



# Math Olympiad and Problem Solving Programs

F130 - Advanced Problem Solving

Problem Set 21.1 - Period

Name:

Date:

1.
2.  or
3.  $0.\overline{428571}$
4.  or
5. (a)  (b)  (c)
6. Let's continue the pattern until we find a repetition.

1, 9, 8, 9, 2, 8, 6, 8, 8, 4, 2, 8, 6, 8, 8, ...

So we've found a pattern. After the first 4 numbers (1, 9, 8, 9), there is a pattern of 6 digits (2, 8, 6, 8, 8, 4) that will continue repeating forever. To find the 2011th number in the pattern, we need to first subtract 4:  $2011 - 4 = 2007$ . So after the first 4 digits, we need to find the 2007th digit in the repeating part. So we divide 2007 by 6, which is 334 remainder 3. So the pattern will continue 334 times, and then the remainder 3 tells us that the 2007th digit will be the 3rd in the pattern. The pattern is 2, 8, 6, 8, 8, 4, and the third number in this pattern is

7. If we divide 123 by 12 (how many chairs there are), we get 10 remainder 3. So if the player starts in Chair 1, he makes 12 hops around the circle 10 complete times with remainder 3 hops, so he hops to chair 1, chair 2, chair 3. So he lands on Chair 3 at the end of the first song. For the second song, we divide 231 by 12 and get 19 remainder 3. So he starts at chair 3, hops to chair 2, chair 1, and all the way around 19 times, and then he hops another 3 chairs back to Chair 1. Now for the third song, we divide 312 by 12 and get 26, no remainder. So that means the player makes 26 full turns. If he starts on chair 1, he lands on the last chair in the circle, or chair . Another interpretation of the problem leaves you with  as the last chair.
8. Note: a point was taken off this problem for not typing up your answers on a separate piece of paper.
  - (a)
  - (c) Obama is an . Depending on which calendar you use, Mrs. Obama could be a  or a .