



Counting: Dots in Various Arrangements

Kindergarten

Formative Assessment Lesson

Designed and revised by the Kentucky Department of Education
Field-tested by Kentucky Mathematics Leadership Network Teachers

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Revised 2016

This Formative Assessment Lesson is designed to be part of an instructional unit. This task should be implemented approximately two-thirds of the way through the instructional unit. The results of this task should then be used to inform the instruction that will take place for the remainder of your unit.

Mathematical goals

This lesson unit is intended to help you assess how well students are able to count objects up to 10 no matter how they are arranged and also how well they are able to represent their counts with written numerals. It will help you to identify students who have the following difficulties:

- Not being able to track where they start/stop counting
- Arranging objects to be counted
- One-to-one correspondence

Kentucky Academic Standards

This lesson involves *mathematical content* in the standards from across the grade, with emphasis on:

Counting and Cardinality K.CC

- Know number names and the count sequence.
- Count to tell the number of objects.

This lesson involves a range of *Standards for Mathematical Practice*, with emphasis on:

- 2. Reason abstractly and quantitatively.
- 7. Look at and make use of structure.

Introduction

This lesson is structured in the following way:

- Before the lesson, students work individually on an assessment task that is designed to reveal their current understandings and difficulties. You then review their work and create questions for students to answer in order to improve their solutions.
- Students work in small groups on collaborative discussion tasks, to match cards with dots in regular patterns, structured 10 frame patterns, unstructured arrangements, and numerals. As they do this, they interpret the cards' meanings and begin to link them together. Throughout their work, students justify and explain their decisions to their peers.
- Students return to their original assessment tasks, and try to improve their own responses.

Materials required

Each individual student will need:

- Two copies of the assessment task *Counting Dots*.
- A sheet of sticky dots or bingo daubers
- A set of flash cards for the whole class introduction

Each small group of students will need the following resources:

- *Card sets: A, B, C, and D.* All cards should be cut up before the lesson and it would be helpful if each set were a different color.

Time needed

Approximately 15 minutes before the lesson for the individual assessment task, one 40 minute lesson, and 15 minutes for a follow-up lesson for students to revisit individual assessment task. Timings given are only approximate. All students need not complete all sets of activity cards. Exact timings will depend on the needs of the class.

Before the Lesson

Assessment task: Counting Dots (15-20 minutes)

Have students do this task individually in class a day or more before the formative assessment lesson. This will give you an opportunity to assess the work, and to find out the kinds of difficulties students have with it. You will be able to target your help more effectively in the follow-up lesson. Depending on your class you can have them complete the assessment task in whole group or small groups (they should still work individually).

Frame the Pre-Assessment

Give each student a copy of the assessment task *Counting Dots*.

Today we are going to work on a task about counting. This task is to help me see ways that I can help you if you are having any problems counting. If you are not sure about all of your answers, it is okay. We are going to do an activity that will help us get better at counting.

On the first page you are going to count the number of dots in each picture. Write the numeral that tells how many dots in the box beside the picture. On the next page, count out sticker dots that match the number in the box. Place them in the box beside of the number.

It is important that the students are allowed to answer the questions without your assistance, as far as possible.

Students should not worry too much if they do not understand or cannot complete everything, because in the next lesson they will engage in a similar task, which should help them. Explain to students that by the end of the next lesson, they should expect to answer questions such as these confidently. This is their goal.

Assessing students' responses

Collect students' responses to the task. Make some notes about what their work reveals about their current levels of understanding, and their different problem solving approaches. Partner/Group students with others who displayed similar errors/misconceptions on the pre-assessment task.

We suggest that you do not score student's work. The research shows that this will be counterproductive, as it will encourage students to compare their scores, and will distract their attention from what they can do to improve their mathematics.

Instead, help students to make further progress by summarizing their difficulties as a series of questions. Some questions on the following page may serve as examples. These questions have been drawn from commonly identified student misconceptions.

We suggest that you write a list of your own questions, based on your students' work, using, but not limited to, the ideas that follow. You may choose to write questions on each student's work. If you do not have time to do this, select a few questions that will be of help to the majority of students. These can be written on the board at the end of the lesson before the students are given the post assessment task.

