WORKSHOP
Problems in Context

planning for authentic tasks

Resources referenced in this professional development:
www.mathalicious.com
'Dating Zone' is an adaptation of the Mathalicious lesson '*Datelines*' http://www.mathalicious.com/lessons/datelines

Part 1: The "Half-Plus-Seven" Rule

When looking to date someone that's younger than yourself, how young is *too* young?

To answer this question, some people use the formula "*half-plus-seven*", which means take your own age, cut it in half, and then add seven.

a) Using the "half-plus-seven" rule, fill in the following table.

Age: older person	16	22	60		40		10
Age: younger person				40		16	

b) Do you agree with the rule? Based on your table, does the rule always make sense?

Part 2: The "Dating Zone"

Let's use the "half-plus-seven" rule to figure out the age range that a person can safely date within (based on their age).

a) The youngest you can go:
Let the variable *a* represent your age and the variable *d* represent the age of your date. Write an equation that represents the age of the **youngest** person you can date.

Check your equation. Does it follow the "half-plus-seven" rule? If so, graph your equation and label the line "youngest".

Your age:	20	40	60	100
Your (younger) date's age:				

b) The oldest you can go:
What if you're the younger person? Using the same variables, write an equation that represents the age of the **oldest** person you can date.

Test out your equation. Do your numbers make sense?
Once you're satisfied, add it to the graph and label the line "oldest".

Your (older) date's age:				
Your age:	20	40	60	100

c) The "Dating Zone"
Now that you've graphed the upper and lower dating limits, shade in the region that represents a person's acceptable dating range (the "dating zone").
Right now your equations give the extremes – the oldest and youngest a person can date. How can you modify your equations to include the entire Dating Zone?

Part 3: Who's in the Zone?

a) Let's take a look at the famous fictional couple – Edward Cullen and Bella Swan – from the *Twilight* book series. Edward, a vampire, was born in June1901, while Bella, a human, was born in September of 1987.

Plot Edward and Bella on your graph. What does their location tell you?

b) Many famous couples also have large (but less extreme) age differences.

Pick two celebrity couples and plot them on your graph.
Be sure to show your work and label your points on the graph.

Couple #1 ________________ and ________________ In Dating Zone?

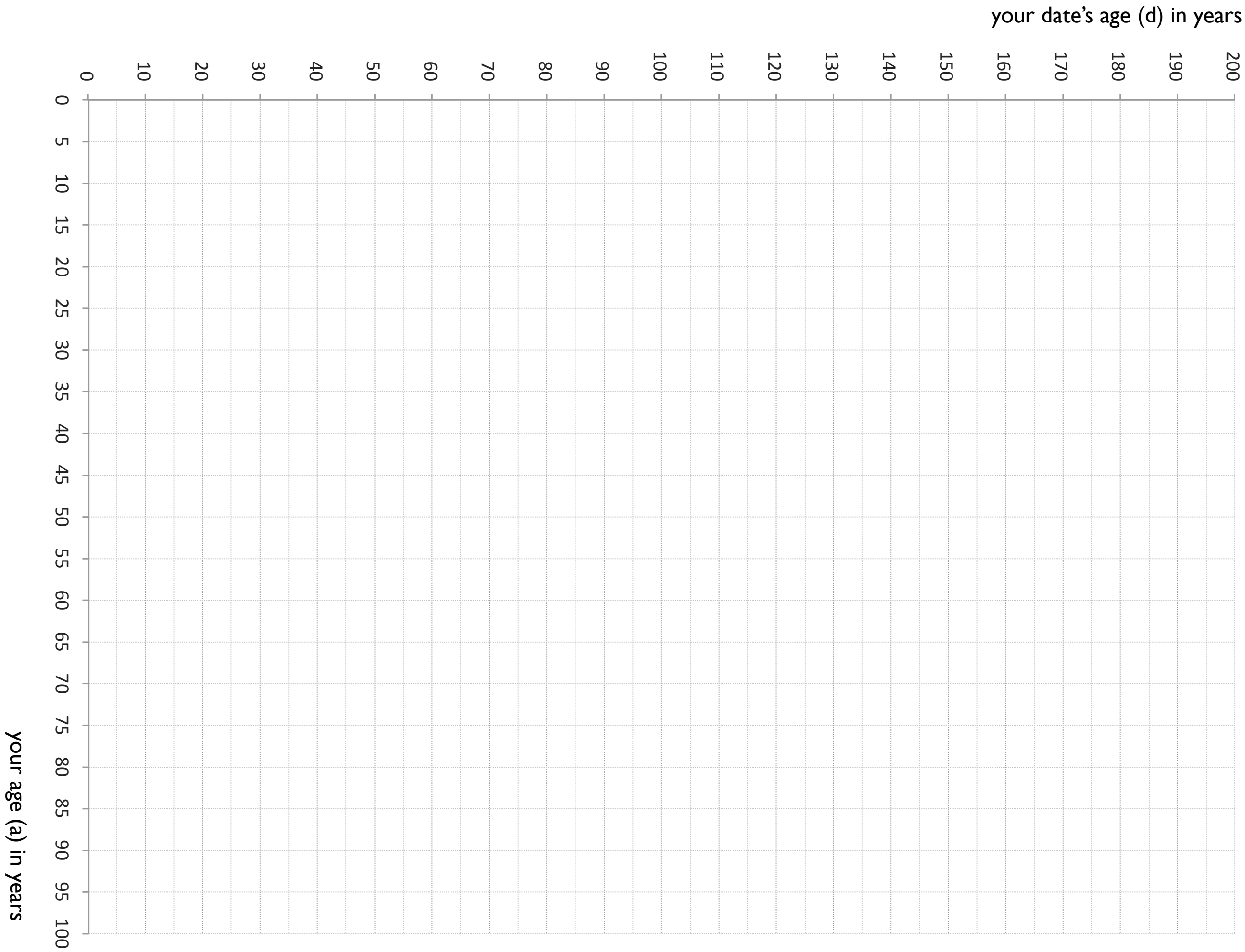
Couple #2 ________________ and ________________ In Dating Zone?

