
9

Math

The math standards place an emphasis on real-world problem solving, so the questions in this chapter are tied to real-world situations. This is a move away from standard textbook problems that have one correct answer. Instead students are encouraged to “make sense of problems and persevere in solving them” (Mathematics: Introduction: Standards for Mathematical Practice). In addition to anchoring these problems in the Common Core State Standards for each grade level, I have designed questions that invite dynamic discussions around the process of arriving at an answer. The Standards encourage students to “construct viable arguments and critique the reasoning of others” (Mathematics: Introduction: Standards for Mathematical Practice), which requires that they have time and space to communicate and collaborate. In life there are often a number of variables that must be considered, which means the answers to a given problem may vary. This variety lends itself to interesting conversations about the problems and the strategies different students use to solve them.

Online conversations require students to articulate their process, ask questions, offer insights, and build on other students’ reasoning. This encourages them to approach math with a mental flexibility. Instead of looking for one right answer, these questions value the approach and process. This makes math less intimidating for students because the focus is no longer on getting the “right answer.”

I have also incorporated elements of both argument and informative writing into these questions to encourage writing across the curriculum. Judy Willis (2011), former neurologist and teacher, asserts,

When learning is examined through shared writing, students are exposed to multiple approaches to solving problems. This is so important in building the flexibility and open-minded approach. . . . Furthermore, students have the chance to communicate using their own words. They build communication skills they will surely use in their collaborations now and in the future science and math communities they will enter. (para. 9)

Dr. Willis highlights the importance of writing to support the brain's ability to take in, process, and retain concepts. She asserts that writing "can increase [students'] comfort with and success in understanding complex material, unfamiliar concepts, and subject-specific vocabulary" (para. 3). Since work done in online discussions must take the written form, this encourages students to explain their approach to math in writing, therefore fortifying their understanding of mathematical concepts.

Common Core State Standards: Upper Elementary Math

The following are the math standards addressed for the upper elementary level. I have also listed the Grades 4–5 writing standards because online work requires that students articulate their ideas in writing and publish them online.

Grades 4–5 Math Standards Addressed

4.NF.4	Apply and extend previous understandings of multiplication to multiply a fraction by a whole number. . . . Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem.
5.G.2	Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

Grades 4–5 Writing Standards Addressed

W.4-5.4	Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
W.4-5.6	With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others.

Note: The language describing each standard is taken directly from the Common Core State Standards Initiative website: www.corestandards.org.

In fourth and fifth grade, the Standards state that students should focus on operations, algebraic thinking, fractions, measurements, and geometry. Though these questions focus on specific mathematical concepts, the question ideas can be applied to a variety of topics.

Example Online Activity 9.1. How Would Graphing Points on a Coordinate Plane Help Solve Real-World Problems?

Common Core Standards

5.G (Geometry)

The coordinate plane feels static and far removed from “real life,” so this question challenges students to select a real-life circumstance and show how a coordinate plane can be used to problem solve. Students are able to choose a situation—astronomy, land use planning, or art—to think about in relation to the coordinate plane. By having several different topics to choose from, students can focus their energy on figuring out how the coordinate plane would be used in this situation. They must think about how charting points on a graph might be helpful to solving a problem in a given field. To do this, they have to consider how a chart would allow an astronomer, land use planner, or artist see relationships between points on the coordinate plane.

Weave Online Work Into the Classroom With Student-Centered Activities

1. *Career Research.* As a class, brainstorm careers that use graphing on a regular basis. Once the class has generated a list, put students in

How Would Graphing Points on a Coordinate Plane Help to Solve Real World Problems?

