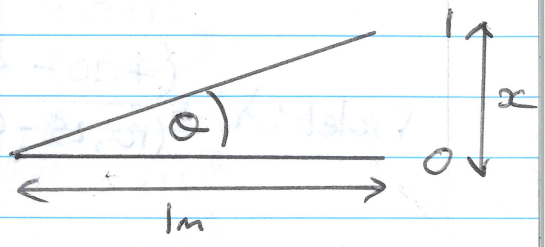
Investigating two-slit interference and diffraction gratings

According to www.en.wikipedia.org/wiki/Laser_pointer (accessed @ 0745 on 14 January 2025):

Red = 650nm, Green = 532nm, Violet = 405nm

order

Diffraction gratings



$$\sin\theta = \frac{n}{d} \cdot \lambda \quad \text{where } n=1$$

$$\theta = \text{atn}\left(\frac{x}{D}\right)$$

Red:

d^{-1}/m^{-1}	x/m	$\theta/°$	$\sin(\theta/°)$
300×10^3	0.200	11.3	0.196
600×10^3	0.440	23.7	0.403
1200×10^3	1.207	50.4	0.770

Errors
for $d^{-1} = 300\times10^3$ red,
biggest $\sin\theta = 0.202$
smallest $\sin\theta = 0.191$

$2\times\Delta x$

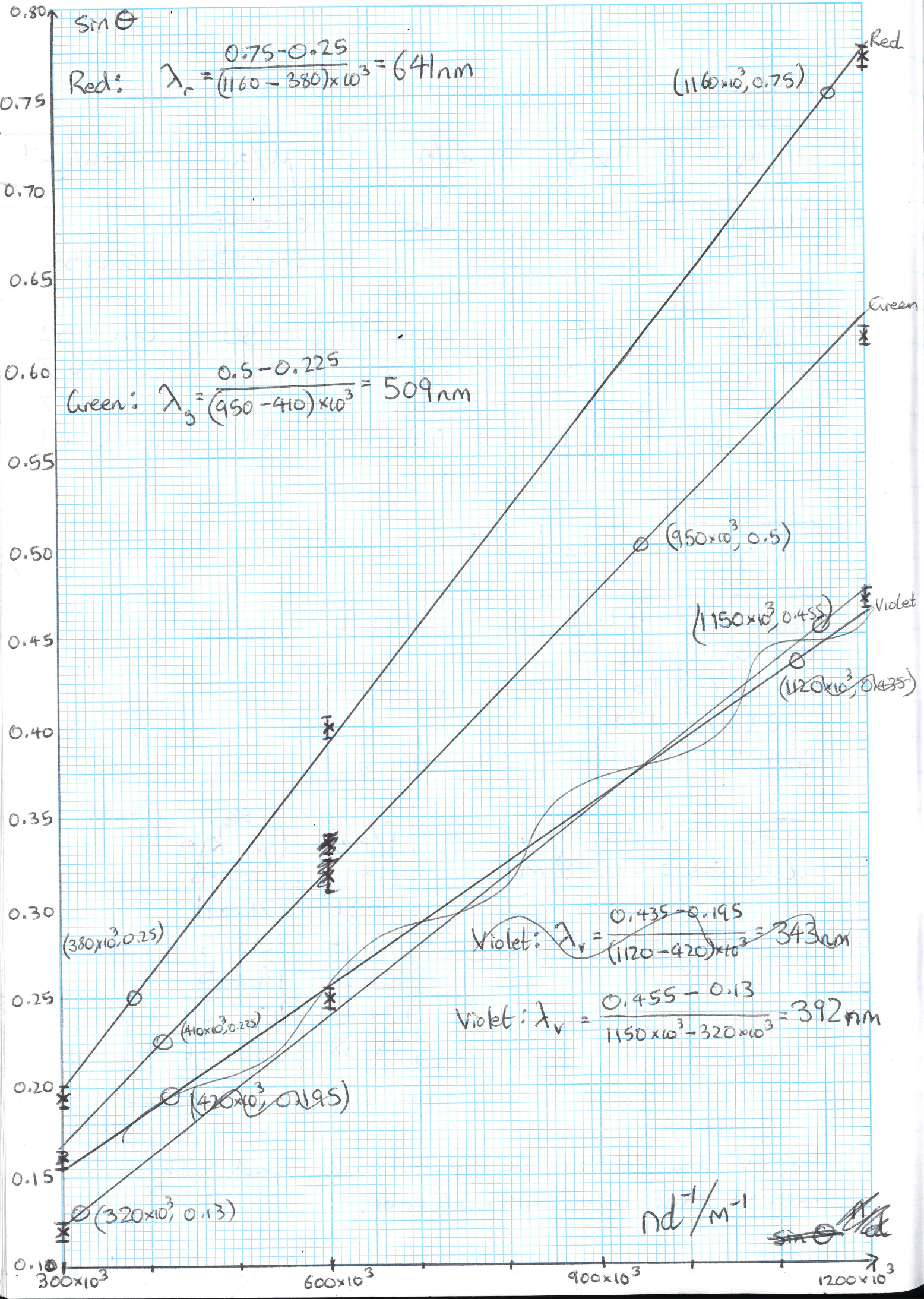
Green:

