Class	Register Number	Name

南洋女子中學校
Nanyang Girls' High School

End-of-Year Examination 2025
Secondary 3

INTEGRATED MATHEMATICS 2

2 hours
Thursday 9 October 2025 **1145 – 1345**

READ THESE INSTRUCTIONS FIRST

1. Write your name, register number and class on all the work you hand in.
2. Write in dark blue or black ink.
3. You may use an 2B pencil for any diagrams or graphs.
4. Do not use staples, paper clips, glue or correction tape/ fluid.
5. Write your answers and working on the separate writing paper provided, unless otherwise stated.
6. Answer **all** questions.
7. Omission of essential working will result in loss of marks.
8. The use of an approved scientific calculator is expected, where appropriate.
9. If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degree to one decimal place. For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.
10. At the end of the examination, fasten all your work securely together.
11. The number of marks is given in brackets [ ] at the end of each question or part question.
12. The total of the marks for this paper is 80.

For Examiners' Use

Question	Marks
1	/ 4
2	/ 4
3	/ 3
4	/ 5
5	/ 3
6	/ 6
7	/ 6
8	/ 6
9	/ 9
10	/ 10
11	/ 6
12	/ 9
13	/ 9
Total	/ 80

This document consists of **21** printed pages and **1** blank page.

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

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

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

1 **(a)** Express $y = x^2 + 6x + 8$ in the form $y = (x + a)^2 + b$, where a and b are constants. [2]

(b) Hence state

(i) the minimum value of y, [1]

(ii) the value of x at which the minimum value occurs. [1]

2 Simplify $\dfrac{\sqrt{27}-3}{\sqrt{48}+8}$, leaving your answer in the form $a+b\sqrt{3}$ where a and b are rational numbers. [4]

3 Given that $\cos A = -\frac{\sqrt{7}}{4}$ and $\tan A$ is positive, without finding the value of A, find the exact value of $4\cos A - 3\tan A$. [3]

4 Express $\dfrac{4x^2+5x-32}{(x+2)^2(x-11)}$ in partial fractions. [5]

5 If $\lg(x-y)=\frac{1}{2}\lg x+\frac{1}{2}\lg y+\lg 3$, prove that $x^2+y^2=11xy$. [3]

6 The function f is defined by $\mathrm{f}(x) = 3\sin 2x$ for $0 \le x \le 2\pi$.

(a) State the amplitude and period of f. [2]

(b) Sketch the graph of $y = \mathrm{f}(x)$ for $0 \le x \le 2\pi$. Indicate clearly the intercepts and the turning points. [4]

7 Given that $\sin 50^\circ = p$, express each of the following in terms of p.

(a) $\cos 50^\circ$ [2]

(b) $\sin 40^\circ$ [2]

(c) $\tan 130^\circ$ [2]

8 **(a)** Solve $\sqrt{2} \times \sqrt{16} \div \sqrt[3]{8} = 32^{x}$. [3]

(b) Evaluate $\dfrac{3^{n+2} - 3^n}{9(3^{n+1}) - 3^{n+2}}$. [3]

9 **(a)** The line $y = (2-k)x - 1$ is a tangent to the curve $y = 2kx^2 - k$. Find the value of the constant k. [4]

(b) Find the range of values of the constant m for which the graph of $y=(m+1)x^2+2mx+(3+5m)$ lies entirely above the x-axis. [5]

10 Solve the following equations.

(a) $5^{3x} = 7^{6x-1}$ [4]

(b) $3\log_2 x - 10\log_x 2 + 13 = 0$ [6]

11 When a cup of hot water is left in a room, its temperature T °C at time t minutes is given by $T = Ae^{-kt} + 24$, where A and k are constants. It is given that when $t = 0$, $T = 94$ and that when $t = 5$, $T = 50$.

(a) Find the values of A and k. [4]

(b) If the same cup of hot water is left in the room for a long time, the temperature of the water approaches L ºC.

Find the value of L and describe its physical meaning. [2]

12 It is given that $\mathrm{f}(x) = x^3 - x^2 + kx + 2$.

(a) Given that the remainder when f(x) is divided by $(x - 2)$ is 2, show that $k = -2$. [2]

(b) Using $k = -2$, solve $\mathrm{f}(x) = 0$, leaving your answers in exact form. [4]

(c) Using your results from **(b)**, solve $8y^3 - 4y^2 - 4y + 2 = 0$. [3]

13 **(a)** Sketch the graph of $y = e^x - 1$, showing clearly, if any, the asymptote(s) and the intercept(s) with the axes. [3]

(b) Joy added a suitable straight line to the sketch of $y = e^x - 1$ in **(a)** and claimed that the equation $\ln(2 - x) = x$ has no solution.

