \div 5$  or 36 square units. If the area of one square is 36 square units, then each side must equal 6 units. There are 12 sides that make up the perimeter of the figure, and  $12 \times 6 = 72$ .
8. (W=3; R=7; N=9; G=1; T=2; I=4) Trial and error works, but careful analysis helps. Logic will tell you first that G=1 since the column with two zeros added results in another number, which can only be 1. With that start, the puzzle is not difficult to finish.

## Commentary

*Neptune, X*

1. (25%) If 60 out of 80 teachers are female, then 20 are male. 20 males out of 80 total teachers equals 25%.
2. (12) For each of the four hats, a different bow will make a different hat. 3 different *green* hats + 3 different *yellow* hats + 3 different *blue* hats + 3 different *purple* hats = 12 different hats.
3. (\$68.44) If each sandwich feeds 8 people, he will need 4 sandwiches to feed himself and 30 friends.  $\$15.99 \times 4 = \$63.96$ . Adding sales tax of 7% can be done in one step by multiplying  $\$63.96 \times 1.07$  to get \$68.44, when rounded up to the next cent.
4. (26) For her overall average to be 70% she must sink 35 out of 50 baskets because  $35/50 = 0.70 = 70\%$ . Therefore if she needs to sink a total of 35 baskets and has already sunk 9, she needs to sink 26 out of her next 30 attempts ( $35 - 9 = 26$ ).
5. (54 sq. in.) There are a number of ways to find this answer. One approach is to determine that each of the nine smaller squares has area  $81 \div 9$  or 9, and count whole (4) and half squares (4) in the shaded part for a total area of  $4 \times 9 + 4 \times 4.5 = 54$ . Another way, once you know each small square has area 9, is to count the whole (1) and half squares (4) in the unshaded part and subtract these amount from 81. Yet another way is to notice that moving the unshaded triangles on the left, with the unshaded figure on the right, produces an unshaded figure that is  $1/3$  of the total figure. So the shaded part would be  $2/3$  of 81, which is 54.
6. (11) Counting by 1.5 makes the full sequence:  
**2.5, 4, 5.5, 7, 8.5, 10, 11.5, 13, 14.5, 16, 17.5** for a total of 11 terms.
7. (14) Students should be encouraged to start analyzing such figures in an organized way. One such approach for this problem is to start counting the smallest squares first, getting 9. Then move to the next smallest size, which is a 2-by-2 square – there are 4 of these. The next size square is the large one itself, giving a total number of  $9 + 4 + 1$ .
8. (\$77) They will need \$152 for 4 admissions to Disney World. Since they already have \$75, they will need to save \$77 more.

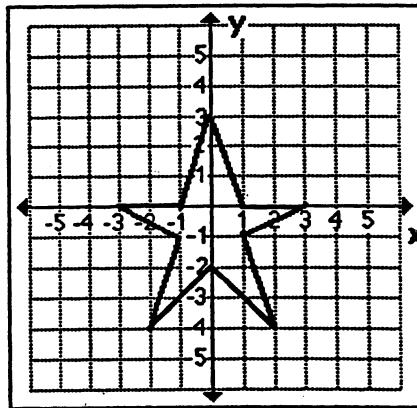


## Commentary

*Neptune, XI*

1. (6) Label the cars, except for the engine, A, B, and C. Then the different arrangements are ABC, ACB, BAC, BCA, CAB, and CBA.

2. (The figure is shown to the right.)



3. (Point E) Point A is  $\frac{1}{4}$  and B is  $\frac{1}{2}$ . Then  $\frac{1}{4}$  of  $\frac{1}{2}$ , or  $\frac{1}{8}$ , is point E.

4. (Monday) 100 days ago was 14 weeks and 2 days ago. If today is Wednesday, 14 weeks ago was also Wednesday and 2 days before that was Monday.

5. (5) Students might use a chart like this:

BUILT	NOT BUILT	EARNINGS
1	9	-50
2	8	0
3	7	50
4	6	100
5	5	150

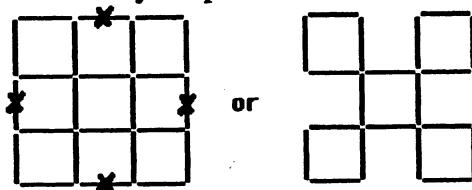
Another approach would be algebraic, setting up and solving the equation  $40x - 10(10 - x) = 150$ , where  $x$  is the number of dog houses made.

6. (2:00 P.M.) 4 hours + 15 minutes + 30 minutes + 20 minutes = 5 hours and 5 minutes after 9 A.M. means Mary will return home at 2:05 P.M. Since the question asks "about what time," 2:00 P. M. is a reasonable answer.
7. (86)  $112 + 88 + 80 + 65 = 345$ , and  $345 \div 4 = 86.25$  This answer is rounded to the nearest whole number, 86.
8. (17 grams) Students can reason that the only difference between the two pictures is that 2 more balloons have been attached to one scale, resulting in 6 less grams. This implies that a balloon weighs -3 grams. Using this fact and the first scale, we have that 2 cups of coffee and -3 grams equals 31 grams, so 2 cups of coffee alone would be 3 more grams than 31, or 34 grams. Therefore one cup of coffee is half that amount, or 17 grams.
9. ( $6t + 15.7 = 58.3$ ,  $t = 7.1$ ) Students might write a different form of the equation, such as  $t + t + t + t + t + t + 15.7 = 58.3$ , which is acceptable.

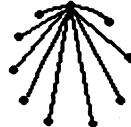
## Commentary

*Neptune, XII*

1. (Sample:  $4 + 4 + 4 + 4 = 9$ )
2. (One correct answer would be to remove the outside middle segments on each of the 4 sides.) Others may be possible.