Popularity: 0
Vote
Comment

Posted By C. Tucker Moderator to M- Upper Elementary on 10/10/2011

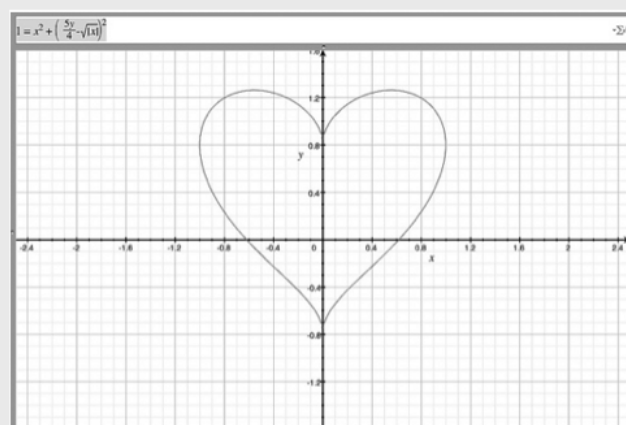
Graphing can be used to determine the relationships between points, lines, rays and angles on a given plane. Select one of the following circumstances and explain how graphing would be a helpful strategy for solving a real world problem related to that field.

Once you have posted your explanation, reply thoughtfully to at least 2 of your classmates. Compliment strong points made, ask questions and build on ideas presented.

Bartlett, Alice. "Graph. " Heart. Flickr. 3 Apr 2011. 10 Nov 2011.
<http://www.flickr.com/photos/23298087@N02/5585190140/>

Attachments

Graphing on a Coordinate Plane



- ☐ study of space
- ☐ building and land use planning
- ☐ art
- ☐ clothing design
- ☐ archeological exploration

View and Comment (0) Watch

small groups and assign a career to each group. Each career group researches how graphing is used in the job they are studying.

- What education is required for this job?
- What type of math must a person learn to work in this occupation?

- When would a person in this profession need to create and/or read graphs?
- Explain how graphs make their work easier or more successful.

This activity can be extended if each group creates a Lino canvas online (for more on Lino, see p. 126) where they post information about the career they researched. This can help students who are interested in math find out more about occupations that require math.

2. *Brainstorming.* In groups, ask students to think about graphs they have seen outside the classroom.

- What kinds of graphs do you see every day?
- What information do they provide?
- How is the graph display of information more helpful than if that information was written out?

Be prepared to share the highlights of your discussion with the class. This brainstorm can take place in class or online using Wall Wisher.

Wall Wisher

www.wallwisher.com

Create a multimedia wall where students can brainstorm ideas, post notes, and attach files, pictures, music, and video.

Free

3. *Creative Graphing Assignment.* Ask students to graph their home or school on a coordinate plane. Tell them to label the important points on the graph that represent key places, rooms, and objects in their home or at school. Make sure they use all four quadrants of the coordinate plane. Include an artistic component by asking them to draw small symbols or pictures to represent locations (e.g., bed to represent a bedroom at home, slice of pizza to symbolize the cafeteria at school). Students can also use the Kids' Zone graph creator available on the National Center for Education Statistics website.

National Center for Education Statistics Kids' Zone

nces.ed.gov/nceskids/createagraph/default.aspx

Create kid-friendly graphs (XY, bar, line, area, or pie).

Free

Example Online Activity 9.2.

Design a Word Problem: Multiplying Fractions to Solve Real-World Problems

Design a Word Problem: Multiplying Fractions to Solve Real World Problems

Popularity: 0
Vote
Comment

Posted By C. Tucker Moderator to M- Upper Elementary on 10/10/2011

Watch this Khan Academy explanation about multiplying fractions. Then think about your life and how you use fractions to solve real problems.

Design a word problem that requires your classmates to multiply fractions to solve a real world situation. Keep your language detailed and specific so your classmates can understand the problem that needs to be solved. Focus on a real word situation or dilemma.

Once you have posted your word problem, select a word problem designed by a peer and attempt to solve their word problem and explain your process. Post a reply to that person and address the following questions: How did you solve this problem? If you struggled to solve the problem, explain why. Was there information left out? Was the wording unclear?

