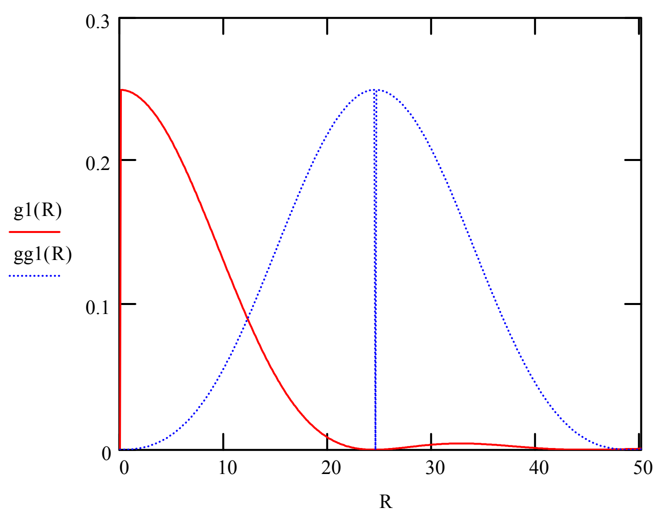
D14FAGRRES3DS **Determination of the wavelength difference for two peaks, resolved according to the Rayleigh criterion**

We call the distance between the maxima b. Radius of apertures a, distance between the apertures d, coordinate on the observation screen R, wavelength λ, and distance from aperture to screen X.

1. Determination of Rayleigh distantance.

$a \equiv .05$ $\quad X \equiv 4000$ $\quad R := 0, .1 .. 50$

$$g1(R) := \left[\frac{J1\left(2\cdot\pi\cdot a\cdot\frac{R}{X\cdot\lambda}\right)}{\left(2\cdot\pi\cdot a\cdot\frac{R}{X\cdot\lambda}\right)}\right]^2 \qquad gg1(R) := \left[\frac{J1\left(2\cdot\pi\cdot a\cdot\frac{R-b}{X\cdot\lambda}\right)}{\left(2\cdot\pi\cdot a\cdot\frac{R-b}{X\cdot\lambda}\right)}\right]^2$$



Distance b is assumed to be: see on top of graph

2. 3D Graph of pattern of two round apertures at distance b.

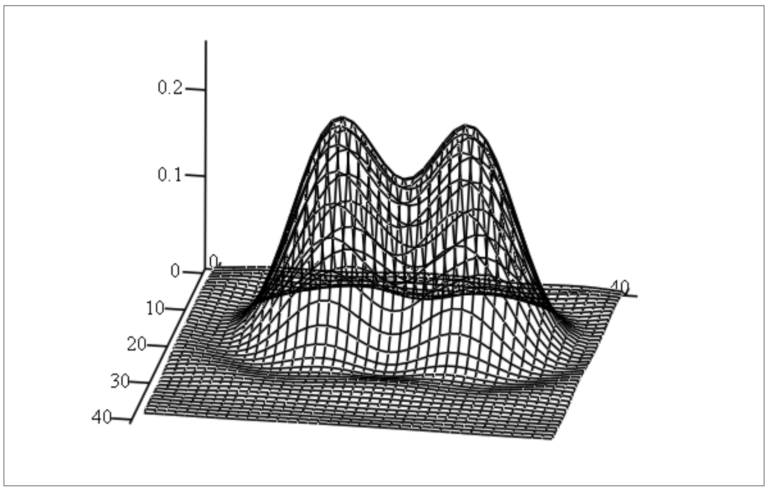
$i := 0..N$ $\quad j := 0..N$

$x_i := (-30) + 2.0001\cdot i$ $\quad y_j := -30 + 2.0001\cdot j$ $\quad \lambda \equiv .0005$

$RR(x,y) := \sqrt{(x)^2 + (y)^2}$ $\quad N \equiv 40$ $\quad X := 4000$

$$g2(x,y) := \left[\frac{J1\left(2\cdot\pi\cdot a\cdot\frac{RR(x,y)}{X\cdot\lambda}\right)}{\left(2\cdot\pi\cdot a\cdot\frac{RR(x,y)}{X\cdot\lambda}\right)}\right]^2 \qquad gg2(x,y) := \left[\frac{J1\left(2\cdot\pi\cdot a\cdot\frac{RR(x,y-b)}{X\cdot\lambda}\right)}{\left(2\cdot\pi\cdot a\cdot\frac{RR(x,y-b)}{X\cdot\lambda}\right)}\right]^2$$

$$M_{i,j} := g2\left(x_i, y_j\right) + gg2\left(x_i, y_j\right) \qquad b \equiv 24.5$$



M

3. Calculation of wavelength difference corresponding to b

The diffraction angle is calculated from $\frac{b}{X} = \Delta\theta$

The grating is made of round apertures of diameter a and spaced at distance d.
From the grating formula we have for the wavelength difference $\Delta\lambda = d\Delta\theta$ or $\Delta\lambda = (d/X)b$.

For $d := .1$

$$\Delta\lambda := d\cdot\frac{b}{X}$$

$$\Delta\lambda = 6.125 \times 10^{-4}$$