

MID-SEMESTER ASSESSMENT PAPER

MODULE CODE: MA4002

SEMESTER: Spring 2013

MODULE TITLE: Engineering Mathematics 2

DURATION OF EXAMINATION: 45 minutes

LECTURER: Dr. 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 $\int \frac{x^2 - x}{\sqrt{x - 1}} dx$.
 Hint: use an appropriate substitution. 2%

(b) Calculate the area between $y = 2^x + \sin x$ and the x -axis for $0 \leq x \leq \pi$. 1%

(c) Express as a definite integral and then evaluate the limit of the Riemann sum $\lim_{n \rightarrow \infty} \sum_{i=1}^n \frac{1}{(c_i + 3)^2} \Delta x$, where $c_i \in [x_{i-1}, x_i]$, and we use the partition P with $x_i = -2 + \frac{5i}{n}$ for $i = 0, 1, \dots, n$ and $\Delta x \equiv x_i - x_{i-1}$. 2%

(d) Evaluate $\frac{d}{dx} \int_{\sqrt{x}}^{2x+1} (\sin t + t^2) dt$. 1%

(e) Find an upper bound for the error E_T in the Trapezoidal Rule approximation of the definite integral $\int_0^2 x \cos x dx$, using n subintervals. Choose n such that $E_T \leq \frac{2}{3} \cdot 10^{-4}$.
 Hint: evaluate $M_2 \equiv \max_{x \in [0, 2]} \left| \frac{d^2}{dx^2} (x \cos x) \right|$. 2%

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2 Evaluate the indefinite integral $\int \cos^3 x dx$. 3%

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3 Find the average value of the function $\frac{4x + 4}{x^2 + 4x}$ on the interval $[1, 4]$. 4%

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4 Evaluate the indefinite integral $\int (8x^3 - 1) \ln x dx$.
 (Hint: use integration by parts.) 4%

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5 Perform a partial fraction expansion of $\frac{x^2 + 3}{(x^2 + 2x + 1)(x^2 + 4)}$;

then evaluate the indefinite integral $\int \frac{x^2 + 3}{(x^2 + 2x + 1)(x^2 + 4)} dx$. 6%

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