SWR, Reflected Power, Reflected Voltage and "Return Loss"

Ever wonder why --on EVERY swr meter -- when the reflected reading is 50% (of the voltage) of the forward reading, the meter is calibrated to indicate an SWR of 3:1?

Now you can know why:

Reflected (Return) Voltage as Percent of Forward	Reflected (Return) Power as Percent of Forward	Reflected (Return) Power dB down from total return ("return loss"		SWR
100.00%	100.00 %	0	dB	Infinite
66.68%	44.46 %	3.52	dB	5
59.98%	35.97 %	4.44	dB	4
50.12%	25.12 %	6	dB	3
33.34%	11.12 %	9.54	dB	2
20.00%	4.00 %	13.98	dB	1.5
9.09%	0.83 %	20.83	dB	1.2
0.00%	0.00 %	infinite	dB	1

The Traditional amateur radio forward/reflected SWR meter is just a **directional coupler that measures the VOLTAGE** of a similar portion of Forward and Reflected waves...and is calibrated to read out in SWR rather than in how much the return power is decreased by the forward power ("return loss")

What is the equation that connects the ratio of reflected to forward power, to SWR? Here it is, but it is complicated:

$$VSWR = \frac{1+\sqrt{\frac{Pr}{Pf}}}{1-\sqrt{\frac{Pr}{Pf}}}$$

Easy enough for a computer to calculate, or a spreadsheet, but it is easy to see why we have PRE-calibratted SWR meters and don't make hams do THAT calculation every time! The beauty of the SWR number is that:

a) It is equal to the RATIO of the impedances that are mismatched, so there's an easy to grasp physical reality of it
b) It can be measured with VERY SIMPLE equipment available for probably 75 years-- some parallel wires with loading resistors at opposite ends make a directional coupler, add a couple diodes and a meter and you're done; sells for $15-$50 on Amazon
c) Unlike impedance, which changes continuously along a mismatched transmission line, the SWR STAYS CONSTANT ALONG THE LENGTH (except for "getting better" further away from the antenna due to LOSSES in the coax.