Commentary

Saturn, I

1. **(4 days)** Students can draw a diagram for the worm's trip. The first day, he reaches 4.5 feet but then slips back to 2 feet level at night. The next day he reaches 6.5 feet, but then slips back to 4 feet at night. The 3rd day he reaches 8.5 feet but then slips back to 6 feet. On the fourth day, he reaches 10 feet and is on top of the hill, so doesn't slip back.

2. **(f)** Problems such as this one should help students realize that their answer should make sense in terms of the real world. Knowing that a soda costs around 60¢, the challenge for the student is to decide which of these answers is the correct way to interpret the calculator display. This problem might lead to a class discussion about common misuse of the decimal point in advertising, such as writing ".60¢" for "60¢" and "$199" for "$1.99."

3. **(Thursday)** Students might list the days of the week, and count from the 9th starting on a Tuesday.

4. **($7\overline{)301}$)** This problem can be approached through *guess-check-revise.*

5. **(Either the top and bottom can be circled, or the two sides)** A set of parallel lines are lines that never cross. These can be demonstrated by having students use pieces of spaghetti to represent lines. They might be encouraged to look for parallel lines immediately around them--notebook paper, the top and bottom of classroom walls, etc.

6. **(96 mm, may want to accept anything from 94 to 97 mm)** Students should use a metric ruler rather than one marked in inches. They might count each centimeter mark as 10 millimeters, and then the extra millimeters, from the eraser to the tip of the pencil.

7. **(10 ways)** Sugar, unifix or wooden cubes can be used for students to go through the experiment in a concrete way. The faces can be colored with a crayon or magic marker, or simply labelled "G" and "W." At home, students can use any box they can find although using only 1 box over-and-over means they must be careful in keeping track of the different cubes already made.

   Combinations: *1 cube each*--6 W; 6 G; 1 G and 5 W; 5G and 1W

   2 ways each--2 G and 4 W; 2 W and 4 G; 3 G and 3 W

8. **(NO)** Students should realize a milk shake costs more than $0.39, unless there's a special. If a student mentions this, they should receive credit also.

9. **(85, 67, 49)** Students might list all the pairs of single digits with a sum of 13. Each such pair of digits make up 2 two-digit numbers. Only the resulting numbers with the odd digit in the units place is not divisible by 2.

   8 + 5 = 13, giving 85 as a solution (but not 58)
   6 + 7 = 13, giving 67 as a solution (but not 76)
   4 + 9 = 13, giving 49 as a solution (but not 94)

Commentary

Saturn, II

1. [(8 ÷ 4) + (6 x 2) = 14] Students can use *trial and error* to find the correct order.

2. **(30 squares)** There are 16 small squares, 9 of the next largest in which 4 of the smallest are put together, 4 of the next largest of 9 small ones together, and the one large square itself.

3. **(left-hand calculator)** Students who have trouble with this problem might be encouraged to think of money. The 0.4 might be $\frac{4}{10}$ of a dollar or 40¢, whereas 0.39 might be 39¢. Another way would be for a student to subtract each number from the other on a calculator. The way which gives a positive number on the display means the largest number was entered first.

4. **(4)** Students might divide the total number of people going by the number of people that can fit in one van, with one person per seat belt. If so, they should realize that 21 people can go in 3 vans, but an extra van is needed for the remaining 4 people. This is a case in which the answer to a division problem requires rounding the decimal remainder up, rather than to the nearest whole number.

5. **(9708.6)** This is a simple recognition of place value task.

6. **(1 kg; 350 mL; 30° C; 2200 km)** Students should be encouraged to use "bench mark" metric measurements to estimate reasonable answers. For example, their math book weighs about a kilogram, a mL is about one drop from an eyedropper, a comfortable room temperature is about 30° C, and the distance across the United States is about 5000 km.

7. **(3 to 10, 3:10, or $\frac{3}{10}$; 4 to 15, 4:15, or $\frac{4}{15}$; boys)** Any of these answer forms are acceptable. To find which ratio is larger, 3:10 or 4:15, students can be encouraged to transform the ratios by doubling, tripling, etc., until they get two ratios with the same size comparison group. By doubling, 3 boys out of 10 is the same as 6 boys out of 20. By tripling, you get the ratio 9 boys out of 30. By doubling, 4 girls out of 15 is the same as 8 out of 30. Since 9 out of 30 is more than 8 out of 30, the boys with braces represents a larger ratio.

