Homework Assignment #7

due in class on Friday, Mar. 21

Note: All homework assignments are due in class one week after being assigned. They must be on standard $8\frac{1}{2} \times 11$ paper and they must be stapled. Assignments which are not stapled will not be accepted. I will not bring a stapler to class. Please put your answers in the boxes and show your work in the spaces provided.

Name (Print): _____ Student No: _____

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1. [4 marks]

(a) Evaluate the integral $\displaystyle\int \frac{x+1}{x^2(x-1)}\,dx$.

(b) Evaluate the integral $\displaystyle\int \ln(1+x^2)\,dx$.

2. [4 marks]

(a) What is the real part of the complex number $z = \dfrac{1-\imath}{2+\imath}$?

(b) What is the imaginary part of the complex number $\dfrac{1+\imath}{3+4\imath}$?

(c) What is the polar form of the complex number $2 - 2\imath$?

(d) Find all solutions of $z^3 = 125$.

3. [8 marks]

(a) Find all solutions of $\dfrac{dx}{dt} = k(x-3)(x-2)$, where k is a positive constant.

(b) Determine $\lim_{t\to\infty} x(t)$ for all non-constant solutions in (a).

(c) Find that solution in (a) satisfying $x(0) = 1$.

(d) Find all solutions of the differential equation $y''(x) + y'(x) + y = 0$.

4. [4 marks] The table below shows the specific heat $s(\theta)$ of water at certain temperatures.

θ^o	0°	2°	4°	6°	8°
$s(\theta)$	1.0064	1.00543	1.00435	1.00331	1.00233

Suppose that $|s^{(k)}(\theta)| \leq \dfrac{k}{1000}$ for $0 \leq \theta \leq 8$ and for all positive integers k. The amount of heat required to raise $1\,gr$ of water from 0^oC to 8^oC is given by the integral $I = \displaystyle\int_0^8 s(\theta)\,d\theta$.

(a) Find the best Trapezoidal approximation you can for I based on the data in the table.

(b) Find the best Simpson's approximation you can for I based on the data in the table.

(c) Determine the maximum possible error in the approximation in (a).

(d) Determine the maximum possible error in the approximation in (b).