72. The radius of the cylinder (0.020 m, the same as r_B) is denoted R, and the field magnitude there (160 N/C) is denoted E_B. The electric field beyond the surface of the sphere follows Eq. 24-12, which expresses inverse proportionality with r:

$$\frac{|\vec{E}|}{E_B} = \frac{R}{r} \qquad \text{for } r \geq R \,.$$

(a) Thus, if $r = r_C = 0.050$ m, we obtain $|\vec{E}| = (160)(0.020)/(0.050) = 64$ N/C.

(b) Integrating the above expression (where the variable to be integrated, r, is now denoted ϱ) gives the potential difference between V_B and V_C.

$$V_B - V_C = \int_R^r \frac{E_B\, R}{\varrho}\, d\varrho = E_B\, R \ln\left(\frac{r}{R}\right) = 2.9 \text{ V} \,.$$

(c) The electric field throughout the conducting volume is zero, which implies that the potential there is constant and equal to the value it has on the surface of the charged cylinder: $V_A - V_B = 0$.