1. Two plane waves of the same wavelength $\lambda$ are propagating along the directions of wave vectors $k_1, k_2$ as shown in the figure below.

1.a) Describe the interference pattern that would be observed on the plane $xy$.

1.b) Describe the interference pattern that would be observed on a plane parallel to $xy$ but one wavelength $\lambda$ away towards the positive $z$ direction.

1.c) Describe the interference pattern that would be observed on the plane $yz$.

![Figure A](image)

Figure A

2. A plane wave and a spherical wave, both of the same wavelength, are co-propagating as shown in figure B on the next page.

2.a) Describe the interference pattern that would be observed on a plane perpendicular to the $z$ axis at a distance of $1000\lambda$ away from the origin of the spherical wave.

2.b) Repeat for the plane located $2000\lambda$ away from the origin of the spherical wave.

2.c) What do you observe? Explain in physical terms.
2.d) What is the relationship between your result and a Michelson interferometer with a lens inserted in one of the two arms?

![Figure B](image)

**Figure B**

3. Repeat the calculations of the previous problem for the case when the plane wave is propagating off-axis as shown in Figure C below. Explain the differences that you observe.

![Figure C](image)

**Figure C**

4. A “fan” of $N$ plane waves are propagating symmetrically with respect to the $z$ axis, as shown in figure D below. The angular spacing between successive members of the fan is fixed and equal to $\Delta \theta$. Describe the interference pattern observed on a plane perpendicular to the $z$ axis.
5. Describe the interference pattern between two counter-propagating plane waves. This is also known as a “standing wave.” Explain why.