Name: _____

Instructor: Sample Test 2, ACMS 20550

This Sample Test does not cover all materials of Chapters 2 and 4. The Error Estimate, and all materials in Chapter 1 after error estimate will be included in our Test 2.

Multiple Choice

1.(6 pts.)The series $\sum_{1}^{\infty}\left(\frac{1+i}{1+2i}\right)^{n}$ is

(a) absolutely convergent

(b) convergent but not absolutely convergent

(c) divergent by ratio test

(d) divergent by preliminary test

(e) divergent by comparison test

2.(6 pts.) Compute all complex roots $(-1)^{1/7}$

(a) $e^{i(\pi/14)}, e^{i(5\pi/14)}, e^{i(9\pi/14)}, e^{i(13\pi/14)}, e^{i(17\pi/14)}, e^{i(21\pi/14)}, e^{i(25\pi/14)}$

(b) $e^{i(2\pi/7)}, e^{i(4\pi/7)}, e^{i(6\pi/7)}, e^{i(8\pi/7)}, e^{i(10\pi/7)}, e^{i(12\pi/7)}, e^{i(2\pi)}$

(c) $1, -1$

(d) $1, -1, i - i$

(e) $e^{i(\pi/7)}, e^{i(3\pi/7)}, e^{i(5\pi/7)}, e^{i\pi}, e^{i(9\pi/7)}, e^{i(11\pi/7)}, e^{i(13\pi/7)}$

Name: _____

Instructor: Sample Test 2, ACMS 20550

3.(6 pts.) Compute all values of $\ln(1+i)$

(a) $\text{Ln } 2 + i\Big(\frac{\pi}{4} \pm 2n\pi\Big), n = 0, 1, 2, \cdots$

(b) $\text{Ln } \sqrt{2} + i\Big(-\frac{\pi}{2} \pm 2n\pi\Big), n = 0, 1, 2, \cdots$

(c) $\text{Ln } \sqrt{2} + i\Big(-\frac{\pi}{4} \pm 2n\pi\Big), n = 0, 1, 2, \cdots$

(d) $\text{Ln } \sqrt{2} + i\Big(\frac{\pi}{4} \pm 2n\pi\Big), n = 0, 1, 2, \cdots$

(e) $\text{Ln } \sqrt{2} + i\Big(\frac{\pi}{2} \pm 2n\pi\Big), n = 0, 1, 2, \cdots$

4.(6 pts.) The disc of convergence of the series $\sum_{1}^{\infty} 2^n z^n$ is

(a) $|z| < 1/\sqrt{2}$, by ratio test

(b) $|z| < 1/2$, by ratio test

(c) $|z| < 1$, by ratio test

(d) $|z| < 2$, by ratio test

(e) $|z| < \sqrt{2}$, by ratio test

Name: _____

Instructor: Sample Test 2, ACMS 20550

5.(6 pts.) $\int_0^{2\pi} e^{i(5x)}dx \;=$

(a) $\frac{2\pi i}{5}$ (b) $-2\pi i$ (c) $-\frac{2\pi i}{5}$

(d) $2\pi i$ (e) 0

6.(6 pts.) If $z = 3x^4 - y^2$ and $x = r\cos\theta, y = r\sin\theta$, find $\left(\frac{\partial z}{\partial x}\right)_r$.

(a) $12x^3 + 2x - 2r$ (b) $12x^3 - 2x$ (c) $12x^3 - 2y$

(d) $12x^3 + 2x$ (e) $12x^3$

Name: _____

Instructor: Sample Test 2, ACMS 20550

7.(6 pts.) For n large, the expression $\dfrac{1}{\sqrt{n+1}} - \dfrac{1}{\sqrt{n}}$ can be approximated by