The solution to all these difficulties is not to teach one particular way of counting-one to one matching-but to help students to find a variety of ways that work in different situations and make sense to them.

Below is a list of common issues and questions/prompts that may be written on individual initial tasks or during the collaborative activity to help students clarify and extend their thinking.

Common Issues:

Suggested questions and prompts:

<p>Student writes numbers that are more than the number of dots.</p>	<ul style="list-style-type: none"> • <i>Did you count each dot only once?</i> • <i>Is there a way to know if you have already counted a dot?</i> • <i>How do you know where you started counting and where you stopped?</i> • <i>Think about how you could remember where you started.</i>
<p>Student writes numbers that are less than the number of dots.</p>	<ul style="list-style-type: none"> • <i>Did you count each dot only once?</i> • <i>Is there a way to know if you have already counted a dot?</i> • <i>How do you know where you started counting and where you stopped?</i> • <i>Think about how you could remember where you started.</i>
<p>Student counts correctly but records an incorrect response. Ex. Student counts five dots, but then writes down a 7.</p>	<ul style="list-style-type: none"> • <i>Point to the numeral and ask can you tell me what numeral this is? Repeat this process with different numerals. (NOTE: If students cannot respond with correct answers then this indicates a numeral identification issue not necessarily a counting issue.)</i>
<p>Students represent the number incorrectly with dots.</p>	<ul style="list-style-type: none"> • <i>Point to the numeral and ask them to identify the numeral?</i> • <i>How do you know you have that many dots?</i> • <i>Show me how you counted the dots?</i>
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	<ul style="list-style-type: none"> •

Suggested lesson outline

Whole Class Introduction (10 minutes)

Today we are going to do some more work with counting.

Cut the cards on pages 8-9 apart. Flash the cards one at a time and ask students, “How many do you see and how do you see the dots (or fingers)?” “Share your thinking with a shoulder partner”. Spotlight different strategies students use.

Collaborative Activity: matching *Card Sets A, B, C, and D* (30 min.)

Strategically group students based on pre-assessment data in to groups of two or three. With larger groups, some students may not fully engage in the task. Group students with others who displayed similar errors/misconceptions on the pre-assessment task.

Give each group *Card Sets A (numerals)* and *B (structured 10-frames)*.

Introduce the lesson carefully:

I want you to work as a team. Take turns placing a numeral card with a dot card that has the same number of dots. Each time you do this, explain your thinking clearly to your partner. If your partner disagrees with your match then challenge him or her to explain why. It is important that you both understand why each card is matched with another one. You will also find some cards that don't have a match. It will be your job to use a blank card and create the match. There is a lot of work to do today and you may not all finish. The important thing is to learn something new, so take your time.

Your tasks during the small group work are to make a note of student approaches to the task, and to support student problem solving. As you monitor the work, listen to the discussion and help students to look for patterns and generalizations.

Make a note of student approaches to the task

You can then use this information to focus a whole-class discussion towards the end of the lesson. In particular, notice any common mistakes. For example, students may consistently loose count or forget where they started and re-count dots.

Support student problem solving

Try not to make suggestions that move students toward a particular approach to the task. Instead, ask questions to help students clarify their thinking. Encourage students to use each other as a resource for learning.

If one student has placed a particular card to make a match, challenge their partner to provide an explanation.

If you find students have difficulty articulating their decisions, then you may want to use the questions from the *Common Issues* table to support your questioning.

If the whole class is struggling on the same issue, then you may want to write a couple of questions on the board and organize a whole class discussion.

Placing Card Set C (*regular patterns*)

As students finish with matching card sets A and B and can explain their work, hand out card set C. These provide students with a different way of interpreting the numbers.

Do not collect card set B. An important part of this task is for students to make connections between different representations of number.

Placing Card Set D (unstructured)

As students finish matching card set C and can explain their work, hand out card set D. Continue to monitor work and listen to discussion.

Taking two class periods to complete all activities

If you have to divide the lesson into two class periods, you may want to have a way for students to save the work they have done with matching the card sets. You may give each group a chart paper or poster board and have them tape the cards down with their matches. You may choose to have them do this even if you are not dividing up the class period just to use as a visual during the class discussion.