c) If someone is out of your Dating Zone, will they ever be **in** it? Explain.

Part 4: Extension

Will Edward and Bella ever be **in** the Dating Zone? If no, why not? If yes, when?

M4.4



Donald and Melania Trump

Age difference: 24 years.

Beyoncé and Jay Z

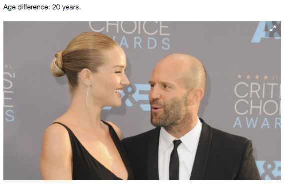
Age difference: 12 years.

Angelina Jolie and Brad Pitt

Age difference: 12 years.

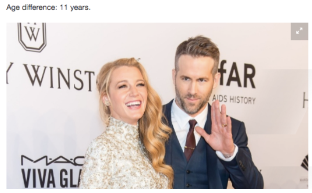
Jason Statham and Rosie Huntington-Whiteley

Age difference: 20 years.



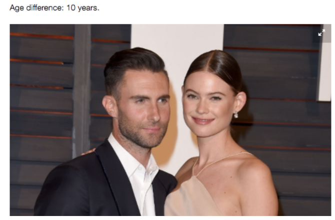
Blake Lively and Ryan Reynolds

Age difference: 11 years.



Adam Levine and Behati Prinsloo

Age difference: 10 years.



Part 1: The "Half-Plus-Seven" Rule

When looking to date someone that's younger than yourself, how young is *too* young?

To answer this question, some people use the formula "*half-plus-seven*", which means take your own age, cut it in half, and then add seven.

a) Using the "half-plus-seven" rule, fill in the following table.

Age: older person	16	22	60	66	40	18	10
Age: younger person	15	18	37	40	27	16	12

b) Do you agree with the rule? Based on your table, does the rule always make sense?

For the most part – doesn't apply when "older person" is too young (<14)

Part 2: The "Dating Zone"

Let's use the "half-plus-seven" rule to figure out the age range that a person can safely date within (based on their age).

a) The youngest you can go:

Let the variable *a* represent your age and the variable *d* represent the age of your date. Write an equation that represents the age of the **youngest** person you can date.

$\frac{a}{2} + 7 = d$

or

$\frac{1}{2}a + 7 = d$

Check your equation. Does it follow the "half-plus-seven" rule? If so, graph your equation and label the line "youngest".

Your age: a	20	40	60	100
Your (younger) date's age: d	17	27	37	57

(a, d) coordinates

b) The oldest you can go:

What if you're the younger person? Using the same variables, write an equation that represents the age of the **oldest** person you can date.

$\frac{d}{2} + 7 = a$

$\frac{d}{2} = a - 7$

$d = (a-7)2$ or $d = 2a - 14$

Test out your equation. Do your numbers make sense? Once you're satisfied, add it to the graph and label the line "oldest".

