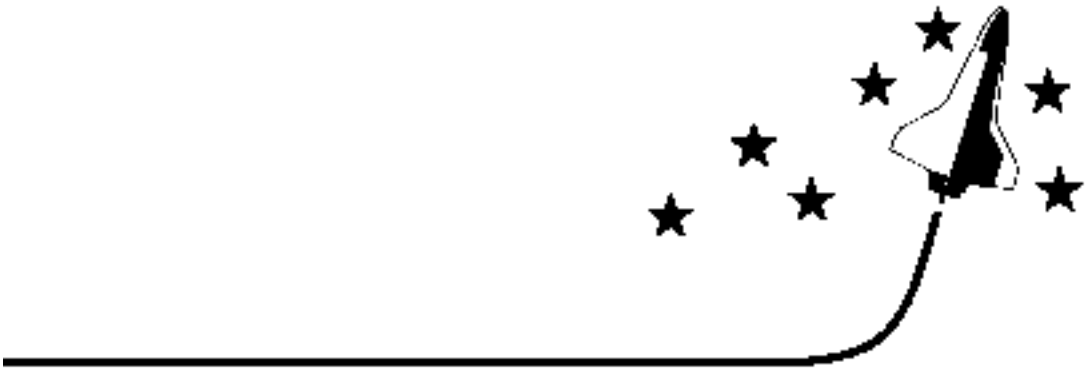
FACULTY NOTES

The LTAs and Spinoffs are designed so that each professor can implement them in a way that is consistent with his/her teaching style and course objectives. This may range from using the materials as out-of-class projects with minimal in-class guidance to doing most of the work in class. The LTAs and Spinoffs are amenable to small group cooperative work and typically benefit from the use of some learning technology. Since the objective of the LTAs and Spinoffs is to support the specific academic goals you have set for your students, the Faculty Notes are not intended to be prescriptive. The purpose of the Faculty Notes is to provide information that assists you to take full advantage of the LTAs and Spinoffs. This includes suggestions for instruction as well as answers for the exercises.



FACULTY NOTES

SPINOFF 7A

Orbits Versus Altitude
Regression with TI™ Graphing Calculators

Background Information

Topics: Learning how to do regression with a graphing calculator.

Level: Intermediate Algebra/College Algebra

Learning Objective: The students will have the opportunity to work within a group to learn how to do linear regression on their calculators. The students will also get a chance to collect data using the Internet.

Mathematical Prerequisites: For Parts A and B students should know the basic concepts of linear equations. For Part C they should be familiar with quadratic functions and be able to solve a quadratic equation either graphically or algebraically.

Time Requirement: The lessons have been broken down into three sections. You can choose to do all or just some of the three lessons.

Parts A and B can be done together in one class period. Divide the class into groups of 3 or 4 students who have the same type of graphing calculator. If possible, try to get one student in each group who is fairly comfortable using and experimenting with a graphing calculator. They should be able to complete these lessons with the group's help.

Part C introduces quadratic regression and shouldn't take the students much time to understand after already having done Parts A and B.

Assessment: Since the students should be able to do most of Parts A and B on their own, this is a good time to circulate through the classroom and listen to and join in on discussions with the students.

Part C could be written up and turned in for a grade or you could just have the students share their results in class.

Solutions

Section I - Linear Regression with TI™ Graphing Calculators

The regression equation is approximately:

$y = 6.285x + 40023.789$

The answers will vary depending on which calculator your students are using, but here is a synopsis.

a = 6.285, which is the slope for this equation. In this particular application it means that our orbit length increases by 6.285 km for each 1 km higher we orbit.

b = 40023.789, which is the y-intercept for this equation. For this problem that would mean if our altitude was 0 km our orbit length would be 40023.789 km, or in other words, when we are on the surface of the earth the distance around the earth (its circumference) would be approximately 40023.789 km.

The correlation coefficient r = 0.9999996309. (You might want to discuss round off error and calculator tolerances with your students. Or you might not.)

Section II - Investigation

1) a) $y = 0.31x + 3.26$
   b) The scatterplot should have the time variable on the horizontal axis and distance on the vertical axis. Make sure that each axis is titled and uniformly scaled.
   c) $r = .907$

2) a) $y = 0.07x + 4$
   b) The scatterplot should have the time variable on the horizontal axis and distance on the vertical axis. Make sure that each axis is titled and uniformly scaled.
   c) $r = .136$

3) a) $y = – 0.4x + 5$
   b) The scatterplot should have the time variable on the horizontal axis and distance on the vertical axis. Make sure that each axis is titled and uniformly scaled.
   c) $r = – 1$

4) At this level, the students should come to the understanding that r seems to be a measure of how well the linear equation approximates the data. The closer the absolute value of r is to 1, the better the linear equation approximates the data. The students should also note that the sign of r indicates the trend that the data follows, that is whether the y-values increase or decrease as the x-values increase.

Section III - Quadratic Regression

1) The equation of this parabola is $A(t) = – 0.031t^2 + 0.62t + 7.3$.

2) $A(4) = 9.284$ km.

3) $A(t) = 9$ when t is approximately 3.28 seconds and when t is 16.72 seconds.