DUNMAN SECONDARY SCHOOL

CANDIDATE NAME			
CLASS		**INDEX NUMBER**	

PRELIMINARY EXAMINATION 2026
SECONDARY 4 EXPRESS

ADDITIONAL MATHEMATICS — 4049/01

Paper 1

19 August 2026

2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Calculator Model

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** 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 marks for this paper is 90.

Total Marks

1. ALGEBRA

Quadratic Equation

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

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

Binomial expansion

$$(a+b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{r!(n-r)!} = \frac{n(n-1)\ldots(n-r+1)}{r!}$

2. TRIGONOMETRY

Identities

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

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

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

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

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

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

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

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

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

Formula for ΔABC

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

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

$$\Delta = \frac{1}{2} bc \sin A$$

1 Express $\dfrac{2x^2-3x-8}{(x+2)^2(x-1)}$ in partial fractions. [5]

2 Solve the equation $\log_3 x - 2\log_9 3 = \log_9(x+4)$. [5]

3 Prove that $\dfrac{1-\sin 2x}{\cos^2 x} = (\tan x - 1)^2$. [4]

4 A school started a weekly Math Café. In Week 1, 60 students attend the session. From Week 2 onwards, the attendance increases by 10% from that of the previous week. The venue can hold up to 150 students. If the attendance exceeds 150 students in a particular week, the Math Café is moved to a larger venue from the following week onwards. Determine the week in which the attendance first exceeds 150 students. [4]

5 The line $y - x = -3$ cuts the curve $x^2 - xy + y^2 = 19$ at the points A and B.
Find the x-coordinates of these two points. [4]

6 A right pyramid has a square base with diagonal $2+\sqrt{8}$ cm.
The volume of the pyramid is $10+6\sqrt{2}$ cm^3.
Without using a calculator,

(a) show that the area, in cm^2, of the square base is $6+4\sqrt{2}$, [3]

(b) find the height, in cm, of the pyramid in the form $c+d\sqrt{2}$, where c and d are integers. [4]

7 **(a)** Find $\frac{\mathrm{d}}{\mathrm{d}x}\left(x\mathrm{e}^{3x}\right)$. [2]

(b) Hence find $\int x\mathrm{e}^{3x}\ \mathrm{d}x$. [4]

8 A company manufactures **open-top** rectangular plastic storage boxes, each with a square base of side x cm and height of h cm.
Each storage box has an external surface area of 432 cm^2.

(a) Show that the volume of the storage box is $\dfrac{432x - x^3}{4}$ cm^3. [3]

(b) Given that x can vary, find the value of x for which the volume is stationary and determine its nature. [4]

9 **(a)** Find the amplitude and period of $4-3\sin 2x$. [2]

(b) Sketch the graph of $y=4-3\sin 2x$ for $0 \le x \le \pi$ radians. [3]

(c) By drawing a suitable straight line in your sketch, explain why the equation $3\pi\sin 2x = -4x$ has no solution for $x > \dfrac{3\pi}{4}$. [3]

10 **(a)** Find, in ascending powers of x, the first four terms in the expansion of $(2-kx)^8$, where k is a positive constant. Simplify the coefficients in your expression. [3]

(b) Given that the coefficient of x^2 in the expansion of $\left(5+\frac{3}{kx}\right)(2-kx)^8$ is 896, find the value of k. [4]

11 The equation of a curve is $y = px^3 + qx^2 + 2x - 2$, where p and q are constants.

(a) Show that y is always increasing if $q^2 < 6p$. [3]

It is now given that $p = 6$ and $q = 1$.

(b) Show that $x = \dfrac{1}{2}$ is an x-intercept of the curve. [1]

(c) Hence explain why the curve $y = 6x^3 + x^2 + 2x - 2$ has only one x-intercept. [2]

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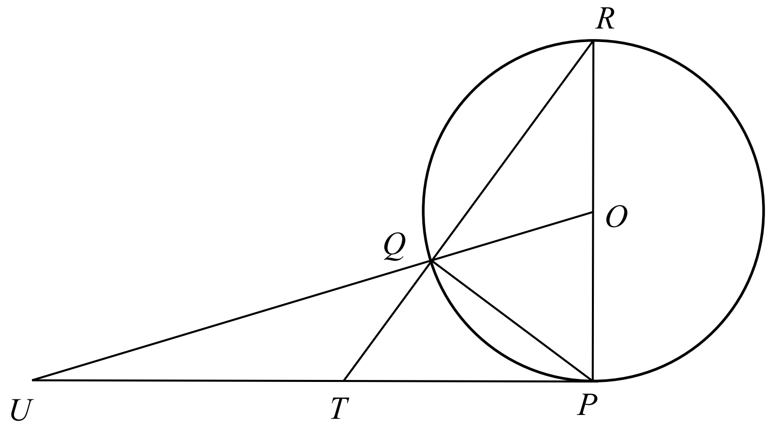

The diagram shows a circle, centre O, with diameter ROP. The tangent at P meets the line OQ extended at U. Point T is the point of intersection of UP and RQ extended.

