

Math TODAY™ Challenge Teacher Edition



NO. 1 IN THE USA

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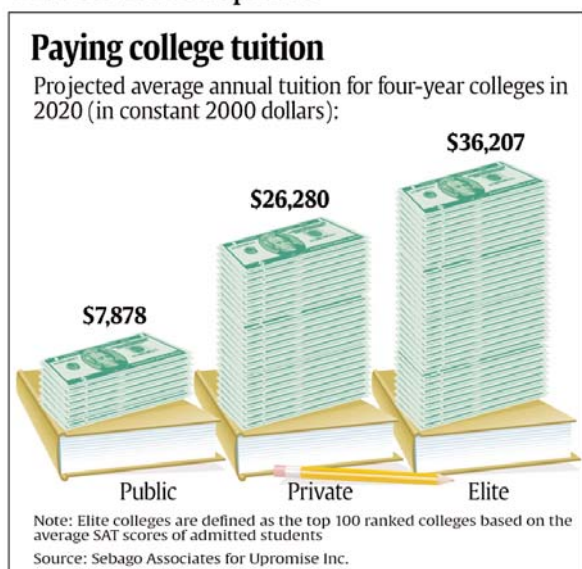
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Paying college tuition

By: Brenda Perkins

USA TODAY Snapshots®



By Karen Sloan and Marcy E. Mullins, USA TODAY

Activity Overview:

Students will write exponential equations based on the percent of increase of college costs and will graph and interpret these equations. Students will then use an inflationary equation based on the USA TODAY Snapshot "Paying college tuition" to project college costs using another factor which affects future expenditures pertaining to higher education.

Concepts:

- Percent of change
- Exponential equations: writing equations, x- and y- intercepts, graphing and interpreting

Objectives:

Students will:

- calculate the percent of change.
- write exponential equations in the form $y = a(b)^x$, given a and b.
- use the exponential equations to do analysis and make predictions.
- graph exponential functions.

Activity at a Glance:

- Grade level: 10-12
- Subject: Algebra II
- Estimated time required: 40-50 minutes

Materials:

- TI 83 Plus family or TI-843 Plus family
- Overhead view screen calculator for instruction/demonstration
- Student handout
- Transparency
- Graph paper
- Table from the USA TODAY article

Prerequisites:

Students should be able to:

- calculate percent of change.
- write, graph and calculate using exponential equations.
- graph and use tables on the handheld.



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Paying college tuition

Background:

As students approach the end of their compulsory education, their sights are set on college. Scholarships, financial aid, decisions between private versus public universities and 2-year versus 4-year degree institutions are all factors affecting the ultimate cost of a post secondary education. In the USA TODAY articles, “Grants more than offset soaring university tuition” and “Public universities raise tuition, fees — and ire” and the USA TODAY Snapshot “Paying college tuition” present another aspect students may not be aware of - the affect that inflation and a slow economy might play in the ultimate cost of their degree. This activity presents a real-life application of exponential equations, one that the majority of students will find pertinent to their immediate future. It offers a timely lesson in reading and understanding data presented in a graphical, as well as written, format.

The USA TODAY articles are effective accompaniments. It helps make the data more concrete and allows for reading in the mathematics classroom. It also creates an opportunity for students to write and develop higher order thinking skills, such as application of concepts, analysis of information and synthesis, to arrive at their solutions.

Preparation:

- Provide one graphing handheld for each student.
- Each student should have a copy of the corresponding student activity sheet.

Classroom Management Tips:

- Students will have a better understanding of how to read the graphic and retrieve data if you use the transparency for a class discussion before the students start working.
- Remind students to carefully read all parts of the graphic before they start collecting data.
- Students can work individually or in small groups on this activity.
- Students can work individually or in groups to assist each other as they learn the various features of the handheld.
- Review calculating the percent of change. The average percent of change can be easily calculated by using the average costs of the two school years. Some students will calculate the mathematical average by entering all of the data they calculated from the chart. The two methods should yield the same result, but there is a greater possibility of error using the calculated data due to the number of pieces of data.
- The independent variable is in years since 2001. This makes calculations easier because of the smaller numbers and gives a point of reference for discussion purposes.

