Homework #2:

1-2. A particle of mass m and kinetic energy E moves in the potential

\[ V(x, y, z) = \begin{cases} 
0 & z < 0 \\
V_0 & z > 0 
\end{cases} \]

The particle is moving in the direction \( \mathbf{k} = k(\sin \theta, 0, \cos \theta) \).

a) Assume \( E > V_0 \). Using Schrodinger’s equation, find the direction of the particle in the region \( z > 0 \).

b) For some angles in your answer to a), the direction is undefined (complex angle). For these angle calculate, up to an overall constant, the probability of finding the particle at different values of \( z \).

3-5. Brooker 1.13 (Skip part 3) Skip anything having to do with Eq. 1.31, instead just confirm that ray tracing and 1.32 give the same results.

6-7. Brooker 1.16 (Skip parts 3&4)

8-10. Consider the following optical arrangement, consisting of an object, a lens, and a viewing screen. A uniform, collimated light beam of the same diameter as the lens and intensity \( I_0 \) is parallel to the optical axis. The object on the left is transparent. Since it is irregular, however, it refracts light at various angles. Neglect diffraction for this problem.

\[ 2F \]

a) Ignore for now the small dot between the lens and the screen. Describe quantitatively what is seen on the viewing screen.

b) The object refracts light entering it at height \( y \) by an angle \( \alpha(y) \). Describe the intensity as a function of \( y \) in the focal plane between the lens and the screen., An explicit answer would be great but a qualitative answer will suffice. What happens at \( y=0 \)?

c) The dot, which is a small opaque object, is placed on the optical axis (\( y=0 \)) a distance \( F \) from the lens. Calculate the intensity as a function \( y \) on the screen.