3. (One possible answer: {70, 80, 90, 100} has a mean of 85 and a median of 85.) Other answers are likely. Each answer will have to be checked individually. The mean is found by summing the four numbers and dividing by four. The median is found by ordering the numbers from smallest to largest, and taking the mid-point between the two middle numbers.
4. (15)  $5 + 8 + 4 = 17$  and  $17 - 2 = 15$ . The two students who are on two teams have been counted twice in the total of 17, and so must be removed from the count one time.
5. (45) Person 1 shakes hands with 9 others, person 2 shakes hands with 8 others, and so on. Another way to see this is with a diagram, as started to the right. A line would be drawn to connect all ten points. The total number of lines is  $9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1 = 45$ .
6. (3/42 or 1/14 or about 7%) The chances you'll scratch off an even number the first time is  $4/8$  or  $1/2$ . If you succeed, the chances you'll scratch an even number is  $3/7$ , since there are now three even numbers left out of the seven spots. If successful, the chances you'll scratch off an even number the third time in a row is  $2/6$  or  $1/3$ . The chances you'll succeed on all three scratches is then the product of  $1/2$ ,  $3/7$ , and  $1/3$ . This computation results in  $3/42$  or  $1/14$  or 0.07 when rounded, which is about 7%.
7. (\$4) The area of the small cookie is  $\pi r^2$ , where  $r$  is the radius of the small cookie. The giant cookie has 4 times the diameter, and hence 4 times the radius, of the small cookie, so its area is  $\pi(4r)^2$  or  $16\pi r^2$ . Therefore the new cookie has 16 times the area of the small cookie, and should cost  $16 \times 25\text{¢}$  or \$4.
8. (55, 385, 13th) The pattern that students will discover for making the buildings is to add the square of the building number to make the next building in line. For example, the number of cubes for the third building is  $9 + 4 + 1$ . The number for the 4th building can be found by adding on to this building a 4-by-4 bottom layer, or 16 more blocks. The 5th building could then be made by adding a 5-by-5 bottom layer, increasing the number of blocks by 25. The 10th building would then take  $1^2 + 2^2 + 3^2 + 4^2 + 5^2 + 6^2 + 7^2 + 8^2 + 9^2 + 10^2$ , or 385, blocks. If you continue adding the squares of the next few whole numbers, the sum for building 13 is 819 and the sum for building 14 is 1015, so you could only make building 13 with 1000 blocks.
9. (50) If you pair each odd number from 1 to 99 with the next even number from 2 to 100, each odd number would be 1 less than its partner. There are 50 such pairs, so the difference is 50.



## Commentary

*Neptune, XIII*

1. **(10 cubes)** 6 on bottom row, 3 in the middle, one on top.
2. **(4:20 P.M.)** Multiples of 16 are 16, 32, 48, 64, and 80. Multiples of 20 are 20, 40, 60 and 80. Therefore in 80 minutes after 3:00 P.M. both buses will arrive at the mall at the same time. (80 is the least common multiple of 16 and 20.)
3. **(6'2")** One approach is to convert the heights to inches. If the average height is 73", then the total team height is  $5 \times 73" = 365"$ . Solve  $73" + 75" + 72" + 71" + x = 365"$ . The fifth player's height  $x$  is then 74" or 6'2". Another approach is to look at the given heights and compare them to the given average -- the first height 6'1" is right on the average, so give it a 0. The 6'3" would be +2, the 6' would be -1, the 5'11" would be -2 from the given average. To get all of these integers back to zero, you need one that's +1. So the last player would have to be 1" more than the average, or 6'2".
4. **(84)** Various strategies may be used including trial and error. Since  $12 + 7 = 19$  and  $12 - 7 = 5$ , the numbers are 12 and 7. Their product is 84.
5. **(about 5 1/2 months)** 1000 hours + 6 hours per day is approximately 167 days. This is about 5 and one-half months.
6. **(\$180)**  $\$45,000,000,000 + 250,000,000 = \$180$ .
7. **(a. 63%, b. 38%, c. 5%)** For (a), he will get on base if the dart lands in 5 out of the 8 equal areas, hence the percent is  $5 + 8 = 0.625$  or about 63%. Likewise, he'll make an out  $3 + 8 = 0.375$  or about 38% of the time. He would make 3 outs in a row about  $38\% \times 38\% \times 38\%$  of the time, or about 5% of the time.
8. **(150)** Compute  $\frac{3}{5} \times 250 = 150$ , or change  $\frac{3}{5}$  to a decimal and compute  $0.6 \times 250 = 150$ . For some students, it might be easier to think of working with the ratio in an intuitive fashion.

Thus, the ratio is:

