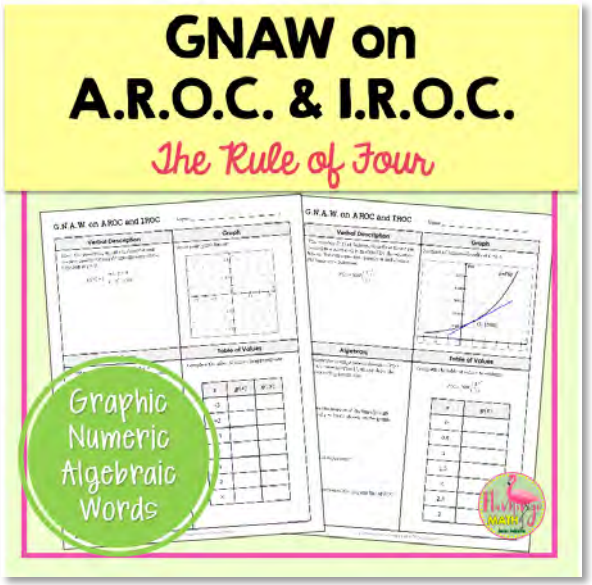


GNAW on A.R.O.C. & I.R.O.C.

Your AP Calculus students will use the Rule of Four to explore concepts of average rates of change and instantaneous rates of change.

College Board® Topics:

Topic 2.1: Defining Average and Instantaneous Rates of Change at a Point
Topic 2.2: Defining the Derivative of a Function and Using Derivative Notation
Topic 2.3: Estimating Derivatives of a Function at a Point

What is GNAW and the Rule of Four?

The "Rule of Four" or G.N.A.W. Approach is a method of thinking about mathematics in order to make connections through multiple representations of our mathematical thinking. Students should be able to represent mathematics in graphic, numeric, algebraic, and verbal formats. G.N.A.W.

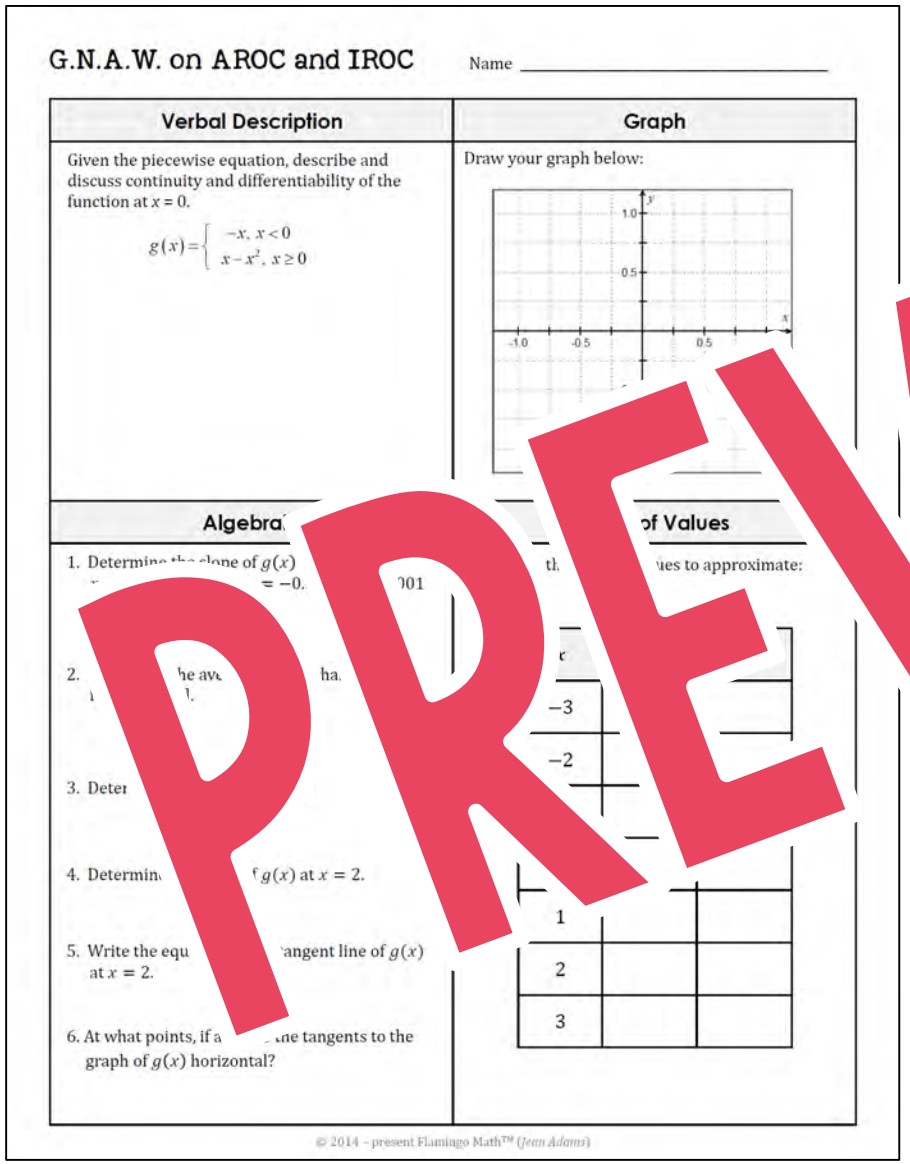
Why should you use the GNAW approach?

