Help on Question #5 of the Vector Dart Lab:

Given x ±∆x (ave and std dev of horizontal positions) and y ±∆y (ave and std dev of vertical positions) you need to propagate these absolute errors through the equation to determine the absolute error in the radial displacement of your average dart. The strategy is to work from the inside out, function by function.

1. x2 : This is an exponential calculation so you need to find the fractional uncertainty in x (∆x/x) and multiply it by 2 to find the fractional uncertainty in x2 : (∆x2/x2) . To find the absolute uncertainty in x2 , ∆x2, multiply the fractional uncertainty in x2 BY the value of x2. The result is the absolute uncertainty in x2, ∆x2.
2. y2 : Repeat #1 for y2.
3. x2 + y2 : This is an addition, so the absolute uncertainty in x2 + y2 , ∆( x2 + y2), is the simple sum of ∆x2 and ∆y2. (But you still need to determine the value of x2 + y2 for the next step.)
4. Square root of x2 + y2: This is another exponential calculation with the exponent = ½. Find the fractional uncertainty in x2 + y2 (∆x2 + y2/ x2 + y2) and multiply it by 1/2 to find the fractional uncertainty in , . To find the absolute uncertainty in r (which = the absolute uncertainty in, you multiply the fractional uncertainty by the value of .