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| UNIT SYNOPSIS |
|---|
| This OPTIONAL unit provides resources for Culture Week. Campuses may already have decided upon activities for math teachers to do during the first week of school, but if they have not, the pages below offer five days' worth of activities teachers can facilitate that will support students' learning during the school year. The purpose for some of the activities provided below is to get students to *think* more. As students engage with the lesson materials provided in this curriculum, it is imperative that students build critical thinking skills and increase their capacity and confidence in tackling more rigorous concepts.<br><br>*Feel free to substitute any of the activities below from this sheet[1] or lessons from Unit 0: Prerequisites on MathMedic.* |

[1]Sheet curated by the admin, moderators, and others from the Building Thinking Classrooms Facebook Group.

## ROADMAP

| AT A GLANCE: Unit 0 – Culture Week (*the order can be rearranged to meet campus needs*) | | | |
|---|---|---|---|
| Day | Date | Lesson | Lesson Title |
| 1 | | 1 | The Raindrop Task & Class Syllabus |
| 2 | | 2 | Are We There Yet? |
| 3 | | 3 | How Much Should Dave Charge for Donuts? & Pre-Calculus Books |
| 4 | | 4 | Imagine Math Diagnostic |
| 5 | | 5 | How Much Does Coldstone Charge? |

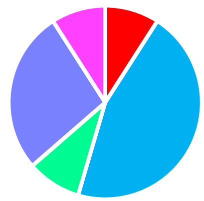
## Notes for Intellectual Preparation & Lesson Planning

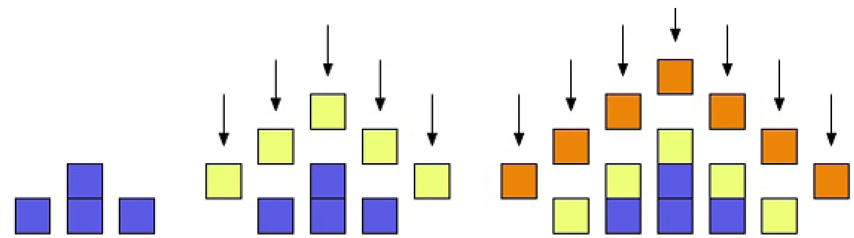
**Necessary Materials and Pre-Lesson Prep**

- Paper, pencils, pens
- One page of chart paper if you want to have classroom posters
- Activity
- Student page (p. 4 in the activity)


Lesson Structure:

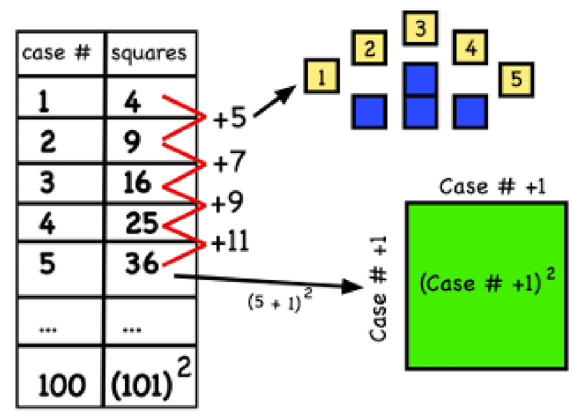
- Welcome (5 min)
- Exploration (25 min)
- Debrief (5 min)
- Class Syllabus (15 min)
- Closing (5 min)





**Mathematical Goal of this Lesson**

Students will visualize how a pattern grows before they determine how many are in any case. After describing the different ways, they see the pattern growing they will generalize the different ways into words, followed by algebraic expressions.




**Other Notes to Inform Your Planning**

**In General:** The time stamps suggested are very flexible. During the first week of school, students, teachers, and administrators are working out scheduling issues. Do not worry if you have to adjust the time stamps or cut some time short.

For **Welcome**: Introduce yourself to students and give them the chance to introduce themselves to their group.

For **Directions**: Distribute the student handout and supplies the way you want items to be distributed all year long. State the task and your expectations for it.