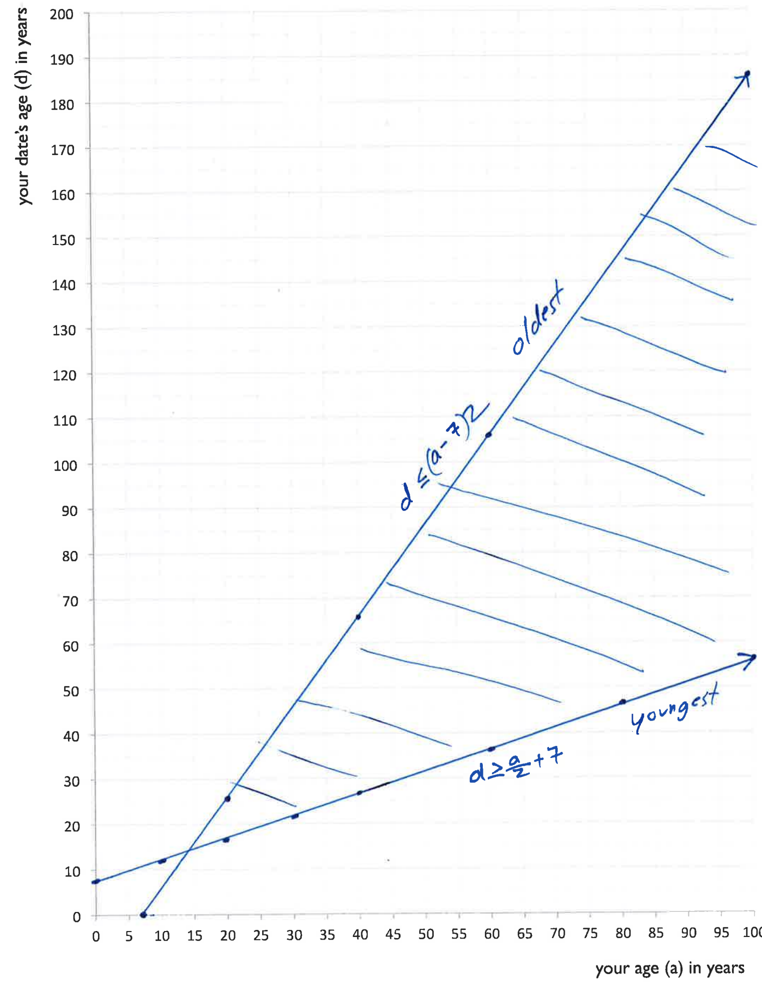
Your (older) date's age: d	26	66	106	186
Your age: a	20	40	60	100

c) The "Dating Zone"

Now that you've graphed the upper and lower dating limits, shade in the region that represents a person's acceptable dating range (the "dating zone").

Right now your equations give the extremes – the oldest and youngest a person can date. How can you modify your equations to include the entire Dating Zone?

$d \geq \frac{a}{2} + 7$ $\quad$ $d \leq (a-7)2$



When planning, go through the task from start to finish. As you do this, consider different approaches students may take (regardless of correctness) and what types of misconceptions may arise.

Planning guide for: Dating Zone: Systems of Inequalities

Evaluate	Troubleshoot	Support
What skills and content knowledge do students need to *understand* the task? - basic mult. & subt. - concept of range	Misunderstandings "half plus seven" gives you age of person you're supposed to date (not youngest you can)	How will students acquire and demonstrate understanding of the task? CFU: students rephrase problem back to class Will circle class ensure first table filled out correctly
Ways students may approach this task (method/steps) - test ages to generate table values. Use those to plot points/write equation - write equation from words then graph - guess and check points to establish general range	Student Misconceptions - may apply "half plus seven" to younger age - may not connect (a, d) coordinates to (x, y) graphing	Guiding questions to support students "does what you've done make sense? look at row titles (older/younger)" "what do the graph axes say?"
What information will students need to obtain? - for "famous couples" ages of each person	What information might students ask for? What issues might they have with the information they find? - birthdays - age depends on time of year - cannot look at year alone	How will students be able to acquire the information they do not have? - can use smartphones to look up ages ↳ can do ind. or as whole class & share
What skills and content knowledge do students need to *complete* the task? - graphing points/line/inequalities - writing equations/inequalities - interpreting graph (intersection, what each line represents, test point locations (couples) shaded region)	What struggles might students experience? At what points in the task will students need assistance or explicit guidance? - changing equation to inequality ↳ if d is on right side ↳ lower limit means d is ≥ (and vice versa) - interpretation of intersection - writing equation of "oldest you can date" (may want to divide then subtract)	What supports will be in place to help struggling students? How will skills, concepts, and/or processes be conveyed to students? - group huddles w/ teacher (one person per group) - class discussion/review of equations - volunteer "experts" circulate room - students present findings on board/doc. cam

Compromised

How were free states and slave states represented in Congress?

In the Constitutional Convention of 1787, there was a debate about how to count states' slave populations for the purposes of determining representation in Congress. One result of that convention was the **Three-Fifths Compromise**, which counted each slave as three-fifths of a person.

In this lesson, students use census data and fraction multiplication to explore the effects of the Three-Fifths Compromise on the balance of power between free and slave states in early America.

Students will

- Given the free and slave populations of various states in the 1790 census, calculate the fraction of each state's total population represented by slaves
- Based on a fixed number of representatives per unit of population, use census data to calculate each state's representation in Congress
- Discuss the impact the Three-Fifths Compromise had on the "population" numbers for the purposes of congressional representation
- Discuss the effects of the compromise from a historical perspective

Before you begin

Students should be able to multiply whole numbers by fractions.

