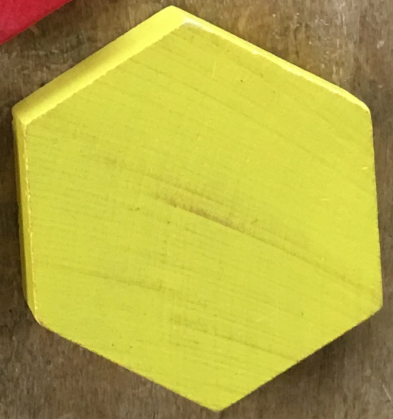
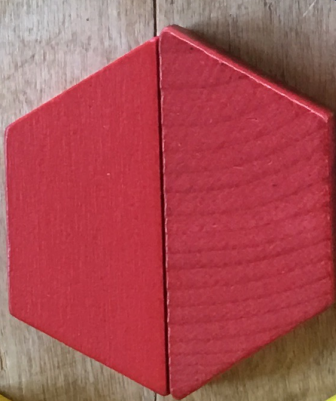
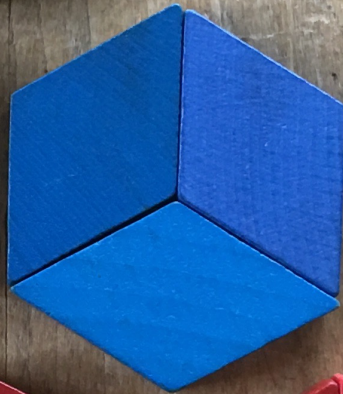
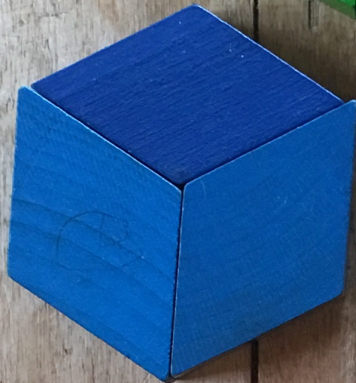


Math for Love

1st Grade



by Dan Finkel & Katherine Cook

Introduction

Welcome to the Math for Love Curriculum! This draft was adapted from a summer program we designed in 2017. The materials are ideal for use in a summer program, or as a supplemental curriculum to provide remediation or enrichment to students.

Goals of the Curriculum

The goals of the program are two-fold:

- Improve student conceptual understanding of mathematics, while exercising skills and fluency
- Give everyone an opportunity to have fun and enjoy math

This curriculum spends ample time exploring conceptual models, giving students opportunities to work concretely and pictorial while making connections to abstract reasoning.

Program Values

The goals of this curriculum are to strengthen student understanding and deepen their enjoyment of math. The values of the program help work toward those goals:

- Students should play, with both games and ideas
- Students should have hands-on experiences, exploring math with manipulatives
- Students should experience math as a meaningful, compelling activity, with multiple ways to approach solving a problem, representing a situation, and developing a strategy.
- Students should have time to think deeply about mathematics.

In short, this curriculum is designed to help you build a classroom where students are *doing math* and *thinking math*.

Teacher's Responsibility

As a teacher in the program, you are tasked with establishing a healthy and dynamic classroom environment where these values are expressed. Your responsibilities are:

1. **Engagement.** Create an classroom where your students spend the bulk of their class time actively engaged in mathematical play and problem-solving.
2. **Differentiation.** Help students encounter problems, games, and activities of the right level of difficulty to create engagement.
3. **Thinking.** Get students thinking as soon as possible every day, and help keep them *productively stuck*, actively working to understand and make meaning in a situation they don't yet fully understand.

4. **Positive Environment.** Help the classroom be a place where students trust themselves, their teacher, and each other, and can make mistakes, ask questions, and grow.

The curriculum is designed to help you in these tasks, and your students and you will get the most out of the summer if you tackle these responsibilities head on. Here are some concrete ideas on how to go about it.

★ **Ask students questions rather than telling them answers**

Rather than telling them whether their answers are correct or not, ask them what they did to solve the problem. Ask them what they think the answer is and why. Invite them to share their thinking with you and their classmates.

★ **Model how to play games, and teach how to win and lose**

Students can sometimes get really attached to winning, and take their wins and losses as deeper signs about themselves. It's best to get ahead of this right away. Talk about how the players of a game are working together to learn about the game, and every loss is a chance to get more information about how to win. Rather than thinking about the other player as your rival, think of them as your collaborator, there to help you learn.

★ **Avoid what doesn't involve math; get students into actual, active thinking situations about mathematics as fast as you can**

Our goal is to make the most of classroom time, and avoid things that use up too much time without much gain in mathematical understanding. Start class right away with a Number Talk or opening game (see the Warm Up in the daily plan). Use the Math Games and Movement Breaks from Appendix 1 for transitions between stations. Establish the classroom as a place where we all are committed to working on improving our understanding of math.

