Homework problems #2 (Lectures 4/5)

1. The first two dark fringes on one side of the central maximum in a single-slit diffraction pattern are 1.0 mm apart. The wavelength of the light is 610 nm and the screen is 1.0 m from the slit. What is the slit width?

2. Light of wavelength 630 nm is incident upon a single slit with width 0.40 mm. The figure shows the pattern observed on a screen positioned 2.0 m from the slit. Determine the distance from the center of the central bright fringe to the second minimum on one side.

3. The diffraction pattern from a single slit is viewed on a screen. Using blue light (λ=430 nm), the width of the central maximum is 2.0 cm. (a) Would the central maximum be narrower or wider if red light (λ=700 nm) is used instead? (b) If the blue light has wavelength 0.43 μm and the red light has wavelength 0.70 μm, what is the width of the central maximum when red light is used?

4. Light of wavelength 490 nm is incident on a narrow slit. The diffraction pattern is viewed on a screen 3.20 m from the slit. The distance on the screen between the central maximum and the third minimum is 2.5 cm. What is the width of the slit?

5. If the two 2^{nd} order maxima (m = 2) are separated by 2.0 cm on the screen in a double-slit experiment, what is the separation of the m = 3 minima? Assume the angle is very small.

A. 1.5 cm
B. 2.0 cm
C. 2.5 cm
D. 3.0 cm
E. 3.5 cm

6. In a single-slit experiment, light of wavelength 500 nm is used to produce a diffraction pattern on a screen 4.0 m away. If the distance between both 3^{rd} order minima is 6.0 cm, what is the slit width?

A. 2.0×10^{-4} m
B. 1.0×10^{-4} m
C. 4.0×10^{-4} m
D. 0.67×10^{-4} m
E. 0.44×10^{-4} m

7. When the slit width is doubled, what happens to the width of the central maximum in the diffraction pattern?

A. Nothing.
B. It doubles.
C. It halves.
D. It quadruples.
E. It quarters.