Khan, Salman. "Multiplying Fractions." Online video clip. Khan Academy. 7 Apr 2011. 17 Oct 2011
<http://www.khanacademy.org/video/multiplying-fractions?playlist=Developmental+Math>

Attachments

Khan Academy Tutorial

Multiplying Fractions

Multiply $\frac{5}{6} \cdot \frac{2}{3}$. Simplify your answer.

$$\frac{5}{6} \cdot \frac{2}{3} = \frac{5 \cdot 2}{6 \cdot 3} = \frac{10 \div 2}{18 \div 2} = \frac{5}{9}$$



Post a Comment

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Common Core Standards

4.NF (Number and Operations—Fractions)

This activity provides a Khan Academy video embedded into the discussion topic to support students' understanding of fractions. Khan Academy is a nonprofit education site with thousands of videos on a variety of academic topics. The videos are short tutorials led by Salman Khan, who explains concepts in a clear, easy-to-understand style. These videos can help support students when they are working at home and struggling with a concept. I highly recommend embedding the videos into discussion topics to differentiate instruction and engage students in conversations about the topics discussed in the tutorials.

Once students have watched the Khan video (once, twice, three times depending on how much support they need), they must think about how they use fractions in their own lives and create a real-life problem involving fractions for their peers to solve. This activity can be applied to a variety of mathematical concepts. Because it requires that students apply the concept to their own lives, the teacher is freed from having to design a collection of real-life scenarios involving fractions. It also challenges students to consider carefully the problem and how they present that problem in writing so that it is clear and easy to understand.

Once students have posted their word problems, other students are able to critique any that are unclear or missing information. This is an incentive for students to take care designing and writing word problems that others can answer. Students must attempt to solve at least one of their peers' word problems and explain their process. This requires that they not only design an original problem but also practice solving one and explain in writing how they got their answer.

Khan Academy

www.khanacademy.org

Access thousands of videos on a variety of topics, including math, science, astronomy, art history, and test preparation. Students can also complete practice questions.

Free

Weave Online Work Into the Classroom With Student-Centered Activities

1. *Group Strategy Session.* Have students share their best tips and/or strategies for solving word problems using their peers' word problems

Google Docs

docs.google.com

Create a shared Google doc for collaboration, or use Google forms to design a survey and collect information.

Free (gmail account needed)

as examples. Once they have shared tips, they can practice writing more complex word problems that require an additional step to solve. The class can add their tips and strategies to a shared Google doc, which they can add to throughout the year, creating a student-generated study guide.

Teacher's Note: Study Guides and Strategies is an education public service website that has a page titled “Solving Math Word Problems”: www.studygs.net/mathproblems.htm.

Educreations

www.educreations.com

Create and share video lessons in minutes. The iPad app is an interactive whiteboard that records what students say and write. Images can also be uploaded into the virtual lesson.

Free

2. *Word Problem Challenge.* In groups, ask students to write another word problem about fractions (or a related topic) and exchange with another group. Students work together to solve the problem, then present the solution with a clear explanation to the class using a whiteboard or projector. If iPads are available,

students could actually record their own student-produced videos, similar to Khan Academy tutorials, using Educreations.

ReadWriteThink

www.readwritethink.org/files/resources/interactives/comic/index.html

Create cartoons and comics with images and thought bubbles to share or print.

Free

3. *Fraction Fun With Comic Strips.* In small groups, ask students to draw a comic strip representation of a word problem based on a real-life scenario, with each square focused on a step in the word problem. Encourage students to be creative with the characters, insert humor, and have fun with this! Students

can use the online comic creator available from ReadWriteThink or design a comic Pixton (for more on Pixton, see p. 105).

Common Core State Standards: Middle School Math

The following are the math standards addressed for middle school. I have also listed the Grades 6–8 writing standards because online work requires that students articulate their ideas in writing and publish them online.

Grades 6–8 Math Standards Addressed

6.RP.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
7.SP.1	Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
7.SP.2	Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.

Grades 6–8 Writing Standards Addressed

W.6-8.4	Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
W.6-8.6	With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others.