★ **Have a *growth mindset* classroom**

Some of your students will believe that they are just bad at math. They will think this is an unchangeable personality trait. These students have what is known as 'fixed mindset' about math. The truth is that every student can succeed in mathematics, regardless of how they've done in the past. Convey to your students, early and often, that math is something you learn to be good at, not something you just know; how making and learning from mistakes is the key to improving; and how everyone can be good at math if they put in the time and the energy.

★ **Embrace mistakes**

One important way to encourage growth mindset is to embrace mistakes. They are a natural part of learning, and even more than that, they actually help us learn more and help us remember what we've already learned. Model for your students how to make mistakes, and how to use mistakes productively.

★ **Give your students *time* to think and explore**

Remember that many of the students in the program are here because they weren't given enough time to establish solid conceptual models. We are going to protect their time to develop those models in the summer. Make sure you don't push them too fast to drop the blocks or pictures. If you need to take more time on some lessons and don't make it through everything that's fine; this curriculum is built to give you more than you might need. Also note that a central place in the curriculum where the students practice fluency is in the games, and the goal is for the practice and experience of growing mastery to be tied to the experience of playing.

★ **Give your students the right amount of struggle**

We want the students to be 'productively stuck', i.e. we want them to be working on material they haven't mastered yet but not material that is so hard they can't get started. Most of the lessons in the curriculum start easy, so make sure everyone is able to begin, and help students break down problems if necessary. However, don't offer so much help that you take away their opportunity to learn. Learning happens when we are trying to do something we know how to begin and don't know how to finish. Keep in mind that many students in this program will be more familiar with the "stuck" part, so try to start them with successes, and then slowly move them toward greater problem-solving stamina.

★ **Value play**

It's easy to feel like students have to suffer to learn math. In fact, the opposite is true. Approach math in a playful way, and you'll see students more willing to struggle and persevere, more willing to take risks and learn from mistakes, and more able to absorb new ideas and put them into practice.

Other Notes and Best Practices

If you use this curriculum as a standalone for a summer program or other intervention, here are some ideas to help get the most out of it.

★ **Math Games and Movement Breaks**

Check out the math-based movement breaks in Appendix 1. These are great to mix in as breaks between activities.

★ **Folder for Worksheets**

Give each student a folder where they can keep their worksheets. If they finish another activity early, they can turn back to their unfinished worksheets and finish them.

★ **Choice Time**

Provide a structure for Choice Time like putting up the choices on a white board and having students put their names at the games or activities they want to try that day. Ideally, they should choose an activity that is right for them, and then stick with it for at least half of Choice Time.

★ **Number Talk Images and other warm ups**

For the Number Talks that require images, see Appendix 2. You can project these images to your class, or, where possible, create physical versions of them with magnetic ten frames or other blocks. Physical versions are sometimes preferable, since students can manipulate the blocks directly.

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Day 1

Goals

1. Establish class norms and community.
 2. Give Pre-assessment & observe student comfort and ability with mathematics.
 3. Play math games and explore situations involving counting, adding, and comparing.
-

Part 1

Opener

Block Free Play

Introduction, name games, class agreements

Exploration of Materials

Warm Up

Counterexamples

Exploration

Pattern Block Triangles

Game

Guess My Number

Part 2

Warm Up

Target Number

Sort and Count

Game

Dots and Boxes

Choice Time

Block Free Play

Wrap Up

Mingle

Opening Game or Station Break

Mingle is a quick name game you can play on the first day of class. You can also return to its more mathematical versions later in the course as a station break.

How to play

The teacher calls out a number (i.e., 3), and the students get themselves into groups of that size (or as near as possible to that size as possible) as quickly as they can. It might be impossible for everyone to get in a group every time, but each new number gives everyone another chance.

Once they are in groups, students can each learn each other's names. Then the teacher calls out a new number.

In the basic game, just call out single numbers. Once students get the idea, you can call out addition or subtraction problems (i.e., "get into groups of $7-4$ ").

Tips for the classroom

1. Call the adults in or out of the game depending on the number of students you have and what numbers you call, in order to give everyone at least one other person to have in their group.
2. Keep the game moving quickly to keep the energy up.
3. Don't forget to call out a group of 1 and a group of however many students are in the entire class at some point in the game.
4. For future games, once everyone knows each other's names, you can lead an optional skip-count with the class by counting the students in the class by group size (i.e., 3, 6, 9, ...).

