Term Test 2

DATE: November 9, 2011
TIME: 70 minutes
COURSE: MATH 3132
EXAMINER: G.I. Moghaddam

NAME:_____

STUDENT # : _____

Q1	Q2	Q3	Q4	Total (out of 40)

[10] 1. Consider the differential equation $x\,y''+(x^2\cos x)\,y'+(\tan x)\,y=0$.

(a) Find all singular points (if any) of the differential equation.

(b) What can be said about the radius of convergence of a power serires solution about $x=1$ of the differential equation.

[10] 2. Use Stokes's theorem to evaluate the line integral

$$\oint_C -x^2yz\,dx + xy^2z\,dy + 3\,dz$$

where C is the curve of intersection of the cone $z = 4 - \sqrt{x^2+y^2}$ and the plane $z = 3$, directed clockwise as viewed from the point $(0, 0, 2)$.

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[12] 3. Solve the differential equation $2x\,y'' + (1-x)\,y' - y = 0$ using power series $y = \sum_{n=0}^{\infty} a_n\,x^n$. Write your answer in sigma notation and simplify as much as possible. Find the interval of convergence.

[8] 4. Find the radius and the open interval of convergence of a power series solution about $x = 3$ for the differential equation

$$(x+3)(x^2+9)\,y'' + (x^2-9)\,y' + (x^4+9x^2)\,y = 0\,.$$

(You are **not** asked to solve the differential equation)

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[10] 5. Find the Fourier series for the periodic function $f(x)$ whose graph is given for $-3 \leq x \leq 3$. Simplify your answer as much as possible. Also draw the graph of the function to which the Fourier series converges for $-3 < x < 3$.

(-3.5,-3)(5,3) [ticks=y]-¿(0,0)(-3.5,-1.5)(4,2)
[linewidth=2pt]o-o(0,0)(1,.99) o-o(1,1)(2,0) o-o(2,0)(3,1)
o-o(-3,1)(-2,0) o-o(-2,0)(-1,1) [linewidth=2pt]o-o(-1,1)(0,0)

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Answers:

Q1) $a = 1\,, b = 1\,, c = 2$

Q2) $\dfrac{2}{3}$

Q3) Yes, 128

Q4) $\dfrac{3\pi}{5}$

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Answers:

Q1: $\frac{3\pi}{2}$

Q2: $a_0 \sum_{n=0}^{\infty} \frac{2^n\, n!}{(2n)!}\, x^n$ and $-\infty < x < \infty$

Q3: $R = 3\sqrt{2}$ and $3 - 3\sqrt{2} < x < 3 + 3\sqrt{2}$

Q4: $\frac{1}{2} - \frac{4}{\pi^2} \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2} \cos(2n-1)\pi x$