Guess the Number, continued

II. Guess the Operation

For each of the following activities, begin by performing the procedures with a few different starting numbers. Try to guess the arithmetic operation relating the original and final numbers. (For example, if you start with 5 and end with 20, it could be add 15, or it could be multiply by 4, or it could be square and subtract 5, etc.)

After making your guess, write out the series of calculations with some starting number in a box (as in Part I) to see if you can verify your guess and **explain why** it is correct.

1. **An Easy Start?**

   Step 1: Pick a number.

   Step 2: Double the number.

   Step 3: Add 4 to the result.

   Step 4: Subtract the number that you started with.

   Step 5: Subtract 9 to obtain the final number.

   How is the final number related to the starting number?
   Verify your guess and **explain why** this happens.

2. **A Little More Complicated.**

   Step 1: Pick a number.

   Step 2: Multiply the number by 6.

   Step 3: Add 13 to the result.

   Step 4: Multiply this by 2.

   Step 5: Subtract 2.

   Step 6: Divide the result by 6.

   Step 7: Subtract the number that you started with to obtain the final number.

   How is the final number related to the starting number?
   Verify your guess and **explain why** this happens.

3. **Even More Fun?**

   Step 1: Pick a number.

   Step 2: Add 3 to the number.

   Step 3: Multiply the result by the number you started with.

   Step 4: Divide the result by 2.

   Step 5: Add 5.

   Step 6: Multiply the result by 2.

   Step 7: Subtract 3 times the number you started with to get the final number.

   How is the final number related to the starting number?
   Verify your guess and **explain** why this happens.

Guess the Number, continued

III. Algebra Based "Tricks"

The following "magic tricks" can be explained using algebra. Try a few examples and see if you can come up with a general explanation.

1. **Card Trick**

   Step 1: Find a standard deck of 52 cards.

   Step 2: Turn 20 cards face up, leaving the rest face down.

   Step 3: Shuffle the deck thoroughly, being careful not to reverse any cards.

   Step 4: Take 20 cards from the top of the deck (or from the middle or bottom, if you prefer).

   Step 5: Turn this deck of 20 cards over.

   Step 6: Count the number of FACE UP cards in the 32 card deck and in the 20 card deck.

   Explain why both decks have the same number of FACE UP cards.

2. **Book of Matches**

   Step 1: Take a standard book of matches (20 total matches).

   Step 2: Pull out any number between 1 and 9 of these matches.

   Step 3: Add up the two digits of the number of matches left over.

   Step 4: Pull out this many more.

   Explain why the number of matches left in the book must always be 9.
   (You should also probably explain why you're playing with matches in class!)