8. **($2.75 total cost and $2.25 change)** Sales tax of 6% can be interpreted by students as paying $.06 on each dollar spent. On $2 spent, the tax would be $0.12 and on 59¢, the tax would be another 4¢. Sales tax is a real-life example in which partial amounts of money are *rounded up*, rather than to the *nearest,* penny. The total cost would then be $2.59 + 12¢ + 4¢ or $2.75; the change from $5 would then be $2.25.

Commentary

Saturn, III

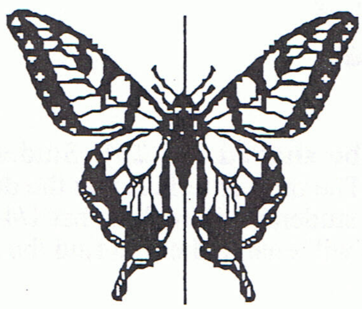
1. **($159.18)** Multiply 36 times $2.38 and 42 times $1.75. Add the two totals together.

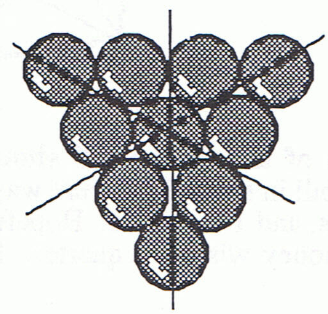
2. **(6 students)** Students can count the number of students for each grade, adding grades 1-3 together and grades 4-5 together, and subtract to find the difference. Or they might count the total number of stars in each group, subtract and find a difference of 2 stars, then multiply by 3.

3. **($15)** Students might find $\frac{1}{4}$ of $100, getting $25. They have $75 left. They can find $\frac{1}{5}$ of $75 by dividing 75 into five equal shares, getting $15 per share. That's the amount saved.

4. **[(8÷4) – (2÷1) is one possibility.]** This is a *guess-check-revise* problem. They must substitute until they come up with the correct order.

5. **Answers shown below.**





6. **Answers will vary.** To decide if the figure is symmetric about the line, fold it and see if the sides match up.

7. **(400)** Students might make a list to organize the approach to this problem. Such a list as the one below helps to observe a pattern:

Group number	People in group	Total
1	1	1
2	3	4
3	5	9
4	7	16
.	.	.
.	.	.
20	39	

If students don't notice the pattern that the total after *n* groups is n^2, they can still solve the problem by adding the "people in each group" column. Notice that 1+39 = 40, 3+37=40, 5+35=40, etc. There are ten such subtotals of 40, giving 400.

8. **(6)** Students might find this in a variety of ways. One way is to look at the third scale and conclude that 1 turtle weighs 0.5, and then from the second scale the 2 turtles would weigh 1 leaving the cake to weigh 12. Then from the first scale, you know that the can must weigh 6 since the cake weighs 12.

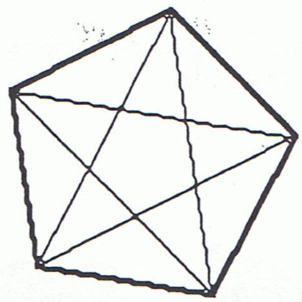
Commentary

Saturn, IV

1. **(10, 15, 21, 28, 36)** Triangular numbers can be found by arranging a number of dots in a pattern , and the pattern forms an equilateral triangle.

2. **($24.00 more)** $5.25 x 40 = $210, $5.85 x 40 = $234, and $234.00 – 210.00 = $24.00. Another approach would be to notice that there's a difference of 60¢ in the hourly rate, and 40 x $0.60 = $24.

3. **(5 diagonals)**



4. **(One fourth of the dollar bill should be shaded. $1.25)** Students can shade in 1/4 of the dollar bill in several different ways. The only criteria is that the dollar bill be divided into 4 equal pieces, and 1 is shaded. Hopefully students will realize that 1/4 of the dollar bill is equivalent, money-wise, to a quarter. This will enable them to find the answer to the second part.

5. **(8 meters and 4 meters)** The students will guess all the pairs of numbers that can be multiplied together to give 32. Then they have to see if the pairs can be added to get a perimeter of 24. Drawing a picture helps.

6. **(50)** This problem is a precursor to solving an equation of the form $3Y + 31 = 181$. Students intuitively know that they can remove the 31 from the scale, and have 3 cans that weigh 150. Dividing 150 by 3 gives that each can weighs 50. So $Y = 50$ solves the equation.

7. **(7 x 12 = 84 or 12 x 7 = 84; 39 x 2 = 78 or 2 x 39 = 78; (20 + 3) x 4 = 92 or (3 + 20) x 4 = 92 or 4 x 23 + 0 = 92)** The problems can be found by using number sense, and estimating mentally. Some students might not use parentheses in writing the last problem. In fact, on most calculators it's not necessary to use parentheses for this problem. However, writing the problem out to be done by hand requires parentheses for without it, *order of operations* would require multiplying 3 x 4 first, and adding that to 20, resulting in 32.