For **Exploration**: Hold students to the expectations you set during the directions. You are setting the tone for the whole year! I also recommend asking students to think on their own at first, and then when they have all thought of a visual approach, to share with their group. If you ask them to start in groups most people will end up seeing it in the 'same' way.

For **Debrief**: When wrapping up the activity, if time allows, get students to share out what they think the answer is to the following extension questions:

- Show an algebraic expression and a visual proof for the number of squares in the $n$th case.
- Which case would have 289 squares?

For **Closing**: Ensure students have cleaned up their space and collected their items. If your campus leadership wants you to practice transitioning to the next class, please do that. Either way, remind students of the collaboration norms you all discussed during the Debrief and let them know that they'll get to practice those norms again tomorrow.

Lesson 2: Are We There Yet? (from MathMedic Pre-Calculus Unit 0, Day 1) Date: ____________

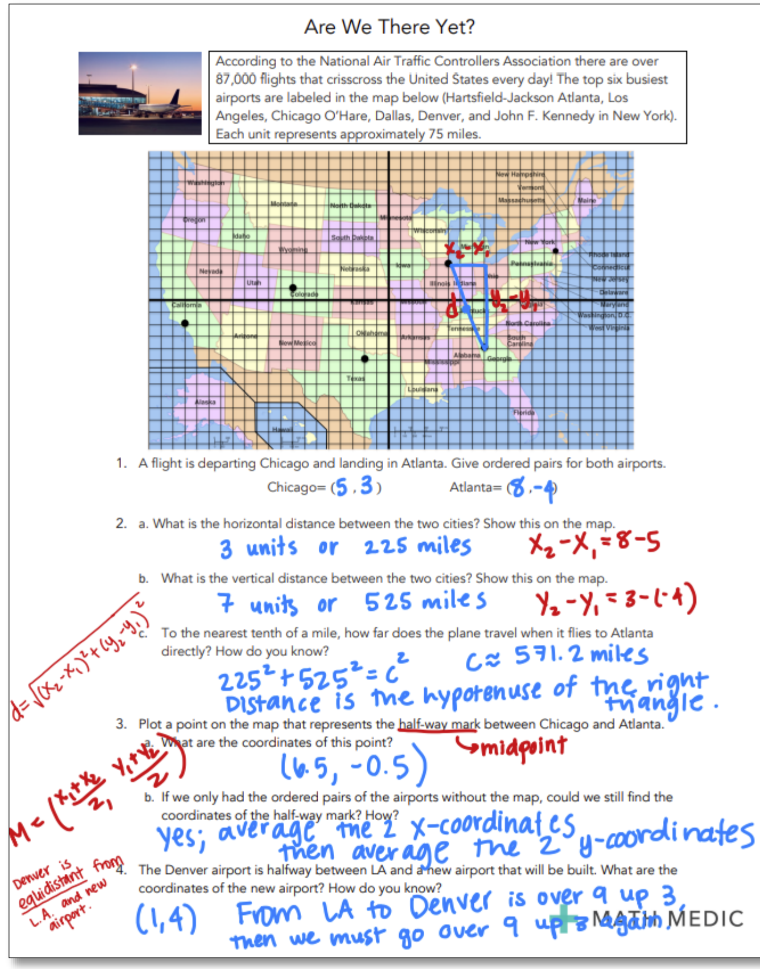
Notes for Intellectual Preparation & Lesson Planning

**Necessary Materials and Pre-Lesson Prep**

- Pencils and scratch paper
- Pre-Calculus books (hand out)
- Student Handout (need login)
- Teacher Handout (need login)

Lesson Structure:

- Activity (20 min)
- Debrief (10 min)
- Important Ideas (5 min)
- Check Your Understanding (15 min)
- Close (5 min)



Are We There Yet?

According to the National Air Traffic Controllers Association there are over 87,000 flights that crisscross the United States every day! The top six busiest airports are labeled in the map below (Hartsfield-Jackson Atlanta, Los Angeles, Chicago O'Hare, Dallas, Denver, and John F. Kennedy in New York). Each unit represents approximately 75 miles.



