

Kinderlogo and the Common Core Standards for Mathematics

The Common Core State Standards Initiative is a state-led effort coordinated by the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO). The standards were developed in collaboration with teachers, school administrators, and experts, to provide a clear and consistent framework to prepare our children for college and the workforce. The Common Core Standards have been adopted by 45 states and 3 territories since 2010. Read more at: www.corestandards.org.

Kinderlogo offers a powerful environment for exploring mathematics. Students construct their own learning as they figure out how to move and turn the turtle, create patterns, and draw many different shapes. The student becomes the teacher.

This document identifies the Common Core Standards for Mathematics for Grades K–3 that apply to Kinderlogo and activities and strategies for implementing them.

Kindergarten Common Core Standards for Mathematics

The following Common Core Standards for Kindergarten can be explored using Kinderlogo.

K.CC Counting and Cardinality

Know number names and the count sequence.

1. Count to 100 by ones and by tens.

Count to tell the number of objects.

4. Understand the relationship between numbers and quantities; connect counting to cardinality.

Compare numbers.

6. Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.

K.OA Operations and Algebraic Thinking

Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.

1. Represent addition and subtraction with objects, fingers, mental images, drawings, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

K.MD Measurement and Data

Describe and compare measurable attributes.

1. Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
2. Directly compare two objects with a measurable attribute in common, to see which object has “more of”/“less of” the attribute, and describe the difference.

K.G Geometry

Identify and describe shapes (squares, circles, triangles, rectangles, hexagons...).

2. Correctly name shapes regardless of their orientations or overall size.

Analyze, compare, create, and compose shapes.

4. Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/“corners”) and other attributes (e.g., having sides of equal length).
5. Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes.
6. Compose simple shapes to form larger shapes.

Kinderlogo Activities for Kindergarten

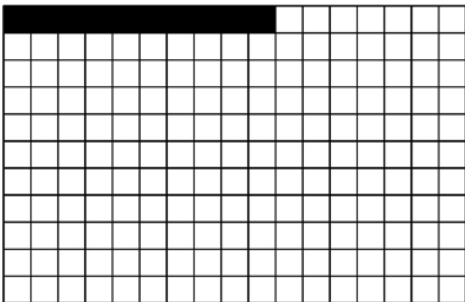
Kinderlogo activities: KL1 (Level 1) and Color Grid (Level 4).

Teaching Strategies:

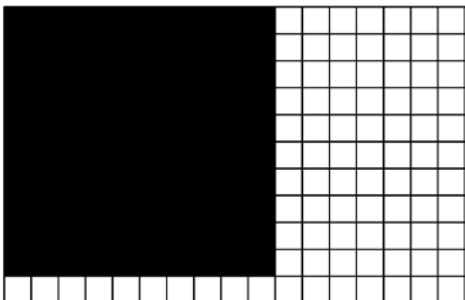
At the Kindergarten level, make sure that the students have an opportunity to explore freely with the turtle, so they can see how it moves and turns. Then try some of these projects.

K.CC Counting and Cardinality

Using the Color Grid activity at Level 4 (you can make a copy of that activity and put it in the Level 1 folder so the students don't need to go into the Level 4 folder), have them count to ten as they click on squares to fill them in.



Then they can drag with the mouse (or click on squares) to fill in the same number of squares in each row, as they count by tens.



Talk to students about squares. Tell them that when they draw a square, each side needs to have the same number of turtle steps.

K.OA Operations and Algebraic Thinking

Ask students:

Can you count out 3 turtle steps? Can you take them away (press X three times)?

Can you count out 5 turtle steps? Can you take away 4 (using the X command)?

Can you add 4 more steps?

K.MD Measurement and Data

Can you make a size 3 square (3 turtle steps on each side)? A size 5 square? A size 10 square?

Make two squares. Which one is bigger? Which one is smaller?

K.G Geometry

Ask students to:

Draw a square. Count the number of turtle steps (**F** commands) you type for each side.

Make each side have the same number of steps.

Count how many **R** or **L** commands make a square corner.

Describe your square.

How many corners does a square have?

How many sides does a square have?

