Math 102 Final Exam
Dr. H. Yamani Fall 2007
Name:

Do each of the following problems. Show all your work. No work shown. No credit.

******GOOD LUCK******

Problem 1. (Answer on pages 1,2,3,4 of the booklet)
Evaluate the following integrals: (5 pts each)

a. $\int \frac{xe^x}{(x+1)^2}\,dx$ **b**. $\int \frac{x^3}{\sqrt{1+x^2}}\,dx$ **c**. $\int \frac{x^2+x-2}{(3x-1)(x^2+1)}\,dx$

d. $\int_1^\infty \frac{4}{(x^9+100)^{5/3}}dx$ (Test for convergence or divergence only). Explain

Problem 2. (Answer on page 5 of the booklet
Find the following limits: (5 pts each)

1) $\lim_{x\to\infty}\left(\frac{x}{3^{\ln x}}\right)$ 2) $\lim_{x\to\infty}\left(\frac{x-2}{x}\right)^{3x}$

Problem 3. (Answer on page 6 of the booklet)
(5 pts) Find the length of the curve
$x = 5\cos t - \cos 5t \qquad y = 5\sin t - \sin 5t \qquad 0 \le t \le 2\pi$

Problem 4 (Answer on pages 7, 8, 9, 10 of the booklet)
a. (5 pts) Find the distance from the point S(1,1,3) to the plane $3x + 2y + 6z = 6$
b. (5 pts) Find the distance from the point S(1,1,5) to the line
L: $x = 1 + t, \qquad y = 3 - t, \qquad z = 2t$
c. (5 pts) Find an equation for the plane through the point (2,1,-1) and perpendicular to the line of intersection of the planes
$2x + y - z = 3, \quad x + 2y + z = 2$
d. (5 pts) Find an equation for the plane through the point (2,4,5) perpendicular to the line
L: $x = 5 + t, \qquad y = 1 + 3t, \qquad z = 4t$

Problem 5. (Answer on pages 11, 12 of the booklet).
a. (5 pts) Find the area of a parallelogram determined by the vectors **u** = -3**i** -2**j** +2**k** and **v** = -2**i** +2**j**+3**k**
b. (5 pts) Write **u** = 2**i** -**j** +3**k** as a sum of a vector parallel to **v** = 4**i** –**j**+2**k** and a vector orthogonal to **v.**

Problem 6. (Answer on pages 13, 14, 15 of the booklet)
(25 pts) Determine the unit tangent vector **T,** the principal unit normal vector **N,** the binormal vector **B,** the curvature κ, and the torsion τ for the curve
r(t) = $(3\sin t)\mathbf{i} + (3\cos t)\mathbf{j} + 4t\mathbf{k}$

Problem 7. (Answer on page 16 of the booklet)
(10 pts) Without finding **T** and **N**, write the acceleration of the curve
r(t) = $(a\cos t)\mathbf{i} + (a\sin t)\mathbf{j} + bt\,\mathbf{k}$ in the form **a** = a_T**T** + a_N **N**