Year 12 Science: A physics investigation with a non-linear relationship

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. Theory says the height h a ball falls is proportional to t^2, where t is the time. What should you plot to get a straight line?

2. At a fixed voltage, current I is proportional to 1/R. What should you plot to get a straight line?

3. A pendulum's period is 1.40 s. Find T^2.

4. A graph of I against 1/R has a line of best fit through the origin and (0.10 Ω^{-1}, 0.60 A). Find the gradient and write the equation.

5. Explain why timing 10 swings gives a more accurate period than timing one.

Your turn: a marble on a ramp

Another Year 12 class let a marble roll from rest down a ramp and measured the time t to roll each distance d, three times each.

Distance d (m)	Mean time t (s)
0.20	0.89
0.40	1.26
0.60	1.55
0.80	1.79
1.00	2.00

6. Their graph of d against t curves upward, steeper and steeper. What should they plot to get a straight line?

7. Find t^2 for d = 0.40 m.

8. The straight-line graph has its line of best fit through the origin and (4.00 s^2, 1.00 m). Find the gradient and write the equation.

9. Name a controlled variable that would change the results if it changed, and say why.

Fix the mistake

10. Correct this statement: "The relationship is $T^2 = 4.02\,L$, so I wrote $y = 4.02x$."

11. Correct this statement: "I worked out the gradient from my first and last data points."

12. Correct this statement: "I kept the mass of the bob the same, so that is my controlled variable."

13. Correct this statement: "My graph of T against L is a curve, so there is no relationship."