1. A distant point source of red light, a mask with two identical, very narrow slits, and a screen are arranged as shown in the top view diagram below right.

The photograph at right shows the pattern that appears on a distant screen. Point $P$, the center of the pattern, and point $Q$ are maxima. Point $R$ marks a minimum to the right of point $Q$.

a. In the space above the diagram at right, clearly label each of the lettered points according to $\Delta D$, the difference in distances from the slits to that point. Express each value of $\Delta D$ in terms of $\lambda$.

b. The screen is 2.2 m from the slits, and the distance from point $P$ to point $R$ is 1.6 mm.

Determine the distance between the slits in terms of $\lambda$. Show your work and describe any approximations that you make in answering this question.

c. Suppose that the width of the right slit were decreased (without changing the distance between the centers of the slits).

i. Would the intensity at each of the following points increase, decrease, or stay the same? In each case, explain your reasoning.

* point $Q$

* point $R$

ii. The graph of intensity, $I$, vs $\theta$ shown at right corresponds to the above double-slit experiment. (The angle $\theta$ is measured relative to the normal to the screen.)

In the space at right, show how the intensity graph would be different if the right slit were made narrower.
2. The graph of intensity, I, vs θ below right corresponds to a double-slit experiment similar to the one described in problem 1.

In each part below, suppose that a single change were made to the original apparatus. In the spaces provided, show how the graph of I vs θ would be different from the original graph (shown dashed). In each case, explain your reasoning.

- the distance between the centers of the slits is increased (without changing the width of the slits)

- the wavelength of the incident light is increased

- the distance from the mask to the screen is decreased

- the width of both slits is decreased (without changing the distance between the centers of the slits)