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| MODULE CODE: MA4002 | SEMESTER: Spring 2025 |
| MODULE TITLE: Engineering Mathematics 2 | DURATION OF EXAMINATION: 40 minutes |
| LECTURER: Prof. N. Kopteva | PERCENTAGE OF TOTAL MARKS: **25%** |

# Please, do NOT open this paper

# until ANNOUNCED by your
# lecturer

EVERYBODY IS SUPPOSED TO START AT THE
SAME TIME

1   (a) Evaluate the indefinite integral $\displaystyle\int \frac{\sin(\ln x)}{x}\, dx$   (for $x > 0$) .

   Hint: use an appropriate substitution.                                                2%

   (b) Calculate the area between $\dfrac{\sin(\ln x)}{x}$ and the $x$-axis for $1 \le x \le 2$.

   Hint: you may use the result of the previous question.                                2%

   (c) Express as a definite integral and then *evaluate* the limit of the Rie-
   mann sum $\displaystyle\lim_{n\to\infty} \left( \sum_{i=1}^{n} \frac{1}{i+n} \right)$.

   Hint: use a uniform partition of the interval $(0,1)$ or another appropri-
   ate interval.                                                                         3%

   (d) Evaluate $\displaystyle\frac{d}{dx}\left( \int_{x^2}^{x+x^2} \cos(1+t^2)\, dt \right)$.                                   2%

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2  Evaluate the indefinite integral $\displaystyle\int (\sin x)^3\, (\cos x)^8\, dx$ .

                                                                                         3%

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3  Find the average value of the function $\dfrac{x+3}{x^2+2x+5}$ on the interval $[-1,1]$.

                                                                                         4%

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4  Evaluate the indefinite integral $\displaystyle\int x\, \tan^{-1} x\, dx$ .

   Hint: use integration by parts.                                                       3%

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5  Perform a partial fraction expansion of $\dfrac{4-3x}{(x^2-x-6)(x^2-4)}$;

   then *evaluate the indefinite integral* $\displaystyle\int \frac{4-3x}{(x^2-x-6)(x^2-4)}\, dx$ .                    6%

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