

# Math 187A - Quiz 1 Corrections

## Problem 9

Q: In year N-1, the 200th day of the calendar year is a Monday. In year N, the 100th day of the calendar year is again a Monday. On what day of the week will the very last day of calendar year N+1 fall? Explain.

### A) (correct solution)

> Assuming years N-1, N, and N+1 are NOT leap years.

Let  $n$  = days since year N-1 started

- (including the first day - i.e.  $n = 1$  corresponds to day 1 of year N-1)

KEY DATES (assuming no leap years)

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$n = 1$	:	1st day of year N-1
$n = 200$	:	200th day of year N-1
$n = 365$	:	last day of year N-1
$n = 365+1 = 366$	:	1st day of year N
$n = 365+100 = 465$	:	100th day of year N
$n = 365+365 = 730$	:	last day of year N
$n = 730+1 = 731$	:	1st day of year N+1
$n = 730+365 = 1095$	:	last day of year N+1

Each  $n$  can be represented as

$$n = 7w + d$$

Where:

- $w$ : represents weeks passed since N-1 started ( $w = 0$  for  $n=0$  through  $n=6$ )
- $d$ : day of the week (will discover correspondance later)

We know that it is Monday for  $n=200$  and  $n=465$

$$\begin{aligned} 200 &= 7(28) + 4 \\ 465 &= 7(66) + 3 \end{aligned}$$

Here we find out that the assumption of no leap years was incorrect. In order for (200th day of year N-1) and (100th day of year N) to land on the same  $d$  (day of the week), their respective values would've had to be  $n=200$  and  $n=466$  ; In order for this to be true, then year N-1 must've been a leap year and the KEY DATES chart would've had to be re-arranged as so:

KEY DATES (N-1 is a leap year)

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n = 1           : 1st   day of year N-1
n = 200         : 200th day of year N-1
n = 366         : last   day of year N-1
n = 366+1 = 367 : 1st   day of year N
n = 366+100 = 466 : 100th day of year N
n = 366+365 = 731 : last   day of year N
n = 731+1 = 732  : 1st   day of year N+1
n = 731+365 = 1096 : last   day of year N+1
```

Now, the given statements match up:

$$200 = 7(28) + 4$$
$$466 = 7(66) + 4$$

We now know that the (200th day of year N-1) and (100th day of year N) occurred on the 4th day of the week, which was given to be a Monday. This lets us generate this day of week chart:

```
Day of Week
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d = 4 : Monday
d = 5 : Tuesday
d = 6 : Wednesday
d = 0 : Thursday
d = 1 : Friday
d = 2 : Saturday
d = 3 : Sunday
```

Finally, we were tasked with finding the day of week that the last day of year N+1 (  $n=1096$  ) would fall on:

$$1096 = 7(156) + 4$$

This tells us that the last day of year N+1 would also fall on the 4th day of the week, which we know corresponds with Monday.

Final answer: The last day of year N+1 would fall on a **Monday**

## B) (What was wrong with solution on quiz / misunderstood key concepts)

1. Assumed no leap years
2. Miscalculated values of  $n$  in my original work, which masked the misalignment that would've revealed the inability to assume no leap years
3. A bunch of arithmetic + logic errors
  - Stated  $n=366$  corresponded with (day 1 of year N) and  $n=466$  corresponded with (day 100 of year N) which is a contradiction: 366 and 465 would correspond or 367 and 466 would correspond
  - Stated  $n=731$  corresponded with (day 1 of year N+1) and  $n=995$  corresponded with (last day of year N) must've mean to add 364 to 731 but accidentally added 264 to 731

## **C) Resources used**

- VSCode to write this markdown file (cleaner + faster than handwriting)
- Calculator (HP Portable Prime -- resorted to a Graphing Calc since I seemed to have misplaced my TI-86X pro)
- Time (I rushed through the quiz on Friday to go to the bathroom)