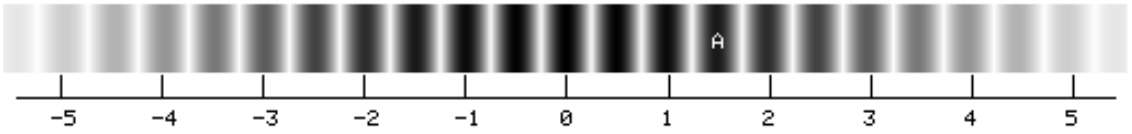
Two-slit Interference

Problem 1: An electromagnetic wave is incident upon two narrow slits separated by a distance of 0.12 mm. The interference pattern shown below is cast upon a screen a distance of 1.1 m away. The markings on the ruler in the figure are in cm, and the center of the pattern is marked as "0". (The black ink represents areas of high intensity.)



a. What is the wavelength of the electromagnetic wave?

b. Consider the point marked "A" on the screen. What is Δr, the difference between the distance from A to one slit and the distance from A to the other slit?

Physics 122-01
Test 3
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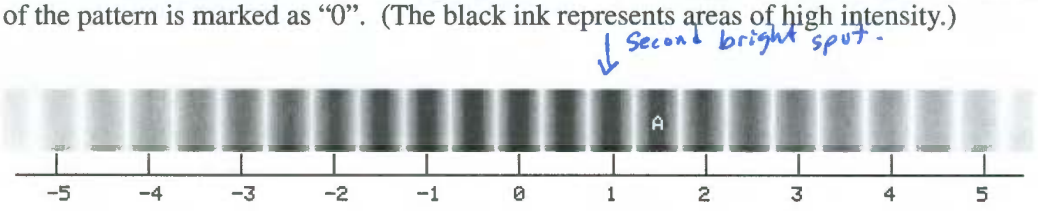
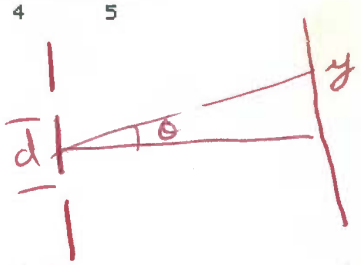
Name: SOLUTIONS

Start all problems with a fundamental principle or with an equation from the equation sheet. Be sure to show your work **clearly** and **draw a box around your answer**. If any question is unclear, please ask immediately.

1. (30 pts.) An electromagnetic wave is incident upon two narrow slits separated by a distance of 0.12 mm. The interference pattern shown below is cast upon a screen a distance of 1.1 m away. The markings on the ruler in the figure are in cm, and the center of the pattern is marked as "0". (The black ink represents areas of high intensity.)



a. (20 pts.) What is the wavelength of the electromagnetic wave?



$d \sin\theta = m\lambda$

$\sin\theta \approx \frac{y_{bright}}{L}$

Look at 2nd bright spot: $m = 2$, $y_{bright} = 1.0\ cm$.

$$\lambda = \frac{d\sin\theta}{m} = \frac{d\, y_{bright}}{mL} = \frac{(0.12\times10^{-3}\ m)(1.0\times10^{-2}\ m)}{2(1.1\ m)}$$

$$\lambda = 5.45\times10^{-7}\ m = \boxed{545\ nm}$$

b. (10 pts.) Consider the point marked "A" on the screen. What is Δr, the difference between the distance from A to one slit and the distance from A to the other slit?

$\Delta r = m\lambda$. For spot "A", $m = 3$

$\Delta r = 3\lambda = 1636\ nm = \boxed{1.636\times10^{-6}\ m}$