

Tuition Costs and STEM Graduates

Tables and Graphs

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Grade Level	9th Grade	**Time Frame**	2-3 class period(s)
Subject	Mathematics	**Duration**	120 minutes
Course	Algebra 1		

Essential Question

How do we use graphical data to analyze, draw conclusions, and make decisions?

Summary

Students will learn to generate and analyze graphs given a table of data.

Snapshot

Engage

Show and discuss tuition costs for both state resident and nonresident students at the University of Oklahoma.

Explore

As a class, generate a table and draw a graph given the data on tuition costs.

Explain

In small groups, students analyze the graph, interpret findings, and discuss other contributing factors to college expenses.

Extend

Students find data on the number of STEM and other OU graduates. They will need to generate a table, draw a graph, and analyze/interpret.

Evaluate

Each group transcribes their table, graph, and findings on a blank white paper to present to the class via a document camera.

Standards

Oklahoma Academic Standards for Mathematics (Grades 9, 10, 11, 12)

A1.A.4.4: Translate between a graph and a situation described qualitatively.
A1.F.2.1: Distinguish between linear and nonlinear (including exponential) functions arising from real-world and mathematical situations that are represented in tables, graphs, and equations. Understand that linear functions grow by equal intervals and that exponential functions grow by equal factors over equal intervals.

Attachments

- OU Tuition Costs 2011-2016 - Spanish.docx
- OU Tuition Costs 2011-2016 - Spanish.pdf
- OU Tuition Costs 2011-2016.docx
- OU Tuition Costs 2011-2016.pdf

Materials

- Blank white paper
- Pencil
- Calculator
- Document camera or some other way to display information
- Chalkboard/whiteboard with corresponding writing apparatus
- OU tuition costs sheet (See attachment)
- Student devices with internet access

Engage

Show how much tuition for both state resident and nonresident students was in the 2013-2014 academic year at the University of Oklahoma. Compare it to the current year's tuition. Find this information on OU's Fact Books page.

Who Cares About Oklahoma?

We used the University of Oklahoma since we live in Oklahoma. If you don't want to use that data, that is fine. Every college has to release their own numbers for the date found throughout this lesson, so pick whichever university you think the kids will want to look at the most.

Explore

Post the following questions for the students to think about and answer using the data using the How I Know strategy:

- How much has tuition changed from 2012 to the current year? Possible reasons?
- How much is the difference between state resident and nonresident students?
- What do you think about the difference?
- What does it mean to be a resident of Oklahoma?
- Is the tuition changing throughout the year or only once per academic year?
- If we graphed this data, would the graph be a function? Continuous?

That is, have students write out their answers to each question and also write how they know the answer is correct in terms of context (like Ms. So-and-So taught me that) or content justification (such as using the definition of a function).

Teacher's Note

They may not be able to answer the last question, or you may have differing answers. This is a good way to lead into the next part.

Explain

Display the data from the **2016 Fact Book** on a document camera or on an interactive whiteboard. Tell the students to use the data to write a table and generate two graphs (one for resident and the other for nonresident). Make sure the students think about what to label the axis, what type of value is the input (independent)/output (dependent), and how the data points should be labeled (3,000 or 3 thousand).

Teacher's Note

Do not try to connect the points (unless you connect them using a step function, which still is not completely accurate)! This is a discrete function, since tuition does not change in the middle of an academic year and students cannot add classes in the middle of a year.

Ask the following questions about the graphs:

- Are these graphs functions?
- Are they continuous?
- How is this data different or similar to the previous data?

Next, have students look at the slope (the rate of change) between two various points on the graph.

Concept Connection

The students are taking the slope of various secant lines, which is the average rate of change. It might help to pick one fixed point and look at the various rates of change between the fixed point and other data points while drawing the secant lines.

Have small groups discuss the graph and findings. Between what consecutive years is the slope of the secant line (i.e., the average rate of change) the steepest? During what years does the graph increase and decrease? What other costs might you consider when attending a university?

Extend

Assign small groups different majors. The University of Oklahoma lists majors from architecture to world cultural studies.

Teacher's Note

Groups should be no bigger than four (preferably two to three). If more groups are needed than majors, assign multiple groups the same major. Then have them get together and compare before presenting as a big group.

In their small groups, have the students look up data on the University of Oklahoma (OU) graduates based on the assigned major from their Fact Book. The number of graduates per major is listed under Part I: Academic, Degrees Conferred by Major in section, 2 page 6. Have the students generate a graph from the data and interpret their findings. To gather the data to generate the graph, students will have to look at the OU Fact Books from previous years. OU includes previous 11 years of Fact Books at the bottom of the site given, and each one has this section (Part I: Academic) where students will find the information they need.

Evaluate

Each group will construct their graph with their findings on a blank white paper and present it to the class.

Resources

- K20 Center. (n.d.). How I Know It. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5067d68
- University of Oklahoma. (n.d.). Fact books (Web page). Institutional Research and Reporting. http://www.ou.edu/content/irr/fact-books.html#pre