1. A flight is departing Chicago and landing in Atlanta. Give ordered pairs for both airports.
   Chicago= (5 , 3) Atlanta= (8 , -4)

2. a. What is the horizontal distance between the two cities? Show this on the map.
   3 units or 225 miles $x_2 - x_1 = 8-5$

   b. What is the vertical distance between the two cities? Show this on the map.
   7 units or 525 miles $y_2 - y_1 = 3-(-4)$

   c. To the nearest tenth of a mile, how far does the plane travel when it flies to Atlanta directly? How do you know?
   $225^2 + 525^2 = c^2$ $c \approx 571.2$ miles
   Distance is the hypotenuse of the right triangle.
   $d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

3. Plot a point on the map that represents the half-way mark between Chicago and Atlanta. → midpoint

   a. What are the coordinates of this point?
   (6.5, -0.5)
   $M = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

   b. If we only had the ordered pairs of the airports without the map, could we still find the coordinates of the half-way mark? How?
   yes; average the 2 x-coordinates then average the 2 y-coordinates

4. The Denver airport is halfway between LA and a new airport that will be built. What are the coordinates of the new airport? How do you know?
   (1,4) From LA to Denver is over 9 up 3, then we must go over 9 up 3 again.
   Denver is equidistant from L.A. and new airport.

MATH MEDIC

**Mathematical Goal of this Lesson**

Students should have fun in math class and practice how to work with a partner while engaging in discourse and critical thinking. By the end of this activity, students will

- Connect the distance formula to the Pythagorean theorem by identifying the distance between two coordinate points as the hypotenuse of a right triangle
- Decompose segments on the coordinate plane into horizontal and vertical components to find missing lengths and coordinates
- Understand that the midpoint of a segment is equidistant from both endpoints and can be found by averaging the x and y coordinates

**Other Notes to Inform Your Planning**

In this lesson, students use a map of the U.S. to reason about the Cartesian plane, calculating the distance between airports and unpacking the idea of a midpoint. The sequence of questions has students use the idea of horizontal distance and vertical distance to reason about the true distance between two points from a right triangle perspective. After students have found the halfway point on the graph, encourage students to notice patterns in the actual ordered pairs. Ask: "What's the relationship between these x-values?" "How could you tell which one is the midpoint and which one is an endpoint?" We anticipate that students in Precalculus will arrive at the idea of an average, though it might not be intuitive for all students. For students who immediately draw on the midpoint formula they used in previous years, probe deeper by asking why this formula works and what it means.

It is important that students understand why the distance formula works and how it is really the Pythagorean Theorem in disguise. Be as explicit as possible about how the legs of a right triangle correspond to the horizontal and vertical components of the flight path. You may wish to color code the legs of the triangle with their components in the distance formula. For many students, the midpoint formula actually obscures the conceptual understanding of a half-way point. Be sure students understand that counting spaces (on a grid or in your head) is just as valid as plugging numbers into the formula. This method may even be preferred when finding the second endpoint, given the midpoint and first endpoint.

Lesson 3: How Much Should Dave Charge for Donuts? (from MathMedic Unit 0, Day 3) Date: ______________

