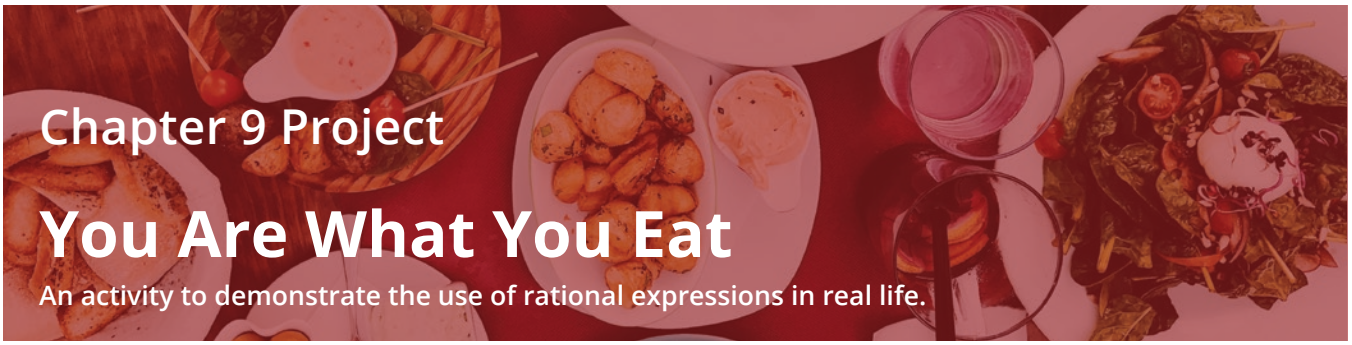

Chapter 9 Project

You Are What You Eat

An activity to demonstrate the use of rational expressions in real life.

When you eat something, your body immediately reacts and responds to the food in a variety of different ways. For example, signals are sent to your brain from your stomach to help indicate when you're full and don't need any more food. Similarly, the central nervous system will calm your body down to indicate a state of relaxation and safety while eating. Amongst thousands of tiny operations your body does while eating, one such action your body takes is regulating the state of acidity inside the mouth based on the food that enters it. We are going to look at two common states our body experiences: eating food and taking an aspirin. Acidity is measured using a scale called pH.

This pH in a human can be determined by the formula $\text{pH} = \frac{20.4x}{x^2+36} + 6.5$, where x is the number of minutes that have passed since the food has been eaten. Normally, the body has a pH of about 7.35 to 7.45 on a scale of 0 to 14.

1. Simplify the equation so that the pH equation is expressed as a single rational expression.

2. Using your simplified equation, determine the acid level after 25 minutes. Round to the nearest hundredth.

3. Assume the pH in a human can be determined by the formula $\text{pH} = \frac{20.4x}{x^2+36} + 6.5$, but the formula for the pH in a rat can be found by the formula $\text{pH} = \frac{0.3\left(x^2-2x\right)}{x^3+x^2-6x} + 6.5$.
   a. Simplify the equation for rat pH so that the equation is expressed as a single rational expression.
   b. Divide the pH formula for a rat by the pH formula for a human. Write the resulting expression as a product of two polynomials in the numerator and the denominator.

4. Does it take longer for the pH level of a rat or a human to level out and normalize? (**Hint:** Try graphing the equations using a graphing calculator or desmos.com/calculator.)
   a. Explain how you arrived at your answer.
   b. Hypothesize what this conclusion means for the pH level of a human and the pH level of a rat.

When an aspirin is taken, there is a concentration of the medication that can be found in the blood. The blood concentration of aspirin brand A is represented by $f(x) = \frac{2x}{3x^2-4x+5}$ where x is in hours. The concentration of aspirin brand B is represented by $g(x) = \frac{x}{2x^2-4x+10}$ where x is in hours.

5. Add the two functions together to find the new function that represents both aspirins in the bloodstream simultaneously. What is the new function? Make sure to distribute and simplify your answer as much as possible.

6. Which of the following three values is greatest? Explain your answer and show your work for each calculation. Round each value to the nearest hundredth.
   a. The concentration of aspirin brand A in the blood after 3 hours
   b. The concentration of aspirin brand B in the blood after 3 hours
   c. The concentration of both aspirin in the blood after 6 hours