M1 The formula $y_m = R \frac{m \lambda}{d}$ for the location of the points of constructive interference from the two slits is valid

A. only for large angles $\theta$.
B. only for small angles $\theta$.
C. for all angles $\theta$, because it is a general formula.

M2 After a laser beam of wavelength $\lambda$ passes through a diffraction grating, the second-order bright spot occurs at an angle of $30^\circ$ from the original direction of the beam. You now shine a different laser beam through this grating and find that the second-order bright spot occurs at $60^\circ$ with respect to the original beam direction. The wavelength of the second beam is

A. $\frac{\lambda}{2}$.
B. $\frac{\lambda}{\sqrt{3}}$.
C. $\lambda \sqrt{3}$.
D. $2\lambda$. 
Problems

P1 In Young’s experiment performed using a red laser (\( \lambda = 610 \text{ nm} \)), the distance between the two adjacent bright fringes is ten times larger than the distance between the slits. If the distance to the screen is \( R = 1 \text{ m} \), what is the distance between the slits?

P2 A monochromatic blue light (\( \lambda = 450 \text{ nm} \)) is incident on a diffraction grating with a spacing of 2 \( \mu \text{m} \). What is the total number of the intensity maxima? (Hint: use the fact that \( |\sin \theta| < 1 \).)

P3 A white light beam is incident at 45\(^\circ\) on a transparent plate of a thickness of 1 cm, which refractive index \( n \) depends on the light wavelength \( \lambda \) as

\[
n = 1.201 + \frac{0.049}{(\lambda[\text{nm}] / 300)^2}.
\]

Determine the size of the rainbow spot at a screen placed behind the plate perpendicular to the beam. Assume that the size of the spot is defined as the difference between the lateral displacements of the violet (\( \lambda = 300 \text{ nm} \)) and the red (\( \lambda = 700 \text{ nm} \)) light component.

P4 A planoconvex lens with a focal length of 20 cm is made of glass with refractive index \( n = 1.5 \). What is the radius of the first red (\( \lambda = 650 \text{ nm} \)) Newton’s ring?