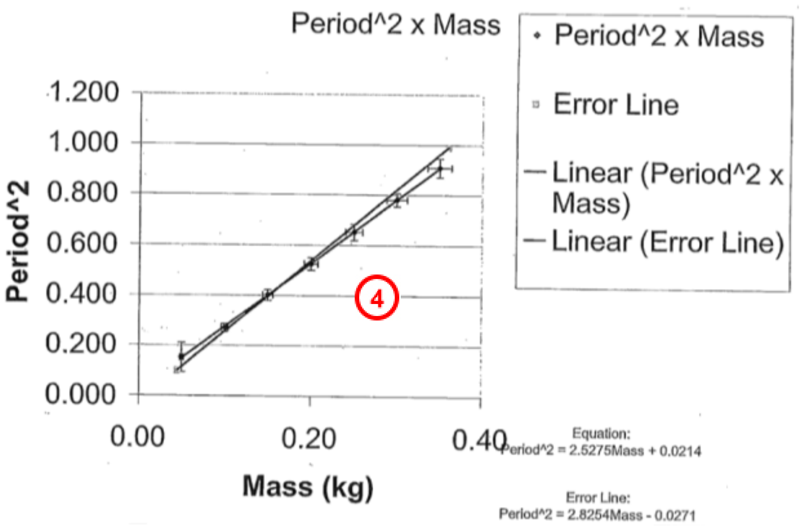
Student 2: High Merit

NZQA Intended for teacher use only



Raw Data

Mass (Kg)	Time 1 (2)	Time 2 (2)	Time 3 (2)	Average (for 10 oscillations)
0.05	3.8	3.96	3.91	3.89
0.10	5.19	5.22	5.19	5.20
0.15	6.31	6.36	6.34	6.34
0.20	7.28	7.23	7.25	7.25
0.25	8.05	8.06	8.09	8.07
0.30	8.81	8.84	8.83	8.83
0.35	9.52	9.56	9.52	9.53

Processed Data

Mass (Kg)	Time (s)	Time^2
0.05±(0.05 x 0.04)=0.002	0.389±(3.96-3.81)=0.075	
0.05±0.002 (3)	0.389±0.075 (3)	0.058
0.10±0.004	0.520±0.015	0.016
0.15±0.006	0.634±0.017	0.022
0.20±0.008	0.725±0.017	0.025
0.25±0.010	0.807±0.020	0.032
0.30±0.012	0.807±0.015	0.026
0.35±0.014	0.953±0.020	0.038

Spring constant k=15±0.75

Final Equation:

T^2= (2.5275±0.2979) m + (0.0214 ± 0.0485)

Where T^2=Period^2 and m=mass

T^2= (2.53±0.030) m + (0.02 ± 0.05)

5 We can check the validity of the final equation by comparing it to the theoretical equation, which states that $2\pi\sqrt{\frac{m}{k}}$. As k=15, we can simplify the equation so that $T^2=4\pi^2\frac{m}{15}$. Then $T^2 = 2.63m$. The final equation was $T^2= (2.53 \pm 0.03)$ m + (0.02 ± 0.05), which matches the theoretical equation, so the final equation is valid. Unexpected results from the experiment could have been caused by friction, which would cause the period of oscillation to decrease as the number of oscillations increases. However, the uncertainty caused by friction would be
1 quite small. Other variables which could have significantly changed the results include the distance at which the spring was released from. A long distance can cause the spring to move uncontrollably, which would cause a major change in the period of oscillation. To avoid this, the spring was released from 0.05m below its expansion.

Limitations of applying the theoretical formula to the practical situation of a real bay bouncer include the fact that babies tend to move around a lot in a horizontal as well as vertical directions while on the baby bouncer. This can cause period to change. Also, babies push up off the ground to start moving, which can cause the vertical force to increase.

At extreme values of mass, the theory is less applicable, as springs have an elastic limit. So at high values of mass, the spring extension will stop increasing as it physically impossible for it to stretch further. This will mean that the period will stop increasing.

An issue that could have affected our results was the inability to stop the stop watch at the exact same time as when an oscillation had complete due to human's slow reactions times. While repeating and averaging makes a result more accurate, we may have stopped the stopwatch too early or too late every time, which would make the results consistently wrong. Depending on whether the stopwatch was stopped consistently before or after the period of oscillation actually ended, the gradient of the final equation could be out by more than the current uncertainty value.