A circular mirror of diameter 0.1mm is uniformly illuminated at 45° to its surface normal by x-axis traveling coherent visible light (~500nm). If one wishes to observe a far-field intensity pattern of the reflection off of the illuminated mirror, how far away in the z-axis should observation be made? The far field spans to infinity, so find an L for which the far field approximation holds well (say 1-10%) that is close by.

Useful formulae:

Fresnel approximation: $D^4/8L^3 << \lambda$

Fraunhofer approximation: $D^2/L << \lambda$