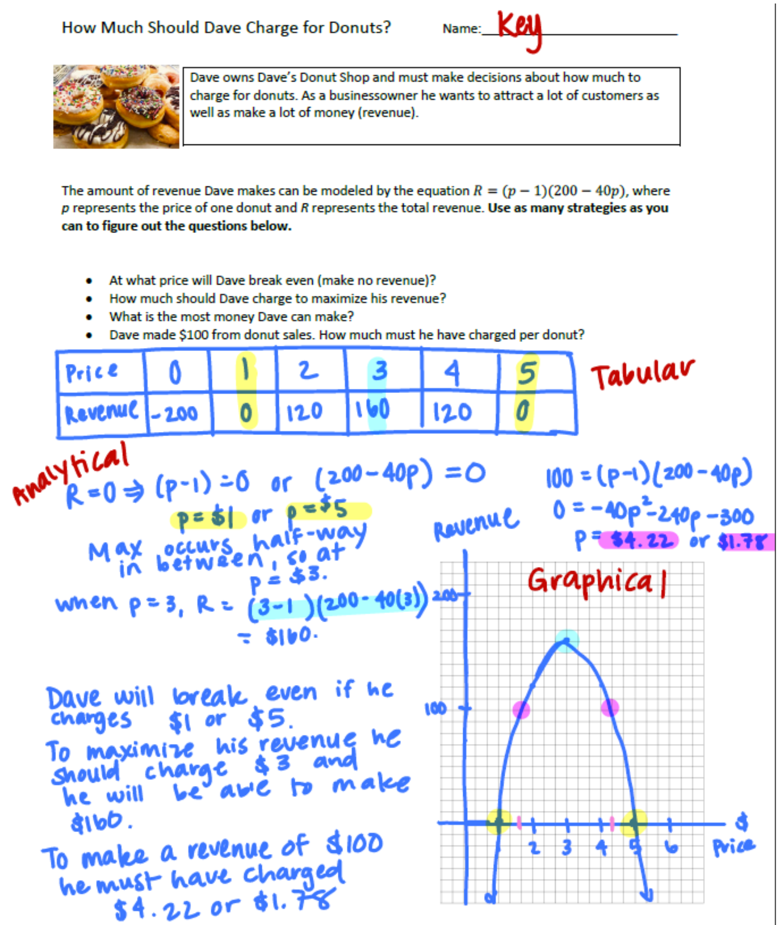
Notes for Intellectual Preparation & Lesson Planning

**Necessary Materials and Pre-Lesson Prep**

- Pencils and scratch paper
- Pre-Calculus books (hand out)
- Student Handout (need login)
- Teacher Handout (need login)

Lesson Structure:

- Activity (20 min)
- Debrief (10 min)
- Important Ideas (5 min)
- Check Your Understanding (10 min)
- Hand out Pre-Calculus Books (15 min)



How Much Should Dave Charge for Donuts? Name: Key

Dave owns Dave's Donut Shop and must make decisions about how much to charge for donuts. As a businessowner he wants to attract a lot of customers as well as make a lot of money (revenue).

The amount of revenue Dave makes can be modeled by the equation $R = (p-1)(200-40p)$, where $p$ represents the price of one donut and $R$ represents the total revenue. **Use as many strategies as you can to figure out the questions below.**

- At what price will Dave break even (make no revenue)?
- How much should Dave charge to maximize his revenue?
- What is the most money Dave can make?
- Dave made $100 from donut sales. How much must he have charged per donut?

| Price | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Revenue | -200 | 0 | 120 | 160 | 120 | 0 |



**Mathematical Goal of this Lesson**

Students should have fun in math class and practice how to work with a partner while engaging in discourse and critical thinking. By the end of this activity, students will

- use graphs, tables, and algebraic methods to find solutions to an equation or to approximate a solution to an equation
- interpret a solution to an equation in a real-world context
- connect the meaning of a solution across multiple representation

**Other Notes to Inform Your Planning**

This lesson is a high-level task designed to get students thinking about multiple paths to finding a solution and interpreting the meaning of that solution in context and across multiple representations. Students may be surprised about the open-ended nature of the task which differs from the usual progression of questions. Encourage students to clearly demonstrate how they are thinking about this problem (using color, diagrams, etc.) and look for students using numeric/tabular, graphical, and analytical representations as you are monitoring. We strongly recommend using Margaret Smith and Mary Kay Stein's 5 practices approach for facilitating this lesson. Express curiosity about students' thinking and be looking for ways to connect different students' work during the debrief.

Although this lesson features a quadratic function, the focus of this lesson is about connecting solutions across multiple representations, and less about the characteristics of parabolas. Invite at least three groups to share their method for solving this problem, intentionally selecting groups that showcase the three main solution paths. Ask students to summarize each others' ideas and make connections between representations. For example, ask how a revenue of $0 shows up in the table and how it is visible in the graph. Then ask how information from the equation allowed the analytical group to find the same value.

If time allows, ask students to discuss the advantages and disadvantages of each representation and when one representation or solution method might be preferable over another.

Use the debrief or Important Ideas to review calculator keys for finding an intersection and have students state in context what it means for the two expressions (curves) to be equal.

