# Puzzle Corner

## Y2K M

## (Yes to Keen Math)

**by Michelle Youngs**

In this time of misplaced millennial madness (the new millennium does not begin until January 01, 2001), we thought we would offer a different twist on all of the Y2K scares that have been going around. *Y2K M* is a new puzzle that is guaranteed to work this year, and this year only. WARNING: Do not attempt to do this puzzle in 1999 or 2001 or disastrously incorrect solutions will occur!

As with all Y2K compliant products, careful operation of this puzzle is *necessary* to insure successful results. As your students say "Yes!" to keen math, they will perform five operations on a number between one and seven, ending up with a three digit number. The first digit of this number will be the number they started with, and the second two digits of this number will be their age. This amazing result is guaranteed with any person of any age as long as all specified instructions are followed. The AIMS Education Foundation cannot be responsible for puzzle misuse.

And if *Y2K M* isn't enough, we have another exciting item for you and your students: *Y2K W*. Also guaranteed to work for the year 2000, *Y2K W* can be done after students have completed work on *Y2K M* and are ready to explore the "Why" behind *Y2K M*. Remember, this is a limited time offer, so act now; don't let this chance to give your students two great problems pass you by!

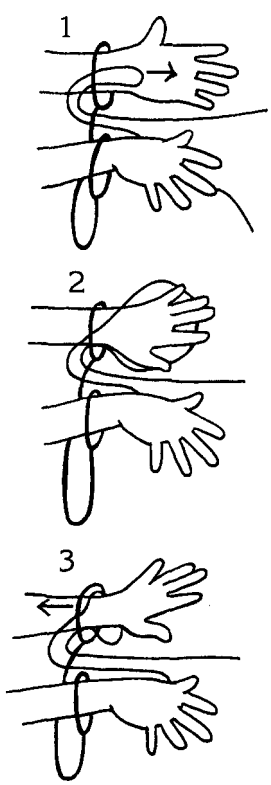
Solutions

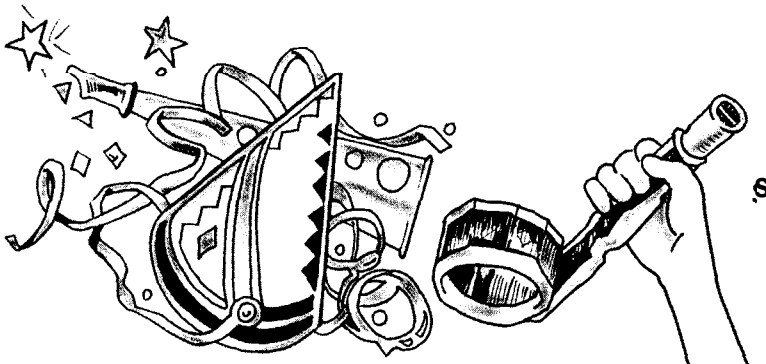
Following are two solutions (out of many) for the October, 1999 puzzle called *A-point-ing Pennies*.

| Move | Point | to Point |
|---|---|---|
| 1 | 5 | 3 |
| 2 | 8 | 5 |
| 3 | 2 | 8 |
| 4 | 4 | 2 |
| 5 | 10 | 4 |
| 6 | 6 | 10 |
| 7 | 1 | 6 |
| 8 | 7 | 1 |
| 9 | 9 | 7 |

| Move | Point | to Point |
|---|---|---|
| 1 | 7 | 1 |
| 2 | 10 | 6 |
| 3 | 9 | 7 |
| 4 | 4 | 10 |
| 5 | 3 | 9 |
| 6 | 2 | 4 |
| 7 | 5 | 3 |
| 8 | 8 | 5 |
| 9 | 8 | 2 |

This is the solution for *Linking Loops* puzzle found in the December, 999 magazine.