3      to      5  
6      to      10  
30     to     50

⋮  
⋮

150    to    250

## Commentary

*Neptune, XIV*

1. (a. 168,000 - 170,000 b. 6 weeks) This problem encourages students to use round numbers, since these are only estimates to begin with. They might begin with rounding 980 breaths per hour to 1000 breaths per hour, and multiply this by 24 hours/day and 7 days/week, to get 168,000. This amount could be rounded to 170,000. For (b), students can divide 1 million by 168,000 or 170,000 to get about 6 weeks. This answer might be written in equivalent forms, such as 1 1/2 months.
2. (6) 20 dimes and 30 pennies is \$2.30. If Ken has \$2.30 with 8 quarters and the rest nickles, then the 30¢ must be all nickles, or 6 nickles.
3. (36) If the perimeter is 48 cm, then each side is  $48 \div 8$  or 6 cm. Therefore the side of the square is 6 cm, which means its area is 36 sq. cm.
4. (\$7.25)  $\$4.00 + 6(\$1.75) = \$14.50$ .  $\$14.50 \div 2 = \$7.25$
5. (40 green, 60 red) A possible solution is to "ratio up" the given amounts. He pulled out 25 jelly beans, and 10 were green. If he grabbed this same amount four times, he would have pulled out all 100 jelly beans, and have pulled 10 green ones each time, for a total of 40. There must then be  $100 - 40$  or 60 red jelly beans also.
6. (35 feet) Students might solve a proportion to find the length  $x$ . In similar rectangles, the sides are proportional, so  $\frac{15}{6} = \frac{x}{14}$ . Finding a common denominator so the numerators of the fractions can be compared, we have that  $\frac{15 \cdot 14}{6 \cdot 14} = \frac{6x}{6 \cdot 14}$ . This implies the numerators are equal, or that  $15 \cdot 14 = 6x$ . Solving for  $x$  by dividing both sides by 6, we have that  $x = 35$ .
7. (43) 254 people divided by 6 people/row gives 42 r 2 rows needed. This means that 43 rows were actually needed to hold all 254 passengers.
8. (22 times) The hands coincide once every hour except between 11 and 1. Between 11:00 and 1:00 the hands coincide only once: 3:17, 4:22, 5:27, 6:33, 7:38, 8:43, 9:49, 10:54, 12:00, 1:06, 2:11. Each one happens twice; therefore  $2 \times 11 = 22$  times.

## Commentary

*Neptune, XV*

1. (0) A number sentence for the action is:  $7 - 2 + 4 - 5 + 3 - 1 + 2 - 1 = 7$ . He had 7 pogs when he started, and 7 when he finished.
2. (a. 19; b. answers will vary) The first 8 letters cost 74¢, leaving \$1.84 - \$0.74 or \$1.10 left for the other letters. At 10¢ each, this comes to 11 more letters. This gives 11 + 8 or 19 as the total. To check (b), make a chart, such as:

8 or fewer ...	74¢
9 letters	84¢
10 letters	94¢ etc.

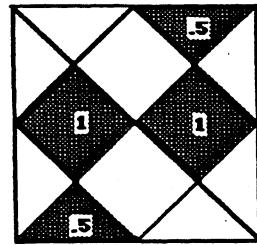
Use this chart to check the value of the name at the top of the sheet.

3. (2:05 P.M.) 215 minutes is 3 hours and 35 minutes. Counting 3 hours and 35 minutes from 10:30 AM gives 2:05 PM.
4. (20%) If 4 out of 5 cars have a tape player or radio, then 1 out of 5 do not. One out of five is written 1/5, and another name for this fraction is 2/10 or 20/100, which is 20%.
5. (-110, 25, and -73.4 should be circled) Students can use their number sense to judge where these real numbers should be on a number line. -110 would be to the left of -100. 25 is positive since there's no negative sign in front of it, so it goes to the right of 0. -73.4 is negative, and hence would be to the left of zero.
6. (125) The volume of the large cube is  $5 \times 5 \times 5 = 125$  cubic inches. The volume of the small cube is  $1 \times 1 \times 1$  or 1 cubic inch. Therefore 125 small cubes fit into the large cube.
7. (13) Assume the worst case: you might draw 3 clubs, 3 spades, 3 hearts and 3 diamonds, a total of 12 cards, and not have four of one suit yet. On the 13th draw, you will draw the 4th heart, club, diamond or spade.
8. (Rowena: 16; Jim: 12) A student might *guess-check-revise* until they find  $x$  and  $y$  such that  $x + y = 28$  and  $x - y = 4$ . Guess  $x = 20$ , and then  $y$  must be 8 for the first condition to hold. But  $20 - 8$  isn't 4, so  $x = 20$  might be revised down. Continue in this fashion.

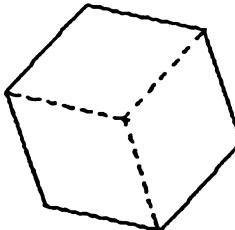
## Commentary

*Neptune, XVI*

1. (18%)  $27 + 24 = 47$  honor students. There were  $47 + 210$  students in all. Therefore the percent of honor students is 47 out of 257, which is  $47 \div 257$  or approximately 18%.
2. (130)  $60 + \frac{1}{2}$  is  $60 \times \frac{2}{1}$  or 120.  $120 + 10 = 130$ .
3. (1350) One approach is to convert 8 inches to  $\frac{8}{12}$  or  $\frac{2}{3}$  of a foot, which is 0.67 feet when written as a decimal. 6 feet 6 inches is 6.5 feet, when written as a decimal. The volume of the mattress is then  $0.67 \text{ feet} \times 5 \text{ feet} \times 6.5 \text{ feet}$ , which can be computed on a calculator easily, giving 21.775 cubic feet. This is multiplied by 62 pounds per cubic foot, given 1350 pounds as the weight of the water bed mattress. Students might now realize why many buildings won't allow water beds on the second floor of an apartment -- with the frame and two people in the bed, it's close to a ton.
4. (21)  $3\frac{1}{4}$  miles =  $\frac{13}{4}$  miles. The depth drops one foot for every  $\frac{1}{4}$  mile, so it drops 13 feet.  $13 + 8 = 21$  feet deep.
5. (21) It will take 4 cuts to cut a log into 5 pieces.  $5\frac{1}{4}$  minutes  $\times 4$  gives  $20\frac{4}{4}$  or 21 minutes.
6. (37.5%) The isosceles triangles are also half squares. Putting together half squares and squares to make whole squares, the shaded part is three squares. The whole area consists of 8 whole squares, and 3 out of 8 =  $\frac{3}{8} = .375 = 37.5\%$



7. (See the figure below.)



