SCHOOL BASED ASSESSMENT

PURE MATHEMATICS
UNIT 1 - TEST 3

TIME: 1 Hour & 30 minutes

This examination paper consists of 3 printed pages.
The paper consists of 3 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 carefully and do **NOT** write your solutions to different questions beside one another.
4. Unless otherwise stated in the question, any numerical answer that is not exact, **MUST** be written correct to three (3) significant figures.

EXAMINATION MATERIALS ALLOWED

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

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1. (a) Determine the following limits:

(i) $\lim_{x \to -2} \dfrac{x^2 - x - 6}{x + 2}$ [3]

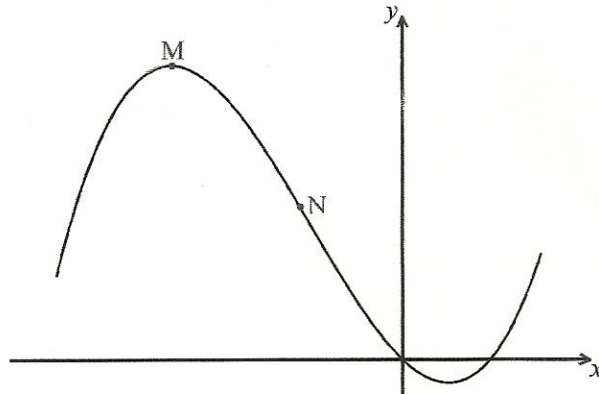(ii) $\lim_{x \to 0} \dfrac{x^2 + x}{\sin 4x}$ [4]

(b) Given

$$f(x) = \begin{cases} 4x - p, & x > 1 \\ 3 & x = 1 \\ qx^2 + 1, & x < 1 \end{cases}$$

Find the values of p and q respectively if $f(x)$ is continuous at $x = 1$. [4]

(c) Determine from **first principles**, the derivative with respect to x, of $y = \sqrt{x} + 2$. [4]

TOTAL 15 marks

2. (a) Consider $f(x) = \frac{1}{3}x^3 + 2x^2 - 5x$. Part of the graph of f is shown below. There is a maximum point at M and a point of inflexion at N.

(i) Find $f'(x)$ [3]

(ii) Find the x-coordinate of M. [4]

(iii) Find the x-coordinate of N. [3]

(iv) The line L is the tangent to the curve of f at (3, 12). Find the equation of L in the form $y = ax + b$. [3]

(b) The percent of concentration, $C(x)$, of a drug in the bloodstream x hours after the drug is administered is given by

$$C(x) = \frac{4x}{3x^2 + 27}$$

How long after being administered does the concentration start to decrease? [4]

(c) A curve is given parametrically by

$$x = 2\sin\theta + 1 \qquad\qquad y = 1 - \cos2\theta$$

Show that $\frac{dy}{dx} = 2\sin\theta$ [5]

TOTAL 22 marks

2

3. (a) The gradient of a curve is given by $\frac{dy}{dx} = (2x - 3)^3$. The point $(2, 2)$ lies on the curve. Find the equation of the curve. [4]

(b)   (i) Find $\int_0^2 \sin(4x + 1)\, dx$ [4]

      (ii) Using the substitution $u = x - 3$, find

$$\int_3^4 x\sqrt{x - 3}\ dx$$ [5]

(c) The shaded region in the diagram below is bounded by $f(x) = \sqrt{x}$, $x = a$ and the x-axis. The shaded region is revolved around the x-axis through $360°$. The volume of the solid formed is 0.845π.
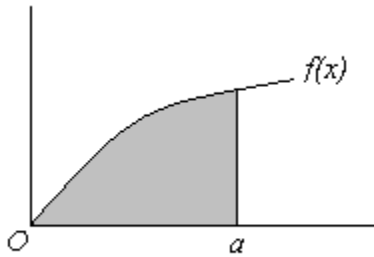
Find the value of a. [5]

(d) Solve the differential equation $\quad \frac{dy}{dx} = 6xy^2$

given that $y = 1$ when $x = 2$. Give your answer in the form $y = f(x)$. [5]

TOTAL 23 marks

End of test