Physics 3041 (Spring 2021) Homework Set 3 **(Due 2/10)**

1. (a) Problem 5.2.3. (5 points)

(b) Problem 5.2.4.(iv). (5 points)

(c) Problem 5.2.5. (10 points)

(d) Problem 5.3.2. (20 points)

2. (a) Problem 5.3.5. (10 points)

(b) Problem 5.3.6. (10 points)

(c) Find $\int_0^\infty xe^{-ax}\cos kxdx$ using Euler's formula. (10 points)

3. Given the intensity pattern for the N-slit interference with separation d between adjacent slits, show that the pattern becomes that for the single-slit diffraction with slit width a when d goes to zero but with a fixed value of $Nd = a$. (10 points)

4. (1) Find the roots z_n ($n = 1, 2, \cdots, N$) of the complex equation $z^N = 1$. (5 points)

(2) Find $S_N = \sum_{n=1}^{N} z_n$ and give a geometric interpretation of the result. (10 points)

(3) Note that $1 - z^N = (1 - z)(1 + z + z^2 + \cdots + z^{N-1})$. Relate this result and the roots z_n to the conditions for destructive interference among N slits. (5 points)