Unit Project

Introduction

As a final assessment in *Moving Straight Ahead*, you may administer the Unit Test or assign the Unit Project, Conducting an Experiment. This optional Unit Project provides students with an opportunity to further develop their understanding of linear relationships. You can formally assign the project near the end of the Unit. We recommend that students work on the project with a partner. Allow one class period for partners to collect their data. They can continue to investigate the task and draft their reports outside of class. Part of a second class period could be used for comparing results and finalizing reports. You may have students share their results in a class summary of the project.

The experiment in Project 1, the leaky faucet experiment, illustrates the relationship between time and amount of water lost. If the pressure of the water in the cup were constant, this relationship would be linear. However, the pressure decreases as the cup empties. Since the experiment is simulating a faucet dripping in which the pressure remains very nearly constant, you may want to suggest that water be added to the dripping cup to keep the height of the water in the cup somewhat constant. In trials, this experiment produced a graph that looks linear and permits convincing predictions.

In the experiment in Project 2, the relationship between the variables, original height and bounce height, is controlled by the fraction of the ball's energy that is lost on impact. This fraction is different for different balls but remains constant for individual balls. Student graphs should be linear, passing through the origin; but, because of measurement errors, students will not have exactly collinear points. The measurements should, however, be satisfactory enough for students to make confident predictions.

Assigning

The Unit Project is divided into two parts, Project 1 and Project 2. You can assign each part to a different group of students, or all students can complete both projects. For Project 1, students are asked to conduct an experiment simulating the water wasted by a leaky faucet so they can make predictions and use their data to answer questions. Project 2 involves an experiment in which students make predictions based on data they collect on the height of a bounce when a ball is dropped from different heights. These two experiments were chosen because the resulting graphs are convincingly linear in appearance. Samples of student projects and a suggested scoring rubric are provided.

Although students should be encouraged to be clever and creative, the emphasis of the project should be on mathematical content.

Providing Additional Support

If you have students who struggle with drawing their own tables and coordinate grids, you can give them **Labsheet: Wasted Water Experiment** and **Labsheet: Ball Bounce Experiment** to help them organize their data. Each labsheet provides students with a blank table and a blank first-quadrant grid. This can allow students to remain focused on the mathematics of the Unit Project while saving time.

Grading

Suggested Scoring Rubric

This rubric for scoring the project employs a scale that runs from 0 to 4, with a 4 + for work that goes beyond what has been asked for in some unique way. You may use the rubric as presented here or modify it to fit your district's requirements for evaluating and reporting students' work and understanding.

4+ Exemplary Response

- Complete, with clear, coherent explanations
- Shows understanding of the mathematical concepts and procedures
- Satisfies all essential conditions of the problem and goes beyond what is asked for in some unique way

4 Complete Response

- Complete, with clear, coherent explanations
- Shows understanding of the mathematical concepts and procedures
- Satisfies all essential conditions of the problem

3 Reasonably Complete Response

- Reasonably complete; may lack detail in explanations
- Shows understanding of most of the mathematical concepts and procedures
- Satisfies most of the essential conditions of the problem

2 Partial Response

- Gives response; explanation may be unclear or lack detail
- Shows some understanding of some of the mathematical concepts and procedures
- Satisfies some essential conditions of the problem

1 Inadequate Response

- Incomplete; explanation is insufficient or not understandable
- Shows little understanding of the mathematical concepts and procedures
- Fails to address essential conditions of problem

0 No Attempt

- Irrelevant response
- Does not attempt a solution
- Does not address conditions of the problem

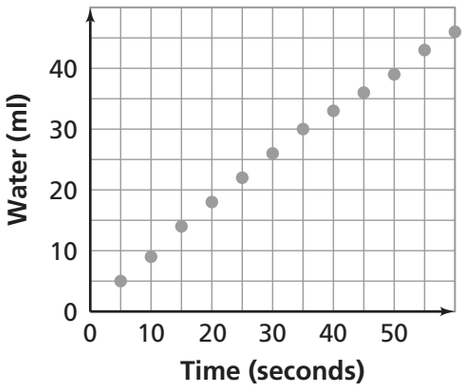
Sample Student Work

Here is a sample of student data from Project 1.

Water Loss

Seconds	Amount of Water (ml)
5	5
10	9
15	14
20	18
25	22
30	26
35	30
40	33
45	36
50	39
55	43
60	46

Water Loss



The table and graphs below show sample student data from Project 2. The balls used to collect this data were dropped on a sidewalk. The material the ball is made of will affect the bounce, as will the surface the ball bounces on. Another factor that can affect the results is the method students use to collect data. Some will collect several pieces of data for each bounce and average these. Some will use the top of the ball to indicate the drop and bounce height.

The data in this experiment are similar to the data students will collect for the bridge experiments in the Grade 8 Unit *Thinking With Mathematical Models*. Experiments like this are subject to measurement error and to other circumstances that may cause the data not to fit exactly on a straight line. However, the data should be very close to fitting on a line.

Ball Bounce Experiment

Drop Height (cm)	Bounce Height (cm)	
	Table-Tennis Ball	Tennis Ball
100	65	58
90	60	52
80	54	47
70	50	41
60	45	34