Exploration of Materials

Students are encourage to explore and play with the materials they'll be using in the class this summer. Free play is ideal, as long as the students stay relatively focused.

In addition, you can include these challenges to motivate students who need extra guidance.

Pattern Block Building Challenges

Pattern Blocks Building Challenges: first, students take option 1, and free build. For students who need additional challenges, look to the next two options.

- **Option 1:** Free build with pattern blocks.
- **Option 2:** Cut out the 12 cards on the following page, and separate into two piles. For a basic building challenge, a student picks a card at random, and then builds according to what is on the card.

Examples: Build a *Person*.
 Build something with *25 blocks*.

- **Option 3:** Advanced challenge: a student gets two cards, one which tells them what to build, and the other how many blocks to use.

Example: Build a *Triangle* using *15 blocks*.

Piles of Tiles with the color tiles and/or the snap cubes

Let students free play and build with the tiles and snap cubes. For students who need more direction, give them a pile of tiles, and challenge them to figure out which color occurs most.

Challenge Prompt: In this pile of tiles, which color is there more of? Write down your guess, and then find out.

Tiny Polka Dot Games and Challenges

with the Tiny Polka Dot decks

PowerDot. This is just like War or Top It: students break a deck into two piles of equal size (or roughly equal size), and turn over their top card. Whoever has the larger number gets to take both cards. You can play this with dominoes as well.

Challenge 1: Pick a suit (i.e., a color). Arrange the Tiny Polka Dot cards in that suit from smallest to biggest. What will it look like if you organize an entire deck?

Challenge 2: Pick a suit. Count all the Tiny Polka Dot cards of that color (in one deck).

Challenge 3: Pick a suit. Count all the dots in that suit!

Challenge Problems

There will be challenge problems to solve throughout the session. Students can try their hands at a few early ones, like the Cross-Sum problems.

Pattern Block Building Challenges

Flower	Bird	Person
Pattern	Triangle	House
5 blocks	10 blocks	15 blocks
20 blocks	25 blocks	30 blocks

Piles of Tiles

Which color tile occurs the most in this pile?

Write your name under the color you think has the most.

Red	Green	Blue	Yellow

When you have voted, count how many of each color there are.

Counterexamples

Topics: logic, deduction, mathematical argument, communication

Materials: None

Common Core: Variable, but especially MP3

Prove the teacher wrong. Rigorously.

Why We Love Counterexamples

Every kid loves to prove the teacher wrong. With Counterexamples, they get to do this in a productive way, and learn appropriate mathematical skepticism and communication skills at the same time.

It is possible to play Counterexamples with kids as young as kindergarteners as a kind of reverse “I Spy” (“I claim are no squares in this classroom. Who can find a counterexample?”). What’s great, though, is that you can transition to substantial math concepts, and address common misconceptions. Counterexamples is a perfect way to disprove claims like “doubling a number always makes it larger” (not true for negative number or 0) or sorting out why every square is a rectangle, but not every rectangle is a square. For older kids, you can even go into much deeper topics, like: “every point on the number line is a rational number.”

The language of counterexamples is crucial to distinguish true and false claims in mathematics; this game makes it natural, fun, and plants the skills to be used later. Counterexamples is also a great way to practice constructing viable arguments and critiquing the reasoning of others.

The Launch

Counterexamples is a fun, quick way to highlight how to disprove conjectures by finding a counterexample. The leader (usually the teacher, though it can be a student) makes a false statement that can be proven false with a counterexample. The group tries to think of a counterexample that proves it false.

The best statements usually have the form “All _____s are _____” or “No _____s are _____.” You can also play around with statements like “If it has _____, then it can _____.” For instance:

It’s often best to start with non-mathematical examples.

- All birds can fly. (Counterexample: penguins)
- No books have pictures in them.
- All books have pictures in them.
- If something produces light, then it is a light bulb.
- If something has stripes, then it is a zebra.

Once students have the hang of it, make the examples more mathematical.

- Doubling any number makes it bigger. (Counterexample: -1 doubled is -2 , which is smaller.)
- Multiplying two numbers never gives the same answer as adding them. (Counterexample: $2 + 2 = 2 \times 2$. Or $3 + 1.5 = 3 \times 1.5$.)
- Fractions are always between 0 and 1.
- No square has a perimeter equal to its area. (Note: “equal” isn’t quite right, since units are different. Counterexample: a 4 by 4 square.)

Example

Teacher: I claim all animals have four legs. Who can think of a counterexample?

Student 1: A person!

Student 2: A spider.

Student 3: A fish.

Teacher: Why is a person a counterexample?

Student 4: Because it has two legs.

Teacher: Right. I said every animal has four legs, but a human being is an animal with just two legs. So I must have been wrong. What about this one: everything with four legs is an animal.