8. (5) As bites are taken, the weight goes down by half each time. The amount remaining after each bite can then be found by multiplying what remains by 0.5, as shown in the chart below.

$$0.5 \times 4 = 2 \quad \text{Bite 1}$$

$$0.5 \times 0.5 = 0.25 \quad \text{Bite 4}$$

$$0.5 \times 2 = 1 \quad \text{Bite 2}$$

$$0.5 \times 0.25 = 0.125 \quad \text{Bite 5}$$

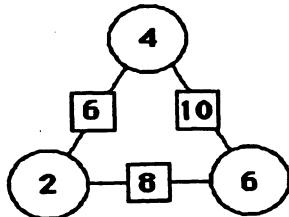
$$0.5 \times 1 = 0.5 \quad \text{Bite 3}$$

## Commentary

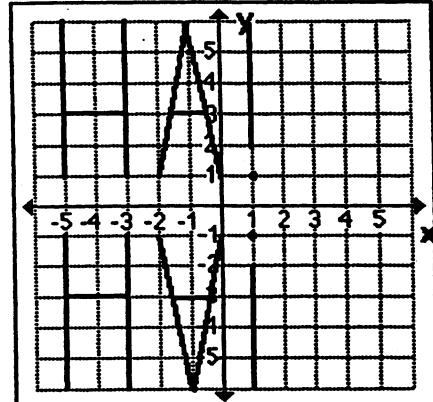
*Neptune, XVII*

1. (**\$3.00**)  $\$8.00 - \$4.25 = \$3.75$  for the extra 3 people. Therefore  $\$1.25$  is the charge for each additional person. Working with  $\$4.25$  for 3 people, and  $\$1.25$  is charged for person #3, we know that  $\$3.00$  is the charge for the driver and 1 passenger.
2. (**15**) Seven are always at the laundry; he picks up seven clean ones for Tuesday - Monday; and he is wearing a shirt when he drops off the laundry.
3. (**60**) From 6:00 A.M. until 9:00 P.M. is 15 hours. If they eat for 3 hours and spend 2 hours buying gas, the actual driving time is  $15 - 5 = 10$  hours.  $600 \text{ miles} + 10 \text{ hours} = 60 \text{ miles per hour}$ .
4. (**24**) Students might make an organized list, using letters of the alphabet to represent the crust, the cheese, and the toppings. If so, they should get  $3 \times 2 \times 4 = 24$  varieties.
5. (**343**)  $294 + 6$  means that the area of each square is 49 square units. If the area of each square is 49 square units, the side length must be 7 units. The volume of a box is length times width times height, or  $7 \times 7 \times 7$ .

6.



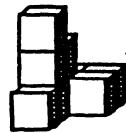
7. (**One**) Use *trial and error*, or a calculator, to find 69545. The possible zip codes are 69141, 69242, 69343, 69444, 69545, 69646, 69747, 69848, 69949, and 69040. The only one divisible by 7 is 69545.
8. (**8,8,8,8; 8,8,9,7; 9,9,7,7; 9,9,9,5; 9,9,8,6**) If the average of 4 whole numbers is 8, the sum of the 4 numbers must equal 32. Given that each number is less than 10, we have  $8 + 8 + 8 + 8 = 32$ ,  $8 + 8 + 9 + 7 = 32$ ,  $9 + 9 + 7 + 7 = 32$ ,  $9 + 9 + 9 + 5 = 32$ ,  $9 + 9 + 8 + 6 = 32$  as the only possibilities.
9. (**HA! is the word.**) You should see this:



## Commentary

*Neptune, XVIII*

1. (9 cubes) 6 on bottom, 2 on second level, 1 on top.



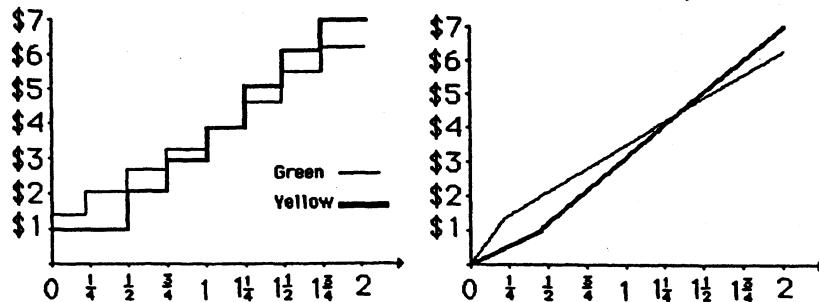
2. (30°)  $360^\circ \div 12 \text{ sections} = 30^\circ$ .

3. (2748) The perimeter of the building would be 5 times the length of a side, so the perimeter would be a multiple of 5. The only number given which is not a multiple of 5 is 2748.

4. (16/100) The chances are the number of tickets that both have together, divided by the total number. The answer can be expressed in a number of equivalent forms: 0.16, 16%, 8/50, 4/25, etc.

5. (a.  $1\frac{1}{4}$  miles; b. the lines coincide or cross) Students should get a star for filling out the chart properly, for making a graph, and for answering each of the two questions. Most students will make a double line graph instead of a step graph, which is technically correct since the fares go up suddenly, rather than gradually, at each quarter mile. However, give students credit for either type of graph, if done correctly. Both types are shown below.

Cost of:	Green	Yellow
$\frac{1}{4}$ mile	\$1.40	\$1.00
$\frac{1}{2}$ mile	2.05	1.00
$\frac{3}{4}$ mile	2.70	2.00
1 mile	3.35	3.00
$1\frac{1}{4}$ miles	4.00	4.00
$1\frac{1}{2}$ miles	4.65	5.00
$1\frac{3}{4}$ miles	5.30	6.00
2 miles	5.95	7.00



6. (The new price is \$1.20 less.) Reducing \$30 by 20% means the reduced price is \$24. Increasing \$24 by 20% can be done easily by multiplying 24 by 120% or 1.2 on a calculator, giving \$28.80. \$28.80 is \$1.20 less than \$30.