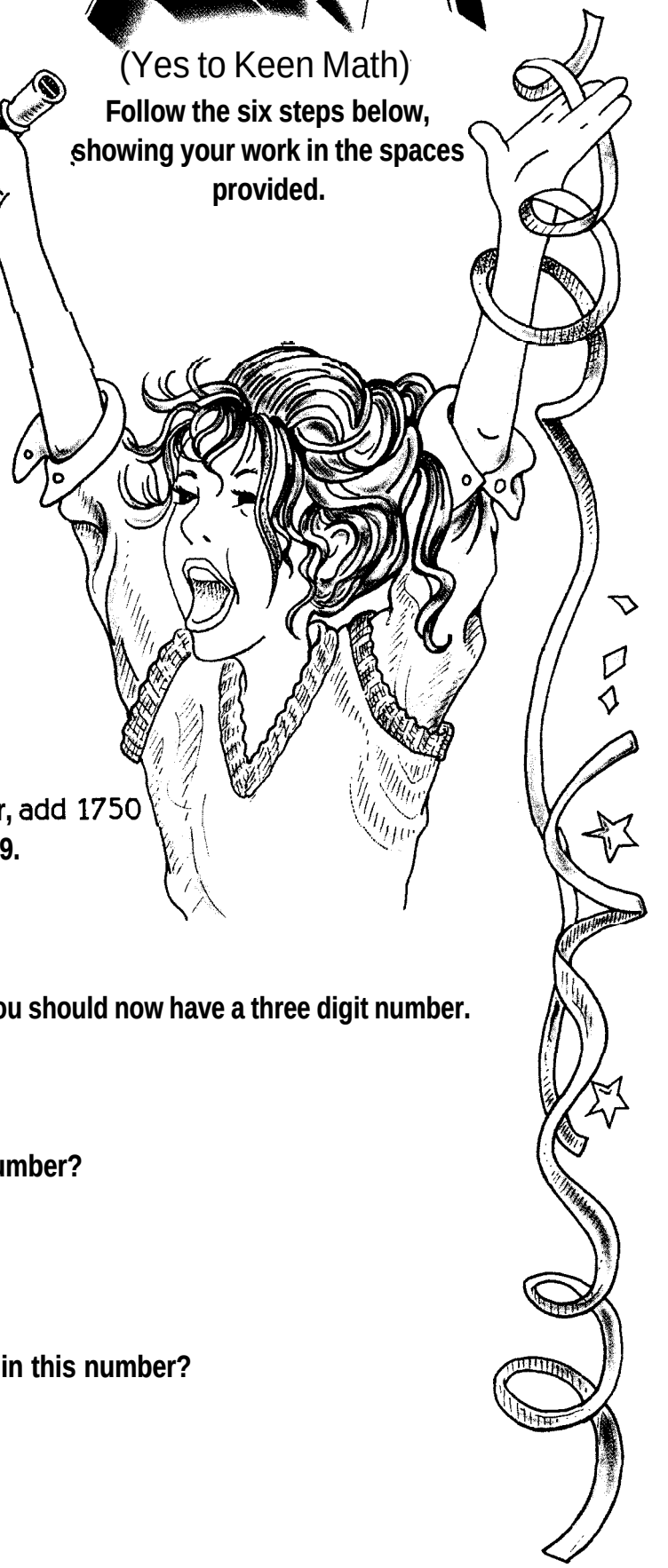




# Y2K M

(Yes to Keen Math)

**Follow the six steps below, showing your work in the spaces provided.**



1. **Pick your favorite number from one to seven.**

2. **Multiply this number by two.**

3. **Add five to the above product.**

4. **Multiply this sum by 50.**

5. **If you have already had your birthday this year, add 1750 to the above product. If you haven't, add 1749.**

6. **Subtract the four digit year that you were born. You should now have a three digit number.**

**What do you notice about the first digit in this number?**

**What do you notice about the second two digits in this number?**

# Maximizing Math

## Y2K W

## (Yearn to Know Why)

**by Michelle and Dave Youngs**

This month's *Maximizing Math* is meant to be done as a follow-up and extension to the *Puzzle Corner* activity. If students have not yet done *Y2K M*, they will need to do so before beginning *Y2K W*.

The challenge in this activity is for students to explain why the *Y2K M* puzzle works. This can be done at various levels of sophistication, depending on the abilities of your students. The most advanced students can come up with an algebraic generalization and then create their own puzzles. Younger students may only be able to give a simple explanation based on the patterns they see.

There are both open-ended and structured versions of this problem. The open-ended version merely asks students to determine why *Y2K M* works without giving any guidance. The structured version has a table for students to complete listing all of the possible answers to each of the steps in the problem. They can then look at the patterns and formulate their explanations. There is a third student sheet with questions that should be given to students using either version. These questions will help students focus their thinking and extend their explanations beyond this puzzle, which only works this year.

| Step | Possibilities | | | | | | |
|---|---|---|---|---|---|---|---|
| # 1 - 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| x 2 | 2 | 4 | 6 | 8 | 10 | 12 | 14 |
| + 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 |
| x 50 | 350 | 450 | 550 | 650 | 750 | 850 | 950 |
| + 1750 | 2100 | 2200 | 2300 | 2400 | 2500 | 2600 | 2700 |
| + 1749 | 2099 | 2199 | 2299 | 2399 | 2499 | 2599 | 2699 |

In order to understand how this problem works, let us examine what is done to the original number in order to get the end result. In five steps, the original number is multiplied, added to, and subtracted from. The number is multiplied twice-once by two and once by 50. This means that it is multiplied by a total of 100, which has the effect of moving it over two decimal places. The original number has things added to it twice-once it gains five (which becomes 250 in the next step when it is multiplied by 50), and once it gains 1750 (or 1749). This gives a four digit number in which the last two digits are the same as those in the current year (or the year just before), and the first two digits are 20 (or 19) more than the original number.