By implementing this process into your classes, students will gain a deeper understanding of the mathematics. The Rule of Four helps students connect and validate concepts and techniques.

How can you use the Rule of Four?

Teachers can model this approach during instructional time to set the "tone" for expected thinking and reasoning. Then, give your students many chances to practice the techniques. It is also important that students learn to make connections between the different representations.

Rule of Four Practice



G.N.A.W. on AROC and IROC Name _____

Verbal Description	Graph
Given the piecewise equation, describe and discuss continuity and differentiability of the function at $x = 0$. $g(x) = \begin{cases} -x, & x < 0 \\ x - x^2, & x \geq 0 \end{cases}$	Draw your graph below:

Algebra | of Values

1. Determine the slope of $g(x)$ = −0. 001 th ues to approximate:
2. he ave ha
3. Deter
4. Determin $g(x)$ at $x = 2$.
5. Write the equ angent line of $g(x)$ at $x = 2$.
6. At what points, if a ne tangents to the graph of $g(x)$ horizontal?

x	$g(x)$
−3	
−2	
1	
2	
3	

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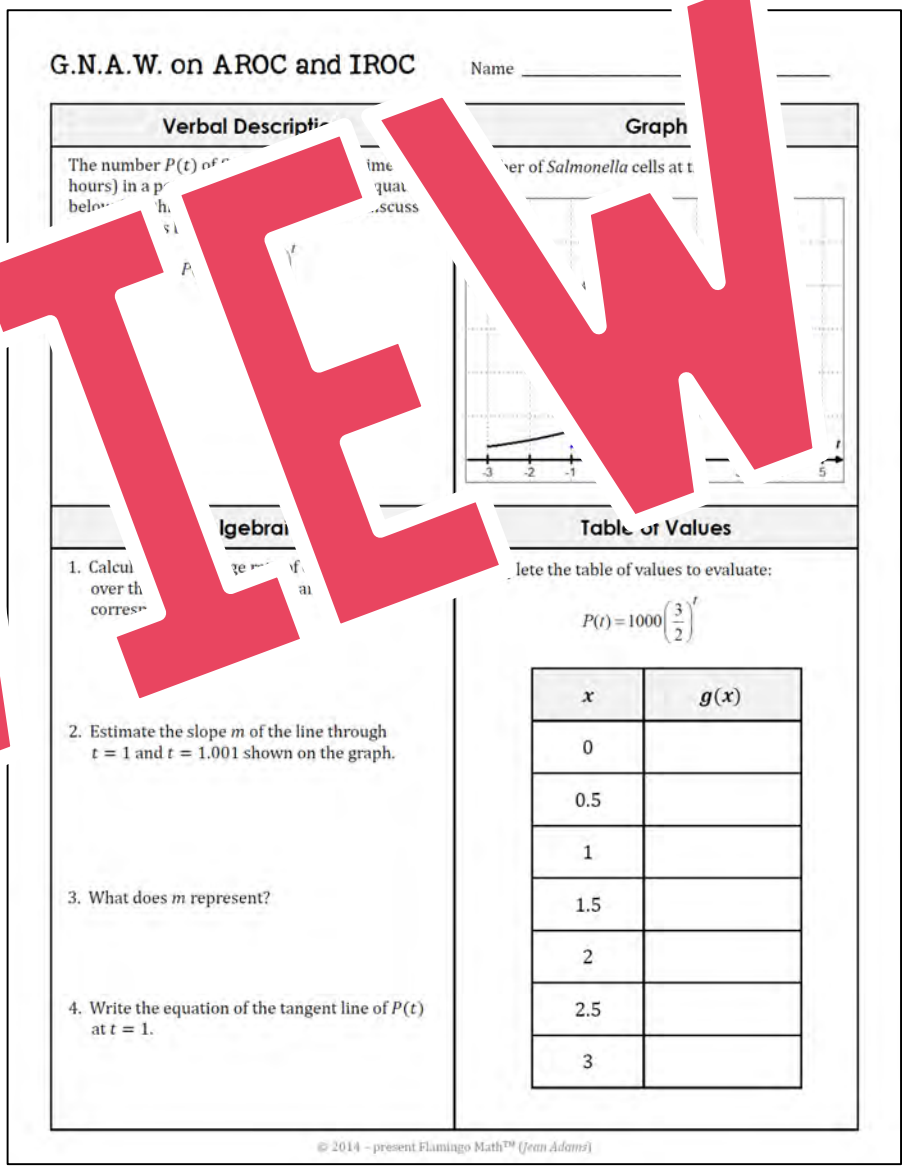

G.N.A.W. on AROC and IROC Name _____

Verbal Descripti	Graph
The number $P(t)$ of ime hours) in a p quat below h scuss	er of *Salmonella* cells at t

lgebra | Table of Values

1. Calcu over th corres
2. Estimate the slope m of the line through $t = 1$ and $t = 1.001$ shown on the graph.
3. What does m represent?
4. Write the equation of the tangent line of $P(t)$ at $t = 1$.

lete the table of values to evaluate:

$$P(t) = 1000\left(\frac{3}{2}\right)^t$$

x	$g(x)$
0	
0.5	
1	
1.5	
2	
2.5	
3	

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PREVIEW

A.R.O.C.
Average Rate of Change

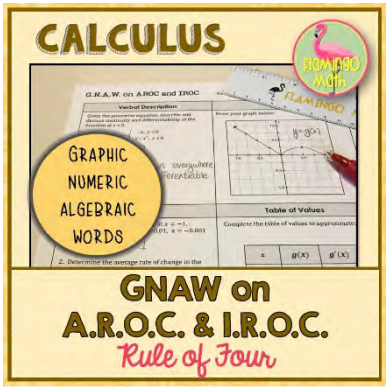
I.R.O.C.
Instantaneous Rate of Change

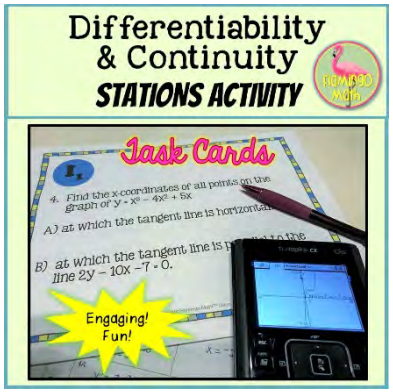


My goal is to help you bring balance into your teacher life by providing relevant content, engaging activities, and comprehensive assessments for your high-stakes math course.

Jean

More Resources for YOU







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TPT

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NEWS LETTER