7. (4) There are several clues to consider in the teacher's rhyme. The first sentence says that there is one more fish than dish. The beginning of the second sentence implies there is an even number of fish; otherwise she couldn't place *two* fish upon each dish. So students might begin by guessing and checking from this list, finding that 4 fish and 3 dishes fit the bill.

fish	dish
2	1
4	3
6	5
.	.
.	.
.	.

## Commentary

*Neptune, XIX*

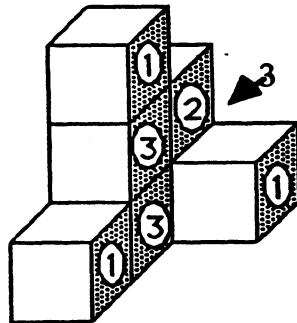
1. (C) For each whole number from 0 to 19 substituted for  $x$ , the value of  $\frac{X}{2}$  is less than 10.
2. (a. 1; b.  $7/16$ ; c. 4; d.  $28/16$ ) Since the area of the 1st square is  $1/16$ , each side of the square must be  $1/4$  of an inch in length. So the perimeter of figure 1 is  $4/4$  or 1 inch. The 3rd figure is made from 7 squares, so its area is  $7/16$  inch $^2$ . Its perimeter can be found by counting the exposed edges, resulting in 16 of the  $1/4$  inch lengths or 4 inches total. The figures beyond the ones seen can each be formed by adding 3 squares to the preceding figure. Counting out to the tenth such figure, there would be 28 squares, each  $1/16$  inch $^2$  in area. Therefore the 10th figure has area  $28/16$  inches $^2$ , or  $1\frac{12}{16}$  inches $^2$ , or  $1\frac{3}{4}$  inches $^2$ .
3. (4) If 1 inch = 16 miles, then  $\frac{1}{8}$  inch =  $\frac{1}{8}$  of 16 miles or 2 miles. Therefore, the area equals 2 miles  $\times$  2 miles or 4 square miles.
4. (2) If  $Y + 1 = 5$ , then  $Y = 4$ . Since  $X + 2 = Y$  also, then  $X + 2 = 4$ , or  $X = 2$ .
5. (D)  $\frac{5N}{4}$ ) Set up a proportion:  $\frac{280}{N} = \frac{350}{X}$ . Then the relationship between  $X$  and  $N$  can be determined.  $280X = 350N$ 

$$X = \frac{350N}{280}$$

$$X = \frac{5N}{4}$$

(Alternative: Simplify the fraction  $\frac{350}{280} = \frac{5}{4}$ .)
6. (50%)  $30 + 6$  gives 36 students in class, of which  $12 + 6$  or 18 are boys. Therefore,  $\frac{18}{36} = 0.5 = 50\%$
7. (C = 8) Students can try the various digits from 1 to 9 for B, and see if the digit gives a true statement. If so, students will find that 9 is the only such digit.  

$$\begin{array}{r} 99 \\ +99 \\ \hline 198 \end{array}$$
8. (28) There are 6 faces on each block, and 7 blocks, resulting in 42 faces altogether. However, some of them are facing other faces and so will have no paint on them. Students might think of each cube individually, and count the number of faces it has that touch other faces, then get a total number of such faces, and subtract from 42. We counted 14 such touching faces, as shown on the block to the right.



## Commentary

*Neptune, XX*

1. **(10 1/2)** There are several approaches to finding the area. One is to find the area of the whole park first by filling in the grid lines and counting 16 acres. Then subtract the acres and half acres that aren't shaded -- 5 1/2 -- leaving 10 1/2 acres for the sports.
2. **(D)** There is 1 chance out of ten the number is 5 and 1 chance out of ten the number is 9. The chance the number is odd is 5 out of ten, and the chance the number is *not* 1 is 9 out of ten.
3. **(C)** The difference between 2 and 3 is 1, so (a) isn't the correct choice. The difference between 3 and 5 is 2, so (b) isn't correct. The difference between 5 and 13 is 8, so (d) isn't correct. (c) is the only other choice, and it is to be true. For the difference of two primes to be an odd number, one of the primes would have to be even but there's only one even prime -- 2 -- and the difference of two and any prime greater than 9 would have a difference greater than 7.
4. **(Median)** The mode (most often occurring number) is 88. The median (middle) number (after numbers are put in order) is between 88 and 90 or 89. The mean is the sum of the numbers -- 528 -- divided by 6, or 88. So the median is the best option for Lin.
5. **(18 and 40)** Starting with 7, the next term is  $2 \times 7 + 4$ , or 18. The following term is  $2 \times 18 + 4$ , or 40. An extension of the problem might be to ask what number could have come before 7.
6. **(Penny, Nickel, Quarter, Dime)** Students can *guess-check-revise* to find the order.
7. **(4096)** The sequence appears to be the powers of 8, in order:  $8^1 = 8$ ;  $8^2 = 64$ ;  $8^3 = 512$   
 $8^4 = 4096$
8. **(32)**  $\frac{2}{6} + \frac{2}{6} + \frac{2}{6} + \frac{2}{6} = \frac{8}{6} = \frac{32}{24}$ . Note that some students will be tempted to say  $\frac{8}{24}$ , since it appears that the denominators of the fractions have been added to get the denominator 24; the temptation for students is to then add the numerators.
9. **(5)** There are many ways that students will approach this problem. Let the first initial stand for each animal -- D for dinosaur, L for lion, E for elephant, and B for burro -- and what the scales show are these:  
  
(a)  $D + L = B$       (b)  $D = E + L$       (c)  $2B = 3E$   
  
Doubling (a), we know that  $2D + 2L = 2B$ . But from (c),  $2B = 3E$ , so combining these, we have (d)  $2D + 2L = 3E$ . From doubling (b), we have that  $2D = 2E + 2L$ . Now  $2E + 2L$  can be substituted in the previous statement (d) to give  $2E + 2L + 2L = 3E$ , or  $2E + 4L = 3E$ . By removing  $2E$  from both sides, we're left with  $4L = E$ . This fact can then be used with (b), substituting  $4L$  for  $E$ , to give  $D = 4L + L$ , or  $D = 5L$ .

