Commentary

Mars, I

1. **(8)** Most students will first add the two groups of marbles they have, 3 and 2, to get 5. The students can then subtract 13 - 5 to find the missing marbles, or use the *counting up* method from 5 to 13.

2. **(95)** The student can use coins to count out the change: 25, 50, 75, 85, 90, 95. The values of each coin can be added for the total: 3 quarters = 75 cents; 1 dime = 10 cents; and 2 nickels = 10 cents, so 75 + 10 + 10 = 95 cents.

3. **($30)** The student can add $7.50 four times or group by two sums of $15. Counting the money like change could be used: $7.50, $15.00, $22.50, $30.00. This leads to the concept of multiplication -- some students might even perform $7.50 X 4 on their calculator.

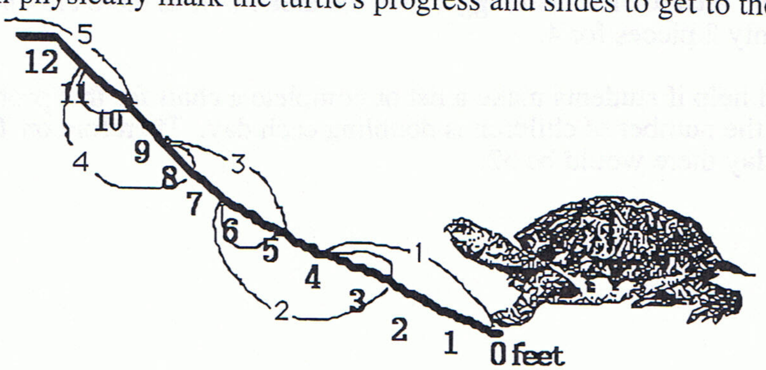
4. **(12, 9, 14)** The repeating pattern is to **add 5**, then **subtract 3**. Once discovered, the student should check to see if the pattern continues on the next few numbers. It does, so they would conjecture that the next three numbers are obtained by: *7 + 5 = 12; 12 -3 = 9; 9 + 5 = 14.*

   Notice that there is no way for the student to be sure they have discovered a pattern that always holds true; also note that students might discover another pattern that would give the numbers 1, 6, 3, 8, 5, 10, and 7, thus arriving at different numbers than 12, 9, and 14.

5. **(15)** The student can *count up* from 8 to 12, or solve 12 - 8 to find that ✻ = 4. Then the student substitutes 4 for the ✻ in ✻ + 11. So, 4 + 11 = 15.

6. **(13)** There are 12 people (6 + 6) in the movie ticket line, excluding Sue. When Sue is counted in the line there would 12 + 1 or 13 people.

7. **(5)** The student can physically mark the turtle's progress and slides to get to the top.



8. **(Tom, Sally, Maria, Bob)** Drawing a picture as each clue is used is a way for the student to find the students places' from tallest to shortest:

Tom is taller then Sally:	Tom Sally
Sally is taller than Bob:	Tom Sally Bob
Maria is taller than Bob but shorter than Sue:	Tom Sally Maria Bob

Commentary

Mars, II

1. **(7, 0, 17, 8)** Students can subtract 7 from the number in column A to get the number in the column B. Students must reverse the thought process to do the last part. The number in B is given, so they must ask themselves "What number, if I subtracted 7, would give me 1."

2. **(59)** Give the students this problem posted where several can read it at one time:

34 + 25 = ?

   and have them write only the answer on their paper.

3. **($0.22)** The class would have to buy 3 small packages of napkins which would cost $2.97. Most students will find this number by adding 99¢ three times, but some might multiply on a calculator. In either case, they must then subtract $2.75.

4. **(15)** Students might first label the two sides of the patio for which they know the length. That would be 20 feet of the 50-foot perimeter. Then students would subtract 20 feet from 50 feet and realize they have 30 feet left for the other two sides. They will use various methods to divide 30 feet into two equal pieces.

5. **(300)** 8 feet is not a reasonable length for a home run. 2,500 feet is also not reasonable, as a mile is about 5,000 feet, so 2,500 feet is about 1/2 mile. 300 feet is reasonable. That's the length of a football field.