Note: The language describing each standard is taken directly from the Common Core State Standards Initiative website: www.corestandards.org.

In sixth and seventh grades, the standards focus on ratios, proportions, the number system, expressions, equations, geometry, statistics, and probability. In eighth grade students also learn about functions. The scope of their study in each area develops each year to include more

complex concepts and build on work done the previous year. As such the activities I designed for this section can be simplified for younger students (sixth) or made more complex for older students (eighth).

Example Online Activity 9.3.

Design a Survey, Take a Random Sampling, and Make a Generalization

Design a Survey, Take a Random Sampling & Make a Generalization

Popularity: 0
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Posted By C. Tucker Moderator to M- Middle School on 10/10/2011

Tasks:

1. Design a short survey on a topic you are interested in. Your survey can take any format you prefer- questionnaire or interview; in person or online (e.g. <http://www.surveymonkey.com>).
2. Survey a random sampling of people.
3. Use your random sampling to make generalizations about how the larger population feels about your topic.

Written Response:

In your response begin by describing your survey. What was the topic of your survey? Why did you focus on this topic? What type of survey format did you use? Then explain how you ensured that you surveyed a "random" sampling of the population. Did you use a strategy to ensure your sampling was random? Are there any factors that might jeopardize the "random" nature of this sampling? What generalizations can you make based on the results of this survey. Use the data collected to support your generalizations.

Once you have posted your explanation, reply thoughtfully to at least 2 of your classmates. Compliment strong points made, ask questions and build on ideas presented.

"TV Viewing Template." Survey Monkey. www.surveymonkey.com

Attachments

Example Online Survey Using Survey Monkey

TV Viewing Template

1. How often do you watch television shows?

- ☐ Extremely often
☐ Very often
☐ Moderately often
☐ Slightly often
☐ Not at all often

2. Out of all the television shows you have ever seen, which is your most favorite?

3. Out of all the television shows you have ever seen, which is your least favorite?

Post a Comment

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Common Core Standards

7.SP.1, 7.SP.2, W.6-8.4, W.6-8.6

This activity asks students to do a variety of different tasks to develop their understanding of statistics and probability. First, they must design a survey about a topic of interest to them; they

can do this on paper or online. SurveyMonkey can be used to create and provide access to an online survey. Second, they must consider what a random sampling is and how it can be achieved. Third, they must collect survey responses and use the results to make some generalizations about the larger population.

Teachers immediately grab student interest when they ask students to design a survey on a topic of their choice; this creates immediate buy-in from students. With a class full of survey topics, results, and generalizations, this activity paves the way for countless follow-up discussions and debate opportunities.

SurveyMonkey

www.surveymonkey.com

Quickly create a survey, get feedback, and analyze the results.

Free

**Weave Online Work Into the Classroom
With Student-Centered Activities**

1. *Survey the Class.* Have students survey the entire class using the survey they designed for homework. Once everyone has taken the surveys, give students time to analyze the results. Have students discuss these questions in small groups:

- What were the results of the survey in class compared to the results of your previous random sampling?
- How did the opinions of your classmates differ from those of your random sampling?
- Were the generalizations you made based on your random sampling representative of the results you got from the class?
- How do you think the age of a population you survey impacts the results?

2. *Debate.* Ask students to debate the following questions:

- Is there such a thing as a truly random sampling? If so, how can this be achieved? If not, what barriers exist that are impossible to overcome?

- What factors impact the truthfulness of a survey?
- Under what conditions might a person you are surveying give a dishonest or inaccurate answer?
- How can this possible inaccuracy be eliminated or reduced?

Creately

creately.com

Create and collaborate on diagrams online. Drag and drop shapes, insert text, and use arrows to connect ideas. Share or export.

Create five free diagrams.