d^{-1}/m^{-1}	x/m	$\theta/°$	$\sin(\theta/°)$
300×10^3	0.162	9.20	0.160
600×10^3	0.355	19.5	~~0.338~~ ~~0.318~~ 0.335
1200×10^3	0.776	37.8	0.613

Violet:

d^{-1}/m^{-1}	x/m	$\theta/°$	$\sin(\theta/°)$
300×10^3	0.123	7.01	0.122
600×10^3	0.259	14.5	0.251
1200×10^3	~~1.207~~ 0.534	28.1	0.471

$\Delta x = 4\text{mm}$ $\Delta D = 0.01\text{m}$ $D = 1.00\text{m}$


sin θ
Red: $\lambda_r = \frac{0.75-0.25}{(1160-380)\times10^3} = 641nm$
Green: $\lambda_g = \frac{0.5-0.225}{(950-410)\times10^3} = 509nm$
Violet: $\lambda_v = \frac{0.435-0.195}{(1120-420)\times10^3} = 343nm$
Violet: $\lambda_v = \frac{0.455-0.13}{1150\times10^3-320\times10^3} = 392nm$
Red
Green
Violet
(1160×10³, 0.75)
(950×10³, 0.5)
(1150×10³, 0.455)
(1120×10³, 0.435)
(380×10³, 0.25)
(410×10³, 0.225)
(420×10³, 0.195)
(320×10³, 0.13)
nd⁻¹/m⁻¹
sin θ
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
300×10³
600×10³
900×10³
1200×10³

Young's Slits

$w = \lambda \cdot \frac{D}{s}$ $\quad s = 0.1\,mm$ $\quad \Delta N_w = 0.2\,mm$

Red:

D/m	N	Nw/mm	w/mm	D/s
1.00	8	52.7	6.59	10×10^{3}
0.95	8	51.1	6.39	9.5×10^{3}
0.90	8	47.5	5.94	9.0×10^{3}
0.85	8	~~5~~ 45.1	5.64	8.5×10^{3}
0.80	8	42.2	5.28	8.0×10^{3}
0.70	8	36.6	4.58	7.0×10^{3}
0.60	8	31.2	3.90	6.0×10^{3}