(a) $\dfrac{1}{2n^{3/2}}$ (b) $-\dfrac{1}{2n^{3/2}}$ (c) $-\dfrac{1}{n^{3/2}}$

(d) $-\dfrac{2}{n^{3/2}}$ (e) $\dfrac{1}{n^{3/2}}$

8.(6 pts.) By the second derivative test, if $z = f(x, y)$ is twice differentiable, and

(a) $\dfrac{\partial f}{\partial x}(a, b) = 0, \quad \dfrac{\partial f}{\partial y}(a, b) = 0, \quad$ and

(b) $\dfrac{\partial^2 f}{\partial x^2} > 0, \quad \dfrac{\partial^2 f}{\partial y^2} > 0, \quad \dfrac{\partial^2 f}{\partial x^2} \cdot \dfrac{\partial^2 f}{\partial y^2} - \left(\dfrac{\partial^2 f}{\partial x \partial y}\right)^2 > 0$ at $x = a, y = b.$

Then

(a) $(x, y) = (a, b)$ is a point of relative minimum

(b) $(x, y) = (a, b)$ is a point of neither a relative minimum, nor a relative maximum

(c) $(x, y) = (a, b)$ is a point of relative maximum

(d) $(x, y) = (a, b)$ is a point of global maximum

(e) $(x, y) = (a, b)$ is a point with a non-horizontal tangent plane

9.(6 pts.) Find the tangent line of $xe^y + ye^x = 0$ at $(0, 0)$.

(a) $y = x$ (b) $y = 2x$ (c) $y = -2x$

(d) $y = 0$ (e) $y = -x$

10.(6 pts.) If $x^2 + y^2 = 2st - 10$ and $2xy = s^2 - t^2$, find $\partial x/\partial t$.

(a) $\dfrac{sx + ty}{x^2 - y^2}$ (b) $\dfrac{-sx + ty}{x^2 - y^2}$ (c) $\dfrac{sx - ty}{x^2 - y^2}$

(d) $\dfrac{sx + ty}{x^2 + y^2}$ (e) $\dfrac{sx - ty}{x^2 + y^2}$

Name: _____

Instructor: Sample Test 2, ACMS 20550

Partial Credit

You must show your work on the partial credit problems to receive credit!

11.(15 pts.) Let $z = \sqrt{x^2 + y^2}$.

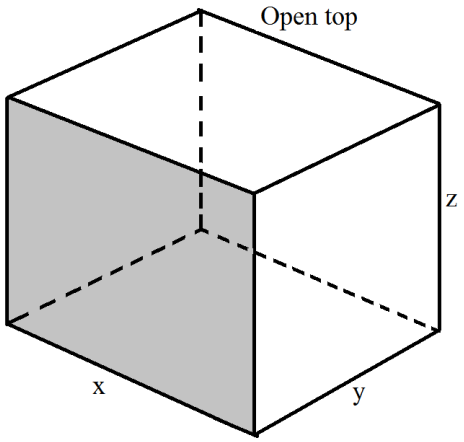
(a) Find the differential dz

(b) Using differential to approximate value of $\sqrt{(3+w)^2 + (4-2w)^2}$ for small w ($|w| < 0.1$) using the result from (a)

Name: _____

Instructor: Sample Test 2, ACMS 20550

12.(15 pts.) A holding tank with **open top** is to be constructed to have a volume of 1 cube meters (i.e., $xyz = 1$). The bottom and the 3 sides are to be constructed with steel costing \$100 per square meter. One final side for viewing is to be constructed with glass costing \$300 per square meter.



Front side (shaded)
Area = xz
Cost: \$300 per square meter

All 3 other sides and bottom
Cost: \$100 per square meter

(a) Write the formula for the cost function $C(x, y, z)$. Then eliminate the variable z to have a function of x, y only.

(b) Find the value x, y and z that minimize the cost (Do not use 2nd derivative test).

Name: _____

Instructor: Sample Test 2, ACMS 20550

Partial Credit

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13.(10 pts.) Compute $\int_{-\pi}^{\pi} \cos x \cdot \cos 2x \, dx$

Show all your work.