This leaves the final step, which is subtracting the birth year of the person doing the problem from the total after the fifth step. Because the final two digits of the number in step five are those of the current year, and the first two digits are either 19 or *20* more than the original number, subtracting your year of birth leaves you with your age in the final two digits, and the original number in the first digit.

As you can see, to adjust this problem to work in any year, simply change the number that is added to the original number in step five. In 1999, you would have added 1749 if your birthday had already occurred, and 1748 if your birthday had not. In 2001, you would add 175 1 if your birthday had occurred, and 1750 if it had not.

The process described above can be shown algebraically as follows:

| Step | Instructions | Algebraic Representation |
|---|---|---|
| 1 | Choose a # from one to seven | x |
| 2 | Multiply by two | 2x |
| 3 | Add five | 2x + 5 |
| 4 | Multiply by 50 | 50(2x + 5) = 100x + 250 |
| 5 | Add 1750 (1749) | 100x + 2000 (100x + 1999) |

When the problem is broken down in this way, it is easy to see that the number in step five is the current year (or the year just before) plus 100 times the original number. Given this generic formula for reaching the target solution, it is easy to see how the original problem can be modified and still work in the same way.

Try the following: Choose a number from one to seven (x). Multiply the number by four (4x). Add seven to this product (4x + 7). Multiply this sum by 25 (25 [4x + 7] = 100x + 175). Add 1825 to this product (1824 if your birthday has not yet happened this year) (100x + 175 + 1825 = 100x + 2000). Subtract the year you were born. You should be left with a three digit number in which the first digit is the number you started with, and the last two digits are your age.

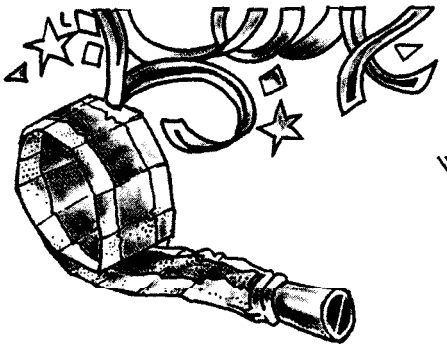
As you can see, the algebraic result of the problem above is the same as the original problem, but the steps used to reach it were different. While it is unlikely that students will be able to reach this level of sophistication in their explanations, they should still be able to give basic reasons for why the problem works. Your complete understanding of the explanation will help you guide their thinking and ask appropriate questions to help them in their discovery.

I hope you and your students enjoyed our two limited time offers for guaranteed year 2000 puzzles. If you have any questions or comments, feel free to write us here at AIMS: PO. Box 8120, Fresno CA 93747 or by email: meyoungs@fresno.edu or dyoungs@fresno.edu.

## Head *in the Clouds* Revisited

Have you ever looked up at the sky and wondered how high the clouds were? That is the intriguing idea behind the activity, *Head in the Clouds*, found in the October 1999 issue of *AIMS*. The dry adiabatic lapse rate applied in this activity is useful for estimating the *general* height of low clouds, those formed from rising air that originates near the Earths surface. And a general idea of height is all that is normally needed. Because the method can easily be committed to memory, it is also more likely to be used in continuing informal cloud observations.

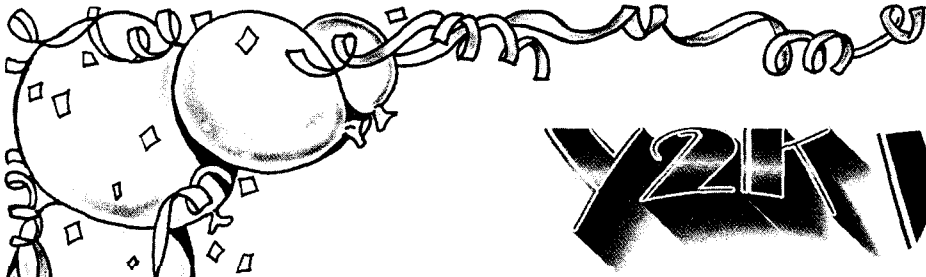
For those who wish to make a more precise estimate of the height of low clouds, another variable needs to be taken into account: dew point decreases 1°F per 1000-foot rise in altitude (1°C per 550-meter rise). To incorporate this variable, add a dew point temperature column next to the air temperature column on the graph and mark the cloud height where the two temperatures coincide.



