Simple Harmonic Motion

$k = 23.50\ Nm^{-1}$ according to Philip Harris;

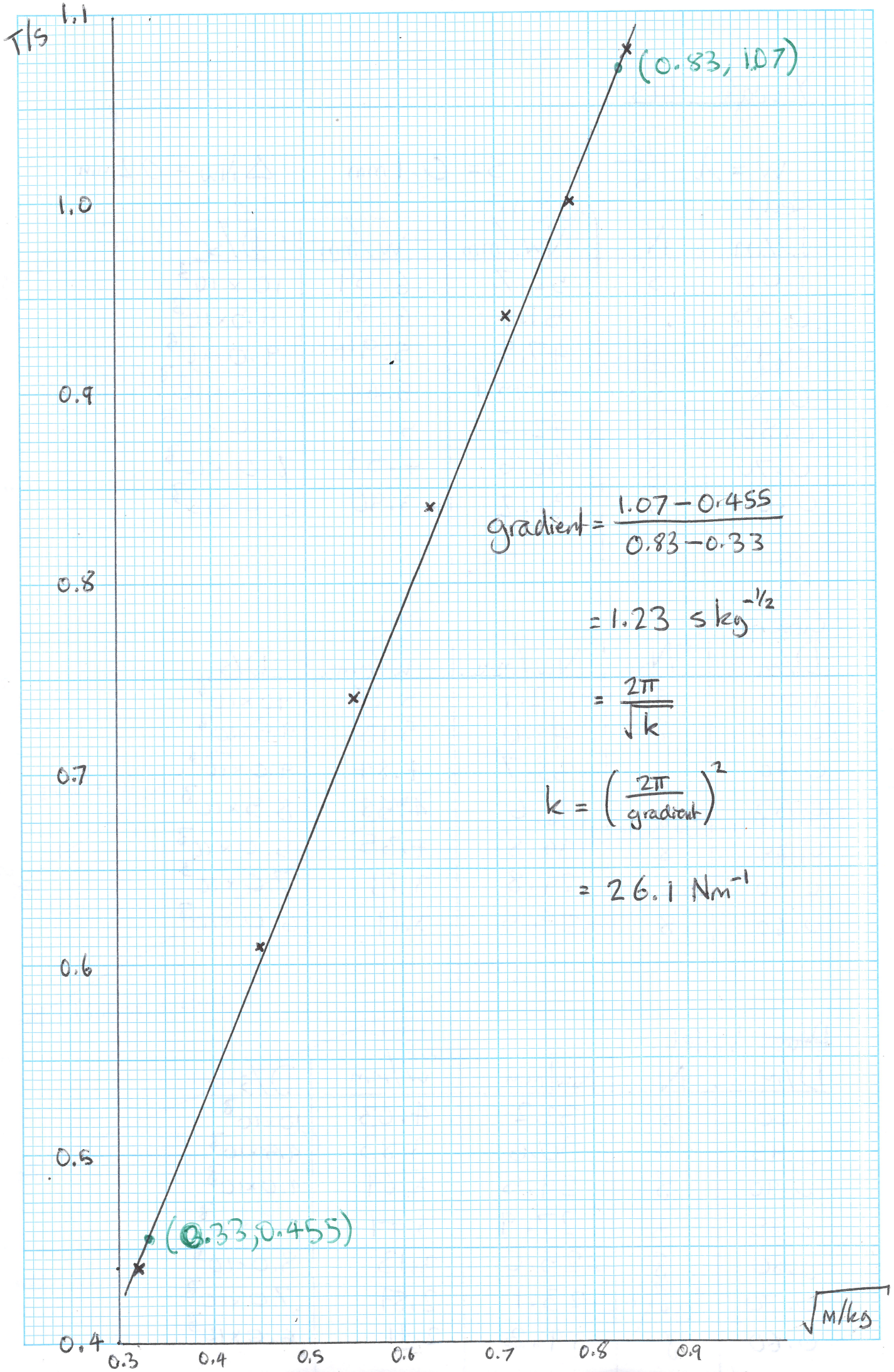
https://www.philipharris.co.uk/product/physics/motions-and-forces/_forces/expendable-steel-springs-pack-of-100/b8a41397
Accessed on 17 March 2025 @ 07:30

$g = 9.80665\ ms^{-2}$ according to wikipedia;

http://en.wikipedia.org/wiki/Gravitational_acceleration
Accessed on 17 March 2025 @ 07:30

Mass-spring system $T = 2\pi\sqrt{\frac{m}{k}}$

Mass/g	30T/s	T/s	$\sqrt{mass/kg}$	$\Delta\sqrt{m}$
100	13.11	0.4370	0.316	0.003
200	18.29	~~0.610~~ 0.6097	0.447	0.004
300	22.09	0.7363	0.548	0.005
400	25.31	0.8437	0.632	0.006
500	28.08	0.9360	0.707	0.007
600	30.41	~~1.037~~ 1.014	0.775	0.008
700	32.43	1.081	0.837	0.008



$$\text{gradient} = \frac{1.07 - 0.455}{0.83 - 0.33}$$

$$= 1.23 \text{ s kg}^{-1/2}$$

$$= \frac{2\pi}{\sqrt{k}}$$

$$k = \left(\frac{2\pi}{\text{gradient}}\right)^2$$

$$= 26.1 \text{ Nm}^{-1}$$

Pendulum

l/cm	30T/s	T/s	$\sqrt{l}$/m	$\Delta\sqrt{l}$
50	42.39	1.413	0.71	0.01
45	40.54	1.351	0.67	0.01
40	38.35	1.278	0.63	0.01
35	35.65	1.188	0.59	0.01
30	32.90	1.097	0.55	0.01
25	30.24	1.008	0.50	0.01
20	26.99	0.900	0.45	0.01

