

### **Math Strand 3: Geometric and Spatial Relationships**

**CLE: 3.3 Apply transformations and use symmetry to analyze mathematical situations.**

**Health Profession: Physician**

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#### **Reference(s)**

Larson, R., Boswell, L., Kanold, T., Stiff, L., McDougal Little Algebra I (2007) Skills Review Handbook. p992.

Heart Information. Retrieved January 29, 2007 from [www.downloadheart.us/what-is-cardiomegaly.html](http://www.downloadheart.us/what-is-cardiomegaly.html)

#### **Objectives:**

**At the completion of this presentation the high school student will be able to:**

- 1. State how dilation relates to aspects of a physicians assessment of a normal heart and an enlarged heart.**
- 2. Demonstrate how to graph dilation in order to see if the image has stretched or shrunk.**
- 3. Identify the importance of this information to a physician.**

#### **Background Summary of Information as Related to Physician and CLE**

**Transformation is a change made to the location, size, or shape of a figure.**

**Dilation is a transformation in which a figure stretches or shrinks with the respect to a fixed point called the center of dilation.**

**In simple terms dilation is when an object or figure changes size but not shape.**

**As a person grows it is expected that each part of the body stay within the normal range of size and of a normal shape. For example, arteries and veins need to be a certain size and shape to allow the blood flow to and away from the heart. If the arteries dilate to a larger size, so in a sense stretch, blood pressure falls. If the arteries constrict to a smaller size (shrink), the patient's blood pressure rises. When the arteries are dilated or constricted it has an effect on the heart muscle. The heart muscle can either atrophy (shrink) or hypertrophy (dilate). If the heart doesn't function properly, than the body as a whole can not function appropriately. When a heart is too large it becomes strained and stretched and can not function properly. When the heart is too small it becomes flaccid and also can not function but for different reasons.**

**The physician can look at an image of a patient's heart and be able to tell that the heart is not of average size. To confirm the diagnosis, doctors usually request an ultrasound to the heart.**

## **Scenario**

**Bob has an appointment to go see his doctor. He has been experiencing shortness of breath, dizziness, swelling of the ankles. The doctor speaks to Bob and assesses his symptoms. Dr. Jones suspects cardiomegaly. Dr. Jones explains to Bob that cardiomegaly is a fancy way of saying that his heart is enlarged.**

**Dr. Jones sends Bob for an ultrasound to get a picture of the heart. The ultrasound will give a clear image of Bob's heart and he will be able to tell if Bob's heart has enlarged. Dr. Jones uses an image of a normal sized heart for a man of Bob's stature to compare Bob's heart to the normal.**

**Ultrasound reveals that Bob's heart has dilated to twice its size.**

**The good news for Bob is that his condition can be treated with medication to relieve some of the workload from Bob's heart.**

**Dr. Jones explains to Bob that his heart is larger than what it should be and his symptoms are related to his heart trying to keep up with the demands of the body. He lets Bob know that there are medications that can help with his symptoms and that will help his heart stop getting any bigger.**

**Dr. Jones gives Bob a prescription and Bob goes to Wal-Greens to have the prescription filled. After taking the medication for a few days Bob can already see a difference in his symptoms.**

## **Activity:**

**Each student will be given a balloon. The balloon can simulate a heart. Half of the class is instructed to blow up the balloon to normal size. This will be the normal size heart. The other half is instructed to blow their balloon up as far as they can without popping it. This will be the heart with cardiomegaly.**

**Have each student gently squeeze their balloon.**

**-Those with the normal 'heart' should have no problems squeezing their heart. Those hearts work fine and have no symptoms.**

**- Those with the enlarged 'heart' should have problems squeezing their heart. These hearts, if squeezed, can not be moved too far and will have symptoms of shortness of breath, dizziness, and swelling. If the balloons (hearts) are pushed too hard they will bust! The heart has failed to keep up with the demand! This is known as heart failure.**

**After the simulation each student should be instructed to get an image of a dilated heart.**

**The coordinates for the normal heart are:**

**1,2 2,3 3,0 3,2 4,3 5,2**

**Connect the points to form the normal heart.**

**Now have half the students, those with normal 'hearts', multiple each vertex by 2, and the other half of the class, those with enlarged 'hearts', multiple their vertex by 5 to see if they have a dilated image of their normal, or original, heart.**

**Supplies for this activity: Balloons**

**Schools for a physician: UMKC in KC; MU Columbia**