THE IGNITE SHOW

IGNITE CURRICULUM GUIDE

HIGH SCHOOL MATH

Aligned to The Common Core State Standards

The Algebra of a Bungee Jump

The students will apply an Algebra I equation to the real life experience of bungee jumping in this engaging lesson. They are given the challenge to design an egg bungee jump with rubber bands and a plastic bag requiring that they predict the number of rubber bands required for a 16 feet high bungee egg drop off their school stadium bleachers. Students collect data from a series of tests in the classroom, plot them out and create an algebraic equation of a line for success in the final egg drop challenge. The winning team will be the one whose egg drops the closest to the ground off the school stadium bleachers without breaking. Student teams will present the results of this challenge and discuss any experimental errors with the class.

WARM UP

This lesson starts with an essential question: How to graph a line in slope intercept form given two points? Students work in small tutoring groups of 3-4 with one person standing at their own medium-sized white board transcribing notes while others begin to solve the equation. This is critical knowledge before they can move forward with the lesson.

LESSON

Each student team has been given the challenge to create a 16 feet high bungee jump for a very fragile package (the egg!). This experiment is positioned to students as being "highly secretive" and all testing must be done inside the laboratory with a ceiling height of only 10 feet. The object dropped will be a raw egg inside a plastic bag harness, but for all experiments they use a test dummy made out of a plastic egg with marbles and M&M's. All testing, data collection, data analysis, and creation of final product must be completed with 30 minutes. Once they are ready to go, and the testing phase is completed, students join you outside (or wherever in your school facility is appropriate) and engage in the real egg drop challenge. Student groups compete in this very fun activity. Whose math was "spot on?"

At the conclusion of the lesson, when back in the classroom, student groups will create a class presentation that describes their results and discusses experimental error.

Requirements and Constraints:

- The test dummy cannot leave the lab due to security requirements.
- The height of the ceiling in the testing room is only about 10 feet high, much less than the required drop height of 16 feet for this challenge.
- All testing, data collection, data analysis, and creation of final product must be completed with 30 minutes.
- No team is allowed to take their design outside the lab to be tested until all teams are ready for the final drop.

Click here for Teacher to Teacher Video

Created by:
Lewis Chappelear
2008 California State Teacher of the Year
James Monroe High School
Los Angeles, CA

Materials

Supplies provided to each team (3-4 students):

- medium wipe-off boards with dry erase
- markers and erasers
- plastic eggs
- marbles and M&M's (test dummy innards)
- medium-size raw eggs – 1 per group
- small zippered plastic re-sealable bags
- measuring tape
- 7 rubber bands (7")
- graph paper

Resource Links (click to open)

achievethecore.org
pltw.org (Project Lead the Way)
bie.org (The Buck Institute for ED)
nctm.org (National Council of Teachers of Mathematics)
YouTube video (bungee jumping)
insidemathematics.org
illustrativemathematics.org

Classroom Tips

Have students work in small teams. Be sure to place measuring tapes to wall and have all other supplies out in small bins ready for students to access and use. Find a place before you start the lesson that is suitable, and available, for them to go and test their real egg drop.

Mathematical Practices:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Special message to teachers, parents and interested others: *This lesson was designed to shed light as to what the actual standards are and how they are being used by teachers all across the country to help all of our children — no matter the zip code — learn to think most strategically, critically and collaboratively. We hope the lesson demonstrates the simplicity and high level of expectations teachers and state leaders have agreed to as most important to help prepare our youth for the workplace. Let's know the facts, then join hands and help our teachers implement these standards in how we reinforce them in our homes and throughout our community.*

The Common Core State Standards www.corestandards.org

Mission Statement: The Common Core State Standards provide a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers. With American students fully prepared for the future, our communities will be best positioned to compete successfully in the global economy.

Mathematics: Toward greater focus and coherence - For over a decade, research studies of mathematics education in high-performing countries have pointed to the conclusion that the mathematics curriculum in the United States must become substantially more focused and coherent in order to improve mathematics achievement in this country. To deliver on the promise of common standards, the standards must address the problem of a curriculum that is "a mile wide and an inch deep." These Standards are a substantial answer to that challenge. It is important to recognize that "fewer standards" are no substitute for focused standards. Achieving "fewer standards" would be easy to do by resorting to broad, general statements. Instead, these Standards aim for clarity and specificity.

The Standards for Mathematical Practice Click here for easy reference to the specific standards. The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

As specified by CCSSO and NGA, the Standards are (1) research and evidence based, (2) aligned with college and work expectations, (3) rigorous, and (4) internationally benchmarked. A particular standard was included in the document only when the best available evidence indicated that its mastery was essential for college and career readiness in a twenty-first-century, globally competitive society. The Standards are intended to be a living work: as new and better evidence emerges, the Standards will be revised accordingly.

CCSS.Math.Practice.MP4 Model with mathematics. Click here for easy reference to the specific standards.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

Mathematics » High School: Algebra » Reasoning with Equations & Inequalities
Click here for easy reference to the specific standards.
Understand solving equations as a process of reasoning and explain the reasoning.

CCSS.Math.Content.HSA-REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

Interpret functions that arise in applications in terms of the context.
Click here for easy reference to the specific standards.

CCSS.Math.Content.HSF-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
CCSS.Math.Content.HSF-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

English Language Arts Standards » College and Career Readiness Anchor Standards for Writing » 6
Click here for easy reference to the specific standards.
Production and Distribution of Writing

CCSS.ELA-Literacy.CCRA.W.6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

English Language Arts Standards » Anchor Standards » College and Career Readiness Anchor Standards for Speaking and Listening
Click here for easy reference to the specific standards.
Presentation of Knowledge and Ideas

CCSS.ELA-Literacy.CCRA.SL.4	Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.

The activities included in this Ignite Curriculum Guide are provided to inspire and equip educators to implement the lesson as seen on The Ignite Show. The intent is not to necessarily imply mastery of the standards, but to offer alignment to a sampling of standards.