MODULE CODE: MA4002	SEMESTER: Spring 2024
MODULE TITLE: Engineering Mathematics 2	DURATION OF EXAMINATION: 40 minutes
LECTURER: Prof. N. Kopteva	PERCENTAGE OF TOTAL MARKS: **30%**

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 $\int x \cos(x^2 + 1)\, dx$. Hint: use an appropriate substitution.   2%

   (b) Calculate the area between $x \cos(x^2 + 1)$ and the x-axis for $0 \le x \le \dfrac{1}{2}$. Hint: you may use the result of the previous question.   2%

   (c) Express as a definite integral and then *evaluate* the limit of the Riemann sum $\displaystyle \lim_{n \to \infty} \left(\frac{1}{n} \sum_{i=1}^{n} \sin \left(\frac{(i-1)}{4n} \right) \right)$.   2%

   (d) Evaluate $\dfrac{d}{dx} \left(\displaystyle \int_{x}^{x\,\sin(x^3)} \ln(1+t)\, dt \right)$.   2%

   (e) Evaluate the integral $\displaystyle \int_{-\pi/2}^{\pi/2} \left(x\,\sin(x^2) + x^2 \cos x \right) dx$.   4%

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2 Evaluate the indefinite integral $\int (\sin x)^2 (\cos x)^3\, dx$.   4%

   ....

3 Find the average value of the function $\dfrac{2x}{x^2 - 4x + 5}$ on the interval $[0, 2]$.   5%

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4 Evaluate the indefinite integral $\int \tan^{-1} x\, dx$.
   (Hint: use integration by parts.)   3%

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5 Perform a partial fraction expansion of $\dfrac{3 - x}{(x^2 - 3x + 2)(x^2 + 1)}$;

   then *evaluate the indefinite integral* $\displaystyle \int \frac{3 - x}{(x^2 - 3x + 2)(x^2 + 1)}\, dx$.   6%

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