Is Joy correct? Explain your reasoning clearly. [4]

(c) The graph of $y = \mathrm{e}^x - 1$ undergoes two successive transformations.

I A reflection in the y–axis.

II A scaling parallel to the x–axis by a factor $\dfrac{1}{2}$.

Write down the equation of the resulting graph. [2]

~ End of Paper ~

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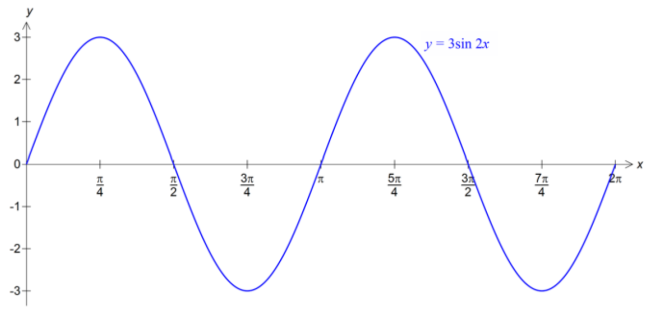
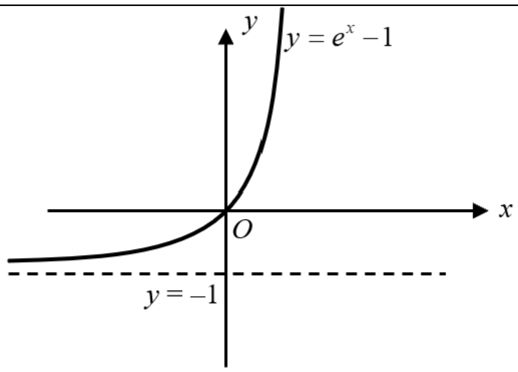
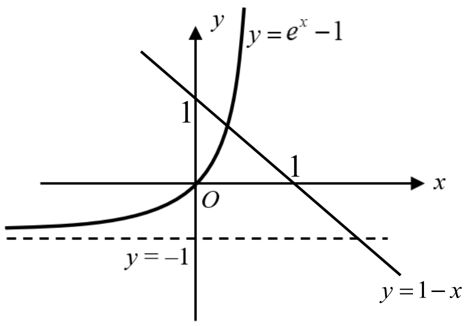
2025 IM2 EOY Answer Key

1a	$y = (x+3)^2 - 1$
1bi **1bii**	$y = -1$ $x = -3$
2	$-\frac{15}{4} + \frac{9}{4}\sqrt{3}$ or $-3.75 + 2.25\sqrt{3}$
3	$= -\frac{16\sqrt{7}}{7}$
4	$\frac{4x^2+5x-32}{(x+2)^2(x-11)} \equiv \frac{1}{x+2} + \frac{2}{(x+2)^2} + \frac{3}{x-11}$
5	Proof Question
6a	Amplitude = 3 (units), period $= \frac{2\pi}{(2)} = \pi$
6b	
7a	$\sqrt{1-p^2}$
7b	$\sqrt{1-p^2}$
7c	$-\frac{p}{\sqrt{1-p^2}}$
8a	$x = \frac{3}{10}$
8b	$\frac{4}{9}$
9a	$k = \frac{2}{3}$

9b	$m > -\frac{1}{2}$
10a	$x = \frac{\lg 7}{6\lg 7 - 3\lg 5} = 0.284(3sf)$
10b	$x = 2^{\frac{2}{3}}$ or $\sqrt[3]{4}$ or $x = \frac{1}{32}$
11a	$k = 0.198$
11b	when t is very large, $L = 24$ This is the room temperature.
12a	Show Question
12b	$x = 1$ or $\sqrt{2}$ or $-\sqrt{2}$
12c	$y = \frac{1}{2}$ or $\frac{\sqrt{2}}{2}$ or $-\frac{\sqrt{2}}{2}$
13a	
13b	Line to add: $y = 1 - x$  From the graphs, One intersection point $\Rightarrow$ one solution only. Joy is wrong.
13c	I: $y = e^{-x} - 1$ II: $y = e^{-2x} - 1$