8. **(37)** The numerical pattern for the number of squares is: 1, 5, 9, 13, 17, ... Adding 4 more squares to each figure produces the next figure. Algebraically, if the figure number is n, the number of squares could be written as $4n - 3$.

Commentary

Saturn, V

1. ($\frac{9}{16}$; $\frac{1}{4}$) This is a real world example where students need to find a common denominator to be able to do the problem mathematically. It might be nice to bring such a set of wrenches so that when students turn in their paper, they can actually compare their results with what the wrenches tell them. Some students might solve this problem using real wrenches at home, avoiding the mathematics altogether.

2. (**$12.72**) Find a third of $18, and then subtract that amount to leave $12. Six percent of $12 is $0.72, which is added. Another way to approach the problem is to multiply $12 by 1.06, which gives the total cost, including sales tax.

3. (**1770**) Students can compute 42 x 35 and add that to 12 x 25.

4. (**45**) A corner of a sheet of paper can be placed over the hole where the piece of pizza is being removed. It's easy to see that this hole is about half of the square corner.

5. (**May; 19.05**) For students to be successful, they need to understand that zeros can be added to the right end of a decimal without changing its value. Therefore 9.6 can be thought of as 9.60, and 9.60 is easy to compare with 9.45. It's also easy to add the two, once they have the same number of decimal places.

6. (**4 yd. 2 ft. 2 in.**) Add and get a total of inches, feet and yards. Then convert each measurement to the next highest measurement.

7. (**15**) Candles can be counted in groups of 3. Each group of three candles represents 5 years. The nine candles on the cake give three groups of 3, which corresponds to 15 years.

8. (**d. Justin**) Make a chart. The chart could have four columns across and four down. The top could be labeled gray, green, blue, and white. The side could then be labeled Tia, Matt, Kenya, and Justin. Eliminate things that can't be true, resulting in the final choice.

9. (**3 is circled; 9, 13, 17, 21, 25 or any number 1 more than a multiple of 4; 4**) Hopefully students will notice as they count to find the answers that there is a numerical pattern that underlies these figures. They repeat every four figures, so number 4 will always be like the other multiples of 4 in the pattern. Number 1 will be like the multiples of four plus 1, and so on.

Commentary

Saturn, VI

1. **($\frac{1}{4}$ or 25%, $\frac{3}{4}$ or 75%)** There are four numbers on the spinner. Therefore, the chances of getting 4 is one out of four or 1/4. The chances of not getting a 4 is 3 out of 4, or 3/4. These could also be written as percentages.

2. **(6¢, 15¢, 24¢, 33¢, 42¢, 51¢, and 60¢)** Students can make a chart or list of the possible combinations of coins that would fit the criteria. A chart like the one below might be made:

pennies	6	5	4	3	2	1	0
dimes	0	1	2	3	4	5	6
money	6¢	15¢	24¢	33¢	42¢	51¢	60¢

3. **(80)** Computing inside the parentheses is important. The problem is written so that students can use number sense to compute inside the parentheses easily -- 7.5 is $7\frac{1}{2}$, and $7\frac{1}{2} + 2\frac{1}{2}$ gives 10. Then 8 x 10 is 80.

4. **(Not enough information -- you need to know the cost to mail the sweatshirt.)**

5. **(Measure the student's line. It should be 52 mm.)**

6. **(850; 150; 450)** For (a), find 350 + 300 + 200 or 850. For (b), compute 350 - 200 to get 150. To find (c), add 350 and 300 to get 650, then subtract 200 to get 450.

7. **(2)** This problem can lead to algebraic thinking. A variable *d* is introduced, along with a diagram that students can use to find the value of the variable. They can *guess-check-revise* to find *d*, or solve the situation logically as they would the equation $4d + 3 = 11$, by subtracting 3 from 11 and then dividing what's left by 4. The problem is intended to help students see a real-life situation that would later lead to an equation, and know that in such cases their solution to the equation should make sense in the real world.

8. **(Thursday)** Students can tell from the graph that the total distance did not change on Thursday, because the line was horizontal at that point. Therefore that's the day when she did not ride her bike to school.

9. **(a. 1,020; b. 782)** For (a), multiply the highest number of students per class by 34. For (b), multiply the lowest number of students per class by 34.

Commentary

Saturn, VII

1. **($31\frac{1}{12}$)** Students will need to find a common denominator for the fractions. 12 is the smallest such, although others (24, 36, etc.) would work also. If the fractions are converted into those with denominator 12, they will sum to 25/12 or $2\frac{1}{12}$. When added to the whole number parts, the answer is $31\frac{1}{12}$.