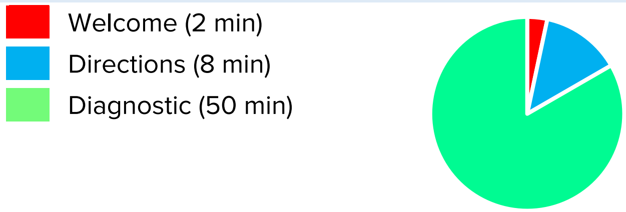
Lesson 4: Imagine Math Diagnostic | Date: _______________

Notes for Intellectual Preparation & Lesson Planning

**Necessary Materials and Pre-Lesson Prep**

- 1-to-1 devices for each student
- Imagine Math Video (3:24)
- Pencils
- Scratch paper

Lesson Structure:




**Mathematical Goal of this Lesson**

By the end of this class period, students should complete their Imagine Math diagnostic. (If they don't finish it, they can complete it at a later time.)

NOTE: Imagine Math can be used in your course to help prepare students for ACT/SAT tests or to fill gaps in student knowledge.

**Other Notes to Inform Your Planning**

**In General:** The time stamps suggested are very flexible. During the first week of school, students, teachers, and administrators are working out scheduling issues. Do not worry if you have to adjust the time stamps or cut some time short.

For **Directions**: Explain WHY we have Imagine Math (in short, it is tailored to each individual student's needs and helps them close any gaps they may have.) Show the Imagine Math video linked above.

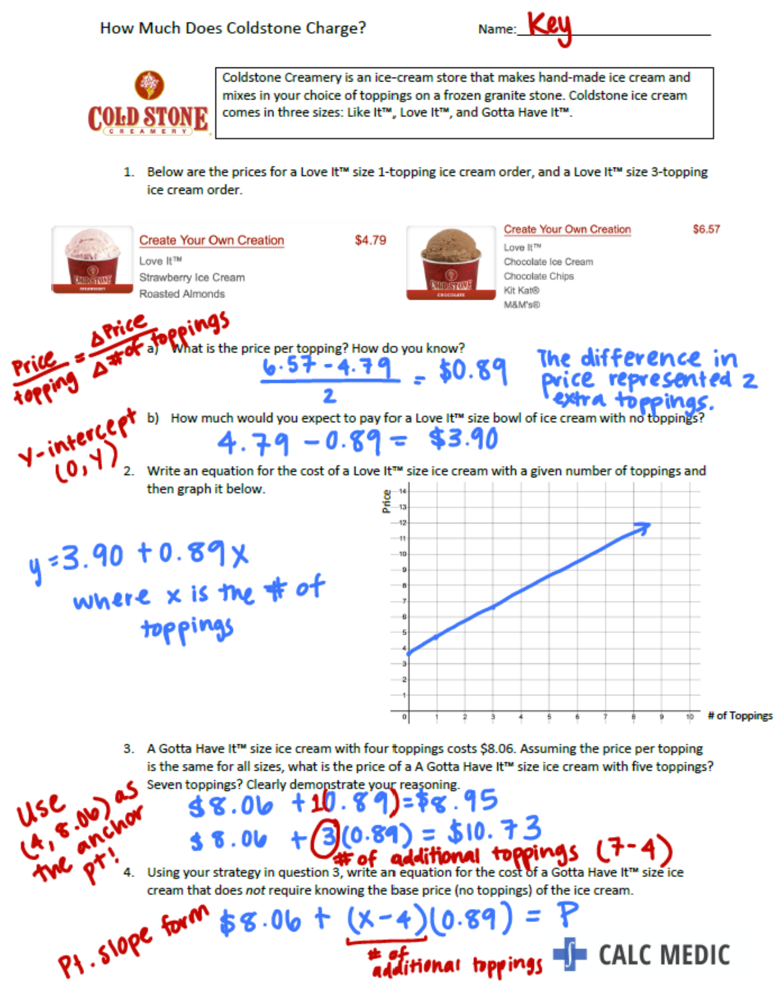
For **Diagnostic**: Begin the benchmark. Once students access Imagine Math through Clever, the first thing they'll be prompted to do is take the benchmark. (When time is up, practice the procedure for putting laptops away.)