Sharing Work (10 minutes)

When students get as far as they can with matching the card sets, allow groups to compare their matches to other groups. Students are permitted to ask questions and make changes to their original decisions.

Extension activities

Ask students who finish quickly to make another set of cards that shows each number in a different way.

Whole-class discussion (10 minutes)

Conclude the lesson by discussing and generalizing what has been learned. The generalization involves first extending what has been learned to new examples, and then examining some of the conclusions the students came up with.

Allow groups to bring up some of their work samples and share why they chose those as matches.

Ask students:

Which cards were easy to count? Why?

Which cards were difficult to count? Why?

Improving individual solutions to the assessment task (10 minutes)

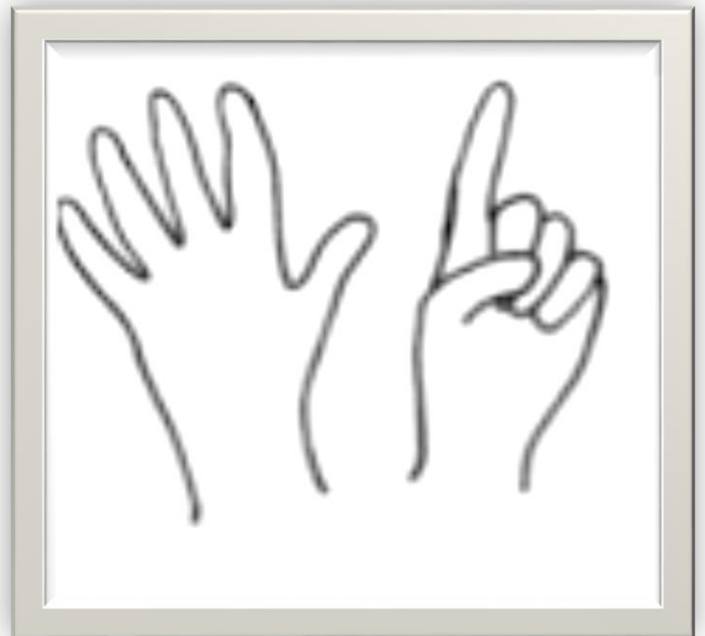
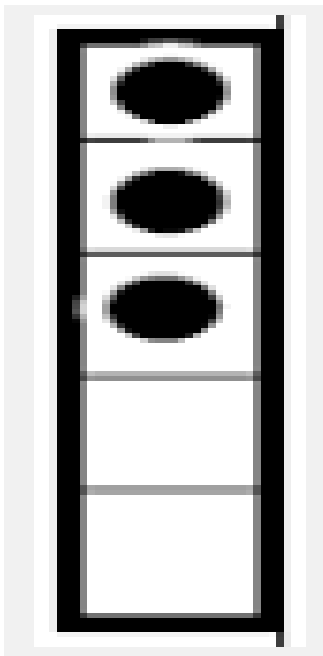
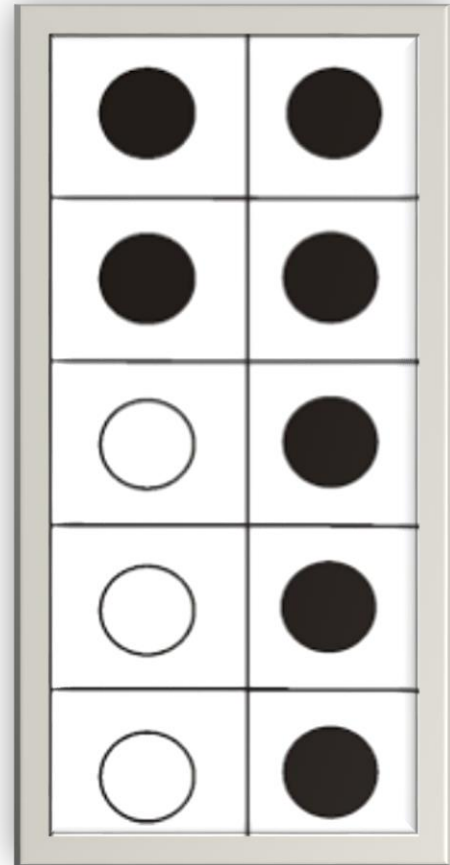
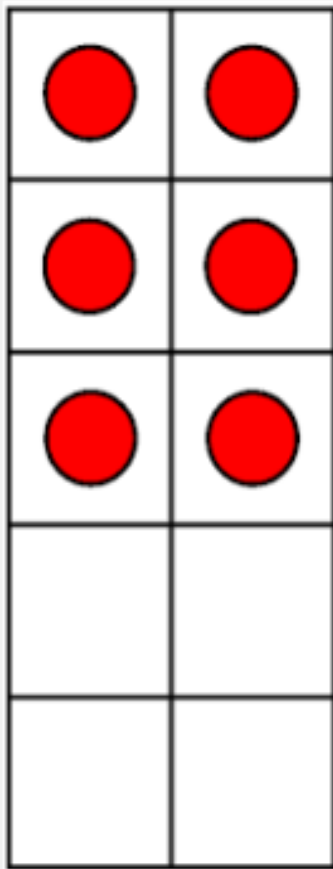
Give the students a new copy of the original task, *Counting Dots*, and more sticky dots.

