Calculus Practice Questions

Additional Exercises

January 27, 2025

Question 1. A smart traffic monitoring system tracks vehicles on a coordinate plane. A vehicle's path is described by the points A(1,3), B(4,7), and C(6,5).

(a) Plot these points and find the total distance traveled.

(b) Write the equation of line AB in point-slope form.

(c) Find the midpoint of line BC.

(d) Determine if point D(5,6) is collinear with points A, B, and C.

Question 2. An AI image recognition system has a circular detection zone centered at (0,0) with radius 6 units.

(a) Write the equation of this circular detection zone.

(b) Check if points P(3,4), Q(5,2), and R(1,6) are inside, on, or outside the detection zone.

(c) Find the distance of point P(3,4) from the center of the detection zone.

(d) Identify the maximum x and y coordinates within this detection zone.

Question 3. A temperature monitoring system uses the following piecewise function:

$$f(x) = \begin{cases} x^2 - 2x & \text{for } x < 2 \\ 4 & \text{for } x \geq 2 \end{cases}$$

(a) Plot this function for $x \in [-1, 4]$

(b) Find f(0), f(1), f(2), and f(3).

(c) Determine the domain and range of this function.

Question 4. A robot arm moves in a rectangular workspace defined by the points A(0,0), B(5,0), C(5,4), and D(0,4).

(a) Write the equations of all four sides of this workspace.

(b) Calculate the perimeter of the workspace.

(c) A point P(2,3) is detected within the workspace. Find its distance from side AB.

(d) Find the coordinates of the point equidistant from all four corners.

Question 5. An autonomous vehicle's path is described by vector components.

(a) Vector = (3,4) and = (1,-2). Find the magnitude of each vector.

(b) Calculate the vector sum = + .

(c) Plot these vectors on a coordinate system.

(d) Find the angle between and .

Question 6. A signal strength follows a semi-circular distribution centered at the origin with radius 4 units.

(a) Write the equation of this semi-circle.

(b) Plot the region bounded by this semi-circle.

(c) Check if points S(0,3), T(2,2), and U(3,1) are inside the region.

(d) Find the area of this region.

Question 7. An AI classification system uses a rational function:

$$f(x) = \frac{x^2 - 9}{x - 3}$$

(a) Find the domain of this function.

(b) Simplify the function and plot it for x [0,6].

(c) Find f(0), f(4), and f(5).

(d) Describe the behavior of the function near x = 3.

Question 8. A communication network covers a triangular region with vertices A(0,0), B(6,0), and C(3,4).

(a) Verify if this is a right-angled triangle.

(b) Calculate the area of the triangle.

(c) Write the equations of all three sides.

(d) Find the perimeter of the triangle.

Question 9. An object tracking system uses two functions:

$$f(x) = x^2 - 3x + 2$$

$$g(x) = 5 - x$$

(a) Plot both functions on the same coordinate system.

(b) Find the points of intersection.

(c) Determine where f(x) ¿ g(x).

(d) Find f(2) and g(2).

Question 10. A sensor network defines a region by the inequality:

$$x^2 + y^2 \leq 16 \text{ and } y \geq -x + 4$$

(a) Sketch this region on a coordinate plane.

(b) Find the boundary points.

(c) Check if points (2,3), (1,4), and (0,5) are inside the region.

(d) Determine the area of this region.