3. *Evaluating Trends in the U.S. Census.* Divide the class into small groups, and provide them with the results of the 2000 and 2010 U.S. Censuses. Ask the groups to identify key pieces of data to compare and analyze. What generalizations, patterns, and trends do they observe? What might be the importance of these

patterns and trends? Students can chart the trends they observe using Creately, an online graph maker.

Teacher's Note: The U.S. Census Bureau (www.census.gov) has posted the census information for both 2000 and 2010.

Example Online Activity 9.4. Real-Life Ratios

Common Core Standards

6.RP.1, W.6-8.4, W.6-8.6

In sixth grade students must “understand ratio concepts and use ratio reasoning to solve problems” (Mathematics: Grade 6: Ratios and Proportional Relationships), then in seventh grade they must begin to “analyze proportional relationships” (Mathematics: Grade 7: Ratios and Proportional Relationships). To effectively move from understanding to analyzing proportional relationships, it is helpful to begin by asking students to discuss how they “see” and understand ratio relationships in their lives. That way they can begin to brainstorm real ratios they encounter and think about problems involving ratios in their lives.

I used the vote or suggest question structure in Collaborize Classroom to allow students to vote for their favorite example. This provides an incentive for students to be creative in their choices and carefully write their answers to ensure they are clear. If you are using a learning platform or learning management system without a voting feature, this activity can be done manually by asking students to select their favorite to share in class.

Khan Academy: Real Life Ratios

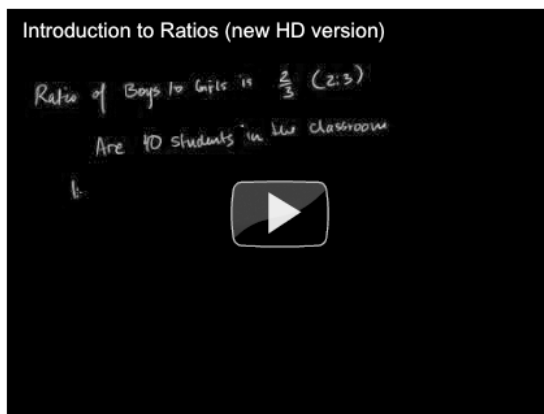
Popularity: 0

Posted By ctucker Moderator to Other on 02/02/2012

Watch this Khan Academy video introducing ratios, then describe a ratio relationship between two quantities that you would encounter in your own life. Once you have described the ratio in writing, write it as a ratio and then as a fraction. Be creative with your choice!

Once you have posted your explanation, read the statements posted by your peers and vote for your favorite. Post a reply to that student you voted for explaining why you liked his/her explanation of the ratio relationship described.

Khan, Salman. "Introduction to Ratios (new HD version)." Video clip online. Khan Academy. 5 Nov 2009. 11 Jan 2012. <http://www.khanacademy.org/video/introduction-to-ratios--new-hd-version?topic=core-algebra>

Attachments**Khan Academy Introduction to Ratios**

Be the first to submit an answer

B	<i>I</i>	<u>U</u>	S	x_2	x^2	Ω	∞	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{7}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$
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Post

[Watch](#)
[Topic Library](#)

Weave Online Work Into the Classroom With Student-Centered Activities

1. *Observing Ratios in Life.* Divide the class into groups, and give each group a picture of a real-life situation. Students then brainstorm as many ratios as they can about the people and/or objects in the photo to share with the class. This could be facilitated as a timed game with groups competing to identify the most ratios in a given amount of time.

Teacher's Note: Google hosts the *Life* magazine photo archive, which has millions of historic photos teachers can use for this activity: images.google.com/hosted/life.

2. *Ratios in Cooking.* Ask students what meals or snacks they prepare at home. What ratios do they use? Have them write a recipe using ratios. This activity can culminate in a demonstration/presentation in which students prepare this dish in front of the class, explaining the ratios involved, or record a video of preparing this dish at home. This activity encourages students to make the connection between ratios and measurements. Students can post these recipes with photos on Pen.io (for more on Pen.io, see p. 128).

