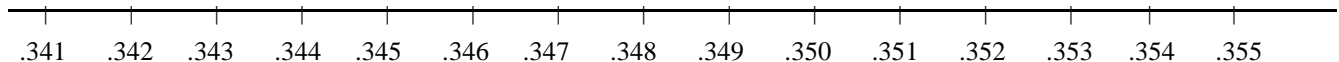


1. Imagine a rectangle with length = 2.3741 ± 0.002 meter and width = 0.1472 ± 0.002 meter:
 - a. Can we be reasonably certain that the first and second digits of the length are "2" and "3" if those measurements were honestly made and the uncertainties were estimated correctly? ___
 - b. The estimated uncertainty of ± 0.002 m tells us the fourth digit of the length may be __, __, __, __, or __. Can we be fairly certain that the fourth digit is not a "0" or a "9"? ___
2. Digits that are known with certainty (as in 1a) are called "*significant*" digits.
 Digits that you are somewhat (but not completely) certain about (as in 1b) are *also* "significant".
 - a. How many significant digits are there in the length mentioned in #1? ___
 - b. How many significant digits are there in the given *width*? ___ (Its *first* digit is a "1".)
3. To find the area of the rectangle you would multiply its length by its width.
 - a. Use a calculator to determine the GLV (greatest likely value) of the product *without* rounding off.
 Remember that all of these quantities have units. (___)(___) = _____
 - b. Now determine the MLV of the product: (___)(___) = _____
 - c. Also determine the SLV of the product: (___)(___) = _____
 - d. $UNC = (\text{_____} - \text{_____}) \div (\text{___}) = \text{_____}$. Please mark and clearly label the points which represent the GLV, MLV, and SLV of the product on this number line. Be as precise as you can be.



4. When I found the MLV in #3, my calculator gave me an eight-digit number. (The zero before the decimal point does not count because it would disappear if you put the number into scientific notation.) My last four digits were "6752". If I deleted those digits, I would be left with a four-digit number ending with a "4". That process is called "*truncating*" the number down to four digits.
 - a. Notice that "rounding off" the number to four digits is not always the same as truncating.
 In this example rounding would produce a four-digit number ending with __.
 - b. Are both versions of the number (i.e. the truncated one and the rounded one) well within the range of uncertainty indicate on the number line above? ___
 - c. Is the distinction between truncating and rounding off important in this example? ___
5. Suppose we change the last three digits from "675" to any other three numerals chosen randomly:
 Will the resulting quantity still be within the range indicated in 3d? ___ (If not, please explain.)
6. If your answer to #5 was "yes", then you must conclude that the digits which you replaced were not even partly significant. In other words, they were "bogus" or pure *fiction*.
 - a. Suppose you want to eliminate *fictional* digits from a number: Is the distinction between truncation and roundoff important in that situation? ___ -Does this answer contradict 4c? ___
 - b. Suppose you want to eliminate digits which are *significant*: -Is the distinction important then? ___
 If so, which procedure (truncation or roundoff) is better? _____
 - c. To avoid excessive roundoff of a product or quotient we keep __ bogus digit and throw away the rest.
 That rule was explained on page 13 and p. 67 in the book. Was it recorded on the back of RS I? ___
 - d. According to 6c, the area of our rectangle should be written as _____ \pm _____.
7. Consider the product of two numbers which both have uncertainties, such as $(A \pm a)(B \pm b)$.
 - a. Use the "FOIL" method to discover a formula for the GLV of the product: **GLV** = _____
 - b. Use reasoning similar to 3c to discover a formula for the SLV of the product: **SLV** = _____
 - c. To discover a formula for the uncertainty of the product you must subtract the SLV from the GLV and then divide by __: **UNC** = _____ Does 6d agree with 7c? ___ *Rule 7c is recorded in #__ on RS I.*
8. Important Rule: Whenever you multiply two numbers you must _____ their units.
 - a. Did you follow that rule in #3? ___ -Did you also use it in 6d? ___
 - b. Suppose "A" is measured in "swings per second" and "B" is measured in "seconds". What units must the product "AB" then have? _____ -What units must the quotient A/B have? _____