Lesson 5: How Much Does Coldstone Charge? (from MathMedic Unit 0, Day 6) Date: ______________

Notes for Intellectual Preparation & Lesson Planning

## Necessary Materials and Pre-Lesson Prep

- Pencils and scratch paper
- Pre-Calculus books (hand out)
- Student Handout (need login)
- Teacher Handout (need login)


How Much Does Coldstone Charge? Name: Key

Coldstone Creamery is an ice-cream store that makes hand-made ice cream and mixes in your choice of toppings on a frozen granite stone. Coldstone ice cream comes in three sizes: Like It™, Love It™, and Gotta Have It™.

1. Below are the prices for a Love It™ size 1-topping ice cream order, and a Love It™ size 3-topping ice cream order.

Create Your Own Creation $4.79
Love It™
Strawberry Ice Cream
Roasted Almonds

Create Your Own Creation $6.57
Love It™
Chocolate Ice Cream
Chocolate Chips
Kit Kat®
M&M's®

a) What is the price per topping? How do you know?

Price/topping = ΔPrice / Δ# of toppings

(6.57 − 4.79)/2 = $0.89

The difference in price represented 2 extra toppings.

b) How much would you expect to pay for a Love It™ size bowl of ice cream with no toppings?

y-intercept (0, y)

4.79 − 0.89 = $3.90

2. Write an equation for the cost of a Love It™ size ice cream with a given number of toppings and then graph it below.

y = 3.90 + 0.89x where x is the # of toppings

3. A Gotta Have It™ size ice cream with four toppings costs $8.06. Assuming the price per topping is the same for all sizes, what is the price of a A Gotta Have It™ size ice cream with five toppings? Seven toppings? Clearly demonstrate your reasoning.

$8.06 + 1(0.89) = $8.95

$8.06 + 3(0.89) = $10.73

# of additional toppings (7−4)

Use (4, 8.06) as the anchor pt!

4. Using your strategy in question 3, write an equation for the cost of a Gotta Have It™ size ice cream that does *not* require knowing the base price (no toppings) of the ice cream.

Pt. slope form $8.06 + (x − 4)(0.89) = P

# of additional toppings

Lesson Structure:

- Activity (20 min)
- Debrief (10 min)
- Important Ideas (5 min)
- Check Your Understanding (15 min)
- Close (5 min)

## Mathematical Goal of this Lesson

Students should have fun in math class and practice how to work with a partner while engaging in discourse and critical thinking. By the end of this activity, students will

- Identify situations with a constant rate of change as describing linear relationships
- Interpret a $y$-intercept and slope in context
- Write an equation of a line in slope-intercept and point-slope for

## Other Notes to Inform Your Planning

Today students reason about linear relationships in the context of the cost of ice cream. The idea of the additional price in the larger size accounting for the additional toppings gives meaning to the slope formula of $\Delta y/\Delta x$. When students graph in question 2, look for groups that use point-by-point graphing in contrast to groups that simply plot two points and "connect the dots". For students who choose the latter, ask why this is allowed. For the former, ask how many points they need to find in order to be confident of their graph. Also push students to articulate what the $3.90 means and what it looks like on a graph. Students' comfort with question 4 may vary depending on their experience with point slope form in previous classes. During the activity, try not to use this language unless students bring it up themselves.

Although these topics are familiar to students, students may still struggle to interpret slopes and y-intercepts in context. Encourage language around "for each additional topping…" When debriefing question 3, make a VERY big deal about how students were able to find the 5-topping price without actually knowing the base price. For students using the expression "8.06+3(0.89)" in the second half of the question, push students to articulate where the 3 came from. (I thought it was 7 toppings!) In our experience, students love slope-intercept form and are not immediately hospitable to point-slope form. We hope that this activity invites students to see the usefulness of point-slope form as a way to predict values without actually knowing the y-intercept. We say that any point, not just the y-intercept, can be used as an anchor point, or point of reference.