(a) Show that angle $QUP = 90° - 2 \times$ angle QPT. [4]

(b) Show that $RP^2 = RT \times RQ$. [4]

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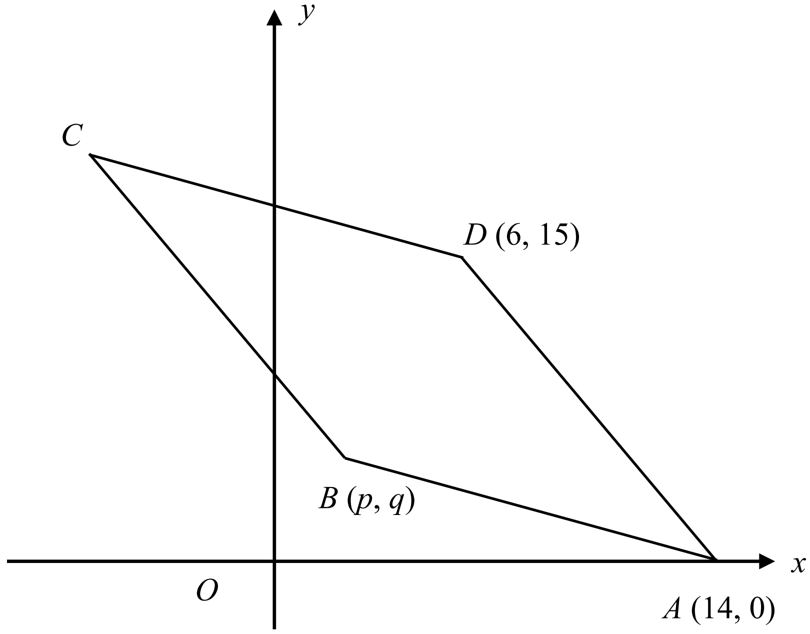

The diagram shows a parallelogram with vertices $A(14, 0)$, $B(p, q)$, C and $D(6, 15)$.
The perimeter of the parallelogram is 60 units. The line $y - x = 3$ passes through B.

(a) Show that $p^2 = 11p - 18$. [6]

(b) Find the coordinates of B, explaining why the diagram is necessary. [3]

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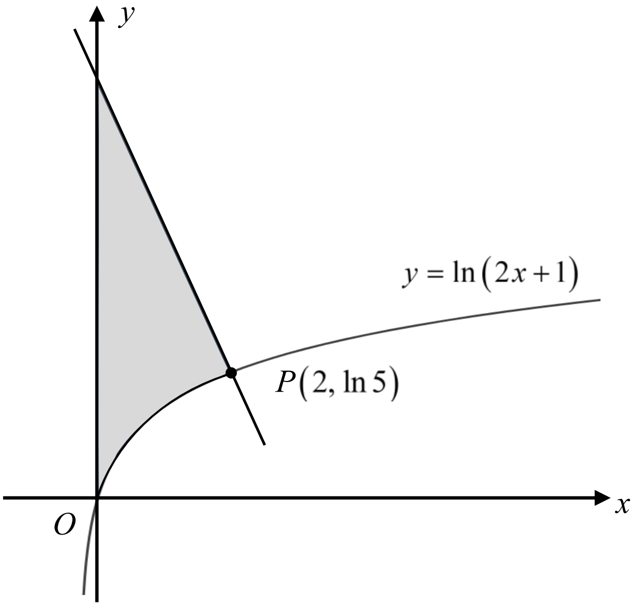

The diagram shows part of the curve $y = \ln(2x+1)$ and the normal to the curve at the point $P(2, \ln 5)$.

(a) Find the equation of the normal to the curve at P, expressing your answer in the form $y = mx + \ln k$, where m and k are constants to be found. Give k in exact form. [4]

(b) Express x in terms of y for the curve. [1]

(c) Hence find the area of the shaded region. [5]

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