A diffraction grating has 2000 $\frac{lines}{cm}$. What is the angle between the 1st-order maxima for red light ($\lambda = 680nm$) and blue light ($\lambda = 410nm$)?

$N = 2000 \frac{lines}{cm}$

$d \sin\theta = n\lambda$

$n = 1$

$\sin\theta = \frac{n\lambda}{d} = n\lambda N$

blue

$\theta = \sin^{-1}(n\lambda N)$

$= \sin^{-1}(1(410E-9)\,2.0E5)$

$= 4.7^\circ$

red

$\theta = \sin^{-1}(n\lambda N)$

$= \sin^{-1}(1(680E-9)\,2E5)$

$= \sout{8.6^\circ}\ 7.8^\circ$

$7.8^\circ - 4.7^\circ = \boxed{3.1^\circ}$

Determine the longest wavelength that can produce a third order maximum using a diffraction grating with 630 $\frac{lines}{mm}$.

$N = 630 \frac{lines}{mm}$

$d \sin\theta = n\lambda$

$n = 3$

$\sin\theta \rightarrow 1$

$\frac{d \sin\theta}{n} = \lambda$

$\frac{\sin\theta}{Nn} = \lambda$ ($\sin\theta \rightarrow 1$)

$\frac{1}{\left(630 \frac{lines}{mm}\right) 3} = \lambda = 5.29E-4 \, mm$

529 nm

White light strikes a diffraction grating with 6700 $\frac{\text{lines}}{\text{cm}}$ at normal incidence.
How many complete spectra will be formed on either side of the central maximum?

violet $\lambda = 400\text{nm}$

Red $\lambda = 700\text{nm}$

$N = 6700 \frac{\text{lines}}{\text{cm}}$

~~$\sin\theta$~~ 1 $\quad d\sin\theta = n\lambda$

$d = n\lambda$

$n = \frac{d}{\lambda} = \frac{1}{N\lambda}$

Note:

Since

$\theta = \sin^{-1}\left(\frac{n\lambda}{d}\right)$

red will be diffracted the most.

$n = \frac{1}{\left(6700 \frac{\text{lines}}{\text{cm}}\right)(700\text{E-}7\text{cm})}$

$= 2.13$

2 complete spectra