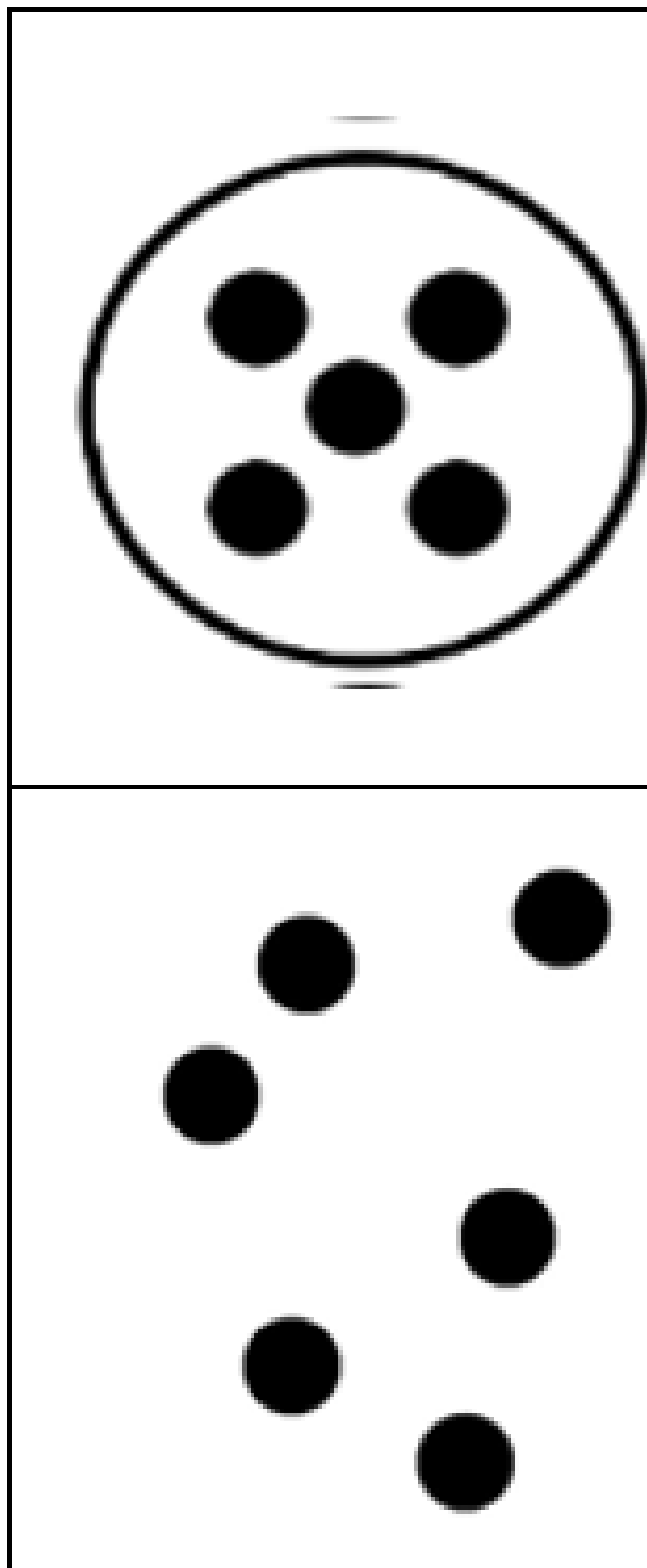
Think about what you have learned during this lesson.