# Y2K W

## (Yearn to Know Why)

Now that you have solved *Y2K M*, your challenge is to determine why it works. Show all your work in the space below, using the back of your paper if necessary.



## (Yearn to Know Why)

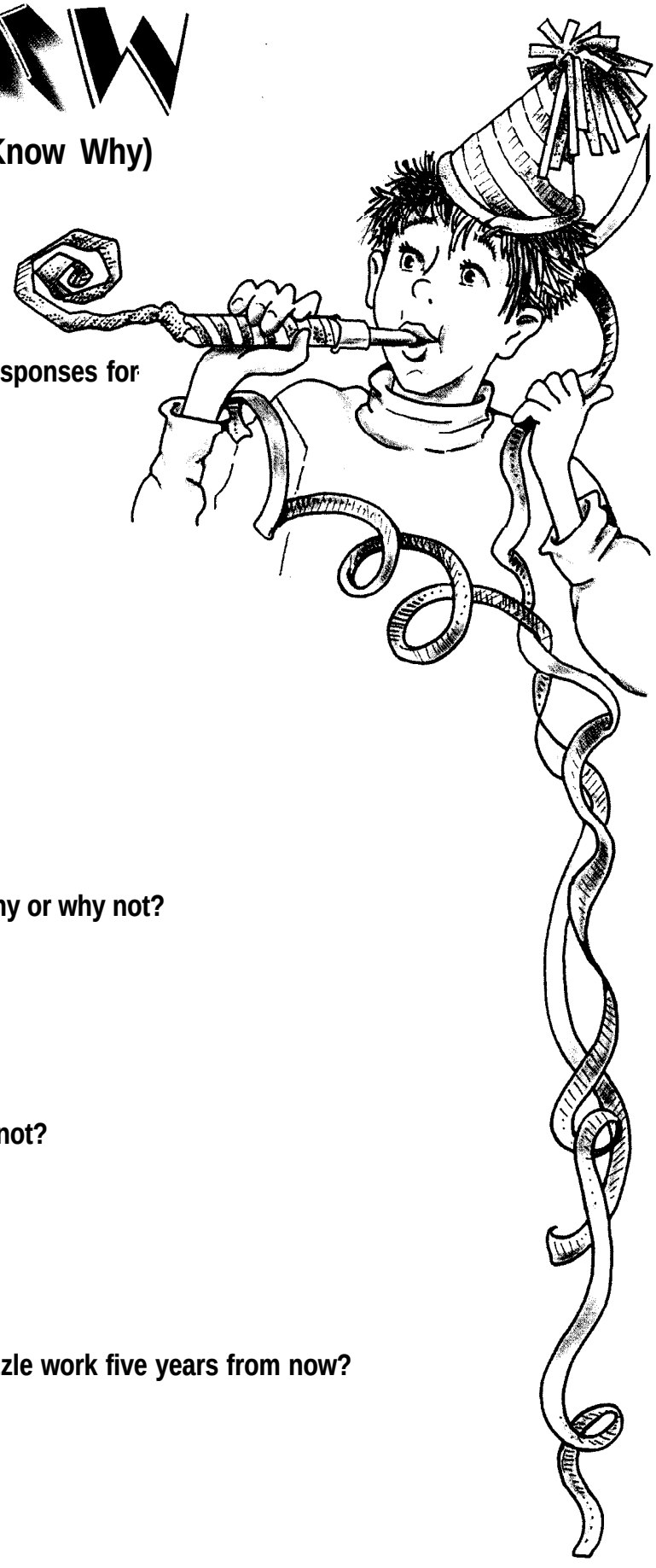
Now that you have solved *Y2K M*, your challenge is to determine why it works. To help you do this, complete the table below by recording each possible answer for all of the steps. The first one has been done for you as an example. After studying the answers, formulate your explanation for why the puzzle works, and record It at the bottom of the page, using the back of the paper if necessary.

| Step | Possibilities | | | | | | |
|---|---|---|---|---|---|---|---|
| # 1 - 7 | 1 | | | | | | |
| x 2 | 2 | | | | | | |
| + 5 | 7 | | | | | | |
| x 50 | 350 | | | | | | |
| + 1750 | 2100 | | | | | | |
| + 1749 | 2099 | | | | | | |

This puzzle works because:

# YKW

**(Yearn to Know Why)**



**Answer the following questions after you have completed your explanation.**

1. **What patterns do you see in the possible responses for each of the questions? Be specific.**

2. **Would this puzzle have worked last year? Why or why not?**

3. **Will this puzzle work next year? Why or why not?**

4. **What would you have to do to make this puzzle work five years from now? Justify your response.**