Student 5: A spider.

Teacher: A spider is an animal with eight legs, so it proves that not every animal has four legs. But I claimed that if you have something with four legs, it must be an animal. To prove me wrong, you have to give me something with four legs that isn’t an animal.

Student 5: Like a table?

Teacher: Who can tell me if a table is a counterexample to my claim?

And so on.

Tips for the Classroom

1. It’s good to make up false conjectures that are right for your students. But start simple.
2. For young students, use silly claims, e.g., “The only one who likes cookies is cookie monster.”
3. Kids can think of their own false claims, but sometimes these aren’t the right kind, and they often have to be vetted.
4. Once you introduce the language of counterexamples, look for places to use it in the rest of your math discussions.
5. You can also use Counterexamples to motivate a normal math question. Instead of saying “draw a triangle with the same area as this square,” you can say, “I claim there is no triangle with the same area as this square.” If students know to look for counterexamples, this will set them to work trying to disprove the claim right away.

References: <http://kuow.org/post/getting-kids-interested-math-without-their-knowing>

Pattern Block Triangles

Math concepts: Addition, counting, geometry

Equipment: Pattern blocks, scratch paper and pencil

Common Core: K.CC.4, K.CC.5, K.OA.1, K.OA.2, 1.OA.1, 1.OA.2, , 1.OA.4, 1.OA.5, 1.G.2, 2.OA.1, MP1, MP2, MP6, MP7, MP8

How many blocks you can use to build a triangle from pattern blocks?

Why We Love Pattern Block Triangles

This beautiful lesson combines student creative work, counting and addition practice, combining geometric shapes, and a slow build from easier to more challenging work.

The Launch

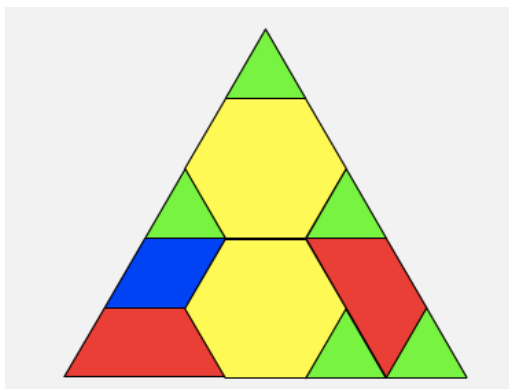
Prep the pattern blocks beforehand by removing the tan rhombuses and orange squares, or else tell students not to use those blocks.

Make sure every student has access to pattern blocks, and start with two warmup challenges: can students build a (filled in) triangle with pattern blocks using

- 1) Exactly 5 blocks?
- 2) Exactly 10 blocks?

Choose one student's work and show how to double-check the count by counting each type of block, and then adding those together, using an equation or a ten frame as necessary. For example, if you were using the triangle below as an example, you might write:

$$2 \text{ hexagons} + 2 \text{ trapezoids} + 1 \text{ rhombus} + 5 \text{ triangles} = 10 \text{ blocks}$$



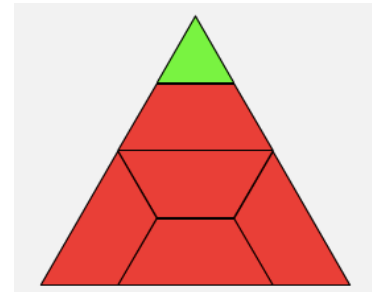
$$\text{Or simply } 2 + 2 + 1 + 5 = 10.$$

Once students are done with the warmups, pose a greater question: is it possible to build a triangle with whatever number of blocks you want? Can you build one with 2 blocks? With 3 blocks? 4 blocks? How far can you go?

Write a list of numbers from 1 to 20, and have students make their own list of numbers. Leave enough space so students can write an equation for each number.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

If students can make a triangle using some number of blocks, they can write an equation for that number. For example, when they make a triangle using exactly 6 blocks, they can write an equation describing that triangle. For the triangle to the right, for example, the equation might be $6 = 5 + 1$.



The big challenge for students is: can they build a triangle for each number from 1 to 20? Or is there any number that they won't be able to build?

Students can work alone or with partners to build different triangles.

