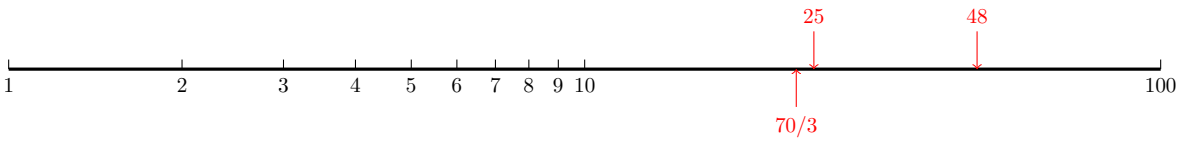
Math 111 - Midterm 1 Review Solutions and Hints

- #1 Hint: Your answer should specifically refer to the **areas** of the squares in the picture. The theorem says something very concrete about the areas of the squares. What is it?
- #2 Solution: For a number to be divisible by 300, it must pass the divisibility test for 3 and end in two zeros.
- #4 Solution: Rational numbers can be expressed as a ratio of two integers, irrational numbers cannot.
- #5 Solution: Rational numbers always eventually repeat when they are written as decimals. Irrational numbers never repeat.
- #8 Solution: The scaling factor is $s = 2$, and the volume grows by a factor of $s^3 = 8$. If you have 8 times as much volume, but you are made of the same stuff, then you would be 8 times as heavy. So the solution is $8 * 200 = 1600$ lbs.
- #10 Hint: The number of dots depends on the area. If the scaling factor is 3, then what is the area growth factor from the first shape to the second shape?
- #11 Solution: $-13 \equiv -2 \equiv 9 \equiv 20 \equiv 31$ (modulo 11). So the first 3 positive numbers equivalent to -13 are 9, 20, and 31
- #14(a) Solution: Using the divisibility test for 3 gives $3+5+6+4 \equiv 18 \equiv 1+8 \equiv 9 \equiv 0 \pmod 3$.
- #14(b) Solution: Using the divisibility test for 11 gives $3-2+7-5+6-3 \equiv 6 \pmod{11}$.
- #14(c) Hint: What is the divisibility test for 9?
- #16 Solution: 100 days from now would be Wednesday. 777 days from now would be Monday.
- #17 Solution: Let x be the day of the week now. Then we have $216 + x = 5 \pmod 7$. We can replace 216 by 6 since 216 mod 7 = 6 so we get $6 + x \equiv 5 \pmod 7$. $x = -1 \equiv 6 \pmod 7$. So $x = 6$. That means that today is Saturday.
- #22 Solution: If you did it correctly, your answers should line up exactly with the arrows below.



- #23 Solutions: (a) 300% increase, (b) 30% increase, (c) 60% decrease, (d) 170% increase.

- #25 Solution: The growth factors are 1.1 and 0.9 respectively. You can multiply these together without a calculator several ways. Here is one:

$$1.1 * 0.9 = 11 \times 10^{-1} * 9 \times 10^{-1} = 99 \times 10^{-2} = 0.99$$

  Since 0.99 is the total growth factor for the last two years, as a percentage change it is a 1% decrease.