**Notes on Investigation Report:**

Generally, it is not necessary for students to show *every* calculation that they do in a lab (for “Results” and “Discussion” sections), but they should show samples of each calculation for you to check. The remaining results they can present in a table or graph as appropriate.

The marking key for the “Results” section states that students should;

*Provide relevant measurements & calculations used to test the assumption of negligible rolling friction of the ramp (Part 1).*

The best way to do this would be for students to calculate a *theoretical* time for the cart to reach the bottom of the ramp and compare it to a *measured* time (with calculated uncertainties for one or both results). If the results match (within uncertainty), then friction is likely negligible and can be ignored. Otherwise, friction force of the ramp may need to be calculated and factored in to subsequent calculations.

The marking key for the “Discussion” section states that students should;

*Provide relevant calculations demonstrating the propagation of uncertainties as appropriate.*

Ideally students should show some *attempt* at error propagation. More than one approach may be valid; adding relative errors is one approach, but for a lab like this calculating a max/min interval estimate for the measurement might make more sense. However, if the kids haven’t done that, don’t stress; I tend to find that, even in Year 12, many students don’t quite have the grip of it. If they’ve made a valid attempt at error propagation, *with supporting calculations*, I’d give them the full mark (8 out of 8, assuming they’ve met all of the other criteria for the ‘A’ standard), even if they have a made a few minor mistakes, or not quite completed the error propagation fully (maybe 7 out of 8 if they’ve made a glaring mistake or two). The kids could minimise the amount of error propagation required through stating a few assumptions i.e., that the velocity at the bottom of the ramp is independent of the mass of the cart (only true if ramp is truly frictionless).

Also, I would award the marks even if this appears in the “Results” section of the student report rather than the “Discussion” section of their report.

\*See “Sample Calcs” pdf for further detail. Note that this document provides more detail than I expect from students, unless their understanding of error propagation is top-notch, hence my suggestion above for some leniency in marking this dot-point.