## Commentary

*Neptune, XXI*

1. (27th floor)  $27 + 3 + 5 + 7 + 9 = 23$

2. (Figure A) Figure A has 36 squares as surfaces, and Figure B has 32 squares as surfaces.

Figure A

Front	10
Back	10
Top	4
Bottom	4
Sides	8
Total:	36

Figure B

Front	5
Back	5
Top	5
Bottom	5
Sides	12
Total:	32

3. (42) Students can approach this in a number of ways. *Guess-check-revise* for the starting number is one way; another is *working backward*. For the latter, if  $x + 6 - 3 = 4$ , then  $x + 6$  must be 7 since  $7 - 3 = 4$ . But if  $x + 6 = 7$ , then  $x$  must be 42 since  $42 + 6 = 7$ .

4. (D, 462) The perimeter of a square is  $4s$ , where  $s$  is the length of one side. This mean the perimeter of a square must be divisible by 4. All of the numbers given except 462 are divisible by 4, with no remainder. But  $462 \div 4 = 115.5$ , so (d) is the only choice.

5. (Acute) An obtuse angle and its supplement equal  $180^\circ$ , and the obtuse angle is  $>90^\circ$ . Therefore its supplement must be acute ( $<90^\circ$ ).

6. ( $\frac{3}{5}$ ) Students can add the two numbers shown and divide by two to find the midpoint.

$$\frac{4}{5} + \frac{4}{10} = \frac{12}{10} \text{ and } \frac{1}{2} \times \frac{12}{10} = \frac{6}{10} \text{ or } \frac{3}{5}.$$

7. (49) Each 2-inch square tile is a square 2 inches on a side. Seven tiles fit across and 7 tiles fit down. The total number of tiles is then  $7 \times 7$  or 49.

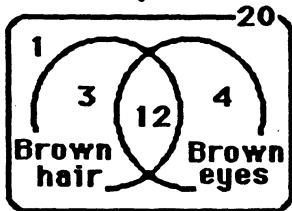
8. (6) John has 4 more brothers than sisters. One way to solve the problem in a concrete fashion would be to assign letters to John's brothers, perhaps A, B, C, D, and E, and let Mary be the only sister. Notice this matches the original condition that John has 4 more brothers (5) than sisters (1). Then the question is how many more brothers than sisters does Mary have? She has 6 brothers, counting John, and no sisters, so she has 6 more brothers than sisters.

9. (a. 24; b. 27; c. 306; d.  $3 \times (n + 2)$ ) Students will likely note that you get from one figure to the next by adding 3 each time. It's therefore easy to get the total for figures 6 and 7. The total for figure 100 probably requires a generalization, looking for the connection between the figure number  $n$  and the total number of dots. (d) gives students a chance to express this generalization algebraically. Notice for alternatives to " $3 \times (n + 2)$ ," such as " $3 \times n + 6$ " and " $n + n + n + 6$ ."

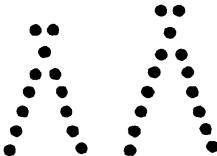
## Commentary

*Neptune, XXII*

1. (4.9) All five scores, when added, must equal  $5 \times 4.6$  or 23. We know  $4.2 + 4.3 + 4.6 + 5.0 = 18.1$ , so the missing number is  $23 - 18.1$  or 4.9.
2. (B)  $\frac{4}{9}, \frac{4}{8}, \frac{4}{7}$  Students should be encouraged to solve this using number sense. For example, in (a) thinking of the fractions as mixed numbers helps to see the answer pretty quickly. For (b) and (c), the numerators are all the same, so the fraction with the smallest denominator is the largest. For (d), the center number is  $1/2$ , which is less than both of the other two. Some students might forget about number sense and find decimal equivalents first using a calculator ( $0.4444\dots, 0.5, 0.5714286\dots$ ), and compare the numbers that way.
3. (10.5 miles) One-fourth of 2 hours is 30 minutes of walking; three-fourths of 2 hours is 90 minutes of running. The running distance, at 1 mile per 10 minutes, is 9 miles for 30 minutes. The walking distance, at 1 mile per 20 minutes, is 1.5 miles for 30 minutes.
4. (200) A strategy would be to "work backward". If 10% of a number is 2, that number must be 20. If 10% of  $x$  is 20, then  $x$  must be 200.
5. (1 student) One strategy is to construct a Venn diagram, working from the overlap area to the outside. I.e., first you insert 12 into the overlap area, and work toward the outside.



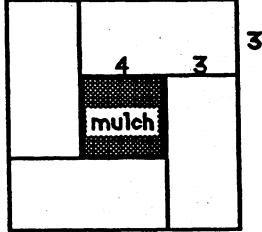
6. (As shown to the right.)



7. (a. 23; b.  $2n + 3$ ) As students seek the answer to (a), they will probably simply continue to count the odd numbers till they reach the 10th odd number after 5. Part (b) forces the student to search for a way to express the function algebraically, using the variable  $n$ . Watch for alternative versions of  $2n + 3$ , such as  $n + n + 3$  or  $(n + 1) + (n + 2)$ . If a student writes in English how to find the number for the  $n$ th figure, instead of as an algebraic expression, give the student 1 star instead of 2.
8. (14) 7 cubes have  $6 \times 7$  or 42 faces, 28 of which are painted.  $42 - 28 = 14$  remain unpainted.
9. (29)  $170 + 6 = 28.3$ , so 29 rows are needed.