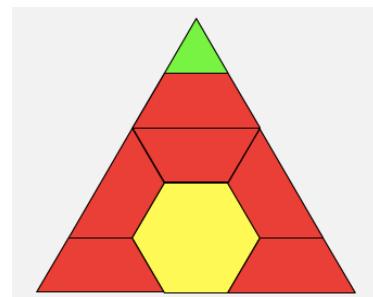
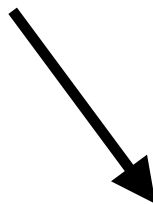
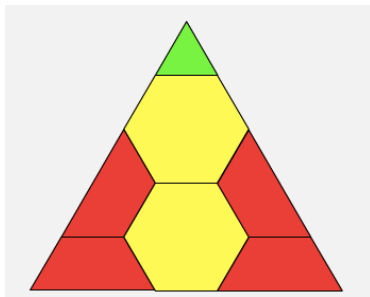
Prompts and Questions

- How many blocks did you use in that triangle?
- Did you record it yet? Show me the equation for that triangle.
- Have you build a triangle with 11 blocks yet? How did you do it?

The Wrap

There is a powerful idea to underline as you wrap up this activity, which is that you can substitute smaller blocks—say, two trapezoids in the place of one hexagon—to raise the number of blocks you used in a triangle without changing anything else. Demonstrate this kind of substitution on a specific triangle, and then ask students if they can predict how making this substitution will change the number of blocks. For example:

2 hexagons + 4 trapezoids + 1 triangle = 7 blocks



1 hexagons + 6 trapezoids + 1 triangle = 8 blocks

Can students use this idea to make triangles using any of the missing numbers from their list?

Tips for the classroom

1. The idea in using the list is that every triangle is a success to start, and then certain holes in the list become more challenging to make.
2. There are two excellent ways to challenge students who successfully make all the triangles from 1 to 20. First, ask them if they can make a larger number, say, 31.
3. Second, challenge them to make a much larger triangle, and show you how they can correctly add all the pieces inside it.
4. For today, by “triangle” we mean triangles made out of pattern blocks with no empty spaces inside. Alternative definitions may pop up from students. Let them know that for today, we just mean triangles of this type.
5. For young students, you can just go from 1 to 10 instead of 1 to 20, and not require writing equations for each triangle.



Guess My Number

Topics: Greater than/less than, logic

Materials: Whiteboard or paper and pencil

Common Core: MP1, MP3, K.CC.C7, 1.NBT.B.3

Guess My Number is a quick, fun, and easy opening game to lead with a small group or the entire class. Students try to guess the number you're thinking of in the fewest number of guesses possible.

Why We Love Guess My Number

It's hard to think of a game more natural than Guess My Number. Kids can immediately start playing, and have a great time doing it. The game is also a perfect way to introduce the basics of logical thought and strategy, and let the game do the teaching with only minimal extra observations from the teacher. Surprisingly replayable and enjoyable, this is a great game to play early and often.

The Launch

As you write the numbers from 1 to 10 down on the board, tell your students that you are going to think of a number from 1 to 10, and they will try to guess it in the fewest number of guesses possible. After every guess, you will tell them whether your number is greater or less than their guess.

Example

Teacher: Who would like to make the first guess? [Students raise hands. The teacher calls on different students for each guess.]

Student: 3.

Teacher: My number is not 3. But my number is greater than 3. [Optional: write "My number >3 ".] Are there any numbers I can cross off my list?

Student: It's not 3. [Teacher crosses off the 3]

Student: It's not 2 or 1 either.

Teacher: Right. Because my number is greater than 3, but those numbers are less than 3 [Teacher crosses off 1 and 2.] Who has another guess?

Student: 9.

Teacher: My number is not 9, but my number is less than 9. [optional: write "My number <9 ".] Can I cross any more numbers off the list?

Student: The 9 and the 10.

Teacher: Because my number is less than 9, so it can't be 9 or 10. [Crosses them off. Looks at the board.] So the only options left are 4, 5, 6, 7, or 8. Take a minute to think about what would be a good next number to guess. Then tell someone sitting next to you what you would guess next, and why. [Students pair and share.] Who has another guess?

Student: Is it 7?

Teacher: My number is not 7, but my number is less than 7 [optional: write "My number

<7]. What numbers can I cross off?

Student: 7 and 8.

Teacher: Right. Because my number is less than 7, so it can't be 7 or 8. [Crosses them off.] So the only options are 4, 5, or 6. Who has another guess?

Student: Is it 5?

Teacher: My number is not 5, but it is... greater than 5. [Students' hands shoot up.]

Whoever thinks they know my number, say it together.

Students: 6!

Teacher: You got it! Now that took you [counts] 1, 2, 3, 4, 5 guesses. Who thinks they could do it in fewer? [Optional: play again.]

Prompts and Questions

- How can you guess my number in the fastest, most efficient way possible?
- Talk to a neighbor about what you think the next guess should be, and why.
- How many numbers do you think that guess will cross out?

Tips for the Classroom

1. **Cheat!** By which I mean, don't actually choose your number ahead of time. If students guess 1, tell them your number is more than 1. Always make each guess give them the least amount of information possible, and deny them the lucky guess. Make them work for it, and they'll be more invested in working smarter.

