MATH C2210E (formerly 150S) – Calculus and Analytical Geometry I with Integrated Support

1. **Who should enroll?**
   - This Calculus course is recommended for any student who majors in STEM and meets eligibility criteria.
   - Students who are eligible to enroll in MATH C2210E can enroll in this class. While many students will see Math C2210 in their eligibility list, the department recommends that students consider their prior preparation, as this course does have expectations of students entering.
   - This course (one of Math C2210, C2210E, or C2210H) is part of the required core for the AD-T in mathematics and for the Data Science degree.

2. **Course Description and Topics Covered**
   - This course is the first in a three-semester calculus sequence designed for mathematics, science, and engineering majors. Topics include limits and continuity; differentiation of algebraic functions and their inverses, trigonometric functions and their inverses, and exponential functions and their inverses; integration and the fundamental theorem of calculus; and applications of differentiation and integration. Utilizing a just-in-time approach, the course provides additional support and reviews topics from precalculus. NOTE: A graphing calculator is required. UC CREDIT LIMITATION: Credit for MATH 115, MATH C2210 (150), MATH C2210E (150S), or MATH C2210H (150H). C-ID MATH-211..
   - Concepts are covered with the expectation that students are preparing to take Calculus II and beyond.

3. **What to expect?**
   - ***Time:*** The most common term lengths are listed below; others would be proportionate. Outside of class time is studying, completing homework, reviewing, etc.

Term Length (weeks)	In-class (hours per week)	Out-of-class (hours per week)	Total weekly time (all types)	Total Term hours (typical)
16	7.75	15.5	23.25	372

   - ***Technology:*** Graphing technology is required, and many instructors use the TI-84CE while others use Desmos and Geogebra. Graphing technology is used regularly.

5. **What prior knowledge do students need to know to be successful?**
   - Solving Equations
     - Solving linear equations like: $3x + \frac{5}{2} = -7$
     - Solving quadratic equations by factoring, square root property, completing the square, and quadratic formula like: $3x^2 + 6x + 3 = 45$
     - Solving radical equations like: $\sqrt{3x - 5} + x = 6$
     - Solving basic exponential and logarithmic equations like: $(1.25)^x = 1000$ or $log_3 x = 10$

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- Solving rational equations like: $\frac{3}{x+2} - 7 = 5$
- Solving linear systems of equations like: $\begin{cases} 2x - 3y = 5 \\ 7x + 4y = -2 \end{cases}$

o Polynomials
- Addition, subtraction, and multiplication of polynomials like: $\left(3x + 7x^2\right)(x - 1) = 7x^3 - 7x^2 + 3x^2 - 3x = 7x^3 - 4x^2 - 3x$
- Factoring like: $2x^2 - 4x - 16 = 2(x - 4)(x + 2)$ or $x^2 + 8x + 16 = (x + 4)^2$

o Inequalities and Interval Notation
- Solving linear inequalities like: $x + 3 > 3x - 5$
- Writing solutions in interval notation including unions and intersections like: $[-5, 7) \cup (7, 13)$

o Exponents and Radicals
- Rules of exponents like: $x^a x^b = x^{a+b}$ or $\left(x^a\right)^b = x^{ab}$
- Simplifying radical expressions like: $\sqrt[3]{16x^3} = 2x\sqrt[3]{2}$
- Rationalizing the denominator like: $\frac{5}{\sqrt{3}} = \frac{5\sqrt{3}}{3}$
- Simplify fractional and negative exponents: $2x^{\frac{1}{2}}(x + 3)^{-2} + 2x^{\frac{3}{2}}(x + 3)^{-3}$

  Solving equations using fractional and negative exponents: $0 = \frac{10}{3}x^{\frac{2}{3}} - \frac{20}{3}x^{\frac{1}{3}}$, $0 = \frac{20}{9}x^{-\frac{1}{3}} - \frac{20}{9}x^{-\frac{2}{3}}$, find where f(x)= $\frac{20}{9}x^{-\frac{1}{3}} - \frac{20}{9}x^{-\frac{2}{3}}$ is undefined

o Rational Expressions
- Reduce to lowest terms by factoring if necessary like: $\frac{x^2-9}{(x+3)} = \frac{(x+3)(x-3)}{(x+3)} = x - 3,\ x \neq -3$
- Multiplying and dividing like: $\frac{(x+3)}{(x-2)} \div \frac{(x-6)}{(x+7)}$
- Least common denominator and addition/subtraction like: $\frac{5}{(x-2)} - \frac{7}{(x+3)}$ have a least common denominator of $(x - 2)(x + 3)$
- Simplifying complex fractions like: $\frac{\frac{2}{x+3}}{\frac{x}{x-3}} = \frac{2(x-3)}{x(x+3)}$
- Polynomial long division like: $\frac{x^2-x-6}{x-2} = x + 1 - \frac{4}{x-2}$

o Relations and Functions
- Determine if a relation defines a function
- Evaluating functions like: $f(x) = \frac{2+x}{x}$ when $x = 10 \rightarrow f(10) = \frac{12}{10} = 1.2$
- Domain and range of a function

o Rectangular Coordinate System
- Graphing a function by plotting points

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- Determine domain and range by looking at a graph
- Graph vertical and horizontal lines like: $x = 4$ and $y = -2$

o Linear Functions

- Find the slope and y-intercept of a linear function like $f(x) = 3x - 5$ having slope of 3 and y-intercept of $(0, -5)$
- Find the equation of a linear function like: $(2, 5)\ and\ (4, 13)$ have a linear function containing them of $f(x) = 4x - 3$.
- Find parallel and perpendicular lines given a starting line like: $y = 2x - 3$ is parallel to $y = 2x + 7$ and perpendicular to $y = -\frac{1}{2}x + 1$.

o Logarithmic and Exponential Functions

- Definitions and Properties
- Graphs of $f(x) = b^x$ and $f(x) = log_b(x)$