Using what you have learned, try to improve your work.

To focus your students, refer to the common issues chart. Use the questions which reflect the greatest need(s) of your students. You may choose to share these aloud with the whole group, ask them of individuals as you move around the room, or work with small groups.

This lesson format was designed from the Classroom Challenge Lessons intended for students in grades 6 through 12 from the [Math Assessment Project](#).





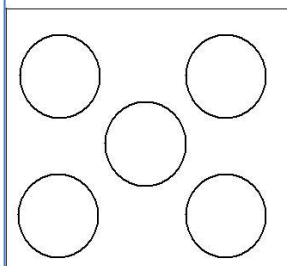
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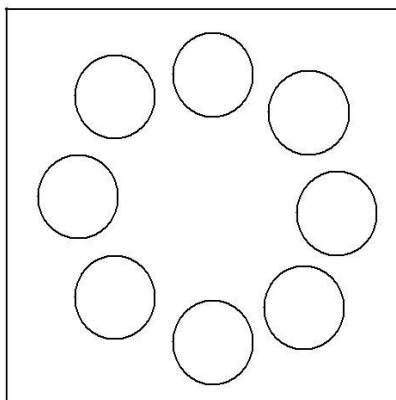
Counting Dots

Count the dots in each picture.

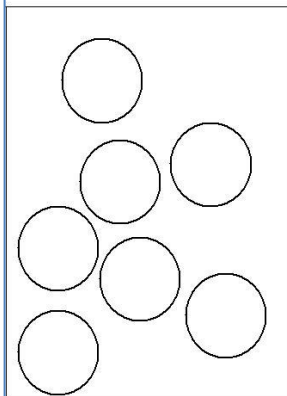
Write the numeral that tells how many dots in the box beside the picture.



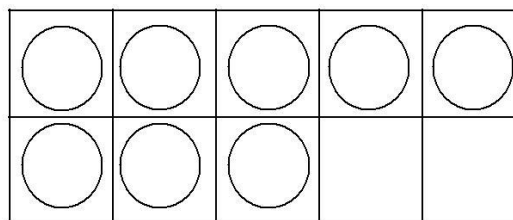
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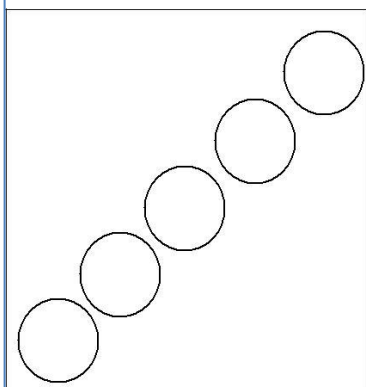
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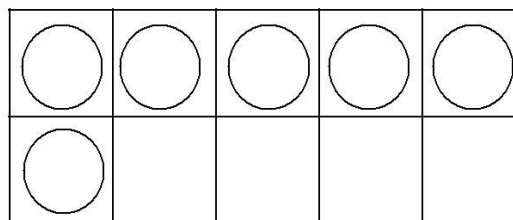
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Count out sticker dots that match the number in the box. Place them in the box beside of the number.

