Name(s)

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Project Number

S1803

Project Title

Trampolines: Force and Compression

Abstract

Objectives/Goals

The objective was to find the change in a trampoline's force when an object is dropped onto it off-center. Using this data, we tried to find the relationship between these two factors to see if there's a "spring constant."

Methods/Materials

First, a bowling ball was dropped onto a trampoline from a constant height, while changing the distance from the center. Trampoline compression was measured by placing a motion detector directly under the drop location. Results were inconclusive so the procedure was altered. The experiment was repeated with one person standing on a device that reduced surface area and the other measuring trampoline compression with string underneath the trampoline. Lastly, the string method was used on a smaller trampoline with varying weight to measure changes in compression in one location.

Results

We concluded that the distance from the center and trampoline compression have a quadratic relationship. At a constant position, mass and compression have a positive linear relationship. At a specific point on a trampoline there's a spring constant, though the spring constant varies with position. As the object's distance from the center of the trampoline changes, the amount the springs are pulled changes due to more force being put on either the material or the spring.

Conclusions/Discussion

From the results we created an equation, which eliminates the spring constant.
$F=(mg*sqrt(dx^2+dy^2))/(dy*(1+dx/(D-dx)))$ We'd like to further simplify this, but the trampoline is an extremely complicated situation. Ideally, we would be able to find the way to make the most efficient trampoline with such an equation.

Summary Statement

We analyzed the changes in a trampoline's force when objects hit it off-center, and created an equation for a trampoline's force according to our results.

Help Received

Discussed concepts with physics teacher