Exam 3 **Name**____________________________________

Math 231-03 **Calculus III** **November 2, 2018**

Guidelines

- **Calculators are not allowed.**
- Read the questions carefully. You have 65 minutes; use your time wisely.
- You may leave your answers in symbolic form, like $\sqrt{3}$ or $\ln(2)$, unless they simplify further like $\sqrt{9} = 3$ or $\cos(3\pi/4) = -\sqrt{2}/2$.
- Put a box around your final answers when relevant.
- Show all steps in your solutions and make your reasoning clear. Answers with no explanation will not receive full credit, even when correct.
- Use the space provided. If necessary, write "see other side" and continue working on the back of the same page.
- $\vec{u} \cdot \vec{v} = ||\vec{u}||||\vec{v}|| \cos\theta$ and $||\vec{u} \times \vec{v}|| = ||\vec{u}||||\vec{v}|| \sin\theta$
- $x = \rho \sin\varphi \cos\theta$, $y = \rho \sin\varphi \sin\theta$, $z = \rho\cos\varphi$, and $dV = \rho^2 \sin\varphi d\rho\, d\varphi\, d\theta$

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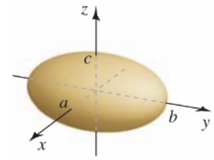
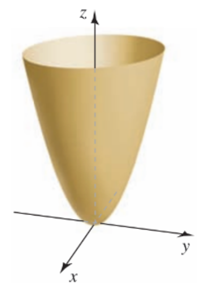
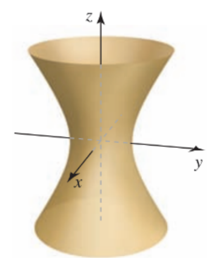
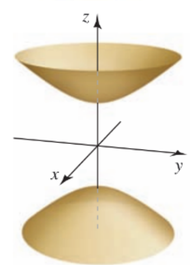
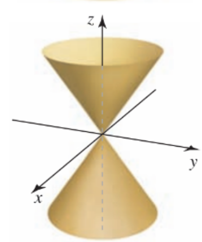
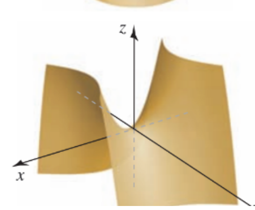
1. (8 points) To be completed once exams are graded and returned. Please correct any problem with points deducted. All corrections should be completed neatly on a separate sheet of paper. Once you have finished your corrections, take your exam and corrections to the Office of Student Learning (OSL), and a tutor will check your answers and sign below. The checked solutions should be given to your instructor.

   Signature: ____________________________________
   Print Name: ____________________________________
   Date: __________________

Table 12.1

Name	Standard Equation	Features	Graph
Ellipsoid	$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$	All traces are ellipses.	
Elliptic paraboloid	$z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$	Traces with $z = z_0 > 0$ are ellipses. Traces with $x = x_0$ or $y = y_0$ are parabolas.	
Hyperboloid of one sheet	$\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = 1$	Traces with $z = z_0$ are ellipses for all z_0. Traces with $x = x_0$ or $y = y_0$ are hyperbolas.	
Hyperboloid of two sheets	$-\frac{x^2}{a^2} - \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$	Traces with $z = z_0$ with $\lvert z_0 \rvert > \lvert c \rvert$ are ellipses. Traces with $x = x_0$ and $y = y_0$ are hyperbolas.	
Elliptic cone	$\frac{x^2}{a^2} + \frac{y^2}{b^2} = \frac{z^2}{c^2}$	Traces with $z = z_0 \neq 0$ are ellipses. Traces with $x = x_0$ or $y = y_0$ are hyperbolas or intersecting lines.	
Hyperbolic paraboloid	$z = \frac{x^2}{a^2} - \frac{y^2}{b^2}$	Traces with $z = z_0 \neq 0$ are hyperbolas. Traces with $x = x_0$ or $y = y_0$ are parabolas.	

Question	Points	Score
1	8	
2	10	
3	10	
4	10	
5	14	
6	10	
7	10	
8	14	
9	14	
Total:	100	

2. (10 points) For $\int_0^2 \int_{1-y}^1 f(x,y)\,dx\,dy$, sketch the region R and re-write as a double integral with the order of integration reversed.

3. (10 points) For $\int_0^3 \int_0^{9-x^2} \int_0^x f(x,y,z)\,dy\,dz\,dx$, sketch the region D and re-write as an iterated integral in the order $dz\,dx\,dy$

4. (10 points) Rewrite the integral $\int_{-2}^2 \int_0^{\sqrt{4-x^2}} \int_{-\sqrt{4-x^2-y^2}}^{\sqrt{4-x^2-y^2}} y^2\sqrt{x^2+y^2+z^2}\,dz\,dy\,dx$ in spherical coordinates. Do no evaluate.

5. (14 points) Find the average value of $z = \sqrt{16 - x^2 - y^2}$ over the disk in the xy-plane centered at the origin with radius 4.

6. (10 points) Convert $\int_0^{2\pi} \int_0^{\sqrt{2}} \int_r^{\sqrt{4-r^2}} 3r \, dz dr d\theta$ to rectangular coordinates with order of integration $dzdxdy$. Do not evaluate.

7. (10 points) Find the volume of the solid that is enclosed by the planes $x = 2$, $y = 0$, $z = 0$, $y = x$ and the parabolic cylinders $z = x^2$. Set up the triple integral but do not evaluate.

8. (14 points) Use cylindrical coordinates to find the volume of the solid bounded by the plane $z = \sqrt{29}$ and the hyperboloid $z = \sqrt{4 + x^2 + y^2}$.

9. (14 points) Use a transformation and evaluate $\iint_R e^{xy} dA$ where R is the region bounded by the hyperbolas $xy = 1$ and $xy = 4$, and the lines $y/x = 1$ and $y/x = 3$ in the first quadrant.