2/28/11

Square and Chop!

Here's another fun iterative procedure. This is simpler than RATS for two reasons. First of all, there are only 100 possible seeds, not an infinite number. Second of all, the "destiny" of each seed is usually pretty short. For these reasons it's possible for a student (or better yet, a team of students) to understand and map this whole universe. Start with any number from 0 to 99. Square your number. (That is, multiply it by itself.) Then divide by 100 and take the remainder. (This is the same as saying, chop the number between the tens and hundreds columns, and take the two digits on the right.) Repeat!

For example, start with 84. $84^2 = 7056$. 7056/100 leaves remainder 56. So now we repeat with 56. $56^2 = 3136$. So 36 is our next number. And we keep going! Can you work in a group and find out what happens with every possible seed? Try to make a well organized diagram to show all your work. If you wish, explore what will happen if you divide by a different number, such as 10, 11 or 12. (With 12, for example, your starting numbers will be from 0 to 11.)

In Square and Chop we can be sure every number will eventually go into a cycle or reach a fixed point. Why is that? Is the same thing true in RATS?

Can you invent an iterative procedure of your own?

Have fun!

2/28/11

Time!

1) Reggie went out for a walk at 11:40 AM. He walked for an hour and a half. What time was it when he came home?

2) Heather starts school at 8:45 AM and finishes at 4:20 PM. How long is she in school?

3) It takes a pump eight hours to empty a big tank. How long will it take to empty the tank if we use four of the same pumps?

4) It takes a teenager one hour to clean a room. How long will it take a team of four teenagers to clean the same room? Explain your answer fully!

5) Ronnie left home to go on a trip on a Monday. She returned on a Tuesday. How long was she away?

6) What is the angle between the hour and minute hands at three o'clock? At 3:30?

7) What is the angle between the hour and minute hands at 12:05? (Be careful!)

8) It takes eight hours to fill a swimming pool using pipe A. Using pipe B it takes five hours. How long will it take if we use both pipes?

9) A band is playing a dance tune that is 32 measures long. Each measure has two beats. The band is playing at 120 beats per minute. How long will it take the band to play the tune once through?

10) A prankster switched the hour and minute hands on a clock. So now when it's really five o'clock, the *hour* hand is pointing to the 12 and the *minute* hand is pointing to the 5. Now that is something you can never see, at any time, on a real clock. In fact most of the time this reversed clock will show the hands in positions that are impossible on a real clock. Here's the question: when will the reversed clock show readings that a real clock could also show?

11) Why do we have leap years? Why do we have leap seconds?

12) On Tuesday, September 20, 1519, Ferdinand Magellan left Spain with five ships in an attempt to sail around the world. His fleet sailed west through the Atlantic, rounded the southern part of South America (through the strait now named *Magellan*) and entered the Ocean to which he gave the name *Pacific*. Magellan died in battle in the Philippines, but the expedition continued westward around the world past India and Africa. After many misadventures, just one ship, with eighteen sick and starving men aboard, returned to Spain on Sunday, September 7, 1522, after a round-the-world journey of almost three years. But wait! An Italian member of the expedition, Antonio Pigafetta, had kept a daily journal of the voyage. Both his journal and the ship's log said it was September 6! Explain that missing day!

13) Have fun!