EL-Menoufia University
Faculty of Engineering – Shebin EL-Koum
The Final Exam of The Second Term 2017-2018
Engineering Mathematics For The Prep. Year

Date: 2-6-2018 **Time: 3 Hrs.**
Marks: 100

Answer All the following questions:

Q1: (24 Marks)

1- prove that $\int e^{ax} \cosh bx \; dx = \frac{e^{ax}}{b^2 - a^2} [b \sinh bx - a \cosh bx] + C$

2- Evaluate the following integrals:

(i) $\int \frac{dx}{\sin x - \cos x + 1}$ (ii) $\int \frac{dx}{(1+\sqrt{x})\sqrt{x - x^2}}$ (iii) $\int_0^1 \frac{\ln(1+x)}{1+x^2} dx$

(iv) $\int \frac{x^3 - 6x^2 + 11x - 6}{\sqrt{x^2 + 4x + 3}} dx$ (v) $\int x^{-11}(1+x^4)^{-\frac{1}{2}} dx$

Q2: (26 Marks)

(a) Using integration, find the volume and the surface area generated when the region bounded by the following curves: $x = 2 - |y - 2|$ and $x = 0$ is rotated about the x-axis. (12 Marks)

(b) Calculate the length of the arc of the curve $y = \frac{1}{6}(x^3 + \frac{3}{x})$ between $x = 1$ and $x = 3$. (5 Marks)

(c) Find the area bounded by the curves $y = x^2 - 6x + 8$ and $y = 2x - 7$. (5 Marks)

(d) Use Simpson's rule to approximate $\int_0^1 \sqrt{x + x^2}\, dx$, using 4 subintervals. (4 Marks)

Q3: (50 Marks)

(a) Prove that the equation $2x^2 + 7xy + 3y^2 + 8x + 14y + 8 = 0$ represents two straight lines. Find the two lines, the angle between them, and bisector equations.

(b) By suitable transformation of cordinate axes, remove first degree term of the equation $x^2 - 4xy + 3y^2 + 6x - 8y + 15 = 0$, then classify the obtained equation.

(c) Discuss and sketch the hyperbola $9x^2 - 16y^2 + 18x + 32y - 151 = 0$, then find the foci, directrices, and asymptotes.

(d) If the normal at the end of a latus rectum of an ellipse passes through one extremity of the minor axis, show that the eccentricity of the curve is givin by the equation $e^4 + e^2 - 1 = 0$.

(e) Find the equation of the common tangent of $y^2 = 8x$ and $x^2 = 12y$.

(f) Sketch the graph of the polar equation $r^2 = 4r\cos\theta$, then transform it into Cartesian coordinates.

Good Luck