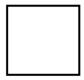
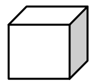
Building Exponential Expressions with Color Tiles and Linker Cubes

Objective: Students will use build models for exponential expressions, will write correct mathematical notation and connect that notation to the models.
Materials: Color Tiles for building a square models, Linker Cubes for building cubed and other exponential models.

In small groups have student take turns building models so that one person is the builder, one person is the coach, one person is the checker, and the other is the encourager. All group members will sketch the diagrams and label the dimensions. With each successive model, students rotate the roles.

1a. First, ask students to build the smallest possible square using Color Tiles. Q. "What do we know about the relationship between length of the sides of any square? (They must be congruent.) Have them sketch, label and write symbolically the measure of the area. 1″ x 1″ = 1^2 = 1 in. ^{2} Explain that 1 is the length of a side and that the exponent, 2, might represent the fact that this model is a two dimensional figure. Have them write $\pi 1 = 1$ asking, "What would the length of a side, or the square's root be if there was only one square in the model?" *TELL them a square root is considered to be the inverse of the square*.

1b. Next, have students use the Linking Cubes to build the smallest possible cube so that the length, width and height are congruent. Have them sketch, label and write symbolically the measure of the volume.
1″ x 1″ x 1″ = 1^3 = 1 in. ^{3}. Q. "What do we know about the relationship between the length, width, and height in a cube?" Explain that 1 is the length, the width and the height, and that the exponent, 3 might represent the fact that this model is a three dimensional figure. Extension connection: Have them write $^3\pi 1 = 1$ asking, "What would the length of a side, or the square's root be if there was only one square in the model?"

2a. Ask students to build the next smallest possible <u>square</u> (2 x 2). Have them sketch, label
follow the same procedure as with 1^2 making the connection between squaring, square root and side length.

2b. Then, ask them to build a cube with length of side being 2 and follow the same procedure as with 1^3 making the connection between the symbolic representation and the congruent length, width and height. Next have them follow the same procedure building a square with length of sides equal to 3 and then a cube with length of sides equal to three.

3a. Ask students to build the next smallest possible <u>square</u> (3 x 3). Have them follow the procedure for squares.

3b. Then, ask them to build a cube with length of side being 3 and follow the procedure for cubes.

4a. Ask students to build the next smallest possible <u>square</u> (4 x 4). Have them follow the procedure for squares

4b. Then, ask them to build a cube with length of side being 4 and follow the procedure for cubes.

5. Ask them to discuss with group members what 2^4 power would look like. They will probably struggle with an idea. One way to create a physical model for this is two cubes containing 2^3 linking cubes:
(2 x 2 x 2)2. Then, what would 2^5 power look like (twice as many as 2^4), and 2^6 would have twice as many linkers as 2^5, doubling every time. Have students write descriptions of what they think these would look like.

6. Have students suggest what 3^4, 3^5, 3^6 would look like.

7. Finally, help them write a variable expression by ask them to think of the same pattern with any length of side or "s" length. Get them to write expressions for s^2, s^3, s^4, and s^5. As they write the expression, have them also write the factors out for each expression.