

20. From symmetry, we see that the net field at P is twice the field caused by the upper semicircular charge $+q = \lambda \cdot \pi R$ (and that it points downward). Adapting the steps leading to Eq. 23-21, we find

$$\vec{E}_{\text{net}} = 2 \left(-\hat{j} \right) \frac{\lambda}{4\pi\epsilon_0 R} \left[\sin \theta \right]_{-90^\circ}^{90^\circ} = -\frac{q}{\epsilon_0 \pi^2 R^2} \hat{j} .$$