AVOID:

Student: Is it 8?

Teacher: It is! Lucky guess! You got it on the first try.

BETTER:

Student: Is it 8?

Teacher: My number is not 8, but my number is less than 8.

2. You can slowly expand up to larger ranges of numbers as students are ready for them. I'll usually go up to 12 after a few games, and soon to 20. Kids love to see the game get harder, as long as it doesn't get too hard too fast. And because you write all the numbers up on the board at the start, they can always see what needs to happen.
3. If kids make a bad guess, don't try to steer them toward a good guess right away. But you can ask the students after you write the guesses down which guesses were most helpful, or whether they would make a different guess if they could take it back.
4. Don't play for too long at one time. One or two games is usually enough to get the kids mentally alert and ready for whatever is coming next.

Target Number

Math concepts: Arithmetic, equivalencies

Equipment: pencil & paper

Common Core: Variable, but especially OA, i.e., 2.OA.B.2, 3.OA.C.7

You know the answer. What's the question?

Why We Love Target Number

This is a quick check-in that adjusts to the abilities of each student, allows for creativity and arithmetic practice together, and is a lot of fun. Target Number is a perfect warm-up.

The Activity

The teacher writes a “target” number on the board. The students try to write down as many different equations as they can that have the target number as the answer. Then students share their favorite answers. For younger students, drawing different pictures or arrangements of ways to see/understand that number is an ok alternative.

Example

The teacher writes 7 on the board, and lets kids write on their own paper for about a minute, then asks students to share what questions they found. Students raise their hands to volunteer solutions while the teacher writes them on the board. These equations may go from simple equations like $6 + 1 = 7$ to the more complex $(4 \times 3) - 5 = 7$. The great thing is, anyone can start, but the sky is the limit!

Prompts and Questions

Don't pursue these questions the first day you play Target Number. When your students are ready to go deeper with this activity, these questions will lead to interesting patterns to explore.

- If we only add 2 numbers, how many answers can we find?
- What if we add 3 numbers, or 4 numbers?
- What about any number of numbers?
- What if we only subtract, or only multiply, or only divide?
- What's the longest number sequence you can find that hits the target number?
- Can you hit the target number if you only use a single number, such as the number 4, in your equation?

Tips for the Classroom

1. Resist the temptation to praise answers with many steps as “smart.” This activity gives everyone a chance to contribute and be valued. You can describe those answers as “long,” or as having many parts.
2. If answers are wrong or unclear, you can take the opportunity to do the arithmetic with the class. On the other hand, if a student uses terms (like square root) that the class isn’t ready for yet, you can write down their answer but move on to other solutions.
3. One opportunity this lesson gives you is the chance to emphasize equivalency. If one student knows that $6+1 = 7$, and someone else knows that $(3 \times 4) - 5 = 7$, then that means that $6 + 1 = (3 \times 4) - 5$. It’s nice to underline the point that there are many ways to equal 7, and that these ways are all equal to each other.
4. To further emphasize equivalency, write $7 = 6 + 1$, rather than $6 + 1 = 7$.
5. **THIS TIP IS ESPECIALLY USEFUL.** Let’s say someone says that $7 = 5 + 3$. Rather than just saying “wrong,” say that $5 + 3$ gets us close to 7, but we need to do something else to get all the way there, then challenge students to find what still needs to be done. If someone can explain that $5 + 3$ is 8, and so you need to take 1 away, you have the number sentence $7 = 5 + 3 - 1$. This is both more sophisticated and accepts the original student’s wrong answer as a path toward a better, accurate answer, rather than a dead end.

Sort and Count

Topics: Counting, skip counting, addition, multiplication (optional)

Materials: Paper, pencil, objects of many types (button, beans, stones, pencils, markers, blocks, etc.), ten frames (recommended)

Common Core: K.CC.A.1, K.CC.A.2, K.CC.A.3, K.CC.B.4, K.CC.B.5, K.MD.B.3, 1.NBT.A.1, 1.NBT.B.2, 1.NBT.B.2.a, 1.NBT.B.2.b, 1.NBT.B.2.c, MP1, MP6

First sort. Then count. Which pile has the most?

Why We Love Sort and Count

Sort and Count is Counting Collections with an extra twist. This is a great way to incorporate sorting, counting, and comparing, and pave the way to adding and subtracting.

The Launch

Set collections of objects in different places in the room. The objects should be various colors or sizes, in some regular way. Square tiles or pattern blocks are a perfect example, since they come in different colors, but match otherwise.

