MATH 1121 (Calculus for Engineering Technology) Course Outline

1.3 Rectangular Coordinates

- Illustrate the following concepts:
  - rectangular coordinate system,
  - x-axis,
  - y-axis,
  - origin,
  - quadrants,
  - coordinates
- Examples:
  - (Example 1) Plot $A = (2, 1)$ and $B = (-4, -3)$.
  - (Example 3) Three verticies of a rectangle are $A = (-3, -2)$, $B = (4, -2)$, $C = (4, 1)$. What is the fourth vertex?
- *Suggested homework: 1-9, 15-16, 21-24*

2.1 Some Basic Definitions

- Distance Formula
  - $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
  - (Example 2) Find the distance between $(3, -1)$ and $(-2, -5)$.
- Slope Formula
  - $m = \frac{y_2 - y_1}{x_2 - x_1}$
  - (Example 3) Find the slope of the line joining $(3, -5)$, $(-2, -6)$.
  - (Example 4) Find the slope of the line joining $(3, 4)$, $(4, -6)$.
- Identify parallel/perpendicular lines by slopes.
  - Parallel: $m_1 = m_2$
  - Perpendicular: $m_1 = -\frac{1}{m_2}$
  - (Example 7) Prove that the triangle with vertices $A = (-5, 3)$, $B = (6, 0)$, and $C = (5, 5)$ is a right triangle.
- *Suggested HW: 1-20, 29-36*

2.2 The Straight Line

- Point-slope form
  - $y - y_1 = m(x - x_1)$
  - (Example 2) Find the equation of the line passing through $(2, -1)$ and $(6, 2)$.
- Slope-intercept form
  - $y = mx + b$
  - (Example 4) Find the slope and y-intercept of the straight line with equation $2y + 4x - 5 = 0$.
- *Suggested HW: 1-21, 33-40*

2.3 The Circle

- A circle is a collection of points equidistant from its center.
- Standard form
  - $(x - h)^2 + (y - k)^2 = r^2$
  - (Example 1) Sketch $(x - 1)^2 + (y + 2)^2 = 16$.
  - (Example 2) Find an equation for the circle with center $(2, 1)$ which passes through $(4, 8)$.
- General form
  - $x^2 + y^2 + Dx + Ey + F = 0$
  - (Example 4) Find the center and radius of the circle $x^2 + y^2 - 6x + 8y - 24 = 0$.
  - (Example) Find two functions whose graphs represent the circle with the previous equation.
- *HW: 1-32, 37-38*

2.4 The Parabola

- Definition
  - A parabola is a colleciton of points equidistant from a focus point and a directrix line.

    - (Example 6) Find an equation for the parabola with focus $(2,3)$ and directrix $(y=-1)$
- Standard forms with vertex at origin and horizontal/vertical directrix
    - $y^2=4px$ with directrix at $x=-p$ and focus at $(p,0)$
    - $y^2=-4px$ with directrix at $x=p$ and focus at $(-p,0)$
    - $x^2=4py$ with directrix at $y=-p$ and focus at $(0,p)$
    - $x^2=-4py$ with directrix at $y=p$ and focus at $(0,-p)$
    - (Example 2) Find an equation for the parabola with focus $(-2,0)$ and directrix $(x=2)$.
    - (Example 4) Find the focus and directrix of the parabola with equation $2x^2=-9y$.
- *HW: 1-28*

Remaining Topics

- 2.5 The Ellipse
- 2.6 The Hyperbola
- 2.7 Translation of Axes
- 1.2 Algebraic Functions
- 1.4 The Graph of a Function
- 3.1 Limits
- 3.2 The Slope of a Tangent to a Curve
- 3.3 The Derivative
- 3.4 The Derivative as an Instantaneous Rate of Change
- 3.5 Derivatives of Polynomials
- 3.6 Derivatives of Products and Quotients of Functions
- 3.7 The Derivative of a Power of a Function
- 3.8 Differentiation of Implicit Functions
- 3.9 Higher Derivatives

- 4.1 Tangents and Normals
- 4.4 Related Rates
- 4.5 Using Derivatives in Curve Sketching
- 4.6 More on Curve Sketching
- 4.7 Applied Maximum and Minimum Problems
- 4.8 Differentials and Linear Approximations
- 5.1 Antiderivatives
- 5.2 The Indefinite Integral
- 5.3 The Area Under a Curve
- 5.4 The Definite Integral
- 7.1 The Trigonometric Functions
- 7.2 Basic Trigonometric Relations
- 7.3 Derivatives of the Sine and Cosine Functions
- 7.4 Derivatives of the Other Trigonometric Functions
- 8.1 Exponential and Logarithmic Functions
- 8.2 Derivative of the Logarithmic Functions
- 8.3 Derivative of the Exponentials Function
- 9.1 The General Power Formula
- 9.2 Basic Logarithmic Form
- 9.3 Exponential Form
- 9.4 Basic Trigonometric Forms