2. **($27.60)** Students can find one-fifth of $34.50 by dividing by 5. They then subtract this from $34.50. Another way would be to find four-fifths (or 80%) of $34.50.

3. **($9.34 and $10.75)** Students will have to use their visual acuity to see the sides of the figures that aren't shown. The top figure has two square faces at $1.49 each, and four rectangular faces at $1.59 each. It's price is given by: ($1.49 x 2) + ($1.59 x 4) = $9.34. The other figure has two triangular pieces at $2.99 each, and three rectangular pieces at $1.59 each. It's total price is given by ($2.99 x 2) + ($1.59 x 3) = $10.75.

4. **(a. > b. = c. > d. <)** In (a), the students can change 1/2 to 0.50 and compare 34.63 to 34.50. In (b), students can think of 1 as 5/5, so by taking 2 whole units from $3\frac{2}{5}$ and changing them into fifths, they would get 10/5. Or, $3\frac{2}{5} = 2\frac{7}{5} = 1\frac{12}{5}$. In (d), students have to realize that 9/100 is smaller than 9/10.

5. **(5 hours 11 minutes)** Count the hours from 8:15 to 1:15, then the minutes from 1:15 to 1:26.

6. **(a. 1,000,000; b. 10,000; c. 1,000)** This is a good problem to check on *number sense* for students. Students who have trouble with (b) and (c) might profit from starting with smaller numbers in similar problems.

7. **(E = 2; F = 1; G = 7; H = 8)** Students might start by noticing several critical features of this problem. E must be either 1 or 2, since the answer does not carry over into the ten thousands place. They might further guess that $E \neq 1$ since this would result in H = 4, and the problem doesn't disallow this, but 4 is already in use so it's not likely. Choose E = 2 and assume H = 8, then, and proceed from there.

8. **(26.46)** Multiplication is called for to find the area of the carpet. 6.3 x 4.2 = 26.46

9. **(How do you keep a turkey in suspense?)** This riddle is a fun way for students to practice finding a fractional part of a set. Some possible answers are "I'll tell you tomorrow!" and "Delay Thanksgiving one day!"

Commentary

Saturn, VIII

1. **(a. true, b. false, c. true)** Perpendicular lines intersect and form right angles. Parallel lines do not cross or intersect. Students can draw diagrams or work with spaghetti to see if these statements seem true to them. For the last one, they might consider the lines on a sheet of notebook paper, for verification.

2. **(6)** This problem can verify if students can use *order of operations*. Work the parentheses first, divide, then add. Notice that if students do this problem left to right, as if entering it in a calculator, they would get the answer 20/3.

3. **(Lisa's stick, by 2 inches)** Lisa's stick is 2/3 of a yard, which is 2 feet. Sandy's is $1\frac{10}{12}$ feet, or 1 foot, 10 inches. 2 feet is longer than 1 foot, 10 inches by 2 inches.

4. **($\frac{3}{8}$)** The square can be divided into eight equal parts. If the square in the lower left corner were partitioned into two parts, three-eighths would be shaded.

5. **(10 hours, 13 minutes)** Adrienne traveled 5 hours, 28 minutes. Erica traveled 4 hours, 45 minutes. The only difficult part is to rename the total minutes, 73, as 1 hour, 13 minutes.

6. **($\frac{2}{18}$ or $\frac{1}{9}$)** There are 18 jellybeans in the bag. Two of them are orange. The chances of pulling out an orange marble would be 2 out of 18. In lowest terms, the answer would be 1 out of 9.

7. **(4 + 3 -7 + [6 ÷ (10 ÷ 5)] is one possibility.)** There may be other solutions. Check each answer. Students may use parentheses.

8. **(2)** Joe gave away 2/3 of six colas, or 4 colas, leaving him 2. Christine gave away half as many as Joe, so she gave away 2 colas, leaving her with 4. So she had 2 more than Joe, in the end.

9. **(5)** The problem will show if some students mistakenly apply the traditional method of solving subtraction word problems -- "*how many left* means to subtract." In this case, the number left is the same as the number who couldn't squeeze into the refreshment stand.

Commentary

Saturn, IX

1. **(2 quarters, 3 dimes, 1 nickel, 2 pennies or 1 half dollar, 2 dimes, 3 nickels, 2 pennies)** Students can experiment with coin values to find the answer. It helps to write down some headings -- half dollars, quarters, dimes, nickels, pennies -- and begin listing coins under them that sum to 87¢, checking to see if you have eight coins. If not, modify the list. Notice that right away, you can tell that you have to have at least two pennies.