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Card Set A: Numeral Cards

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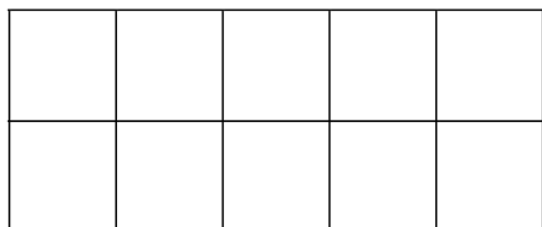
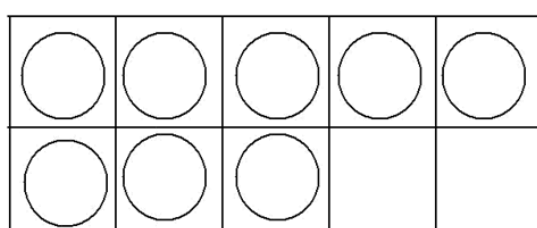
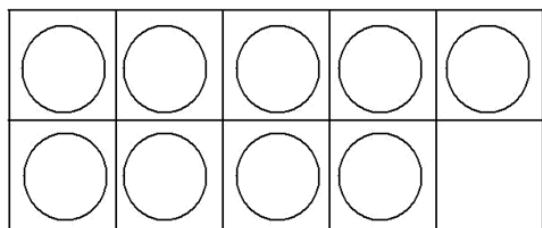
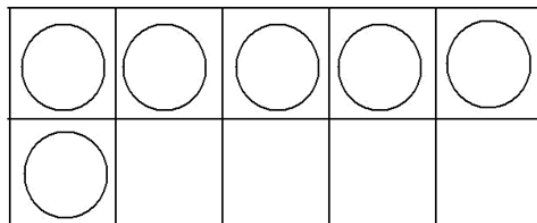
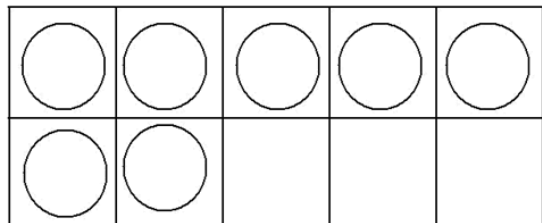
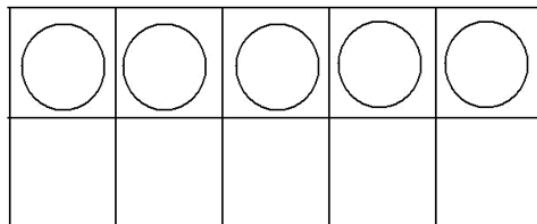
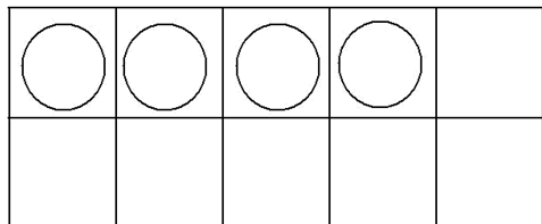
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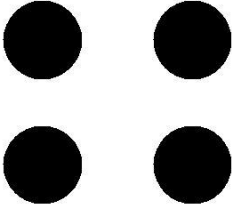