## Commentary

*Neptune, XXIII*

1. (10:40 A.M.) The hands would show the normal position for 10:40.
2. (a. clockwise; b. counterclockwise; c. clockwise; d. clockwise) Hopefully students will notice a pattern in this problem. An extension of the problem for the classroom is to define how the  $n$ th gear would turn, which depends on whether  $n$  is odd or even.
3. (12) Students might approach this by making an organized list. Using the first initial of each course, the list might start with  $\{(F, L, v), (F, L, s), \dots\}$ . As there are 2 choices for language, 2 for computer course, and 3 for physical education class, there will be  $2 \times 2 \times 3$  items in the list.
4. (7, 3. The drawing is shown to the right.) From the drawing, with the 4 m square of mulch sitting in the center, the distance from the mulch to the out edge of the garden is 3 m. From this, the width of the rectangle is 3 m. The length of each is then  $3 \text{ m} + 4 \text{ m}$ , or 7 m.
5. (30 miles per hour) 20 miles in 40 minutes is 10 miles in 20 minutes. Taking this rate 3 times means you could travel 30 miles in 60 minutes, or, 30 miles per hour.
6. (28) Students might find this by guess-check-revise, continually guess what  $x$  might be until they are successful with a check. However, they might decide to simplify the equation to  $X = 14 + \frac{1}{2}X$ , and solve by subtracting  $\frac{1}{2}X$  from both sides, getting  $\frac{1}{2}X = 14$ , or  $X = 28$ .
7. (B) The pattern is determined by counting by tens in the negative direction. Therefore once you start with -10, -20, -30, ..., you can simply switch to the positive numbers and count by tens as 10, 20, 30, ... and decide where 500 would be in such a count. If you count several such rows, you'll notice that column F is the multiples of 6, with a negative sign and zero added (-60, -120, -180, ...). The closest such number to -500 would be -480, so -480 would go in column F. This means -490 is in A, and -500 is in B.
8. ( $3b + 31 = 47.2$ ; 5.4 grams) Students should see that there are 3 balls on the scale, so  $b + b + b$  gives the weight of the 3 balls alone. This amount, added to 31, gives 47.2. This equation might be written as shown above, or in a number of alternate ways, such as  $3b + 31 = 47.2$ . A student might solve this equation, or they might solve the problem intuitively by removing 31 from the scale and calculating what the new scale would show, then dividing this amount into 3 equal piles. In either case, the answer would be 5.4.

## Commentary

*Neptune, XXIV*

1. (2003) On a calculator, students can use the repeating function concept to repeatedly multiply by 90%, finding the value for each new year in one step. Seven years from 1996 (2003) the car will have a value less than \$21,000.
2. (17) Denise might put one apple in the first bag, two apples in the second bag, three apples in the third bag, and so on. By the sixteenth bag, 136 apples will have been used. If you put 17 in the next bag, which the pattern leads you to do, you would then have 17 left for the 18th bag but this would repeat the number seventeen. However, by placing 34 apples in the 17th bag, the problem is solved.
3. (450) The hare's rate of 9 meters per minute is  $9 \times 60$  or 540 meters per hour. Likewise, the tortoise's rate is  $1.5 \times 60$  or 90 meters per hour. So, in one hour the hare was  $540 - 90$  or 450 meters ahead. Some students may figure that the hare's rate is 7.5 m/hr faster, so  $7.5 \times 60 = 450$  meters.
4. (12) The days that Al will call will follow this pattern: 3, 6, 9, 12, ... The days that Bob will call will follow this pattern: 4, 8, 12, ... The days that Chris will call will follow this pattern: 6, 12, 18, ... Notice that 12 is common to all 3 patterns, so that is a day that all three will call.
5. (3 adults, 4 children) A possible approach to this problem is to make a chart. Fill in possible amounts spent on adult tickets. Decide for each if it's possible to have a whole number of children with the remainder. The only adult possibility is 3 with 4 children.

Adult Cost	Money left	\$ left for Children + ticket cost
1 \$12.00	\$56 - \$12 = \$44	\$44 + \$5 = 8.8 children (not possible)
2 \$24.00	\$56 - \$24 = \$32	\$32 + \$5 = 6.4 children (not possible)
3 \$36.00	\$56 - \$36 = \$20	\$20 + \$5 = 4 children (possible)
4 \$48.00	\$56 - \$48 = \$8	\$8 + \$5 = 1.6 children (not possible)

6. (One possible solution:  $(4 + 4 + 4) + 4 = 3$ ) Answers may vary; students can try various operations and record the results.
7. (59) The lowest average would come from making 0 on the last test. The average would then be  $(92 + 84 + 0) + 3 = 58.666\ldots$  or 59 to the nearest whole number.
8. ( $\frac{8}{52}$  or  $\frac{2}{13}$  or 0.15 or 15%) There are 4 fours and 4 eights, a total of 8 number cards out of 52 that are evenly divisible by 4. Therefore the chances are  $8/52$  or one of its equivalent forms.