3. *Ratios in the Classroom.* Clear space in the classroom so students can comfortably move around and place a line down the center of the room. Then ask them to split based on gender, hair color, height, favorite sports, and so on. After each movement, ask them to observe the ratios in the room. Follow this activity with a discussion in small groups or a reflective writing assignment.

- What trends did the students notice?
- What generalizations can they make about the larger school population based on this activity?
- What did they realize about their classmates?

Common Core State Standards: High School Math

The following are the math standards addressed for high school. I have also listed the Grades 9–12 writing standards because online work requires that students articulate their ideas in writing and publish them online.

Grades 9–12 Math Standards Addressed

A-CED.1	Create equations and inequalities in one variable and use them to solve problems.
A-RED.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

S-IC.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
S-MD.5	Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.

Grades 9–12 Writing Standards Addressed

W.9-12.4	Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
W.9-12.6	Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

Note: The language describing each standard is taken directly from the Common Core State Standards Initiative website: www.corestandards.org.

The standards for high school are listed in categories by concept: number and quantity, algebra, functions, modeling, geometry, statistics, and probability. These mathematical concepts span multiple courses in Grades 9–12 and vary in complexity depending on the grade level.

Example Online Activity 9.5. Which Is More Dangerous—Men's Rugby or Women's Cheerleading?

Common Core Standards

S-IC.1, S-MD.5, W.9-12.4, W.9-12.6

This question requires students to use math modeling to link “classroom mathematics and statistics with everyday life, work, and decision-making” (Mathematics: High School: Modeling: Introduction). To answer the question students have to decide on the mathematical process and statistical information needed to solve this problem.

Real-world events and problems “are not organized and labeled for analysis; formulating tractable models . . . and analyzing them is appropriately a creative process” (Mathematics: High School:

Which is More Dangerous- Men's Rugby or Women's Cheerleading?

Popularity: 0
Vote
Comment

Posted By C. Tucker Moderator to M- High School on 10/10/2011

How can you use mathematical modeling to answer this question?

Questions to consider:

- What information do you need to answer this question?
- What variables exist? Which of those variables represent essential features?
- How will you represent the relationships between variables in your model?
- Will you use geometric, graphical, tabular, algebraic or statistical representations?
- How will you validate your conclusions?

In your response, explain **how** you used modeling to answer this question. Do you feel confident that you model helped you to correctly answer this question? Explain.

Once you have posted your explanation, reply thoughtfully to at least 3 classmates. Compliment strong points made, ask questions, offer opposing view points and/or build on ideas shared.

Kinner, Colin. "Question Mark Sign." *Sign. Flickr*. 18 Jan 2008. 14 Nov 2011.
<http://www.flickr.com/photos/22206521@N03/2200500024>

Attachments

Rugby vs. Cheerleading



- ☐ Men's Rugby
- ☐ Women's Cheerleading

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Modeling: Introduction). This creative element requires that students ask questions, conduct research to locate necessary data, identify significant variables, and consider a variety of approaches to problem solving. In addition to using mathematical modeling to answer the

question, students must clearly report “on the conclusions and reasoning behind them” in writing (Mathematics: High School: Modeling: Introduction). Because they must select the sport they believe is most dangerous and justify their answer with evidence and analysis, this also has an element of argument writing.

Weave Online Work Into the Classroom With Student-Centered Activities

1. *Group Discussion.* Divide the class into small groups to discuss the following questions:

- What strategies do you use when you come across a problem you cannot solve?
- How do you cope with not having enough information to solve a problem?
- How can learning to deal with problems that seem impossible help you solve difficult word problems?
- Why is it crucial to have strategies to solve problems when dealing with real-life situations?

Once they have had a conversation about these questions, ask students to create a helpful tips poster with their strategies for problem solving that they can post in the classroom. This can also be done online with a creative tool like Glogster (for more on Glogster, see p. 93).

2. *Group Challenge.* In small groups, students write a word problem based on a real-life situation with a piece of missing information and then exchange with another group. The groups work together to solve the problem despite the missing piece of information. After they have attempted to solve their problem, they explain their process with the class.