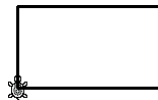


Draw a rectangle. Describe it to me.

How many corners does a rectangle have?

How many sides does a rectangle have?

How is a rectangle different from a square?



Draw a triangle. Describe it to me.

How many corners does a triangle have?

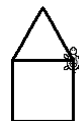
How many sides does a triangle have?

How is a triangle different from a square?

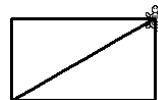


Can you make a size 5 triangle (5 turtle steps on each side)? A size 3 triangle? A size 1 triangle?

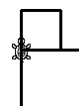
Can you make a house out of a square and a triangle?



Can you make a rectangle out of two triangles?



Can you draw a size 2 square on top of a size 3 square?



How many steps tall are your squares in all?

Grade 1 Common Core Standards for Mathematics

The following Common Core Standards for Grade 1 can be explored using Kinderlogo.

1.MD Measurement and Data

Measure lengths indirectly and by iterating length units.

1. Order three objects by length; compare the lengths of two objects indirectly by using a third object.
2. Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps.

1.G Geometry

Reason with shapes and their attributes.

1. Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.
2. Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape.
3. Partition circles and rectangles into two and four equal shares, describe the shares using the words *halves*, *fourths*, and *quarters*, and use the phrases *half of*, *fourth of*, and *quarter of*. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.

Kinderlogo Activities for Grade 1

Kinderlogo activities: KL1 (Level 1), KL2 (Level 2), and Color Grid (Level 4).

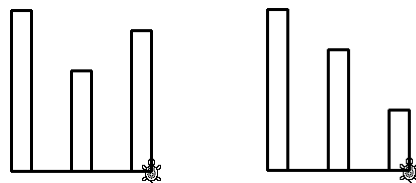
Teaching Strategies:

If students are new to Kinderlogo, make sure that they have an opportunity to explore freely with the turtle, so they can see how it moves and turns.

Even if students have not yet explored Level 3 commands and activities, they can use Color Grid at Level 4. They press number keys to change the colors and click to fill squares with color.

1.MD Measurement and Data

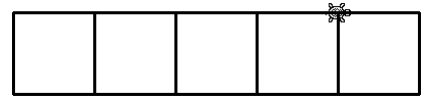
Ask students to draw three rectangles with different lengths. Ask them to compare their heights. Then, ask them to draw three rectangles in order from tallest to shortest.



Use the S command (to draw a square) in KL2 for these activities:

Draw a row of squares that is 5 squares long.

Draw a row of squares that is 8 squares long.



1.G Geometry

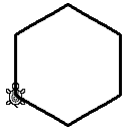
Draw a small triangle.

Draw a large square.

Draw a rectangle that is tall and thin.

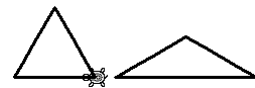
Draw a rectangle that is short and wide.

Draw a trapezoid.

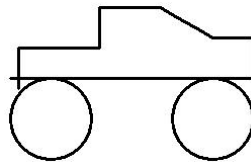


Draw a hexagon.

Draw two different types of triangles (such as equilateral and isosceles; right triangles are more difficult to draw in Kinderlogo, but are possible).



Draw a vehicle using lines and circles.



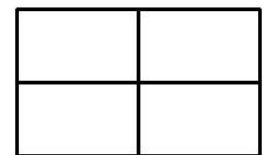
Draw a building using squares and triangles.



Draw a rectangle and then draw another line to divide it in half.

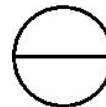


Draw a rectangle and then draw lines to divide it into quarters.

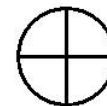


Use the C command (to draw a circle) in KL2 for these activities:

Draw a circle and then draw a line to divide it in half.

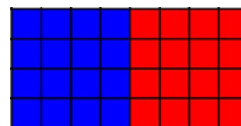


Draw a circle and then draw lines to divide it into quarters.



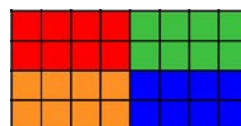
Using the Color Grid activity, draw a rectangle.