Let students know that their job will be to **sort** each collection into groups by color or type (in the natural way, depending on what objects you're using). Then they'll **count** how many are in each group and write those numbers down. Finally, they'll **compare** the piles and arrange them from smallest to largest, and, if they're ready, **write** the numbers in order from least to greatest, optionally using a $<$ sign between them.

Prompts and Questions

- How do you know the red pile has more than the blue pile?
- How many more does it have?
- Try writing those numbers down. How many in the shortest pile?
- Have you tried using the ten frame to help you count? I bet it would be helpful. Let's use it.
- (extension) How many tiles are in the green and blue piles altogether?

Wrap Up

You don't have to wrap up this activity after the first day; like Counting Collections, Sort and Count can be something to return to, to let students test their methods on larger and more difficult groupings of objects.

However, it can be nice to discuss different strategies along the way. After students have done their counting for the day, ask for reports on counts, and discuss strategies kids used for counting. Was it easier to count by 2s? By 10s? Was it helpful to arrange the objects in some neater organization, like a grid, or on top of a ten frame? What about

comparing the piles? Was there an easy way to tell if the numbers/piles of objects were bigger or smaller than others?

Tips for the Classroom

1. You can differentiate Sort and Count most easily by including collections with many or fewer objects to count.
2. On the first day of Sort and Count, make sure you have many small collections (5 - 20 objects) for students to count.
3. Make ten frames available as a counting aid.
4. It's very natural to extend Sort and Count into questions of addition and subtraction. For addition questions, ask how many objects are in 2 or more piles. (How many tiles are in the green and blue piles altogether? How many tiles are in the red and yellow pile? What about all the piles?)
5. For subtraction, ask how many more are in the biggest than the second biggest. (There are more yellow tiles than red, huh? How many more?)

Dots and Boxes

Topics: Logic, counting, shape recognition, strategy

Materials: Dot Paper, pencils or crayons

Common Core: K.CC.B.5, K.CC.C.6, K.G.B.5, 1.G.A.1, MP1, MP6, MP7

A game of squares and strategy that is easy to learn and hard to master.

Why We Love Dots and Boxes

This is a classic you may remember from childhood. The game is like a more sophisticated tic-tac-toe: fun and challenging for young kids, with simple counting and shape recognition practice built in, and connections to deeper mathematical strategy at play in the background. It's a perfect game for stations or ten extra minutes.

How to Play

Dots and Boxes is a game for two players, played on a small grid of dots. On your turn, add a vertical or horizontal edge between neighboring dots. If you complete a square, get one point and go again. Keep track of the score by coloring in your square, or writing your initial inside it.

Whoever has the most squares at the end wins.

Example Game

This graphic is of a small game of Dots and Boxes from Wikipedia. Players A and B play a game in nine turns.

Notice that A's last turn consists of several moves, since every box completed gives A an extra move.

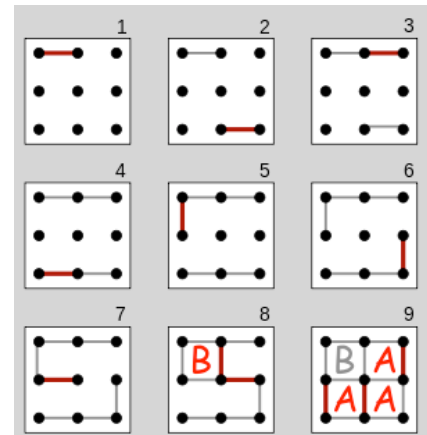


Image by of Wikipedia User Tiger66

Prompts and Questions

- Is it better to go first or second?
- Why did you win/lose your last game?
- Are draws possible?