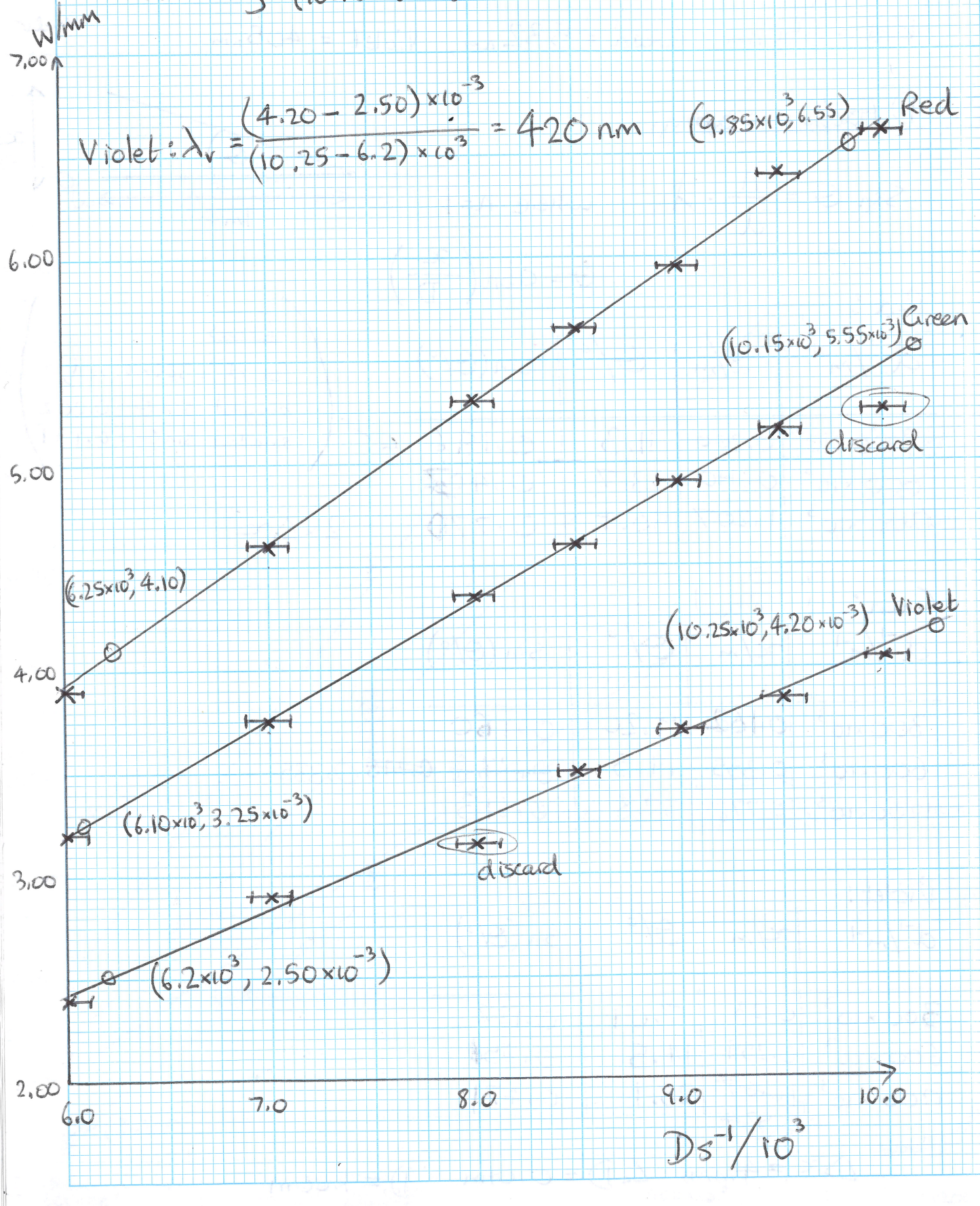
Green:

D/m	N	Nw/mm	w/mm	D/s
1.00	8	42.1	5.26	10×10^{3}
0.95	8	41.0	5.13	9.5×10^{3}
0.90	8	38.7	4.84	9.0×10^{3}
0.85	8	36.6	4.58	8.5×10^{3}
0.80	8	34.8	4.35	8.0×10^{3}
0.70	8	29.8	3.73	7.0×10^{3}
0.60	8	25.5	3.19	6.0×10^{3}

~~Blue~~: Violet:

D/m	N	Nw/mm	w/mm	D/s
1.00	8	32.2	4.03	10×10^{3}
0.95	8	30.6	3.83	9.5×10^{3}
0.90	8	29.5	3.69	9.0×10^{3}
0.85	8	27.9	3.49	8.5×10^{3}
0.80	8	25.0	3.13	8.0×10^{3}
0.70	8	23.1	2.89	7.0×10^{3}
0.60	8	19.3	2.41	6.0×10^{3}

Red: $\lambda_r = \frac{(6.55 - 4.10)\times10^{-3}}{(9.85-6.25)\times10^{3}} = 681\,nm$

Green: $\lambda_g = \frac{(5.55 - 3.25)\times10^{-3}}{(10.15-6.10)\times10^{3}} = 568\,nm$

Violet: $\lambda_v = \frac{(4.20 - 2.50)\times10^{-3}}{(10.25-6.2)\times10^{3}} = 420\,nm$