Data Source:

Sebago Associates for Upromise Inc.

National Council of Teachers of Mathematics (NCTM) Standards*:

Algebra Standard

- Understand patterns, relations, and functions.
- Represent and analyze mathematical situations and structures using algebraic symbols.
- Use mathematical models to represent and understand quantitative relationships.
- Analyze change in various contexts.

Connections Standard

- Recognize and apply mathematics in contexts outside of mathematics.

Communications Standard

- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.

*Standards are listed with the permission of the National Council of Teachers of mathematics (NCTM), www.nctm.org. NCTM does not endorse the content or validity of these alignments.

Additional Resources:

- Student Handout
- Transparency
- TI Technology Guide, for information on the following: TI-73 Plus family, TI-84 Plus family, List Editor, ScienceTools, Finance and Cabri® Jr.
- TI-Navigator™ Basic Skills Guide for information on using the TI-Navigator Classroom Learning System

Paying college tuition

Activity Extension:

- Use in-state costs and have students create a map graph to analyze college costs by national regions.
- Have students investigate the tuition and other fees of a college of their choice. Calculate the cost of attending for four years. Finally, have them develop a budget and a method of paying for this college tuition.
- Using the inflationary equation, have students draw a financial picture of the year 2020. Have them project food, entertainment, housing and transportation costs. To round out the activity, have them fill in their personal information or have them describe a typical Wednesday with all details of their day.

Curriculum Connections:

- Social Studies/Economics
- Business
- Career Planning

Teacher Notes:

Paying college tuition

Reading the articles:

“Public universities raise tuition, fees — and ire”

Q. What is the primary factor for the current increase of college/university costs?

A. Cuts in state funding

Q. Although most colleges and universities have kept increases to single digits which universities show some of the larger increases?

A. University of Kansas at 21%, Texas A&M at 26% and the University of South Carolina at 17%

Q. Why is increased enrollment putting a strain on college and university budgets?

A. 1) The revenue gained is merely funds lost to state cuts rather than additional value. 2) The largest share are low-income students, many of them minorities and the first in their families to aspire to college. 3) Many of these students will need financial aid and basic skill remediation, two more budget drainers.

Q. Even with the substantial increases in tuition and fees, why does the article propose that a public college or university education is still a bargain?

A. State schools are still a bargain compared to tuition at private universities.

Q. What is the University of Kansas doing with a portion of their tuition increase?

A. The University of Kansas is investing \$1.5 million, or about 20% of the revenue raised by the undergraduate tuition increase, into need-based aid.

Q. What is another factor adding to the increase in college and university enrollments?

A. Enrollments have increased in part due to the economy. Many people who have lost their jobs are going back to school.

Q. What are some of the other ways colleges and universities have increased income without general tuition hikes?

A. Purdue and Indiana University are charging a one-time-only \$1,000 new student fee. The University of Illinois is adding a similar \$1000 surcharge. Some universities are charging higher tuitions for upper-level students due to their increased usage of high-tech facilities.

“Grants more than offset soaring university tuition”

Q. Explain what the article means when it states: “For most students, it’s a lot cheaper to go to a four-year public university today than it was just six years ago.”

A. This is because tuition has been supplemented in recent years with tax breaks and grants. Few people pay full price.

Q. Why supplement tuition with tax breaks and grants? Why not just charge less for tuition?

A. According to James Garland, president of Miami University in Oxford, Ohio, the high price makes students realize the value of their education.

Paying college tuition

Assessment and Evaluation:

Activity One Questions

Q. What are the two exponential equations you wrote and entered in y1 and y2.

A. College/University: answers will vary $y1 =$ answers will vary

Average Cost Equation $y2 = 9517(1.08)^x$

Q. In both equations "a" is the y-intercept, but what real world implication do they have?

A. The cost of a year of college for the base year of 2001 - 02.

Q. Using your handheld, approximate the x-intercepts. What is the real meaning of this value?

A. There is no x-intercept. The cost of a college education has never been zero.

Q. Using the equation for the average cost, how much will you pay in tuition and fees your freshman year?

A. Answers will vary.

Q. Based on your exponential equation, how long will it take for the cost of one year of college to reach \$20,000 (round your answer to the nearest year)?