3. *Creative Assignment.* Divide the class into small groups, and present them with a real-life problem to be solved (e.g., designing the layout of the booths for Club Awareness Day, creating an emergency plan for the school to evacuate quickly and effectively during a fire, analyzing the possible risks to students on campus). Ask them to show their process using a flowchart with images to represent the problem, variables, relationship between variables, operations, results, and conclusions. They then present this visual to the class and explain how they solved the problem. Students can also create an online flowchart using Glicfy (for more on Glicfy, see p. 111).

Example Online Activity 9.6. Algebra: How Much Is College Going to Cost You?

Algebra: How Much is College Going To Cost You?

Posted By C. Tucker Moderator to M- High School on 11/14/2011

Popularity: 0

Vote

Comment

Choose a college from the list below that you would like to attend. Research the tuition for that college.

- How much will it cost to attend this school for a year?
- How much has tuition increased each year on average?
- What is the standard rate for a student loan?
- How long will it take you to pay off your student loan?

Complete the necessary research on your chosen college and identify the variables present, then write this problem as an algebraic equation. Under the algebraic expression, explain your process, discuss what you found out during your research, and identify the variables present in your equation.

Once you have posted your equation, read the equations posted by your peers and reply thoughtfully to at least 3 other students. Compliment strong points, ask questions and build on ideas shared!

Kros, Kris. "Campus Bikes." Bikes. Flickr. 24 Oct 2007. 14 Nov 2011
<http://www.flickr.com/photos/37369621@N00/2571971105/>

Attachments

College



- ☐ UCLA
- ☐ Cornell
- ☐ Harvard
- ☐ Notre Dame
- ☐ Columbia
- ☐ MIT
- ☐ Other?

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Common Core Standards

A-CED.1, A-RED.1, W.9-12.4, W.9-12.6

The rising cost of college is a hot topic in education, and it is a subject of interest to many students considering postsecondary studies. This question presents students with a multistep problem. To solve the problem and answer the question, they must apply their understanding of algebra.

First, students must select a college to research. They need to find out the yearly tuition for that school and then factor in the rate at which the tuition is increasing on average each year. They must also find out how much time the average undergraduate spends at that school before earning his or her degree.

Once students have done this preliminary research, they have to research college loans and determine how long it would take to pay off their loan if they attended this school for X (number of years) at an annual rate of Y (cost of tuition per year) factoring in Z (the rate of increase in tuition per year). Then they take that number and determine how long it would take to pay off a standard student loan for the cost of their college degree.

For many students not only does this question deal with a topic they care about, but the information they find during their research will be important to consider as they progress in school.

Weave Online Work Into the Classroom With Student-Centered Activities

1. *Class Discussion.* In small groups, ask students to discuss the following questions and then be prepared to discuss as a whole class:

- Were you surprised by the cost of tuition?
- Do you think the cost of college is worth the benefits?
- What are the benefits of attending a 4-year college or university?

This could also be extended into another research assignment and discussion.

Teacher's Note: The Pew Research Center, a nonpartisan fact tank, released a report in May 2011 titled "Is College Worth It?" This would make an interesting addition to the discussion of college, the costs associated with earning a degree, and the benefits of having a degree in today's job market. A summary of the report is available at

pewresearch.org/pubs/1993/survey-is-college-degree-worth-cost-debt-college-presidents-higher-education-system.

2. *Cutting College Costs*. Ask students to research their “safety school” to see if it is a better deal than the school they initially researched. Have them compare the two schools and brainstorm ways they could cut costs. What is the price of housing? Is there an alternative place to live near the campus that would be cheaper? What does a meal plan cost? Could you work part time? If so, what would you do for work, how many hours could you reasonably work a week, and what would a realistic income be? How could saving money or earning money help you manage the cost of college without incurring huge debt? Ask students to present their findings in small groups.