Color one half red and the other half blue.



Using the Color Grid activity, draw a rectangle.

Divide it into four equal quarters by filling each share with a different color.



Grade 2 Common Core Standards for Mathematics

The following Common Core Standards for Grade 2 can be explored using Kinderlogo.

2.OA Operations and Algebraic Thinking

Work with equal groups of objects to gain foundations for multiplication.

4. Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.

2.MD Measurement and Data

Measure and estimate lengths in standard units.

1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
3. Estimate lengths using units of inches, feet, centimeters, and meters.
4. Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

2.G Geometry

Reason with shapes and their attributes.

1. Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.
2. Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.
3. Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words *halves*, *thirds*, *half of*, *a third of*, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

Kinderlogo Activities for Grade 2

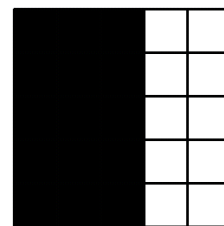
Kinderlogo activities: KL1 (Level 1), KL2 (Level 2), KL4 and Color Grid (Level 4).

Teaching Strategies:

Prepare for each student (or have them make) a paper ruler marked in inches, and another one marked in centimeters. Paper and pencil, or a computer-based writing tool, such as NotePad, should be available for written activities.

2.OA Operations and Algebraic Thinking

Have students make rectangles by filling boxes in the Color Grid activity. They should color in no more than 5 rows and columns. Ask them to tell you or to write down an equation to represent the number of boxes filled in.



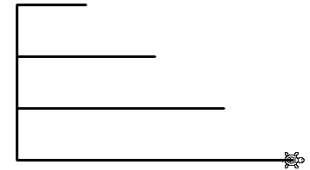
$$3+3+3+3+3 = 15$$

2.MD Measurement and Data

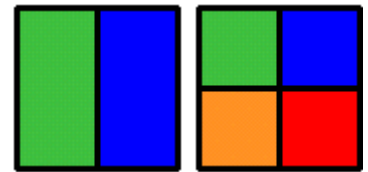
Have them use a paper ruler to measure lines that the turtle draws in inches and centimeters. They can measure lines that are horizontal, vertical, and at an angle.

Note that because of differing aspect ratios of the computer monitors, and of pixels, which may not be perfectly square, the measurements may vary even when the turtle goes the same number of steps. They can still compare the measurements of lines that extend in the same direction.

At the right are a 1" line, a 2" line, a 3" line and a 4" line (reduced in size for this document). Each inch took 4 turtle steps to draw.

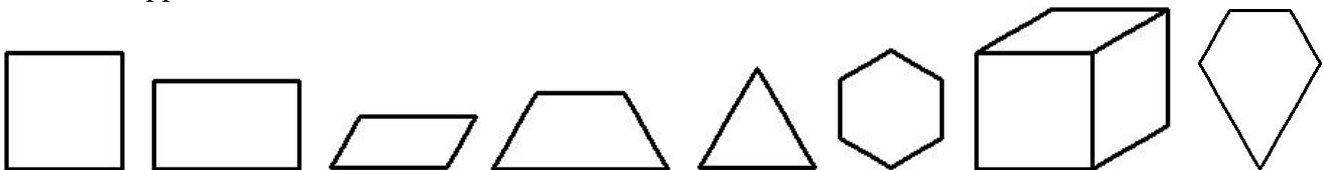


Using KL4 at Level 4, ask the students to draw a square. (They can press S, or you can require that they draw a square step by step, with an even number of steps on each side.) Then ask them to draw a line to divide the square in half and color each half a different color. They will need to use the number keys to change the colors, PenUp command (to raise the turtle's pen so that it can go to the middle of an area without drawing a line), the PenDown command (to lower the turtle's pen so it can draw again), and the P command to paint in the area surrounding the turtle.

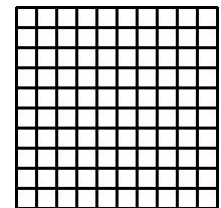


2.G Geometry

Have the students draw various triangles, quadrilaterals, pentagons, hexagons, and cubes. Some regular shapes are impossible to draw in Kinderlogo because not all angles are available. However, students can make approximations of them.