A. If the equation $y2$ is used, then it will take approximately 11 years. If the student used the equation in $y1$ then the answer will vary, but should be close.

Activity Two Questions

Q. What is the approximated cost of tuition that you calculated for an elite college or university in the year 2020 dollars? Round your answer to the nearest dollar.

A. $y = \$72,044$

Q. Write similar exponential equations to convert the data in the USA TODAY Snapshot "Paying college tuition" to calculate anticipated costs for public and private colleges and universities in 2020 using the same inflationary rate? Type these equations into y4 and y5 of your handheld. Graph all three equations on the same coordinate plane on your graph paper.

A. public: $y4 = 7878(1.035)^x$ private: $y5 = 26280(1.035)^x$

Q. The USA TODAY Snapshot "Paying college tuition" and the table in the USA TODAY article "Public universities raise tuition, fees-and ire" seem to be presenting almost contradictory information. By reading carefully, you can discover they are discussing two different aspects of the future costs of college. Compare and contrast the information presented in both graphics.

A. Write your answer on a separate sheet of paper.

Paying the price as a full-time freshman

When it comes to college costs, most of the focus is on tuition. But students also pay other fees associated with enrollment and campus living. What's the total price tag of a year at a public university? USA TODAY's In-Sung Yoo surveyed 68 major public universities - at least one in each state - to find out what first-year, full-time freshmen would be expected to pay this year, compared with last year, if they shared a dorm room with another student and selected the most popular meal plan.

University	In-state students			Out-of-state students		
	2001-02	2002-03	Chg.	2001-02	2002-03	Chg.
University of Alabama, Tuscaloosa	\$7,202	\$7,590	5%	\$12,822	\$13,658	7%
Auburn University, Auburn, Ala.	8,880	9,370	6%	15,400	16,670	8%
University of Alaska, Anchorage	8,186	8,350	2%	12,242	12,526	2%
University of Arizona, Tucson	8,610	9,151	6%	16,476	17,671	7%
Arizona State University, Tempe	7,872	8,072	3%	15,410	16,594	8%
University of Arkansas, Fayetteville	12,120	13,497	11%	23,236	26,241	13%
UCLA	11,455	12,014	5%	22,529	24,393	8%
University of California, Berkeley	13,120	14,709	12%	23,364	27,088	16%
University of Colorado, Boulder	9,255	9,838	6%	23,265	25,182	8%
University of Connecticut, Storrs	12,122	12,588	4%	21,240	22,262	5%
University of Delaware, Newark	10,824	11,462	6%	19,914	20,992	5%
University of Florida, Gainesville	7,874	8,221	4%	15,762	17,686	12%
Florida State University, Tallahassee	7,835	8,312	6%	15,723	17,856	14%
University of Georgia, Athens	8,527	9,120	7%	16,423	18,490	13%
Georgia State University, Atlanta	7,792	8,152	5%	15,688	16,522	5%
University of Hawaii, Manoa	7,060	7,356	4%	13,540	13,836	2%
Idaho State University, Pocatello	7,344	7,986	9%	13,584	14,226	5%
University of Illinois, Urbana-Champaign	11,885	13,108	10%	19,705	21,712	10%
Illinois State University, Normal	9,236	10,099	9%	13,180	14,289	8%
Indiana University, Bloomington	10,252	11,203	9%	19,987	21,813	9%
Purdue University, West Lafayette, Ind.	9,529	11,278	18%	19,237	21,958	14%
Iowa State University, Ames	7,869	8,841	12%	15,203	17,533	15%
University of Iowa, Iowa City	8,193	9,631	18%	16,621	19,273	16%
Kansas State University, Manhattan	7,075	7,944	12%	14,002	15,204	9%
University of Kansas, Lawrence	7,304	8,126	11%	13,601	15,329	13%
University of Kentucky, Lexington	7,765	8,569	10%	14,305	15,121	6%
Louisiana State University, Baton Rouge	8,014	8,504	6%	13,314	13,804	4%
University of Maine, Orono	10,845	11,268	4%	18,615	19,438	4%
University of Maryland, College Park	12,221	13,051	7%	20,293	21,815	8%
University of Massachusetts, Amherst	10,327	11,955	16%	18,550	20,178	9%
Michigan State University, East Lansing	10,305	11,033	7%	18,652	20,100	8%
University of Michigan, Ann Arbor	13,003	13,851	7%	27,713	29,731	7%
University of Minnesota, Twin Cities	11,528	11,976	4%	20,994	22,550	7%
University of Mississippi, Oxford	8,826	10,546	19%	13,372	15,455	16%
University of Missouri, Columbia	9,820	10,634	8%	18,265	19,787	8%
Montana State University, Bozeman	8,451	9,121	8%	15,217	16,758	10%

