| Name | Index Number | Class |
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WOODGROVE SECONDARY SCHOOL

A COMMUNITY OF FUTURE-READY LEARNERS AND THOUGHTFUL LEADERS

# N LEVEL PRELIMINARY EXAMINATION 2025

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| **LEVEL & STREAM** | : | SECONDARY 4 NORMAL (ACADEMIC) |
| **SUBJECT (CODE)** | : | ADDITIONAL MATHEMATICS (4051) |
| **PAPER NO.** | : | 01 |
| **DATE (DAY)** | : | 29 JULY 2025 (TUESDAY) |
| **DURATION** | : | 1 HOUR 45 MINUTES |

**READ THESE INSTRUCTIONS FIRST**

Write your name, index number and class in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an 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.

**DO NOT TURN OVER THE QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.**

| **Student's Signature** | | **Parent's Signature** | |
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| **Date** | | **Date** | |

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| **70** |

This document consists of <u>13</u> printed pages including this cover page.
Setters: <u>Mdm Zuraidah</u>

*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 $\Delta ABC$*

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$
$$a^2 = b^2 + c^2 - 2bc \cos A$$
$$\Delta = \frac{1}{2} bc \sin A$$

Answer **all** questions.

**1** Circle $C$ has equation $(x+1)^2+(y-3)^2=36$.

**(a)** Write down the radius and the coordinates of the centre of the circle. [2]

**(b)** Explain why any line that passes through the point $(-1,\ 1)$ will intersect circle $C$ at two points. [1]

**2** Given that $\cos A=\frac{3}{7}$ where $0\le A\le\frac{\pi}{2}$, find the exact value of

**(a)** $\sin A$, [2]

**(b)** $\sin 2A$. [2]

3 **Do not use a calculator in answering this question.**

Express $\frac{1+\sqrt{7}}{5-\sqrt{7}}$ in the form $\frac{a+b\sqrt{7}}{c}$, stating the values of the integers $a$, $b$ and $c$. [4]

4 **(a)** It is given that $y = \frac{4x-1}{2x+5}$ for $x \neq -\frac{5}{2}$, find $\frac{dy}{dx}$. [3]

**(b)** Explain why $y$ is an increasing function. [1]

5 Express $\dfrac{6x^2-21x+25}{2x^2-5x}$ in the form $A+\dfrac{B}{x}+\dfrac{C}{2x-5}$. [5]

6 (a) Express $2x^2 - 6x + 7$ in the form $p(x-q)^2 + r$, where $p$, $q$ and $r$ are constants. [3]

(b) Hence explain why the minimum point of the curve $y = 2x^2 - 6x + 7$ is $\left(\frac{3}{2}, \frac{5}{2}\right)$. [1]

(c) State the range of values of $k$ for which $y = k$ has no solutions. [1]

7 The volume, $V$ cm$^3$, of a spherical balloon is given by $V = \frac{4}{3}\pi r^3$, where $r$ cm is the radius of the balloon. The radius is increasing at a rate of 2 cm/s.

Calculate the rate at which the volume of the balloon is increasing when the radius is 10 cm. [4]

8 Show that $\frac{\cos\theta}{\sec\theta + \tan\theta} = 1 - \sin\theta$. [5]

9 (a) Find $\int \frac{7}{\sqrt{11x+5}}\,dx$. [3]

(b) Hence evaluate $\int_1^4 \frac{14}{\sqrt{11x+5}}\,dx$. [3]

10 (a) Solve $x(x-4)>12$ and represent the solution set on a number line. [4]

(b) Without using a diagram, determine whether the line $y=2x+3$ and the curve $y=2x^2-5x+4$ have 0, 1 or 2 points of intersection. [4]

11 **(a)** Write $2\sin\theta + 3\cos\theta$ in the form $R\sin(\theta+\alpha)$, where $R > 0$ and $0° \le \alpha \le 90°$. [3]

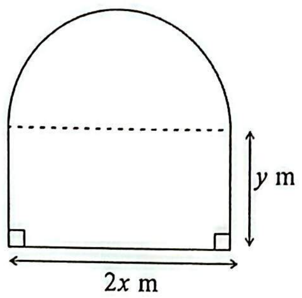
**(b)** Hence find the greatest value of $2\sin\theta + 3\cos\theta - 1$, giving your answer in exact value. [1]

**(c)** Determine the value of $\theta$ for $0° \le \theta \le 180°$ at which the greatest value occurs. [2]

**12** **(a)** Show that the equation $3\tan^2\theta = 10 - \sec\theta$ can be written in the form $3\sec^2\theta \div \sec\theta - 13 = 0$. [2]

**(b)** Hence solve $3\sec^2\theta + \sec\theta - 13 = 0$ for $0° < \theta < 360°$. [5]

13 The diagram shows a windowpane which is formed by a rectangle with sides $2x$ m by $y$ m, and a semicircle of radius $x$ m.
The perimeter of the window is 12 m.



(a) Show that $y=\frac{1}{2}(12-2x-\pi x)$. [2]

(b) Hence show that the area, $A$ m$^2$, of the windowpane is $A=12x-2x^2-\frac{\pi x^2}{2}$. [2]

**(c)** Find the value of $x$ for which $A$ has a stationary value, correct to 2 significant figures. [3]

**(d)** Determine whether the stationary value of $A$ is a maximum or a minimum. [2]

**END OF PAPER**