6. **(6-3-5-6-2-3-1-2-5 is one solution)** All successful solutions have these in common: they either start at 6 and end at 5, or start at 5 and end at 6. That's because 5 and 6 are the only places in this network that have an odd number of paths going in and coming out.

7. **(a. 3; b. 1)** The area for 3 is twice as much as that for 2, so 3 is twice as likely as a landing for the spinner. The area for 1 is also bigger than the area for 4, as there are three equal sized pieces that make up 1 and only 2 pieces for 4.

8. **(32)** It will help if students make a list or complete a chart for this problem. If so, they will likely notice that the number of children is doubling each day. Therefore on Thursday there would be 16, and on Friday there would be 32.

Commentary

Mars, III

1. **(26)** The student can count up from 19 to 45, or subtract 19 from 45 to get 26.

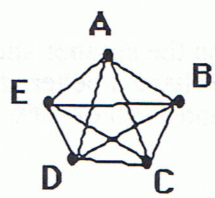
2. **(7:00)** A clock for hands-on exploration would assist the student in adding 30 minutes to find 6:45, then adding 10 minutes to find 6:55, and adding 5 minutes to reach 7:00 AM.

3. **(21)** The student can add 3 groups of 7 or use the multiplication fact, 3 x 7 = 21.

4. **(No)** The student could start at $1.25 and count the change left if buying only the crayons. If 75¢ is left, then the paste for 79¢ would make the cost over $2.00. Most students will simply add $1.25 and $0.79 and realize that $2.04 is more than Drew has.

5. **(21)** The pattern involves adding one more at each step than the step before. Start with 1 on Monday, then add 2 to get Tuesday's total, then 3 for Wednesday's total, then add 4 for Thursday and 5 for Friday, and finally 6 for Saturday. The total is 21.

6. **(10)** This problem resembles the handshake problem. It can be solved by assigning the 5 teams a letter or number and drawing a picture that shows team A plays B, C, D & E; Team B plays C, D, and E (they've already played A). Team C plays D & E as they have already played A and B. Team D plays E. Then the games are added: 4 + 3 + 2 + 1 = 10. Repeated work with this type of problem shows a pattern in the solutions.



AB	BC	CD	DE
AC	BD	CE	
AD	BE		
AE			

7. **(5 coins; 1 quarter, 1 dime, 1 nickel, and 2 pennies)** Some students may choose 4 dimes and 2 pennies (6 coins) to make 42¢. Extra work with using quarters in change will increase their skill with the least amount of coins in making change.

8. **(The answers are shown below.)** Using the concepts of counting up, counting back, or addition and subtraction sense, the missing numbers can be found. Problems B & C involve regrouping ones and tens.

A	B	C
2 **3**	5 4	6 5
+ **4** 6	+ 2 **7**	+ **7** 3
6 9	**8** 1	1 3 **8**

Commentary

Mars, IV

1. **(40)** Students will need good spatial skills to be able to count the cubes that aren't visible, or the students might actually build such a set of steps and count the cubes they use.

2. **(8; +; + or -)**

3. **(25)** The pattern is that the numbers increase by five each time: 5, 10, 15, ... The next two numbers would be 20 and 25.

4. **($15)** There are a number of ways students will solve this problem. One is with a calculator, adding $2.50 six times or possible multiplying $2.50 by 6. Another is that they might add $2.50 plus $2.50 to get $5, and then add $5 three times.

5. **(37)** Students might add the two sides then subtract from 96. Or they might subtract one side from 96, then the other side from the difference. If students have trouble with the problem, encourage them to label the sides of the triangle shown with the two numbers given.

6. **(13)** Students might count by twos for the dark candles, then count by ones for the light candles.

7. **(a. John, Mary, Sue, and Tom; b. 15; c. Mary and Sue; d. 7)** The problem involves reading and interpreting a bar graph.

8. **(girl)** Since the girls have 3 of the equal-sized areas on the spinner and the boys have 2, the girls have more area on the spinner. Therefore the girls have a better chance of winning. There's a 3/5 or 60% chance a girl will win any spin, and a 2/5 or 40% chance that a boy will win.

