From engineering to medicine to 3D graphics, Calculus is foundational for all STEM careers. However, Calculus courses today have among the highest failure rates of any course on any campus.

According to the Mathematical Association of America, national failure rates within Calculus I courses are reaching 38%.

By providing students an opportunity to take a more active role in the learning process, Variant engages and motivates students like no other learning tool.

“Great game! Really loved it and hopefully it can be used in classes! It’s really engaging.”

Student comment from a national play test

**CALCULUS TOPICS COVERED IN VARIANT: LIMITS**

Variant: Limits promotes conceptual understanding through direct interaction and immediate feedback in the game environment.

- **Finite Limits:** Introduction to limits, one-sided limits, and limits of combined functions.
- **Continuity:** Limit definition of continuity at a point, continuity of combined functions, and the intermediate value theorem.
- **Infinite Limits:** Horizontal and vertical asymptotes.

**GAME FEATURES:**

- Students manipulate objects within the 3D world using calculus principles and theories.
- Players are immersed in an environment that includes an engaging narrative, hidden backstory, and a high-stakes adventure.
- Intuitive feedback and game interaction allow players to play and explore at their own pace.
- Intelligent game analytics allow instructors to monitor student activity and provide insight into student progress.
ZONE 1: THE NATURE OF POINTS

Learning objectives covered:

» Given the graph of a function, the learner will be able to approximate the limit of the function as \( x \) approaches a given value. *Understand

» Given a function graphically the learner will be able to determine whether or not the function is continuous at a particular point of its domain. *Apply

» The learner will be able to identify when a function is continuous from the left and from the right at a particular point. *Remember

ZONE 2: FUNCTIONS, FUNCTION RELATIONSHIPS TO LIMITS & LIMIT LAWS

Learning objectives covered:

» The learner will be able to relate the graphical representation of a function to the graphical concept of limit. *Understand

» The learner will apply the rules and principles of limits to determine the limit of a function. *Apply

ZONE 3: RELATING CONTINUITY TO LIMITS

Learning objectives covered:

» The learner will be able to relate the notion of continuity to both the notion of limit and the value of a function at a point. *Understand

» The learner will use the properties of continuity and relate them to corresponding properties of limits. *Apply

» The learner will be able to apply the Intermediate Value Theorem in various different contexts. *Evaluate

ZONE 4: ASYMPTOTES

Learning objectives covered:

» The learner will be able to determine function behaviors as \( x \) infinitely increases or decreases. *Analyze

» The learner will be able to identify vertical asymptotes and oscillating behaviors of functions. *Analyze

*Level of Cognitive Domain in the Revised Bloom’s Taxonomy (Anderson et al., 2001)