Quiz 27.1A

Light of wavelength 656 nm is incident on two slits with spacing d. The interference pattern is displayed on a screen 3.44 meters away from the slits. The first minimum is located 1.30 cm above the central maximum of the pattern.

a) What is the spacing between the slits?
b) What is the path difference (in meters) between the light from slit A and slit B as it travels to the location of the first minimum?
c) What is the path difference (in waves) between the light from slit A and slit B as it travels to the location of the first minimum?
d) If the wavelength and distance to the screen are held constant and the two slits are moved closer together, does the distance from the center of the pattern to the first minimum increase, decrease or remain the same? Justify your answer.

a) $\frac{dy}{L} = \frac{\lambda}{2}$

$d = \frac{\lambda L}{2y} = \frac{(656\times10^{-9})(3.44)}{2(.0130)} = \boxed{8.68\times10^{-5}\ m}$

b) $\Delta\ell = \frac{1}{2}$ wave or $\frac{656}{2} = \boxed{328\ nm}$

c) $\Delta\ell = \boxed{0.500\ waves}$ 0.5 is fine here

d) Since $d = \frac{\lambda L}{2y}$, $d \propto \frac{1}{y}$

so if $d\downarrow$, $y\uparrow$ y gets larger

E.g. $d = \frac{1}{2}(8.68\times10^{-5}) = 4.34\times10^{-5}$

$y = \frac{\lambda L}{2d} = \frac{(656\times10^{-9})(3.44)}{2(4.34\times10^{-5})} = .0260\ m$

(double y from a).