Commentary

Mars, V

1. **(5,738)** The purpose of this problem is for students to unscramble the place values before writing the answer. Students can use a place value chart to check their number.

2. ($\frac{5}{12}$) There are 12 marbles in the bag. Since there are 5 red marbles, then there is a 5 in 12 chance of pulling out a red marble. "Five in twelve" can be written as the fraction $\frac{5}{12}$.

3. **(7)** The 2 absent students can be removed from 30, which leaves 28. Then the situation becomes a division problem: $28 \div 4 = 7$. The student could use counters or marks to "act out" the last part of the problem -- taking 28 counters and removing them in groups of four, asking *how many groups are removed* -- as many students will not have met division yet..

4. **(9)** Numbering the small rectangles provides an organized way to count them.

1	2
3	4

1 big rectangle - 1&2&3&4
4 small rectangles - 1, 2, 3, 4
4 medium rectangles - 1&2, 3&4, 1&3, 2& 4

5. **(25)** Students might write the numbers less than 40 as they count by 5: *5, 10, 15, 20, 25, 30, 35* . The sum of the digits adding to 7 means that 25 is the number.

6. **(6)** From the top left scale, taking half of each side means that 2 marbles balance 1 tape dispenser. So 2 marbles can be substituted for the tape dispenser in the top right scale, giving that 2 marbles balance 4 pencils. This means each marble balances 2 pencils. Therefore 3 marbles balance 6 pencils. This type of thinking is a precursor to algebraic thinking in that students gain an intuitive notion of substituting equal quantities for other quantities, multiplying or dividing both sides of a balanced situation by the same amount, and so on.

7. **(3)** Dan has \$3.00 left to spend (\$20.00 - \$17.00). Each disk costs 90¢ which is almost a dollar each. So the student reasons he can get 3 disks with the remaining \$3.00. The more advanced student might multiply \$0.90 times 3 which is \$2.70.

8. **(4 measures long; 3 measures wide)** (Paper size being 8 1/2 inches by 11 inches.) Students might mark the length on a piece of paper and use it to measure. Making a small mark at the end of each measure will help them count the number of times they measure.

Commentary

Mars, VI

1. **(8)** Students might find this answer by drawing pictures of hot dogs and labeling each one "2 ounces", and counting by twos until they reach sixteen. The problem also relies on students knowing that 16 ounces is one pound -- many third graders might have to be told this.

2. **(7 + 5 - 9 + 3 = 6 is one solution)** Students can try writing the numbers and signs on small pieces of paper or index cards, and moving them around until they reach a solution. They might try lining up the numbers in a certain order, and just manipulating the signs to see if they can get a number sentence that works. If not, change the order of the numbers and try again.

3. **(83,472)** The problem has students unscramble the order of the numbers given, according to place value.

4. **(28)** The pattern involves increasing the number of cookies by four, for each new grade level.

5. **(40)** The problem tests students' number sense, in that 400 is far too many students for a school bus, and 4 is obviously too few. Therefore 40 is the only reasonable number.

6. **(26)** The four sides can be added together and that sum subtracted from the perimeter. Some students might prefer to subtract each number in turn from the perimeter.

7. **(The figure is shown below.)** The repeating pattern involves adding another vertical line to the circle, and then another horizontal line to the circle, each time you move to the right.

8. **(llama)** There are 4 llama cards and 2 giraffe cards out of the 13 in the box. This problem does not ask directly what is the probability of pulling each card out of the box, but gives a hint that there is some mathematical basis for such a question. The chances of pulling out a llama card is 4/13, while the chances of pulling out a giraffe card is 2/13.

9. **(6)** The problem involves several steps, and is a precursor to algebraic thinking. Students know a hat weighs 3 pounds from the scale on the right. On the scale to the left, the two hats would then weigh 6 pounds out of the 18 total, leaving 12 pounds for the two rabbits. Each rabbit then weighs 6 pounds. In later grades, equations such as "$2r + 2h = 18$ and $h = 3$" might be used to show the existing situations, and students would solve the equations for r.

Commentary

Mars, VII

1. **(3)** The first number in each pair is 4 times the second number. Students who have mastered their multiplication facts might have discovered this pattern. Other students might be having trouble if they are looking for an addition or subtraction relationship.

