CARIBBEAN ADVANCED PROFICIENCY EXAMINATION

SCHOOL BASED ASSESSMENT

PURE MATHEMATICS

UNIT 1 – TEST 3

1 hour 20 minutes

This examination paper consists of **2** printed pages.

This paper consists of **10** questions.

The maximum mark for this examination is **60**.

INSTRUCTIONS TO CANDIDATES

1. Write your name clearly on each sheet of paper used.
2. Answer **ALL** questions.
3. Number your questions identically as they appear on the question paper and do **NOT write your solutions to different questions beside each other**.
4. Unless otherwise stated in the question, any numerical answer that is not exact, **MUST** be written correct to <u>three</u> (3) significant figures.

EXAMINATION MATERIALS ALLOWED

1. Mathematical formulae
2. Scientific calculator (non-programmable, non-graphical)

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1) a. Find

$$\lim_{x \to 3} \frac{x^2 - 9}{x - 3}$$ [3]

   b. Find

$$\lim_{x \to 0} \frac{\sin 3x}{\sin 4x}$$ [5]

2) Given that

$$\lim_{x \to -2} [4f(x)] = 5, \text{ evaluate } \lim_{x \to -2} [f(x) + 2x]$$ [5]

3) Determine the real values of x for which the function

$$f(x) = \frac{x}{|3x| - 8} \text{ is continuous.}$$ [3]

4) Differentiate with respect to x, from first principles, the function $f(x) = 3x^2 + 4x - 5$. [5]

5) Find the equation of the normal to the curve $y = x^3 - 3$ at the point for which $x = 2$ [6]

6) A curve has equation

$$y = \frac{x}{\sqrt{2x^2 + 1}}, \text{ show that } \frac{dy}{dx} = (2x^2 + 1)^{\frac{-3}{2}}.$$

[5]

7) The gradient of a curve is given by $f'(x) = 3x^2 - 12x - 15$. The curve passes through the point $(1, -19)$.
   a. Find the equation of the curve. [4]
   b. Find the coordinates of the stationary points and determine their nature. [6]

8) If $\int_0^a (x - 1)dx = \frac{1}{2}\int_0^a (x + 1) \, dx$ and $a > 0$, find the value of a. [4]

9) Determine the exact value of the integral
$\int_2^6 \sqrt{2x - 3} \, dx$ by using the substitution $u = 2x - 3$ [6]

10) A piece of machinery using laser technology is programmed to cut decorative pieces from a thin sheet of coloured glass. The path of the laser beam traces out the curve $y = \cos t, 0 \le t \le \pi$, after t seconds.
   a. Sketch the curve traced out by the laser. [3]
   b. Calculate the exact area of a side of each decorative piece. [5]