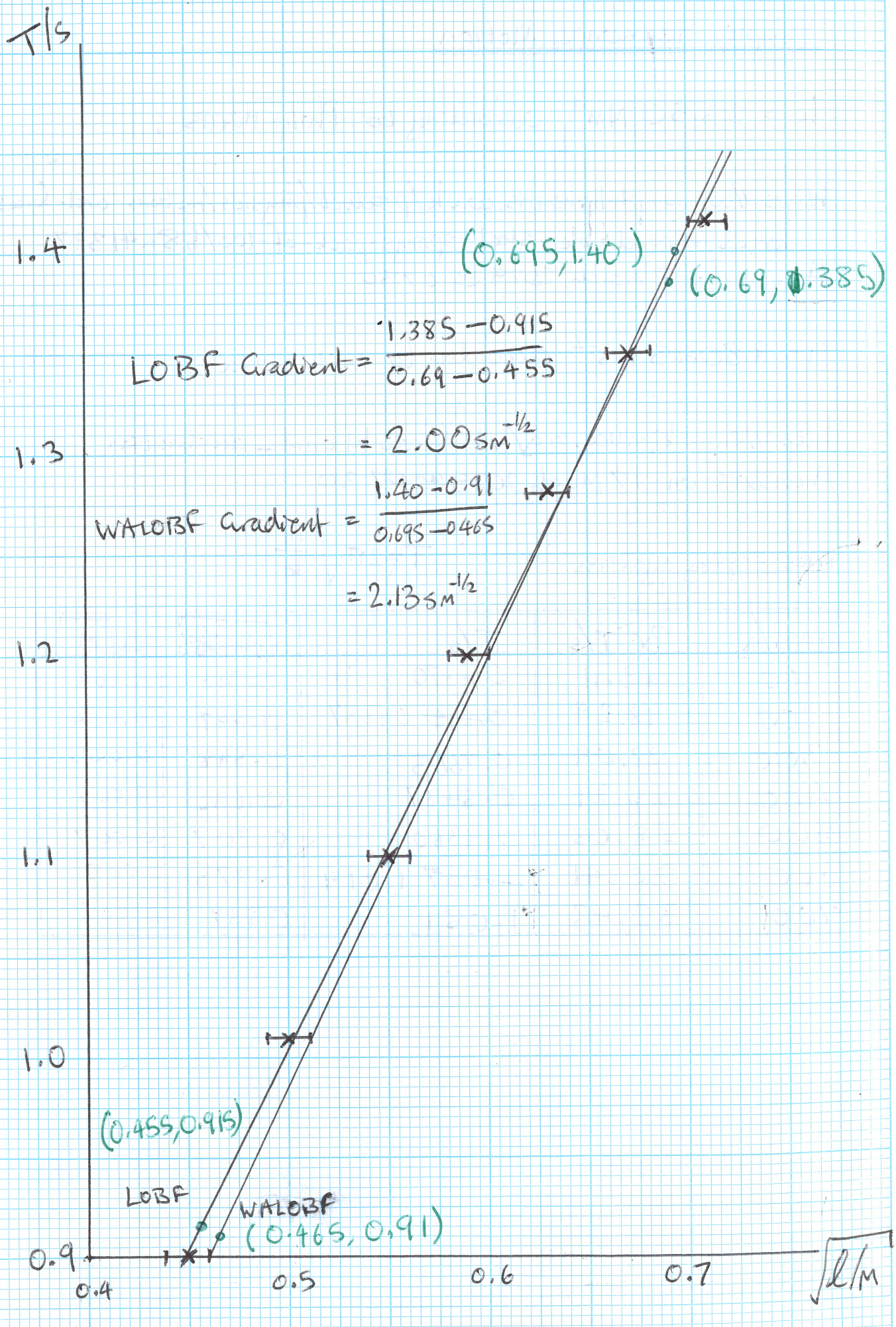
Gradient $= (2.00 \pm 0.13)\ s\,m^{-1/2}$

$$= \frac{2\pi}{\sqrt{g}}$$

$$g = \left(\frac{2\pi}{\text{gradient}}\right)^2 = 9.87\ m s^{-2}$$

$$\varepsilon g = 2 \times \varepsilon \text{gradient} = 2 \times \frac{0.13}{2.00} = 13\%$$

$$g = (9.87 \pm 1.28)\ m s^{-2}$$



$$\text{LOBF Gradient} = \frac{1.385 - 0.915}{0.69 - 0.455}$$

$$= 2.00\,\text{sm}^{-1/2}$$

$$\text{WALOBF Gradient} = \frac{1.40 - 0.91}{0.695 - 0465}$$

$$= 2.13\,\text{sm}^{-1/2}$$