AS SEEN IN USA TODAY NEWS SECTION, THURSDAY, AUGUST 8, 2002 PAGE 1A

The University of Montana, Missoula	8,405	8,935	6%	14,417	15,719	9%
University of Nebraska, Lincoln	8,325	8,990	8%	13,927	15,583	12%
University of Nevada, Las Vegas 1	8,043	8,518	6%	15,258	16,303	7%
University of New Hampshire, Durham	13,304	14,012	5%	22,724	23,712	4%
Rutgers University, New Brunswick, N.J.	13,438	14,436	7%	18,876	20,412	8%
University of New Mexico, Albuquerque	9,219	10,679	16%	17,617	18,946	8%
University at Buffalo (SUNY)	11,108	11,392	3%	16,008	16,292	2%
SUNY at Stony Brook	10,825	11,159	3%	15,725	16,059	2%
University of North Carolina, Chapel Hill 2	8,847	10,356	17%	18,839	21,640	15%
University of North Dakota, Grand Forks	7,015	7,796	11%	11,615	2,728	10%
Ohio State University, Columbus	10,485	11,910	14%	19,251	21,333	11%
Ohio University, Athens	11,769	13,113	11%	17,838	20,595	15%
University of Oklahoma, Norman	7,616	7,890	4%	12,340	13,108	6%
University of Oregon, Eugene 3	10,219	10,646	4%	20,641	22,175	7%
Pennsylvania State University, University Park	12,696	14,042	11%	20,822	23,270	12%
University of Rhode Island, Kingston	12,372	13,215	7%	21,150	22,685	7%
University of South Carolina, Columbia	8,206	9,128	11%	15,146	17,248	14%
Clemson University, Clemson, S.C.	9,022	10,288	14%	15,816	17,386	10%
University of South Dakota, Vermillion	7,035	7,451	6%	11,391	11,984	5%
The University of Tennessee, Knoxville	8,126	8,756	8%	15,912	17,108	8%
Texas A&M University, College Station	8,984	10,156	13%	14,470	15,824	9%
University of Texas, Austin	49,974	10,555	6%	16,304	17,095	5%
Utah State University, Logan	6,770	7,078	5%	12,078	12,379	2%
University of Vermont, Burlington	14,761	15,352	4%	26,821	27,842	4%
University of Virginia, Charlottesville	9,356	10,011	7%	23,388	25,221	8%
Virginia Polytechnic Institute and State University, Blacksburg	7,636	8,006	5%	16,460	17,622	7%
University of Washington, Seattle	10,355	11,206	8%	19,630	21,907	12%
Washington State University, Pullman	9,935	10,216	3%	17,316	17,966	4%
West Virginia University, Morgantown	8,304	8,812	6%	14,188	15,282	8%
University of Wisconsin, Madison	9,789	10,410	6%	21,849	24,330	11%
University of Wyoming, Laramie	7,200	7,737	7%	12,672	13,997	10%
Average	\$9,517	\$10,280	8%	\$17,283	\$18,769	9%

1 -- Does not include major-specific fees

2 -- 2002-2003 data pending approval by North Carolina General Assembly

3 -- Maximum. 15% discount for late-afternoon courses.

4 -- Average. Fees depend on program enrollment.

Source: USA TODAY research



If you are using the TI-Navigator Classroom Learning System, send the provided LearningCheck assessment to your class to gauge student understanding of the concepts presented in the activity. See the TI-Navigator Basic Skills Guide for additional information on how this classroom learning system may be integrated into the activity.