Hi guys,
This is in conjunction with another post which has questions dealing with remainders (collection-of-remainder-problems-in-gmat-74776.html). I'm just trying to put together a list of tips and tricks which we can use to solve these kind of problems with greater accuracy and speed. Please feel free to comment and make suggestions. Hopefully we can add onto this list and cover all sorts of strategies that would help us deal with remainders!
Cheers.

Please read this first :

1) Take your time with these points. Some of them might be a little difficult to follow in the first reading, but don't give up. The concepts are fairly simple.
2) These tips if mastered will be extremely valuable in the GMAT to help solve a variety of questions not limited specifically to remainders. I have been using them for quite a while now and they have not only helped me improve my accuracy but also my speed.
3) If you have any doubts, please do not hesitate to ask (no matter how stupid you might think them to be!). If you do not ask, you will never learn.
4) Lastly, have fun while trying to understand these tips and tricks as that, according to me, is the best possible way to learn.

All the best!

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NOTE: Where ever you see R of 'x' it just stands for Remainder of x.

1) The possible remainders when a number is divided by ‘n’ can range from 0 to (n-1).

Eg. If n=10, possible remainders are 0,1,2,3,4,5,6,7,8 and 9.

2) If a number is divided by 10, its remainder is the last digit of that number. If it is divided by 100 then the remainder is the last two digits and so on.

This is good for questions such as : ' What is the last digit of…..' or ' What are the last two digits of…..' .

3) If a number leaves a remainder ‘r’ (the number is the divisor), all its factors will have the same remainder ‘r’ provided the value of ‘r’ is less than the value of the factor.

Eg. If remainder of a number when divided by 21 is 5, then the remainder of that same number when divided by 7 (which is a factor of 21) will also be 5.

If the value of 'r' is greater than the value of the factor, then we have to take the remainder of 'r' divided by the factor to get the remainder.

Eg. If remainder of a number when divided by 21 is 5, then the remainder of that same number when divided by 3 (which is a factor of 21) will be remainder of 5/3, which is 2.

4) Cycle of powers : This is used to find the remainder of n^x, when divided by 10, as it helps us in figuring out the last digit of n^x.

The cycle of powers for numbers from 2 to 10 is given below:

2: 2, 4, 8, 6 → all 2^{4x} will have the same last digit.

3: 3, 9, 7, 1 → all 3^{4x} will have the same last digit.

4: 4, 6 → all 4^{2x} will have the same last digit.

5: 5 → all 5^x will have the same last digit.

6: 6 → all 6^x will have the same last digit.

7: 7, 9, 3, 1 → all 7^{4x} will have the same last digit.

8: 8, 4, 2, 6 → all 8^{4x} will have the same last digit.

9: 9, 1 → all 9^{2x} will have the same last digit.

10: 0 → all 10^x will have the same last digit.

5) Many seemingly difficult remainder problems can be simplified using the following formula :

$$Rof\frac{x*y}{n} = Rof\frac{(Rof\frac{x}{n})*(Rof\frac{y}{n})}{n}$$

Eg. $Rof\frac{20*27}{25} = Rof\frac{(Rof\frac{20}{25})*(Rof\frac{27}{25})}{25} = Rof\frac{(20)*(2)}{25} = Rof\frac{40}{25} = 15$

Eg. $Rof\frac{225}{13} = Rof\frac{(15)*(15)}{13} = Rof(2)*(2)13 = Rof\frac{4}{13} = 4$

6) $Rof\frac{x*y}{n}$, can sometimes be easier calculated if we take it as $Rof\frac{(Rof\frac{(x-n)}{n})*(Rof\frac{(y-n)}{n})}{n}$

Especially when x and y are both just slightly less than n. This can be easier understood with an example:

Eg. $Rof\frac{(19)*(21)}{25} = Rof\frac{(-6)*(-4)}{25} = 24$

NOTE: Incase the answer comes negative, (if x is less than n but y is greater than n) then we have to simply add the remainder to n.

Eg. $Rof\frac{(23)*(27)}{25} = Rof\frac{(-2)*(2)}{25} = -4.$ Now, since it is negative, we have to add it to 25. $R = 25 + (-4) = 21$

[Note: Go here to practice two good problems where you can use some of these concepts explained : numbers-86325.html]

7) If you take the decimal portion of the resulting number when you divide by "n", and multiply it to "n", you will get the remainder.

[Special thanks to h2polo for this one]

Note: Converse is also true. If you take the remainder of a number when divided by 'n', and divide it by 'n', it will give us the remainder in decimal format.

Eg. $\frac{8}{5} = 1.6$

In this case, $0.6 * 5 = 3$

Therefore, the remainder is 3.

This is important to understand for problems like the one below:

If s and t are positive integer such that s/t=64.12, which of the following could be the remainder when s is divided by t?

(A) 2

(B) 4

(C) 8

(D) 20

(E) 45

OA :