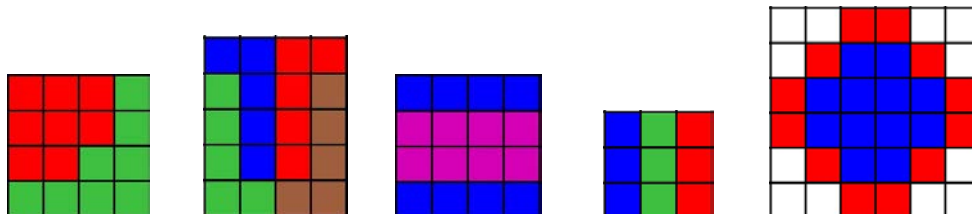


Have students draw a rectangle and partition it into squares of equal size. If students can master saving a procedure at Level 5, they can store commands to make a small square, then, using that building block, store a second procedure to draw a row of small squares.



They can also draw squares by hand or use the ready-made square command at Level 2.

Using Color Grid (Level 4), have students create various ways to divide shapes into halves, thirds, and quarters.



Grade 3 Common Core Standards for Mathematics

Common Core Standards for Grade 3 that apply to Kinderlogo explorations:

3.OA Operations and Algebraic Thinking

Represent and solve problems involving multiplication and division.

1. Interpret products of whole numbers.
2. Interpret whole-number quotients of whole numbers, e.g., interpret $56 \div 8$ as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each.
3. Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.

3.NF Numbers and Operations - Fractions

Develop understanding of fractions as numbers.

1. Understand a fraction as a number on the number line; represent fractions on a number line diagram.

Represent and interpret data.

3. Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories.

3.MD Measurement and Data

Geometric measurement: understand concepts of area and relate area to multiplication and to addition.

6. Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).
7. Relate area to the operations of multiplication and addition.
 - a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.

Represent and interpret data.

3. Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories.

Geometric measurement: understand concepts of area and relate area to multiplication and to addition.

7. Relate area to the operations of multiplication and addition.
 - a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.

Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.

8. Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

3.G Geometry

Reason with shapes and their attributes.

1. Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.
2. Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as $\frac{1}{4}$ of the area of the shape.*

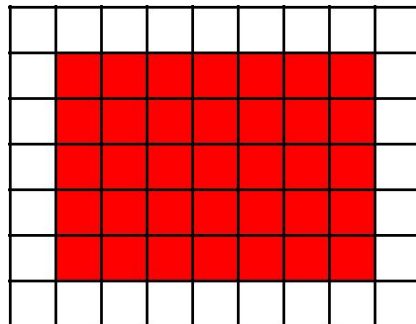
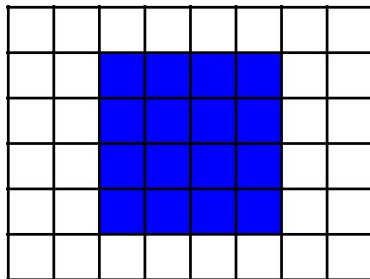
Kinderlogo Activities for Grade 3

Kinderlogo activities: KL1 (Level 1), KL2 (Level 2), KL3 (Level 3), and Color Grid (Level 4).

Teaching Strategies:

3.OA Operations and Algebraic Thinking

Using the Color Grid activity, ask students to show you 4×3 , or 8×6 . They can fill in squares to represent these products.



Give them word problems to represent using the Color Grid activity.

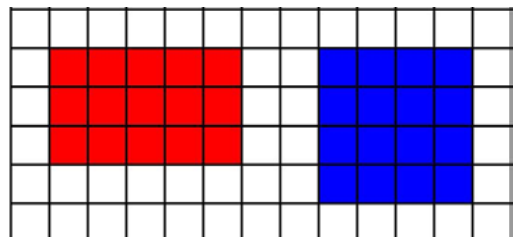
For example:

Tom had 15 apples. Dawn had one more apple than Tom.

Make two rectangles to show these values.

