ACMS 20550: Applied Math. Method I
Exam II, Version Gold
October 14, 2021

Name: ______________________________

Instructor: ___________________________

- The Honor Code is in effect for this examination. All work is to be your own.
- You may use a BASIC calculator. (Cell phone calculator -YES. Graphic calculators - NO).
- The exam lasts for 75 minutes.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 8 pages of the test.

It is a violation of the honor code to give or to receive unauthorized aid on this Exam.

Good Luck!

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!

1.	a	b	c	d	e
2.	a	b	c	d	e
3.	a	b	c	d	e
4.	a	b	c	d	e
5.	a	b	c	d	e
6.	a	b	c	d	e
7.	a	b	c	d	e
8.	a	b	c	d	e
9.	a	b	c	d	e
10.	a	b	c	d	e

Please do NOT write in this box.

Multiple Choice	________
11.	________
12.	________
Total	________

Multiple Choice

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

(a) absolutely convergent by ratio test

(b) absolutely convergent by comparison test

(c) divergent by preliminary test

(d) absolutely convergent by integral test

(e) convergent but not absolutely convergent

2.(6 pts.) Compute all complex roots $i^{1/5}$

(a) $\frac{1}{5}, -\frac{1}{5}, \frac{i}{5}, \frac{-i}{5}, \frac{1+i}{\sqrt{10}}$

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

(c) $e^{i(2\pi/5)}, e^{i(4\pi/5)}, e^{i(6\pi/5)}, e^{i(8\pi/5)}, e^{i(10\pi/5)}$

(d) $e^{i(\pi/10)}, e^{i(5\pi/10)}, e^{i(9\pi/10)}, e^{i(13\pi/10)}, e^{i(17\pi/10)},$

(e) $1, -1, i, -i, \frac{1+i}{\sqrt{2}}$

3.(6 pts.) Compute the value of $2\cos(i\ln 7)$. (For this problem, here $\ln 7 \approx 1.946$ represents the principle branch, please do not include $2k\pi i$)

(a) $7 + \dfrac{1}{7}$ (b) $7 + \dfrac{i}{7}$ (c) $7 - \dfrac{i}{7}$

(d) $7i - \dfrac{1}{7}$ (e) 0

4.(6 pts.) The disc of convergence of the series $\displaystyle\sum_{1}^{\infty} \frac{(1-i)n^3}{(n+1)^2}\left(\frac{z}{3}\right)^n$ is

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

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

(c) $|z| < \dfrac{1}{3}$, by ratio test

(d) $|z| < 3$, by ratio test

(e) $|z| < \dfrac{3}{2}$, by ratio test

5.(6 pts.) If $z = e^{xy}$, then $dz =$

(a) $xe^{xy}dx + ye^{xy}dy$

(b) $ye^{xy}dx + xe^{xy}dy$

(c) $e^{xy}dx - e^{xy}dy$

(d) $e^{xy}dx + e^{xy}dy$

(e) $xye^{xy}dx + xye^{xy}dy$

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

(a) $6x^2$ (b) $6x^2 - 2r$ (c) $6x^2 + 2x$

(d) $6x^2 + 2r$ (e) $6x^2 - 2x$

7.(6 pts.) If $z = x^3 + e^{5y}$ and $x = \sin 2t$, $y = \cos 3t$, then $\dfrac{dz}{dt} =$

(a) $2(\sin 2t)^2 \cos 2t + 3e^{5\cos 3t} \sin 3t$

(b) $3(\sin 2t)^2 \cos 2t - 5e^{5\cos 3t} \sin 3t$

(c) $6(\sin 2t)^2 \cos 2t - 15e^{5\cos 3t} \sin 3t$

(d) $2(\sin 2t)^2 \cos 2t - 3e^{5\cos 3t} \sin 3t$

(e) $3(\sin 2t)^2 \cos 2t + 5e^{5\cos 3t} \sin 3t$

8.(6 pts.) A particle moving in the complex plane is described by the equation $z = \dfrac{2t+i}{t-2i}$. Find the speed (i.e., magnitude of the velocity).

(a) 0

(b) $\dfrac{5}{t^2+4}$

(c) $\dfrac{5}{t^2+4t+4}$

(d) $\dfrac{2}{t^2+4}$

(e) $\dfrac{2}{t^2+4t+4}$

9.(6 pts.) Find the tangent line of $x\cos y + \sin 2y = 0$ at $(0, 0)$.

(a) $y = -\frac{1}{2}x$ (b) $y = 0$ (c) $y = -2x$

(d) $y = 2x$ (e) $y = \frac{1}{2}x$

10.(6 pts.) For n very large, the expression $(n+1)^{1/3} - n^{1/3}$ can be approximated by

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

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

Partial Credit

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

11.(20 pts.) (a) The Taylor series for $\sin x$ is given by $\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots$. Estimate the error for $\sin 1$ using only 2 terms, namely, estimate $\left|\sin 1 - \left(1 - \frac{1}{3!}\right)\right|$. No need to simply your answer – You may leave your answer as a fraction containing factorials.
Hint: Is this series alternating and absolutely decreasing?

(b) Compute $\int_0^{2\pi} \sin 3x \cdot \cos 5x \, dx$. Show all your work.
Hint: $\cos z = \frac{1}{2}(e^{iz} + e^{-iz})$, $\quad \sin z = \frac{1}{2i}(e^{iz} - e^{-iz})$

12.(20 pts.) (a) Compute $\dfrac{d}{dx}\displaystyle\int_0^{x^3} \dfrac{\sin(xt)}{t}dt$ using Leibniz rules, *no credit will be given for using a series.* Show all your work.

(b) Find the point on the plane $x + 2y - 3z = 6$ for which $f(x, y, z) = \dfrac{1}{2}x^2 + y^2 + \dfrac{3}{2}z^2$ is minimum. Show all your work.