PALINDROMES AND MATH MAGIC

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1. Did You Get The Same Color?

Let's begin with a simple magic trick.

Problem 1.1. *Pick any number between 1 and 10. Then perform the following steps (show your work on the side!)*
(1) Take your number, and multiply it by 2.
(2) Take that number, and subtract 1 from it.
(3) Take that number and multiply it by 9.
(4) Then take the digits of the number, and add them together. For instance, if you get 43, you would now have 4 + 3 = 7.
(5) Look at the phrase below. Pick the letter in the phrase corresponding to the number you now have;
<div align="center">

Like a pony he ran away
</div>

For instance, if you had 7 at this point, you would pick the letter "o".
(6) Think of a color that begins with that letter.
When both of you and your neighbor have gotten your colors, compare your answer with your neighbor. Do you have the same color? How did the magic trick work?

Definition 1.2. A number "a" is said to be divisible by "b" if "b" completely divides "a" without leaving any remainder.

Problem 1.3. *Answer in "yes" or "no" with reasons.*
(1) Is 8 divisible by 2?
(2) Is 27 divisible by 9?
(3) Is 35 divisible by 8?
(4) Is 132 divisible by 11?

Fact
"All multiples of a number are divisible by that number."

Problem 1.4. *Answer in "yes" or "no" with reasons.*
(1) We know that 36 is multiple of 9. Is it divisible by 9?
(2) We know that 48 is multiple of 12. Is it divisible by 12?
(3) We know that 77 is multiple of 11. Is it divisible by 11?
(4) Is 9a divisible by 9?

Date: October 27, 2014.

Fact

"A number is divisible by 9 if and only if the sum of it's digits is divisible by 9."

Problem 1.5. *Answer in "yes" or "no" with reasons.*
(1) *Is 54 divisible by 9?*
(2) *Is 468 divisible by 9?*
(3) *Is 658 divisible by 9?*

Can you now see how did the magic trick work?

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