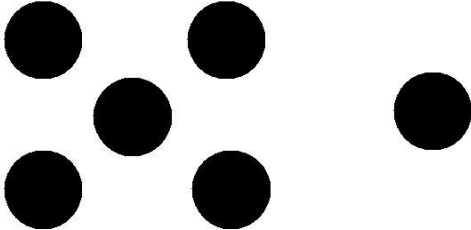
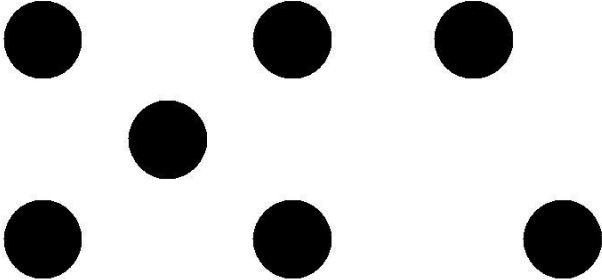
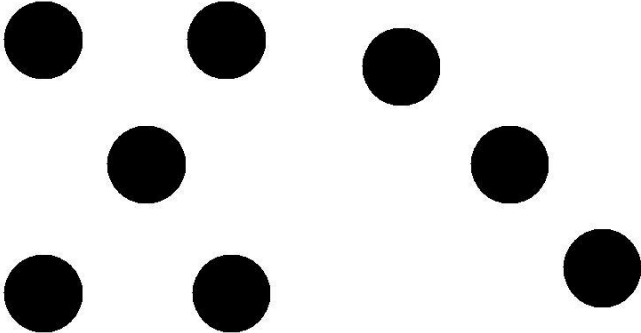
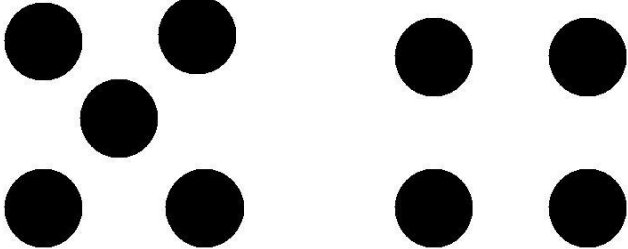
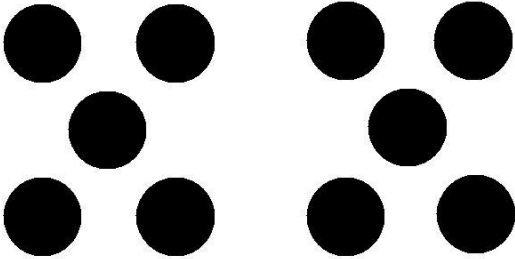
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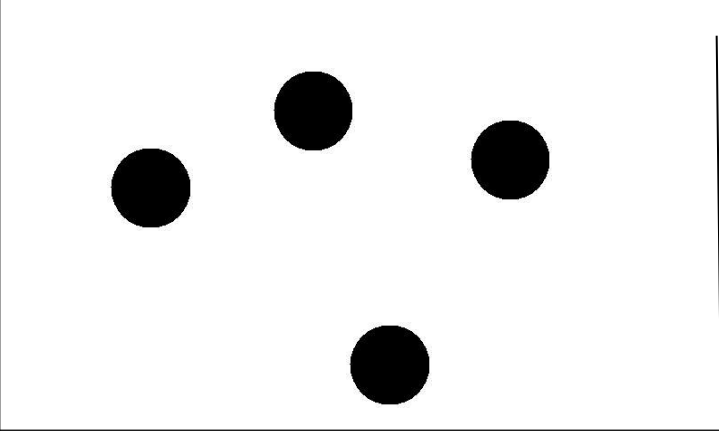
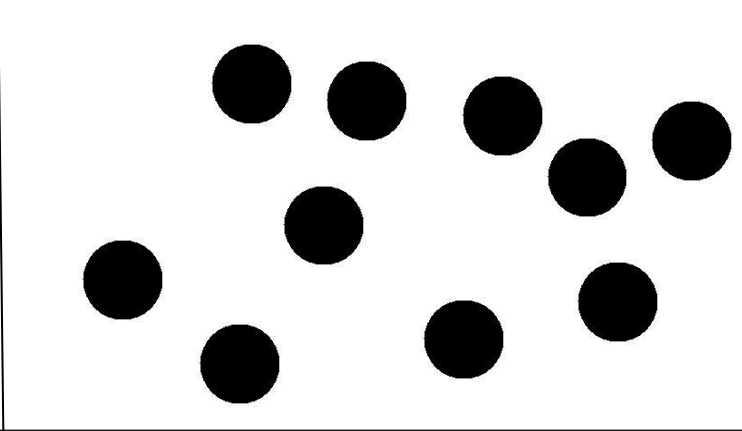
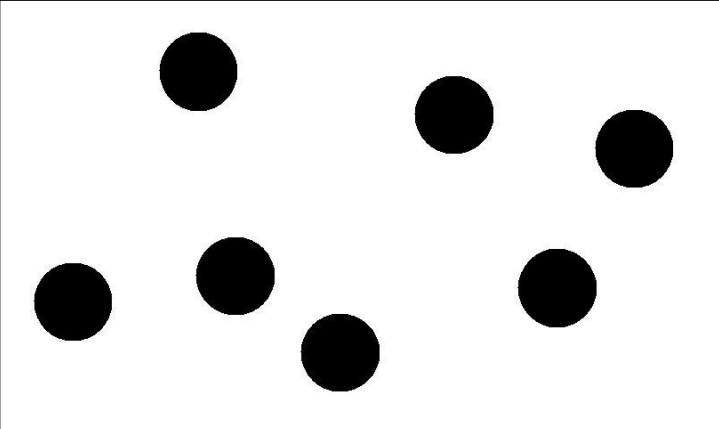
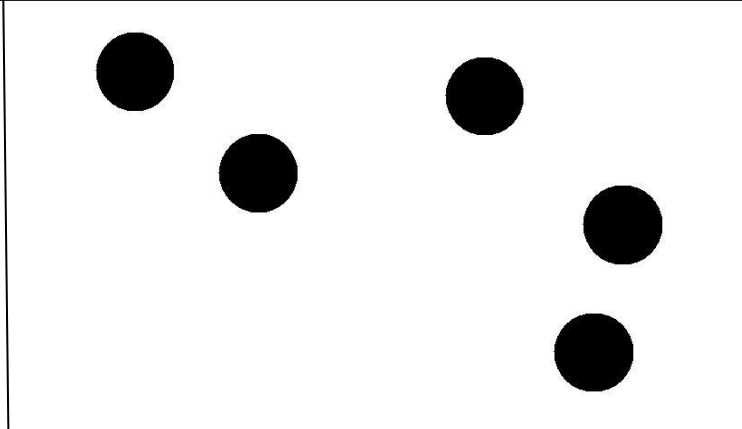
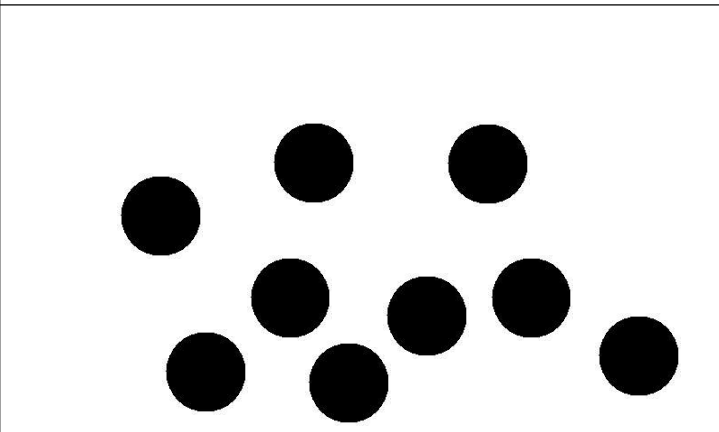
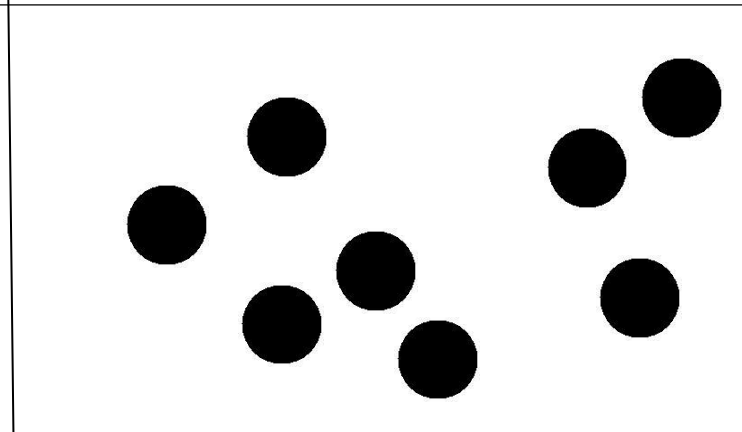
Card Set B: Structured Ten Frames



Card Set C: Regular Patterns

Card Set D: Unstructured

 <p>A card containing 5 black dots arranged in a scattered pattern.</p>	 <p>A card containing 10 black dots arranged in a scattered pattern.</p>
 <p>A card containing 8 black dots arranged in a scattered pattern.</p>	 <p>A card containing 7 black dots arranged in a scattered pattern.</p>
 <p>A card containing 9 black dots arranged in a scattered pattern.</p>	 <p>A card containing 8 black dots arranged in a scattered pattern.</p>
<p>Card Left Blank/Student Draws Dots</p>	