3. *Interest Rates Activity*. Have students graph how much money they would owe if they paid off their student loan in 5, 10, 15, or 20 years. (Note: Students should use the total cost of college they calculated from the online activity.) Their graphs should visually show the difference in total costs for each year marker. Ask them to consider the following questions:

- How much would your payments change if you paid off your student loan earlier?
- How much money could you save if you paid off your loan in 10 years versus 20 years?
- What did this exercise teach you about interest?

Students should be prepared to share their charts with the class. Students can create their charts using Gliffy (for more on Gliffy, see p. 111) or Creately (for more on Creately, see p. 174).

Chapter Summary

The math standards identify key areas of focus per grade level from kindergarten through eighth grade. Each year the math concepts build on the work done the previous year. Mathematical concepts become increasingly complex as students move through school. Because students move from a general to a more specific understanding of these ideas, it is critical that they have a solid foundation on which to build. Providing students with a space to discuss, describe, analyze, question, collaborate, and problem solve makes it possible for them to understand challenging mathematical concepts.

The high school standards identify key conceptual categories of study that students need in order to be prepared for life beyond high school: number and quantity, algebra, functions, modeling, geometry, statistics, and probability. These areas of study span multiple courses and build on the foundation created in Grades K–8.

Incorporating online discussions and group work into the traditional math curriculum takes math from solitary practice to collaborative effort. Students have a support network of peers they can talk with about problems they encounter. It also makes it easier for teachers to present students with real-life scenarios and problems that they need to solve. This need to make tangible connections between math concepts and real life is stressed throughout the Standards.

In this chapter I have designed two online math problems with real-life relevance for each level: upper elementary, middle school, and high school. These activities engage students in problem solving and collaboration. They include media to grab student interest and make abstract concepts more concrete. These activities can be made simpler or more complex depending on your student population.

Book Study Questions

1. How do you make math relevant for your students? What connections do you make between math and real-life situations that impact your students? Is it a challenge to connect the math curriculum to topics that interest your students? How can the integration of technology into your math curriculum increase student interest?
2. How do you currently support the development of reading and writing in your math curriculum? What do students typically read? What do they do when they read from their text—take notes, annotate, discuss? How might you use online discussions to engage them in conversations about their math reading?
3. What are the benefits of teaching writing in math? How do you currently incorporate writing into your math curriculum? What challenges do you face teaching writing in math? How might you address these challenges using a blended instruction approach to writing? How would the online space help you improve your writing program? How might writing more help your students better understand math? Brainstorm creative approaches to writing using a blended learning model.

4. How do you currently use media in your curriculum? What types of media do you use? What is the biggest hurdle you face in using media? How have your students responded to media? Where do you find it? Do you have resources you would recommend for quality media for other math teachers?
5. If you could introduce concepts online by embedding lectures, video tutorials, and demonstrations, how would you use your time in the classroom to increase student engagement with the curriculum? What hands-on activities, creative assignments, experiments, and fieldwork would you like to do if you had more class time? How might introducing information online help your students better understand the content?
6. How would developing an online community with online discussions and group work make it possible to provide students with more opportunities to formulate questions, design word problems, and collaborate on results? What strategies could you use to engage students in a more active role using online work to encourage them to be active participants in the math curriculum? How can online research and the integration of technology in general motivate students to problem solve and think critically about math topics?
7. How could you use your online space to facilitate online math study groups? How would you group students online? What benefits would you expect to see if students were able to discuss mathematical concepts online after class? How might these conversations positively impact their comprehension and engagement?
8. Why is it beneficial for students to design problems? How does asking students to design real-life problems force them to understand mathematical concepts? How can the online space be leveraged to give students more opportunities to design questions, problems, and challenges for their peers to solve?

Reference

- Willis, J. (2011). The brain-based benefits of writing for math and science learning. *Edutopia*. Retrieved from <http://www.edutopia.org/blog/writing-executive-function-brain-research-judy-willis>