Ball Sports

Student Activity

7 8 9 10 11 12

TI-Nspire™ Investigation Student 50 min

Introduction

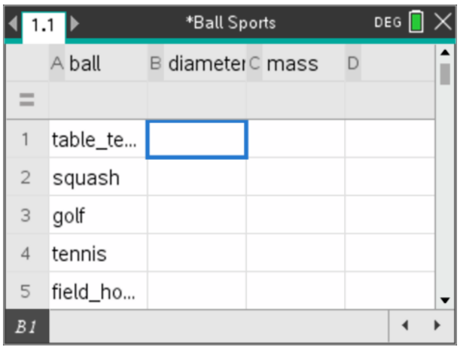
In this activity you will explore a range of ball-sports to see if a relationship exists across a range of sports when it comes to ball design.

Data Collection

Open the TI-Nspire document: Ball Sports.

The document contains a list of balls used in common sports. Column B contains the heading: diameter and column C contains the heading: mass.

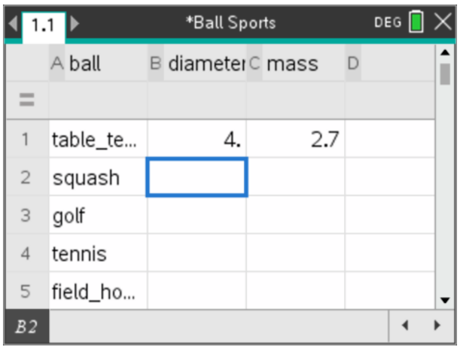
For this activity the diameter is measured in centimetres (cm) and mass in grams (g)



	A ball	B diameter	C mass	D
=				
1	table_te...			
2	squash			
3	golf			
4	tennis			
5	field_ho...			

Your first task is to collect data for each of the ball types. Do not enter units, just the measurements. The table tennis ball is shown opposite.

Once the data has been entered, construct a scatterplot of ball diameter (independent or explanatory variable) on the horizontal axis and mass (dependent or response variable) on the vertical axis.



	A ball	B diameter	C mass	D
=				
1	table_te...	4.	2.7	
2	squash			
3	golf			
4	tennis			
5	field_ho...			

Question: 1

A cricket ball is not included in the original list. If cricket ball data was added to the list, where would it reside on the scatterplot?

Question: 2

Use the Analysis option to create a linear regression model for the data and determine the equation.

a) What is the equation for the least squares regression line?

b) A new ball sport is being developed. The proposed ball has a diameter of 14cm. Determine an appropriate mass for the ball, assuming it falls into line with other ball sports.

c) A new children's size basketball is being developed. It is made from the same material as the sanctioned basketball but is made lighter so that it is easier for young children to throw. If the new ball is half the mass of the original, suggest a size for this new ball.

Author: P. Fox

Australian Rules Football

Unlike all the other balls in the data, an Australian Rules football approximates an ellipsoid, so it doesn't have a diameter. In this section you will explore where the Australian Rules football might fit amongst the data.

Question: 3

One way to compare would be to average the three measurements: height, width and length and substitute this as the 'diameter' measurement. Collect the appropriate data for an Australian Rules football and plot it on the scatterplot.

Another way to compare an Australian Rules football would be to consider comparing all balls by volume.

Question: 4

Use column D in the spreadsheet to record the volume of each ball. **Remember**, column B contains the diameter of each ball. Record all your volume measurements.

The formula for the volume of a sphere is: $V = \frac{4}{3}\pi r^3$

Question: 5

Graph volume versus mass in the scatterplot. The linear regression line no longer fits the data nicely.

a) Express the volume in terms of the diameter of a sphere.

b) Transpose your volume equation to make D (diameter) the subject.

c) Replace the D in your original least squares regression equation with your equation from (b), above.

d) The volume of an ellipsoid is given by the equation: $v = \frac{\pi hwd}{6}$ where h = height, w = width and d = depth.

Determine the volume of a football.

e) Use your equation from part (c) to estimate the mass of a football and comment on your answer.

Question: 6

Russell notices that ball density decreases with size. Use your volume vs mass relationship to show that Russell's statement is correct.

Question: 7

Daisy is designing a new ball using a special rubber-polymer compound with a density of 0.8 g/cm^3. The lining of the ball is 1cm thick. To ensure the ball conforms approximately with the relationship between ball diameter and mass, how large should Daisy make the ball?

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