## Commentary

*Neptune, XXV*

1. (90) The highest possible average would mean you made 100% on the last test. Then your average would be  $(83\% + 91\% + 86\% + 100\%) \div 4$ , or 90%.
2. (One answer:  $(4 \times 4 + 4) \div 4$ ) Students will likely try various combinations and compute each to see if it is correct.
3. (Letters above the line are: T, V, W, X, Y, and Z. The others, P, Q, R, S, and U are below the line.) Some students will get this immediately, and others will struggle trying to find a numerical pattern that underlies the placement of the letters. The rule used is that letters made strictly with line segments are above the line -- those with curves go below the line. If a student does find a numerically-based pattern so that all of the given examples fit, they should get credit for the problem.
4. ( $4\pi^2$  or about 39) The circumference of the circle is given by  $\pi d$ , where  $d$  is the diameter. In this case, the circumference is  $8\pi$ . If this is also the perimeter of the square, then each side is  $8\pi \div 4$  or  $2\pi$ . Then the area of the square is  $(2\pi)^2$  or  $4\pi^2$ .
5. (97) One pattern is that you add 3, then 6, then 12, then 24, doubling what you add each time to get the next number. Another way to describe the pattern is that you double each number to get the next term, and subtract 1. Students may notice other ways to describe this pattern.
6. (8, 8, and 8) If you choose one radius shown, you can count one acute angle for the next radius you meet proceeding. Then you move to the next radius and proceed around the circle clockwise until you return to the starting radius. The same procedure will show that there are the same number of right and obtuse angles.
7. (3,000,000,000) For a female:  $70 \times 60 \times 24 \times 365 \times 79 = 2,906,600,000$  -- for a male:  $70 \times 60 \times 24 \times 365 \times 75 = 2,759,400,000$ . Each of these numbers rounds to 3 billion.
8. (Sam) One way to begin is to ask "What happens if someone is lying?" For example, if Sue is lying, then all three are lying by looking at the other two clues. But all three lying can't happen because of the conditions. So Sue is telling the truth and didn't take the cookies. Then if Sam is lying, he must have taken the cookies because we know that Sue didn't -- this means Bob is lying also, which is possible. Could Sam be telling the truth? If so, then Bob is also telling the truth, which is impossible because all three can't be telling the truth by the conditions. The only possibility, then, is that Sam took the cookies and lied, Bob lied also, and Sue told the truth.

## Commentary

*Neptune, XXVI*

1. (Possible answer:  $(4 + 4) + 4 + 4 = 6$ )
2. (About 51%) The volume of the larger cube is  $5^3$  or 125 cubic inches. The volume of the smaller cube is  $4^3$  or 64 cubic inches.  $64 + 125 = 0.512$  or about 51%.
3. (about 67%) They won 12 games out of 18 played.  $12 \div 18$  is 0.666..., which rounds off to 67%, to the nearest whole percent.
4. (8) Six laps in 12 minutes means 1 lap in 2 minutes. Therefore 4 laps would take 8 minutes.
5. (1/16) 1 quart = 2 pints = 4 cups =  $1/4$  gallon: Four quarts is 1 gallon, so one quart is  $1/4$  of a gallon. Each ate 1 cup. So  $1/4$  of  $1/4$  of a gallon would be  $1/16$  of a gallon.
6. (Angles 2, 3, 6, & 7 =  $60^\circ$ ; angles 1, 4, 5, & 8 =  $120^\circ$ .) These angles show what happens when a transversal line cuts a pair of parallel lines.
7. ( $\frac{1}{9}$ ) The first day, there is a  $1/3$  chance of getting the grand prize. So this should happen  $1/3$  of the time. Given that it does happen, there's a  $1/3$  chance that you'll open the right door the second time also. This results in  $1/3$  of  $1/3$  of the time that both will hold true, or  $1/9$  of the time.
8. (1.69) (A calculator will help students get this answer.  $2.5 \text{ mm/week} \times 52 \text{ weeks/year} \times 13 \text{ years} = 1690 \text{ mm}$ . This is 1.69 meters.)
9. (alligator) If the circumference of the belt initially is 25,000 miles, it is 132,000,000 feet. The radius from the center of the earth would then be found by using  $C = 2\pi r$ . This radius is 21,019,108 feet. With 10 feet added to the circumference, producing 132,000,010 feet, the radius of the loosened belt would be 21,019,109.5 or about a foot and a half more than before. This would be room for an alligator to crawl under.

## Commentary

*Neptune, XXVII*

1. (Sample answer:  $4 + 4 - (4 + 4) = 7$ )
  2. (20) One way to approach this problem is to consider each cube in turn, asking how many faces it has that are glued to another face. The numbers on the cube faces show the numbers for each cube. Their sum is 19.
- 
3. (3:54) One inch per minute is a rate of 1 foot in 12 minutes. The depth must go from  $3\frac{1}{2}$  feet to 8 feet, which is  $4\frac{1}{2}$  feet. Therefore the number of minutes required is  $(4\frac{1}{2}) \times 12$  or 54 minutes.
  4. (91) Students might begin by looking at the multiples of 7, and checking to see which of those have a remainder of 1 when divided by 3, 5, and 6. The first of these is 91. ( $91 \div 3 = 30$  R 1;  $91 \div 5 = 18$  R 1;  $91 \div 6 = 15$  R 1;  $91 \div 7 = 13$ , no remainder)
  5. (34, 55, 89, 144) The pattern is the widely-known Fibonacci sequence, which starts with 1, 1 and from there on, each term is the sum of the two preceding terms. This sequence has been linked to many natural occurrences on earth.
  6. (490) The largest possible such integer would be paired with the four smallest other positive integers. Therefore this number is paired with 1, 2, 3, and 4, and we know it must be 490 since  $490 + 1 + 2 + 3 + 4 = 500$ .
  7. (50)  $200 \div 4 = 50$  letters per typist for 2 days, or 25 letters per day per typist. So 2 typists can do 50 letters per day.
  8. (6) Denote the three members by A, B, and C. The ways they can be arranged are then: ABC, ACB, BCA, BAC, CAB, CBA.
  9. (Equation:  $37 = 1/2 + 1.5y$ ;  $y = 24.3$ ) Students might write alternate versions of the equation, and 24.3 has been rounded to the nearest decimal. The equation can be solved by intuition or *guess-check-revise*, or by a formal procedure that involves subtracting  $1/2$  from both sides, then dividing both sides by 1.5, to isolate the variable  $x$ .
  10. (Equation:  $88 = 10 + 52\frac{a}{2}$ ;  $a = 3$ ) Again, students might write alternate forms of the equation. The equation can be solved by intuition or *guess-check-revise*, or by a formal procedure that involves subtracting 10 from both sides, then dividing both sides by 26, to isolate the variable  $a$ .



Florida Department of Education