2. **(9)** Some students might choose to draw marks or use counters. If so, they will find that 8 boxes are needed for 48 golf balls, with 4 balls left over. This means a ninth box is needed.

3. The student should first add to find the sum of the diagonal which has all three numbers showing. Then each box can be solved by adding the two numbers and subtracting to find the missing number. See the magic squares below:

6	1	8
7	5	3
2	9	4

12	7	14
13	11	9
8	15	10

4. **(9, 5)** The *guess and check* method is one that can be used. A quicker method is to think of the fact families of 14.
Then you look for a difference of 4 between the numbers.
The numbers 9 and 5 meet both conditions.

7 + 7 = 14 but 7 - 7 = 0
8 + 6 = 14 but 8 - 6 = 2
9 + 5 = 14 and 9 - 5 = 4 √
10 + 4 = 14 but 10 - 4 = 6

5. **(28)** Students should be encouraged to approach this problem in an organized way. For example, they might count all of the small rectangles first, those made by the individual lines, and get 7. Then they count all the next larger size, those formed by putting two small rectangles together -- this gives 6. They proceed in this fashion, finding 5 of the next size, 4 of the next, then 3, 2, and 1, which is the whole card itself.

6. **(7)** Either *guess-check-revise* or *work backwards* strategies can be used to find the starting number. With *working backward*, you would ask yourself "What number multiplied by 3 gives 30?" The answer is 10. You would then ask "What number, less 4, gives 10?" The answer is 14. Finally, "What number, when 7 has been added, gives 14?" The answer is 7.

7. **(6)** Once students organize their plan, finding these 6 numbers will be easy.
Starting with the 2 as the hundreds digit : 234, 243
Starting with the 3 as the hundreds digit: 324, 342
Starting with the 4 as the hundreds digit: 423, 432
The condition of using each number only once limits the number to 6.

8. **(20, 10, 20)** Students with good number sense can intuitively find half of numbers such as 40 and 20 at this time. Other students might need to actually make 40 or 20 marks on a sheet of paper, or work with cubes or other concrete materials to represent the beads, and divide them into two piles with the same amount in each.

Commentary

Mars, VIII

1. **(b)** The given picture shows a rectangle that is one-half of the square. In (b) the half-circle is one-half of the circle. In (a) and (c), the two shapes are not similar and their areas are not in the same relationship as in the given figure. However, if students choose (a) or (c), listen to their reasons -- they might have used some other logical reason for selecting them.

2. **(The chances are the same that she'll pick either color.)** The question is designed to measure both the child's sense of probability, and their confidence. The confidence factor comes in because the question is asked in such a way that they think they should answer with one particular color.

3. **(356)** The challenge is for the student to put the place values in the correct relationship, before finding the total. Most textbooks show pictures like this, but the tens and hundreds blocks have already been placed in their correct, left-to-right order.

4. **(10)** The students can count by 20's, and get to 80 books on 4 shelves. Therefore 10 books, the difference in 80 and 90, will not have a shelf.

5. **(12 rose and 8 holly bushes)** Students might draw a picture of the nature trail, and sketch and label the five bushes at each stop. They would continue until they have 20 bushes in all, then go back and count the rose and holly bushes separately. Making a chart is another way for students to organize this information.

6. **(25)** Students might make such stacks using index cards or some other manipulative. They can then see physically why the answer is 25. This problem is a physical introduction to the concept of the *mean*.

7. **(first row: 5 4 9; second row: 10 6 2; third row: 3 8 7)** Students can begin this magic square by finding the sum along the diagonal which is complete -- 18. Then they look for rows and columns for which there is one missing number, and knowing the sum must be 18, they can find that number.

8. **(4)** Some students will not know a key fact here, which is that 1 kilogram is 1,000 grams. Once they have been reminded of this, they might think of 251 grams as 250 grams, since the problem involves an estimation. Then 250 and 250 is 500, and another 500 would be 1000. Therefore four cans of soup would be about 1000 grams, or 1 kilogram.

