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| **Lesson Title : Regression Models** | **Unit #: 1** | **Lesson #:**  **2** | **Activity #:**  **4** |
| **Activity Title: The Challenge** |

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| **Estimated Lesson Duration:** | **8 days** |
| **Estimated Activity Duration:** | **4 days** |

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| **Setting:** | **Classroom** |

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| **Activity Objectives:**  Students will   * Receive cell phone functions to explore as it relates to battery life (For example, how using YouTube affects batter life) * Collect data points using their own cell phones relating battery life over time while using a particular function * Plot data points in Excel and find line of best fit (linear) or curve of best fit (exponential) * Use regression models to make predictions about battery life over time * Develop two strategies to conserve battery cell phone life * Compile brief report to communicate strategies and supporting mathematical evidence * Communicate strategies as a public service announcement in the form of a flyer to be posted around the school |

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| **Activity Guiding Questions:**   * What is the relationship between battery percentage, time and the application used? * How does “low power mode” conserve phone battery life? * Which applications on the phone use the most battery life? * Which applications on the phone use the least battery life? * How can we track the loss of battery life over time? * How effective is charging the battery while using it? (Extension: System of Equations) * Is there an “optimal battery percentage” time to use high draining applications? |

| **Next Generation Science Standards (NGSS)** | |
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| **Science and Engineering Practices (Check all that apply)** | **Crosscutting Concepts (Check all that apply)** |
| ☒ Asking questions (for science) and defining problems (for engineering) | ☒ Patterns |
| ☒ Developing and using models | ☐ Cause and effect |
| ☒ Planning and carrying out investigations | ☐ Scale, proportion, and quantity |
| ☒ Analyzing and interpreting data | ☐ Systems and system models |
| ☒ Using mathematics and computational thinking | ☐ Energy and matter: Flows, cycles, and conservation |
| ☒ Constructing explanations (for science) and designing solutions (for engineering) | ☐ Structure and function. |
| ☒ Engaging in argument from evidence | ☐ Stability and change. |
| ☒ Obtaining, evaluating, and communicating information |  |

| **Ohio’s Learning Standards for Science (OLS)** |
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| **Expectations for Learning - Cognitive Demands (Check all that apply)** |
| ☐ Designing Technological/Engineering Solutions Using Science concepts **(T)** |
| ☐ Demonstrating Science Knowledge **(D)** |
| ☐ Interpreting and Communicating Science Concepts **(C)** |
| ☐ Recalling Accurate Science **(R)** |

| **Ohio’s Learning Standards for Math (OLS) and/or**  **Common Core State Standards -- Mathematics (CCSS)** | |
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| **Standards for Mathematical Practice (Check all that apply)** | |
| ☒ Make sense of problems and persevere in solving them | ☒ Useappropriate tools strategically |
| ☒ Reason abstractly and quantitatively | ☒ Attendto precision |
| ☐ Construct viable arguments and critique the reasoning of others | ☐ Look for and make use of structure |
| ☒ Model with mathematics | ☒ Look for and express regularity in repeated reasoning |

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| **Unit Academic Standards (NGSS, OLS and/or CCSS):** |

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| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies)   * Microsoft Excel * Desmos Graphing Calculator * Flyer Rubric * Written Report Guidelines |

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| **Teacher Advance Preparation:**   * Rubric * Written Report Guidelines |

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| **Activity Procedures:**  **Day 1: Brainstorming/ Plan for collecting data**   1. Review the survey data collected and create topics of focus student teams will investigate 2. Give students their topic of focus. Allow them to brainstorm possible strategies relating to the topic that they will investigate. Students will choose one solution and implement it, recording steps along the way.   Day 2: Collecting/ Analyzing Data   1. Collect data and input to Microsoft Excel. Determine if data points more appropriately represent a linear or exponential model. Based on observations, apply line of best fit or curve of best fit. Use equation of line (or curve) to make predictions and draw conclusions.   Day 3: Draw Conclusions/ Written Report/ Public Service Announcement   1. Draw final conclusions from data – Determine three strategies 2. Begin drafting report and PSA   Day 4: Complete draft of written report/ Public Service Announcement   1. Complete written report 2. Complete PSA |

**Formative Assessments:**

* Line and curve of best fit

**Summative Assessments:**

* Written Report

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| **Differentiation:** |

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| **Reflection:**  Overall, this activity was a success. Through the final assessment (the written report), it was evident that students gained an understanding of how to find linear and exponential regression models for a data set and use the model to make predictions. Students engaged with challenge and were excited to share the strategies they had discovered, tested and proven.  To make the challenge better, I would schedule meeting times with the groups to ensure I am spending enough time discussing the content with them and checking on their progress. At times the students felt overwhelmed with the amount of work because they had not planned appropriately. At times, the challenge seemed drawn out and the students were losing momentum when collecting data points. While some groups were testing features of the phone that affected battery life more rapidly (like SnapChat or Video Messaging), other students tested strategies that were less exciting. For example, a group tested the affect high brightness had on cell phone battery life. To keep all other variables constant, students did not use their phone for an hour and checked in five- minute intervals how much the battery had changed. There was a lot of down time for this group. In the future, I would like to have something else for students to do as they collect data points instead of waiting idly. Some students did not collect enough data points to apply a linear or exponential regression. Depending on the phone feature the group explored, some groups had models that were more accurate because they had more data points. Some students also were unaware of keeping as many variables constant as possible. Finally, a student commented that there was no point in collecting data since everyone’s phone would yield different results. This was a major concern since in a class of 21 there were at least 10 different phone models used for collecting data. |