Math 135 - Pre-Calculus Mathematics

1. **Who should enroll?**
   - This pre-calculus course can be taken by any student who majors in STEM based on the placement rules after successfully completing Math 126 or being placed into the course.
   - Math 131 is the second in a two-semester precalculus sequence designed for students majoring in STEM. Concepts are covered with the expectation that students are preparing to take Calculus I and beyond.

2. **Course Description and Topics Covered**
   - This course covers functions and their properties as well as basic concepts of analytic geometry and trigonometry. Topics include linear, quadratic, polynomial, rational, trigonometric, inverse trigonometric, exponential, and logarithmic functions; systems of equations and inequalities; solving applied problems with right triangles; trigonometric identities; polar coordinates; conics; vectors; and sequences and series. This course prepares students for MATH C2210/C2210H (formerly MATH 150/150H). Enrollment Limitation: Not open to students with prior credit in MATH 126, MATH 126S, MATH 131, or MATH 131H.

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	6.6	13.2	19.8	317
8	13.2	26.4	39.6	317

   - ***Technology:*** Graphing technology is required, and many instructors use the TI-84CE while others use Desmos and Geogebra. Graphing technology is used regularly.
   - This course requires memorization of mathematical facts and formulas. Students will be asked to demonstrate logical arguments and methods of proof.

4. **What prior knowledge do students need to know to be successful?**
   - Solving Equations
     - Solving linear equations like: $3x + \frac{5}{2} = -7x + 2$
     - Solving quadratic equations by factoring, square root property, completing the square, and quadratic formula like: $3x^2 + 6x + 3 = 45$ or $3x^2 - 3 = 9$
     - Solving radical equations like: $\sqrt{3x - 5} + x = 6$
     - Solving basic exponential and logarithmic equations like: $(1.25)^x = 1000$ or $log_3 x = 10$
     - Solving rational equations like: $\frac{3}{x+2} - 7 = 5$

Math 135 - Pre-Calculus Mathematics

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

- 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: $2x^3-18x^2-8x+72=2(x+2)(x-2)(x-9)$ or $6x^2+11x-10=(3x-2)(2x+5)$
  - Factoring algebraic equations for the purposes of solving equations, and completing the square to rewrite equations in different ways like: $x^2-6x=y$ turning into $(x-3)^2=y+9$
- Inequalities and Interval Notation
  - Solving linear inequalities like: $x+3>3x-5$
  - Writing solutions in interval notation including unions and intersections like: $[-5,7)\cup(7,13)$
- 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: $\frac{5}{\sqrt{3}}=\frac{5\sqrt{3}}{3}$
- 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: $\frac{(x+3)}{(x-2)}\div\frac{(x-6)}{(x^2-5x+6)}$
  - 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: $\frac{x^2-x-6}{x-2}=x+1-\frac{4}{x-2}$
- Complex Number System
  - Standard form of a complex number like: $12-7i$
  - Addition, subtraction, multiplication, division of complex numbers like: $(3-i)(2+4i)=6-2i+12i-4i^2=10+10i$
- Relations and Functions
  - Determine if a relation defines a function like: $f(x)=\sqrt{2-x}$
  - Evaluating functions like: $f(x)=\frac{2+x}{x}$ when $x=10\rightarrow f(10)=\frac{12}{10}=1.2$
  - Relations and Functions like: $f(x)=\frac{3}{x-2}$ having a domain of $(-\infty,-2)\cup(2,\infty)$ and range of $(-\infty,0)\cup(0,\infty)$.

Math 135 - Pre-Calculus Mathematics

- Inverse functions and their graphs & properties
- Inverses of functions and notation like $f^{-1}(x)$, and knowing this notation is not the same as $(f(x))^2$ or $\frac{1}{f(x)}$

o Rectangular Coordinate System
- Graphing a function by plotting points
- 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: $f(x) = 3x - 5$ has a slope of 3 and y-intercept of $(0, -5)$
- Find the equation of a linear function like: $(2, 5)$ and $(4, 13)$ are both points on a line with slope of 4 and y-intercept of (0, – 3), so the linear function containing them is $f(x) = 4x - 3$.
- Find parallel and perpendicular lines given a starting line, like: given an initial line $y = 2x - 3$, the line $y = 2x + 7$ is parallel to it and the line $y = -\frac{1}{2}x + 1$ is perpendicular to it.

o Logarithmic and Exponential Functions
- Definitions and Properties like: $e^x e^y = e^{x+y}$, $\left(7^x\right)^y = 7^{xy}$, $ln(e) = 1$, $log(7^x) = xlog(7)$, $log(x) + log(y) = log(xy)$, etc.
- Graphs of $f(x) = b^x$ and $f^{-1}(x) = log_b(x)$