Commentary

Mars, IX

1. **(5)** *Working backwards* is one strategy to use. The student asks, "What number, when I subtract 3, leaves 17?" The answer is 20. Continuing, the student asks, "What number multiplied by 4 gives 20?" The answer is 5. By *working backward* the student arrives at 5.

2. **(a. >; b. >; c. <; d. =)** If students compute on both sides of the box, they'll find in (a) that they get 65 on the left and 61 on the right. For (b), they get 20 and 18, for (c) they get 14 and 23, and for (d) they get 8 and 8.

3. **(4)** The student needs to subtract the 68 students that ride the bus from the total of 84. That leaves 16 students to ride in cars. Since 4 students can ride in each car, counting by 4's will show that four cars are needed.

4. **(at least 9)** This problem can be solved by multiplying 4 x 2, or adding 2 four times, since the doorbell rang 4 times and 2 friends arrived at each ring. But the student must remember to add Gina herself to the 8 friends, so there are at least 9 people at the party -- there may be more than 9 since Gina might have someone else at her home that attends the party.

5. **(43)** The perimeter is found by adding all the sides together. So 8 + 9 + 2 + 14 + 10 are added together to find 43 feet.

6. **(6)** The student needs to substitute 3 ✈'s for each ☎. So ✂✂ = 12 ✈'s. Since there are 2 ✂'s, then each ✂ is worth 6 ✈'s.

7. **($9.00)** The student should use subtraction since the cost of the game is given. The cost is taken from the total spent ($28 - $19 = $9).

8. **(65)** The student can use the number Bill picked -- 23 -- to find Joe's total since Joe picked 8 less (23 - 8 = 15). Tom picked 12 more than Joe's 15, so Tom picked 27 oranges. Adding all of these together gives 65.

Commentary

Mars, X

1. **(2/13; 5/13)** It might help students to draw the correct number of each shape mentioned, then look at them as parts of a total set. 2 figures out of 13 figures are squares; 5 figures out of 13 are circles.

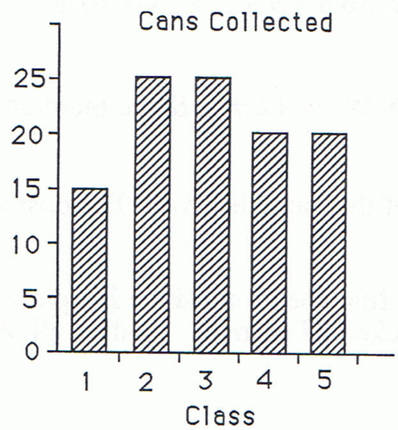
2. **(c)** The figures can be traced and then cut out of paper, for students to set how (c) folds into a box. Students who can do this problem without such an aid have very good spatial sense.

3. **(4; 7)** Line segments do not include curved lines. Therefore 2, 3, and 5 are eliminated.

4. **($2.25)** The problem tests a student's number sense and knowledge of the real world. $10.25 would be too much for twelve pencils -- that would be almost $1 per pencil. Likewise, 10¢ is too little -- that would be less than a penny per pencil. $2.25 is the only reasonable answer -- this would be almost 20¢ per pencil.

5. **(35 minutes)** Students are likely to start at 7:00 and add on a half-hour to get 7:30, and then add on the other intervals individually to arrive at 7:55 when she's through. This leaves her 5 minutes till 8:00 arrives to read, and 30 minutes after that, totally 35 minutes.

6.



7. **(21)** The problem is an intuitive introduction to finding the mean of a collection. At this point, students will simply add the number of cans together to get 105, then use their intuition and number sense to divide 105 cans into 5 groups. One concrete way would be to make 105 marks on their paper and divide these marks fairly. A more sophisticated strategy would be to estimate that each group would have 20, which would be 100 marks altogether, then distribute the remaining five marks.

8. **(128)** Have the problem 4 x 32 written on chart paper or index cards so that several students can see it at the same time, when they turn their papers in. They have to do the problem mentally, and put their answers correctly on their papers.

9. **(8)** This problem is an introduction to the concept of *ratio*. Students might find the answer by drawing the tables and placing the right number of markers on each, until they have used up 24 markers. This would require four tables. Then they would draw 2 pieces of poster board on each table.