

Mathematics Prerequisite Test 1

Section 1: Differential and Integral Calculus

1. Derivatives:

- **Question 1:** Find the derivative of the function $f(x) = 5x^3 - 2x^2 + 3x - 7$.

2. Integrals:

- **Question 2:** Calculate the integral of the function $g(x) = 4x^2 - 6x + 2$.

3. Applications of Derivatives:

- **Question 3:** Find the critical points of the function $h(x) = x^3 - 6x^2 + 9x + 1$.

4. Applications of Integrals:

- **Question 4:** Find the area under the curve of $f(x) = x^2$ between $x = 1$ and $x = 3$.

Section 2: Vector Calculus

5. Vectors and Operations:

- **Question 5:** If $\mathbf{a} = 2\mathbf{i} + 3\mathbf{j} - \mathbf{k}$ and $\mathbf{b} = -\mathbf{i} + 4\mathbf{j} + 2\mathbf{k}$, find $\mathbf{a} + \mathbf{b}$.

6. Dot Product:

- **Question 6:** Find the dot product of $\mathbf{a}$ and $\mathbf{b}$.

7. Cross Product:

- **Question 7:** Find the cross product of $\mathbf{a}$ and $\mathbf{b}$.

Section 3: Algebra

8. Quadratic Equations:

- **Question 8:** Solve the quadratic equation $x^2 - 5x + 6 = 0$.

9. **Systems of Linear Equations:**

- **Question 9:** Solve the following system of equations:

$$\begin{cases} 2x + 3y = 5 \\ 4x - y = 11 \end{cases}$$

Section 4: Trigonometry

10. **Trigonometric Functions:**

- **Question 10:** If $\sin(\theta) = \frac{1}{2}$ and θ is in the first quadrant, find $\cos(\theta)$.