Candidate Name: __________________________ (   ) Class: ________

4N(A)
Session 2

KRANJI SECONDARY SCHOOL
Preliminary Examination
Secondary 4 Normal (Academic)

ADDITIONAL MATHEMATICS **4051/01**
Paper 1

Tuesday **1 Aug 2023** 1 hr 45 min

READ THESE INSTRUCTIONS FIRST:
Do not open this question paper until you are told to do so.

Write your name and register number in the spaces at the top of this page.
Write in dark blue or black pen.
You may use HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an approved scientific calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 70.

Question	Marks
1	
2	
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11	
12	
13	
Total	

Setter: Mdm J Yap

This question paper consists of 14 printed pages including the cover page

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Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1 = 1 - 2\sin^2 A$$

$$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} ab \sin C$$

1 Express $\dfrac{18x+7}{(x-1)(4x+1)}$ in partial fractions. [4]

2 A line has equation $y=1-2x$ and a curve has equation $y=3x^2+x+5$. Determine, with reasons, whether the line intersects, is a tangent to, or does not intersect the curve. [3]

3 **(i)** Mrs Lee has two rectangular flowerbeds.
Flowerbed A has length $(5x+3)$ m and breadth $(x-2)$ m.
Flowerbed B has an area of 6 m^2. Find the range of values of x such that the area of flowerbed A is greater than the area of flowerbed B. [4]

(ii) If x is an integer, state the smallest possible value of x. [1]

4 The polynomial $\mathrm{f}(x)$ is given by $\mathrm{f}(x) = 2x^3 + 5x^2 - 4x - 3$.

(i) Divide $\mathrm{f}(x)$ by $x + 3$. [2]

(ii) What can you deduce about $x + 3$? [1]

(iii) Solve the equation $\mathrm{f}(x) = 0$. [2]

5 Factorise $x^3 - 8$ and explain why $x = 2$ is the only real root of the equation $x^3 - 8 = 0$. [4]

6 **(i)** Express $-2x^2 - 4x + 3$ in the form $a(x-h)^2 + k$, where a, h and k are constants. [3]

(ii) Hence state the maximum value of the curve $y = -2x^2 - 4x + 3$. [1]

7 The volume, V cm^3, of water in a container is given by $V = \dfrac{4x^3}{3} - 2x + 3,$ where x cm is the depth of water in the container. Given that water is being poured into the container at a constant rate of 52 cm^3/s, find the rate at which the depth of water is increasing when $x = 5$ cm. [4]

8 A curve is such that $\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2} = 12x - 2$.

The point (2, 15) lies on the curve and the gradient of the curve at this point is 27.

Find the equation of the curve. [5]

9 **(a)** Find the principal values, in degrees, of

(i) $\sin^{-1}(\frac{\sqrt{3}}{2})$, [1]

(ii) $\cos^{-1}(-\sin 45°)$. [1]

(b) **(i)** Write down the period and the amplitude of $y = 3\cos 2x - 1$. [2]

(ii) Sketch the graph of $y = 3\cos 2x - 1$ for $0° \le x \le 180°$. [3]

10 In the triangle ABC, angle $B = 90°$, $AB = (\sqrt{7} + 2)$ cm and $BC = (\sqrt{7} - 2)$ cm.

(i) Find the exact length of AC. [3]

(ii) Express $\tan A$ in the form $\frac{a + b\sqrt{7}}{3}$, where a and b are integers. [3]

11 **(i)** Prove that $\dfrac{\sin 2x}{1+\cos 2x} = \tan x$. [3]

(ii) Hence or otherwise, solve the equation $\dfrac{\sin 2x}{1+\cos 2x} = 2$ for $0 \le x \le 2\pi$. [3]

12 **(a)** Given that $y = \dfrac{x^4}{\sqrt{1+2x}}$, find $\dfrac{dy}{dx}$ in the form $\dfrac{x^3(a+bx)}{(1+2x)^{\frac{3}{2}}}$, where a and b are integers.

[4]

(b) Given that $y = x^2(x-1)^5$, find

(i) $\dfrac{dy}{dx}$, [3]

(ii) the range of values of x for which y is decreasing. [2]

13 A curve has the equation $y = x^2 + 2x + 8$.

The tangent to the curve at the point where $x = 1$ and the normal to the curve at the point $x = 4$ intersect at the point P.

Find the coordinates of P. [8]

End of paper