Lesson 5

The YELLOW Face

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21st Century Learning Skills

Learning & Innovation Skills:
• Creativity and Innovation
• Critical Thinking and Problem Solving
• Communication and Collaboration

Life & Career Skills:
• Flexibility and Adaptability
• Initiative and Self Direction
• Social and Cross-Cultural Skills
• Productivity and Accountability
• Leadership and Responsibility

Media Literacy:
• Information Literacy
### CONTENT STANDARDS & SKILLS: LESSON 5

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<td><strong>Algebra</strong>&lt;br&gt;● Recognize and describe patterns&lt;br&gt;<strong>Geometry</strong>&lt;br&gt;● Use visualization, spatial reasoning &amp; geometric modeling to solve problems</td>
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<td>3-5</td>
<td>CCSS.MATH.CONTENT.4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.</td>
<td><strong>Algebra</strong>&lt;br&gt;● Analyze change in various contexts&lt;br&gt;<strong>Geometry</strong>&lt;br&gt;● Predict and describe the results of sliding, flipping, and turning two-dimensional shapes</td>
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Each lesson in this series begins with a review of the previous lesson and ends with a review of the current lesson. The review of the current lesson is always followed by a math extension which may or may not apply to your grade level. The last slide in each lesson is a trivia question. Many of the slides are animated so what you see in this guide may not appear all at once in the presentation. Please modify your presentation to best meet the needs of your students.

Review: Slides 3 - 5

This is a static slide. Review terms as you see fit. Basic suggestions below:
Symmetry: a fold line where one half matches the other half exactly
Edge: where 2 faces meet
Rotation: a turn (90° on a Rubik’s Cube)
Corner: where 3 faces meet
Face: the side of a cube
Horizontal: going across
Vertical: going up/down
Layer: a horizontal section (layer cake)
Lesson Content: Slides 6 - 22

There are two parts to solving the YELLOW face. The first part is to solve for the YELLOW cross. The second part is to make the UP tile of the corners YELLOW. The corners will be matched to their correct FACE in Lesson 6, the final stage.

Just as with the WHITE cross, focus on the EDGE pieces. If there is not already a YELLOW cross, students will have a YELLOW “backwards L” in the upper left corner (middle image), a row of YELLOW tiles (right image), or neither (left image). Students should find the best match and hold the cube as shown.

There will be 0, 2, or 4 YELLOW EDGE pieces. If there are 1 or 3 YELLOW EDGE pieces, then the MIDDLE Layer has not been solved. The MIDDLE Layer must be solved to continue.
For the stages of solving YELLOW face, the orientation of the cube is very important. Students should hold their Rubik’s Cubes to match one of the 3 examples.

HINT: Keeping the Cube on the table or desk may help students attend to the orientation of the cube which is an important concept as they solve.

Orientation is key! Each time the algorithm is completed, the cube must be turned to match one of the 3 examples. Then, the algorithm is repeated.

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The LEFT/FRONT/UP corner is the key to placing YELLOW corner tiles on the UP face to complete the YELLOW face. (The answer to “which corner is hidden?” is RIGHT/BACK/DOWN.)

The next 4 slides show the matching positions. Each time you repeat the algorithm for the corners, students will need to match the placement of the YELLOW tile on the LEFT/FRONT/UP corner, depending on the number of YELLOW tiles already on the corners of the UP face.

If there are no YELLOW corner tiles, turn the entire cube (the whole cube) until the LEFT/FRONT/UP corner has a YELLOW tile on the LEFT.
If there is **one** YELLOW corner tile, turn the entire cube (the whole cube) until there are no YELLOW tiles on any of the lateral sides of the LEFT/FRONT/UP corner.

**HINT:** Make the “fish” dive!

If there are **two** YELLOW corner tiles, turn the entire cube (the whole cube) until the FRONT of the LEFT/FRONT/UP corner is YELLOW. It doesn’t matter where the 2 corner YELLOW tiles are.

**HINT:** Try this saying: *If there’s two, towards you.*

(If there are 2 YELLOW corners, then a YELLOW tile on the LEFT/FRONT/UP corner faces you.)

This slide illustrates turning the whole cube to find the best match.

Note the image on the left is the starting position.
For the stages of solving YELLOW face, the orientation of the Rubik’s Cube is very important. Students should hold their Cubes to match one of the 3 examples.

HINT: Keeping the Cube on the table or desk may help students attend to the orientation of the Cube, which is an important concept as they solve.

Orientation is key! Each time the algorithm is completed, the Cube must be turned to match one of the 3 examples. Then, the algorithm is repeated.

When the YELLOW face is complete, the lateral faces of the corners may not match their corresponding CENTER tiles. This last step will be accomplished in the next lesson.
Generally, transformations involve moving an object in a specific way. After the transformation is complete, the result will be congruent to the original object. This may contradict students' non-math understanding of transformations such as the Transformer series of toys and cartoon characters.

Students may be familiar with line symmetry. Younger students could be challenged to find all the lines of symmetry on a single face. Explore how color influences lines of symmetry.

Older students may more easily grasp the concept of rotational symmetry by turning a Rubik's Cube. Challenge students to create other patterns on a face of a cube that have rotational symmetry. This may work well with partners (or with 2 cubes) so that one Cube remains in the same position while the second Cube is turned and compared to the first. Place the Rubik's Cube on a paper plate to turn it easily.

A translation or slide is a movement of an object along a line. This may seem obvious and the point can easily be lost. Have students think about where translations are seen in their world. Fabric and wallpaper with repeating patterns can be examples of translations. What would happen if the creator "stamped" a design without paying attention to whether or not the stamps were placed along a line? (The fabric or wallpaper may look crooked.) Students might try this using stamps or stickers to get a better sense of the concept of translation. Use a ruler as the slide line, the line along which the Rubik's Cube will move.
In a reflection, the image of the object is flipped over a line. Placing a small mirror or a piece of plexiglass between 2 cubes may help students see the line of reflection.

Rotations are turns of an object around a point, the center of rotation. Place the Rubik’s Cube on a paper plate or Lazy Susan and mark the center of rotation. Place a finger on the center as the plate is turned.

The plate could be placed on top of a larger piece of paper with an xy axis so that students could see the 90° turns.
Review: Slides 27 - 29
These slides could be printed as a reference for students, perhaps in a learning center.

REVIEW THE YELLOW CROSS.

Hold your cube to match one of these.

1st GOAL:
Follow the algorithm to make the YELLOW cross. You may need to repeat the algorithm 2 or 3 times, remember to match the top of your Cube each time.

To solve the YELLOW cross.

2nd GOAL:
To get the YELLOW corners on the UP face.

REVIEWING the YELLOW Face
Match your Rubik’s Cube to one of these. Pay attention to the corners!

2nd GOAL:
Follow the algorithm.

Re-match and repeat the algorithm until all the YELLOW corners are on the UP face.

TRIVIA: Slide 30-31

Question: How big was the largest Rubik’s Cube? Who built it?

Answer: The largest Rubik’s Cube was built by Tony Fisher of the UK in 2016. It is fully functional and stands 1.5 meters tall x 1.5 meters long x 1.5 meters wide (which is about 5’2” on each side).
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