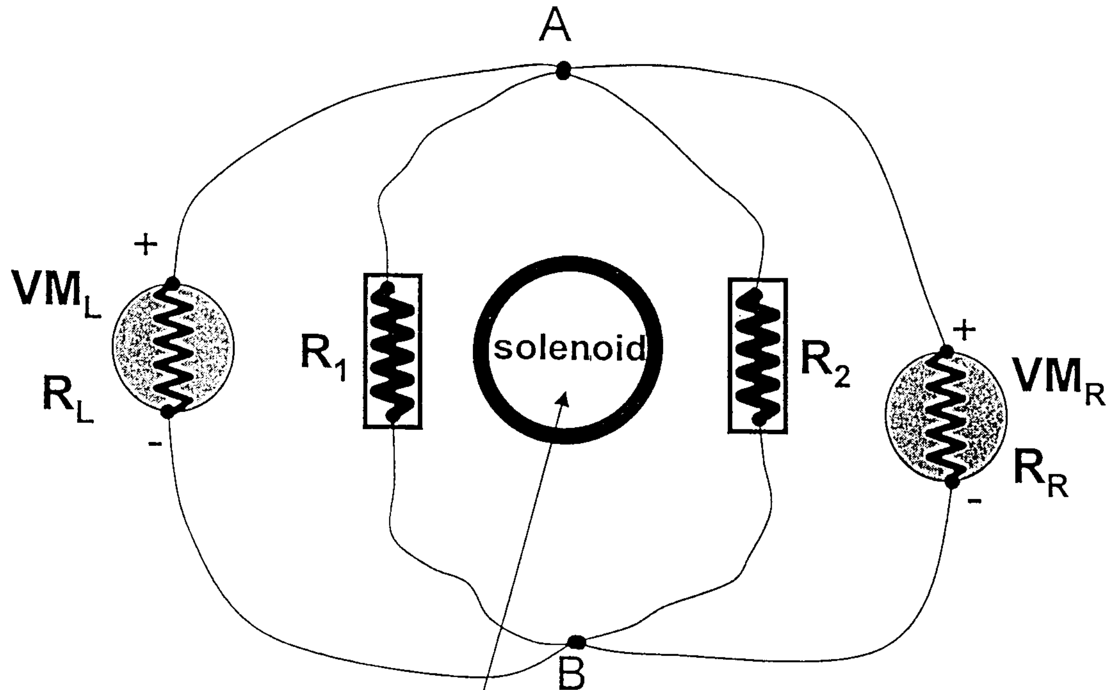

Radius of solenoid = a $\vec{B}_{solenoid} = \hat{z} B_0 \sin(\omega t)$

Consider a very long cylindrical solenoid in which the current varies sinusoidally. The solenoid is infinitely long in the z-direction (z is perpendicular to the page). The two AC voltmeters, VM_L and VM_R, with effective internal impedances R_L, R_R, are considered to function as ideal voltmeters (ie $R_L, R_R >> R_1, R_2$). These voltmeters measure time dependent voltages $V_L(t)$ and $V_R(t)$, respectively. The polarity of the *terminals* of the voltmeters are shown in the figure. The frequency, ω (radians/second), is low enough so that non-ideal effects, such as skin effects, do not play a role. The resistors have the relative values $R_2=2R_1$. The voltmeters are connected as shown so that they measure the voltage between point B and point A of the figure. The dark points (small black circles) are electrical connections that have no resistance (solder with no resistivity, if you will). The physical wires connecting the resistors and voltmeters are shown as thin lines, and they have no resistance, inductance or capacitance.

1) Calculate an expression for the rate of change in flux of the magnetic field as a function of time.

2) Calculate an expression for the current through each of the two resistors, R_1 and R_2.

3) What is the relative polarity of the *voltages* measured by VM_L and VM_R at any time, t? Give a reason to justify your answer.

4) Derive an expression for the *AC voltage* measured in each voltmeter as a function of time.