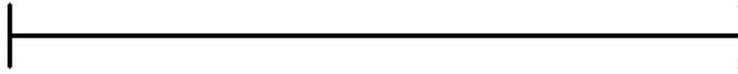
Are there numbers that you can't represent by a rectangle?

How many can you think of?

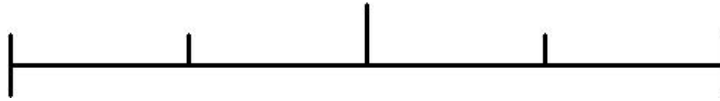


3.NF Numbers and Operations - Fractions

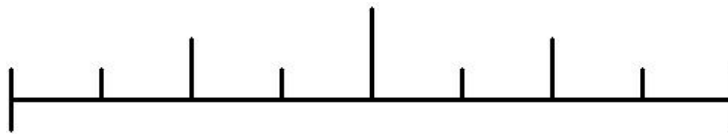
Have the students draw a horizontal line of 24 turtle steps. Draw a short line at each end.



Have them draw a longer mark at $\frac{1}{2}$ and shorter marks at $\frac{1}{4}$ and $\frac{3}{4}$.



Can they also draw marks at every eighth?

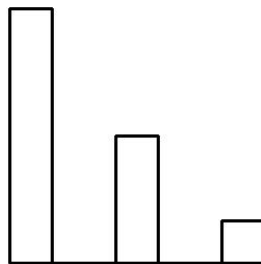


Ask them to draw a bar graph that represents a data set you provide.

For example, Jack had 12 cars, Juan had half that number. Amy had just 2 cars.

Make a bar graph that shows how many cars they each had.

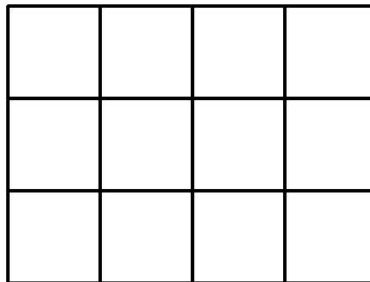
In this graphic, every turtle step represents one car.



3.MD Measurement and Data

Have students use the KL2 activity to build a grid of a specified area using the **S**quare command.

For example, build a rectangle of 12 square units.

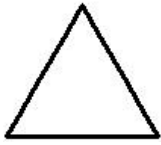


Have students fill in a rectangle using the Color Grid activity, then compute its area.

Or one student can fill in a rectangle at a computer and a different student compute its area.

Challenge students to create shapes with various perimeters. Either you can specify the shape and perimeter, or the student can choose the shape and perimeter and then explain it to you.

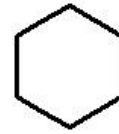
For example, have students draw a shape and tell you its perimeter.



Triangle: perimeter = 15



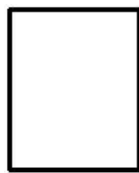
Trapezoid: perimeter = 17



Hexagon: perimeter = 12

Or you can ask them to make a triangle with a perimeter of 24 steps. When they have finished, ask them how many turtle steps were on each side.

Ask them to draw two rectangles with the same perimeter and different areas.

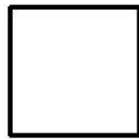


Area = 20 (5 x 4)
Perimeter = 18



Area = 18 (3 x 6)
Perimeter = 18

Ask them to draw two rectangles with the same area and different perimeters.



Area = 16 (4 x 4)
Perimeter = 16

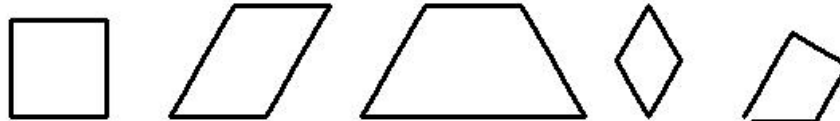


Area = 15 (2 x 8)
Perimeter = 20

Ask them to draw several shapes that have the same perimeter and area.

3.G Geometry

Ask students to draw various types of quadrilaterals and name them.



Have students use KL 4 commands (Level 4) to draw shapes and partition them into equal fractional parts. Have them tell you what shape they drew and describe the fractional parts they created.