2. **(Yes, to the problem below.)** Write this problem on several 3 by 5 cards so students can read the problem privately, estimate, and write their answer down when they hand in their paper:

Martin has $20. He wants to buy a magazine for $3.95, a baseball cap for 5.99, and a cola for 89¢. Will he have enough left to spend $6 on a movie ticket?

3. **(4 green, 2 blue, 3 white)** Finding the least common multiple will help students determine that Jack must buy 12 of each color ornament. An intuitive way for students to find the *least common multiple* is: Start with the largest number, 6, and look at its multiples, 6, 12, 18, and so on. When you find a number that's also a multiple of both other numbers, you've found the *least common multiple.*

4. **(vertical line down the middle, 8)** The "fold line" or *line of symmetry* splits the space ship in half, along the vertical. The area is found by counting 6 whole squares and 4 half squares, for a total are of 8.

5. **(The center number is 5. Numbers in "opposite boxes" total 10)** Students might solve this by guess and check, or they might think of what must be true for 3 numbers to sum to 15. Their average would have to be 5, so start by placing 5 in the center box. Then the other two numbers along each line have to total 10 for the whole line, including 5, to sum to 15. So just pick numbers for "opposite boxes" that sum to 10.

6. **(a. 11 million b. 8.5 million c. 16 million)** Answers may vary somewhat from these given, particularly (b), but they should be close to these numbers.

7. **(a. 3rd from left b. $\frac{3}{4}$ or 75% c. $\frac{1}{4}$ or 25%)** In this problem, the chances of winning are related to the area of the circular space. The white team's space is about $\frac{1}{4}$ of the area of the circle in the 1st and 2nd spinners, and about $\frac{1}{2}$ in the 4th spinner.

Commentary

Saturn, X

1. **(474.25 or 474 1/4 feet, Flights--about 11)** The first part of this problem is simply averaging the four distances given -- 120, 585, 340, and 852. Students might have to look up the number of feet in a mile -- 5,280. They can then divide that number by their average and round off the answer.

2. **(39 or 40 feet)** The scale shows 10 feet. Measuring accurately gives 39.5 feet, so accept an answer anywhere between 39 and 40 feet. It might be interesting to extend the thinking by asking questions such as -- would this plane fit in your classroom? In your garage?

3. **(a. 324 times b. 81)** Students might first find 1/3 of 162 games, then double that amount for 2/3. That answer of 108 is then multiplied by 3, obtaining 324. Very few students will notice that 3 x 2/3 x 162 can be found by simply multiplying 2 x 162. For part (b), students can either find 1/4 of 324 by dividing by 4, or find 25% of 324 by multiplying 324 by 0.25.

4. **(a. 432 ft. b.$694.98)** Students might profit from drawing a sketch of the yard, and labeling the four sides with their lengths. The first answer is obtained by simply adding 96, 120, 96, and 120. The second can be found by dividing 432 by 8 and then multiplying by $12.87.

5. **(4)** It is possible to pull out one of each color marble on the first three draws. Therefore, the fourth marble will match one of the first three.

6. **($95)** Have the problem below written on several 3 by 5 cards for students to read prior to handing in their paper. They must do the problem in their heads, and simply write the answer in the space provided. Number sense will play a role here, as $18.95 is about $1 less than $20. So 5 times $18.95 should be close to 5 x $20, less $5.

> Chris needs to buy five new shirts for a vacation trip coming up over Thanksgiving. The shirts are on sale for $18.95 each. What is the best estimate of what the five shirts might cost?
>
> a. $75 b. $85 c. $95 d. $105

7. **(7)** Students should be encouraged to *guess-check-revise* to find the value of *X*. They might try *X* = 1 to start, and see that this results in less than 18 when used in the left side of the number sentence. So they would adjust their guess up, and continue until they found that *X* = 7 produces 18, when the left side is computed.

8. **(a. $1 b. $2.50 c. $1.50)** Snacks consume 20% of Danny's money, and 20% of $5 is 1/5 of $5, or $1. The graph is divided so that his savings are half of his money, and half of $5 is $2.50. The percent spent on entertainment can be found by adding 50% and 20% to get 70%, and realizing that the rest of the chart must then be 30%. The entertainment money is then 30% of $5, or $1.50.

9. **(a. 60 b. 80)** Drawing a picture might help students interpret what "3 boys for every 4 girls" means. They can put together two such groups and know that "6 boys for every 8 girls" is the same ratio, but with larger numbers. Continuing in this fashion, by using ten such groups, they would have the proper number overall -- 140 students, consisting of 60 boys and 80 girls.