Welcome to mini practice final exam 2, where the questions are made up and points don't matter. (However, it is probably helpful to take it seriously, including finishing on time, since it will help you learn what sections are your weakest.) Approximate time you should take to finish every question: 55-65 minutes. If you finish the first 10-11 questions in 50 minutes, time shouldn't be a problem on the real exam.

1. (18 points) Let $N = \dfrac{p+q}{p+r}$, where p, q, r are functions of u, v, w defined by $\begin{cases} p = u + vw, \\ q = v + wu, \\ r = w + uv. \end{cases}$

   Compute $\dfrac{\partial N}{\partial u}, \dfrac{\partial N}{\partial v}, \dfrac{\partial N}{\partial w}$, at $u = 1, v = 2, w = 3$.

2. (6 points) Find the limit, if it exists, or show that the limit does not exist:

$$\lim_{(x,y)\to(1,2)} \frac{xy}{x^2+y^2}.$$

3. (6 points) Find the limit, if it exists, or show that the limit does not exist:

$$\lim_{(x,y)\to(1,2)} \frac{(x-1)(y-2)}{(x-1)^2+(y-2)^2}.$$

4. (6 points) Find the limit, if it exists, or show that the limit does not exist:

$$\lim_{(x,y)\to(0,0)} \frac{x^4-y^4}{x^2+y^2}.$$

Note that there are no squeeze limit questions above, but you might want to review squeeze theorem in case these questions are too easy.

5. (9 points) Evaluate $\iint_D \frac{y}{1+x^2} dA$ where D is the region bounded by $y = \sqrt{x}, y = 0, x = 1$.

6. (9 points) Evaluate $\int_0^2 \int_{-\sqrt{4-y^2}}^{0} \int_0^{\sqrt{4-x^2-y^2}} y\sqrt{x^2+y^2+z^2}\, dz dx dy$.

TRUE OR FALSE

7. (5 points) If $PV = nRT$, where n, R are constants, then $\dfrac{\partial P}{\partial V} \cdot \dfrac{\partial V}{\partial T} \cdot \dfrac{\partial T}{\partial P} = 1$.

8. (5 points) $x^2 - 2y^2 = 4 - z^2$ is an equation of a hyperboloid of one sheet.

9. (5 points) $2x^2 + 2y^2 = 4 - z^2$ is an equation of a hyperboloid of two sheets.

MULTIPLE CHOICE

10. (7 points) Which of the two planes are parallel?

A. $x + y + z = 1$	and	$x + y = 1$
B. $2x - 2y + 2z = 1$	and	$2x + 2y + 2z = -1$
C. $x - y - z = 1$	and	$z - x + y = 2$
D. $x + 2y + 3z = 2$	and	$z + 2y + 3x = 4$
E. $-x - y - z = 0$	and	$z = 0$

11. (7 points) The lines $\mathbf{r}_1(t) = \langle 1 - t, 1 + t, 2 + 3t \rangle$ and $r_2(s) = \langle 2s - 4, s, s + 3 \rangle$ are

A. Parallel

B. Orthogonal

C. Intersecting

D. Skew

E. None of the above

12. (7 points) The length of $\langle 2t^{3/2}, \cos(\pi t), \sin(\pi t)\rangle$ from $\langle 2, -1, 0\rangle$ to $\langle 16, 1, 0\rangle$ is

A. 14

B. $\sqrt{9t + \pi^2}$

C. $\frac{2}{27}(36 + \pi^2)^{3/2}$.

D. $\frac{1}{3}\Big((38 + \pi)^{3/2} - (14 + \pi^2)^{3/2}\Big)$

E. None of the above

13. (7 points) Find the linearization of xe^{xy} at $(2, 0)$.

A. $L(x, y) = x + 4y + 2$

B. $L(x, y) = x + 4y$

C. $L(x, y) = 4x + 2y + 1$

D. $L(x, y) = 4(x - 0) + 2(y - 0) + 2$

E. $L(x, y) = 2x$