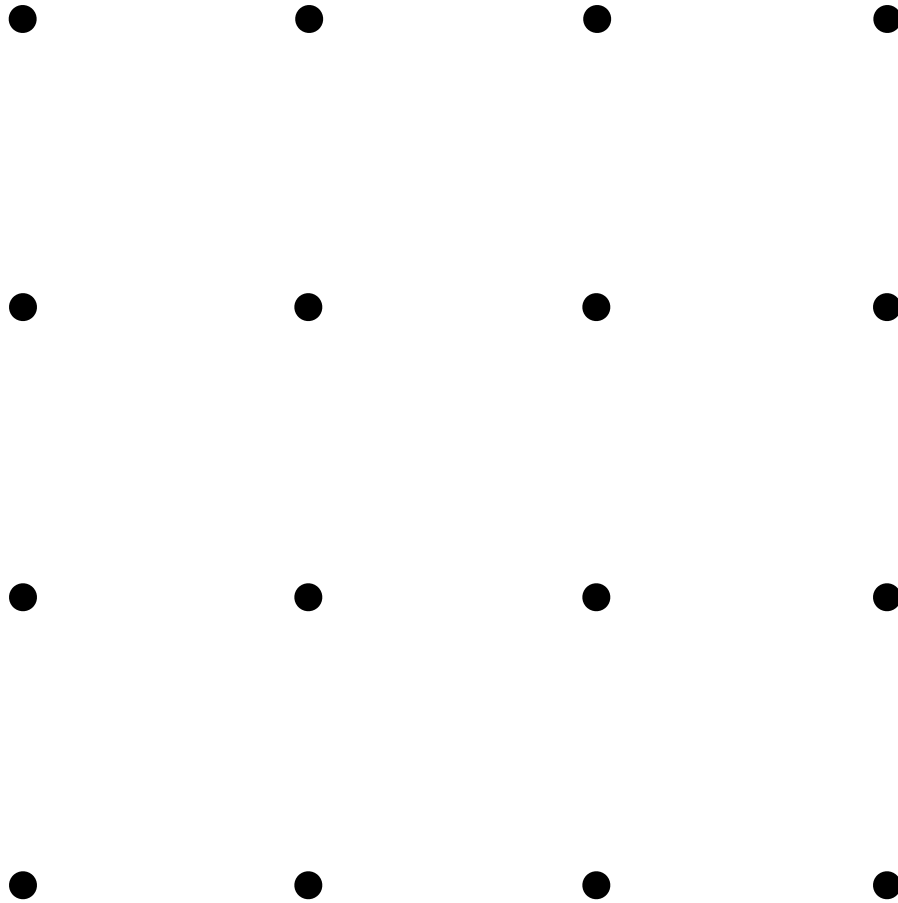
The Wrap

Ask students how many boxes there are altogether in a finished board. What are the possible scores? For example: 9 to 0, 8 to 1, etc. Can they come up with all the possible scores?

Tips for the Classroom

1. Small games are better, especially to start.
2. Play enough demonstration games with students so that the rules are clear.
3. Use different colored crayons or pencils while playing for a clearer game.
4. Placing square tiles on completed squares may help keep track of the score.

Dots and Boxes 3 by 3

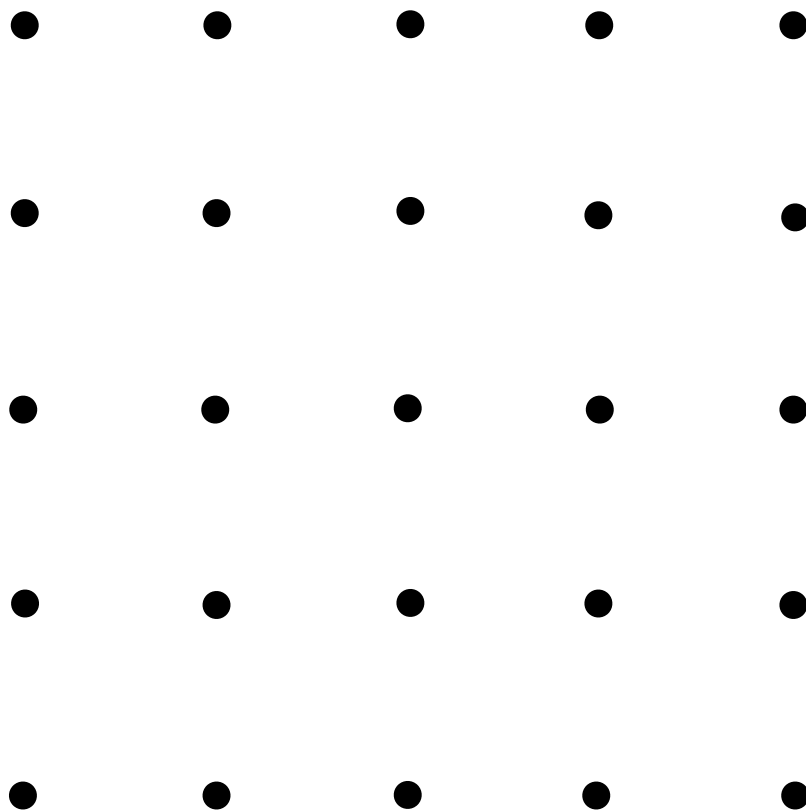


Dots and Boxes is a 2-player game.

On your turn, add a vertical or horizontal edge between dots. If you complete a square, get one point and go again. Keep track of the score by coloring in your square, or writing your initial inside it.

Whoever has the most squares at the end wins.

Dots and Boxes 4 by 4



Dots and Boxes is a 2-player game.

On your turn, add a vertical or horizontal edge between dots. If you complete a square, get one point and go again. Keep track of the score by coloring in your square, or writing your initial inside it.

Whoever has the most squares at the end wins.