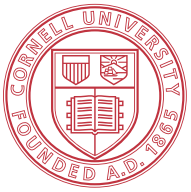

Math 1920 Name _____

Prelim 2 7 November 2017 7:30–9:00 pm

PLACE AN X IN THE BOX BY YOUR DISCUSSION SECTION NUMBER

☐	201	Aleksandra Niepla	MW 7:30–8:20P	☐	214	Shrinidhi Pandurangi	TR 9:05–9:55A
☐	202	Aleksandra Niepla	MW 8:35–9:25P	☐	215	Andres Fernandez	TR 9:05–9:55A
☐	203	Andres Fernandez	TR 8:00–8:50A	☐	216	Dylan Peifer	TR 9:05–9:55A
☐	204	Dylan Peifer	TR 8:00–8:50A	☐	217	Feng Liang	TR 12:20–1:10P
☐	205	Thomas Reeves	TR 8:00–8:50A	☐	218	Max Jenquin	TR 12:20–1:10P
☐	206	Bram Wallace	TR 8:00–8:50A	☐	219	Feng Liang	TR 1:25-2:15P
☐	207	Shrinidhi Pandurangi	TR 8:00–8:50A	☐	220	Ryan McDermott	TR 1:25-2:15P
☐	209	Bill Wu	TR 8:00–8:50A	☐	221	Itamar Oliveira	MW 7:30–8:20P
☐	210	Thomas Reeves	TR 9:05–9:55A	☐	222	Itamar Oliveira	MW 8:35–9:25P
☐	211	Bram Wallace	TR 9:05–9:55A	☐	223	Max Jenquin	TR 1:25–2:15P
☐	213	Bill Wu	TR 9:05–9:55A	☐	224	Ryan McDermott	TR 2:30–3:20P

INSTRUCTIONS—PLEASE READ NOW

- Write your name and check the box with your discussion section number *right now*.
- There are 6 problems and this booklet has 7 sheets. You may use the back of each sheet as scratch paper.
- You have 90 minutes to complete the exam. You may leave early, but if you finish within the last 15 minutes, please remain in your seat.
- Show your work and simplify your answers. To receive full credit, your answers must be neatly written and logically organized.
- You are allowed a one-sided letter size sheet of notes. No books or electronic devices or any other resources are allowed.
- Academic integrity is expected of all Cornell University students at all times, whether in the presence or absence of members of the faculty. Understanding this, I declare I shall not give, use, or receive unauthorized aid in this examination.

Please sign below to indicate that you have read and agree to these instructions.

_____

Signature of Student

OFFICIAL USE ONLY

1.	_____ /	15
2.	_____ /	15
3.	_____ /	15
4.	_____ /	15
5.	_____ /	20
6.	_____ /	20
Total	_____ /	100

1 (15 points)**.** Find the global minima and maxima of the function $f(x, y, z) = -x + 2y + z$ over the solid ellipsoid given by $x^2 + y^2 + \frac{1}{4}z^2 \leq 1$.

2 (15 points)**.** Let $\mathscr{W}$ be the solid enclosed between the surface $z = \sqrt{x^2 + y^2}$ and the plane $z = h$, where h is a positive constant.

(a) Find the volume of $\mathscr{W}$.

(b) Find the centroid of $\mathscr{W}$. (Recall that the centroid is the center of mass with respect to a constant density function equal to 1.) You may use the symmetries of $\mathscr{W}$ to shorten your calculations.

(The answers will depend on h.)

3 (15 points)**.** Find the work done by the force $\mathbf{F}(x, y, z) = \langle yz, xz, xy \rangle$ along the path $\mathbf{r}(t) = \langle t, t^2, t^3 \rangle$ for $0 \leq t \leq T$. (The answer will depend on T.)

4 (15 points)**.** Let a be a constant and let $\mathbf{F}$ be the vector field

$$\mathbf{F}(x, y) = \left\langle x \ln y + ye^x, \frac{1}{2}x^2 y^a + e^x + 1 \right\rangle.$$

The domain of $\mathbf{F}$ is the planar region $\mathscr{D}$ defined by $y > 0$.

(a) Is $\mathscr{D}$ simply connected?

(b) For what value of a is $\mathbf{F}$ conservative?

(c) For the value of a you found in part (b), find a potential of $\mathbf{F}$.

5 (20 points)**.** Let $f(x, y) = x^3 + y^3 - 3xy$.

(a) Find all critical points of f in the plane $\mathbf{R}^2$.

(b) For each critical point state whether it is a local minimum, local maximum, or saddle point.

(c) Does f have global extrema? Explain your answer.

6 (20 points)**.** Let $\mathscr{W}$ be the solid enclosed by the two spheres $x^2+y^2+z^2 = R^2$ and $x^2+y^2+(z-R)^2 = R^2$, where R is a positive constant.

(a) Sketch the solid $\mathscr{W}$. Include sufficient detail, such as coordinate axes and some indication of scale.

(b) Set up the integral $\iiint_{\mathscr{W}} xyz\, dV$ in cylindrical coordinates with the variables in the order $dz\, dr\, d\theta$. Write the answer as an integral with explicit limits of integration. Do not attempt to evaluate the integral.

(c) In the integral of part (b) change the order of integration to $dr\, dz\, d\theta$. Do not attempt to evaluate the answer.