Note: Clearly slavery is a sensitive topic in the American conversation, particularly for those who continue to experience personal and systemic racism as a daily reality. While this lesson focuses on the mathematical nature of the Three-Fifths Compromise as a mechanism for determining congressional representation, that is obviously not its only feature, or even its primary feature. If you're not sure whether you're prepared to discuss the implications of and circumstances surrounding the compromise, it might be helpful to collaborate with colleagues in other departments before beginning, or before extending the lesson further.

Common Core Standards

Content Standards

6.NS.2

Mathematical Practices

MP.3

Downloads

Lesson Guide

Student Handout

Shoutouts

Rafranz Davis

http://www.mathalicious.com/lessons/compromised

Grading Scales of Justice

How should grades be calculated?

Teachers spend a lot of time thinking about how to fairly grade their students. And students spend a lot of time thinking about how their work will affect those grades. But how does a teacher's choice of a grading system affect how students are assessed?

In this lesson, students use averages and weighted means to examine some different grading schemes and decide what other factors ought to be considered when teachers assign grades.

Students will

- Given a list of grades (as either percentages or raw scores), calculate the mean of a dataset
- Investigate how using a weighted mean affects a grading scheme
- Use computed averages to plot mean grade over time
- Discuss what factors or considerations should be included in a grading system

Before you begin

Students should be able to calculate the mean of a dataset. This lesson also deals with weighted averages, but it assumes no prior knowledge of weighting and can serve as an introduction.

Common Core Standards

Content Standards

6.SP.1 6.SP.3

Mathematical Practices

MP.3

Downloads

Lesson Guide

Student Handout

http://www.mathalicious.com/lessons/grading-scales-of-justice

Cartogra-fail

What does Earth really look like?

You've probably seen a map. But have you ever wondered about whether that map was lying to you? And if so…what does the earth really look like?

In this lesson, students approximate the areas of different landmasses by decomposing them into triangles and rectangles. They do this for two different maps, and find that the areas of different continents depend highly on the map they use. Finally, students debate whether or not the map you use affects how you see — both literally and figuratively — the world.

Students will

- Decompose the shapes of different landmasses into rectangles and triangles in order to estimate areas
- Approximate the relative sizes of landmasses using ratios
- Compare area estimates using two different map projections
- Discuss non-mathematical implications of using one map over another

Common Core Standards

Content Standards

7.G.1 7.G.6

Mathematical Practices

MP.3 MP.4 MP.6

Before you begin

Students should be able to calculate the area of a rectangle given its side lengths, and the area of a triangle given its base and its height.

Downloads

Student Handout

Lesson Guide

http://www.mathalicious.com/lessons/cartogra-fail

Tricks of the Tray'd

What's the best way to design a food tray?

It's not always easy to get students to make healthy choices in the lunchroom, but one possible solution might be right under their noses: the cafeteria tray. By giving more visual real estate – but not more actual space – to the most enticing items, students might feel like they're getting more of the foods they love, without going overboard on calories.

In this lesson, students calculate volumes of rectangular prisms and use that information to design an appealing and well-balanced tray.

Students will

- Find the volume of a rectangular prism with whole-number or fractional edge lengths
- Given the dimensions of its base, calculate the height/depth necessary to form a rectangular prism with a particular volume
- Design a lunch tray that holds the appropriate volumes of different food groups, while maximizing the visibility of the most desirable foods
- Discuss the effects of food presentation and placement on people's food choices

Common Core Standards

Content Standards

6.G.2

Mathematical Practices

MP.3 MP.7

Before you begin

Students should be able to calculate the area of a rectangle with known dimensions. The lesson focuses on calculating the volume of a rectangular prism, but that's not a prerequisite. As long as students are able to calculate rectangular area, they can make arguments about packing unit cubes in order to develop a general rule for calculating the volume of a rectangular prism.

Downloads

Student Handout

Lesson Guide

http://www.mathalicious.com/lessons/tricks-of-the-tray-d

Planning guide for: ___________________________________

Evaluate	**Troubleshoot**	**Support**
What skills and content knowledge do students need to *understand* the task?	Misunderstandings	How will students acquire and demonstrate understanding of the task?
Ways students may approach this task (method/steps)	Student Misconceptions	Guiding questions to *support* students
What information will students need to obtain?	What information might students ask for? What issues might they have with the information they find?	How will students be able to acquire the information they do not have?
What skills and content knowledge do students need to *complete* the task?	What struggles might students experience? At what points in the task will students need assistance or explicit guidance?	What supports will be in place to help struggling students? How will skills, concepts, and/or processes be conveyed to students?