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# BMX Stunt Bike Riding Investigation

**Answer the following questions on loose-leaf paper.**
**Due date: _____**

1. For a dirt jump, design a procedure to find the maximum height of a BMX stunt bike rider using Vidshell software, quadratic equations and graphs. Describe the procedure, state any assumptions made and comment on any limitations of the resulting model.
   3 marks
2. Use VidShell and the BMX video supplied by your teacher to collect coordinates of the rider's path. If you are not able to use VidShell yourself then record the coordinates, supplied by your teacher, and plot the points on an X-Y plane.
   1 marks
3. Enter the coordinates into the lists on a graphics calculator. Draw a scatterplot with the data using the calculator's statistical plotting features.
   3 marks
4. Find the quadratic regression equation for the data using the statistical commands on the graphics calculator.
   2 marks
5. Graph the regression equation on the same axis as the scatterplot and record it in your answers.
   3 marks
6. Does the regression equation 'fit' the data well? Are all the points on your graph close to the regression line?
   2 marks
7. Now find the maximum height of the rider by
   a rewriting the quadratic regression equation in turning point form
   b using the X intercepts of the quadratic regression equation
   c reading the maximum height from the graph of the quadratic regression equation
   d measure the maximum height by running the video and using VidShell commands.
   2+2+1+1 marks
8. For the maximum heights found in Question 7, compare the actual maximum height (from Question 7d) and estimated maximum height (Question 7a, 7b and 7c) by giving the percentage error for each method (ie 7a, 7b and 7c) using the formula

   $$\text{Percentage error} = \frac{\text{Predicted value - actual value}}{\text{actual value}} \times 100\%$$

   1+1+1 marks
9. When the rider is 1.5 m horizontally from the take-off point what is his height?
   2 marks
10. Use your quadratic regression equation to find how far from the take-off point the rider is when he has reached ¾ of his maximum height. Use the maximum height found in Question 7a.
    3 marks
11. After completing the above questions describe any further limitations of your model.
    2 marks

**Total Marks: 30**