

Math 241, Final Exam, Fall, 2017 1:15 class

Write everything on the blank paper provided. **PLEASE RETURN this piece of paper.** If possible: return the problems in order (use as much paper as necessary), use only one side of each piece of paper, and leave 1 square inch in the upper left hand corner for the staple. If you forget some of these requests, don't worry about it – I will still grade your exam.

The exam is worth 100 points. Each problem is worth 10 points. Please make your work coherent, complete, and correct. Please **CIRCLE** your answer. Please **CHECK** your answer whenever possible.

**No Calculators, Cell phones, computers, notes, etc.**

- (1) Find the equation of the plane through the points  $(0, 8, 8)$ ,  $(8, 0, 8)$ , and  $(8, 8, 0)$ .
- (2) Find the point on the plane  $x - y + z = 4$  that is closest to the point  $(1, 2, 3)$ .
- (3) Find parametric equations for the line of intersection of the planes

$$x + 2y + 3z = 1 \quad \text{and} \quad x - y + z = 1.$$

- (4) Consider the set of points in 3-space which satisfy  $z = y^2 - x^2$ . What is this set of points called? Describe the set of points. Draw the set of points.
- (5) An object is traveling in 3-space. The position vector of the object at time  $t$  is  $\vec{r}(t) = (\cos t)\vec{i} + (\sin t)\vec{j} + t\vec{k}$  for  $0 \leq t \leq 2\pi$ . How far did the object travel?
- (6) Find the equation of the line normal to  $z = x^2 + y^2$  at the point where  $x = 1$  and  $y = 3$ .
- (7) Find the maximum and minimum of  $f(x, y) = 5x - 3y$  subject to the constraint  $x^2 + y^2 = 136$ .
- (8) Compute  $\int_{-1}^0 \int_{-\sqrt{1-x^2}}^0 \frac{2}{1+\sqrt{x^2+y^2}} dy dx$ .
- (9) Find the volume of the solid in the first octant between the planes

$$x + y + 2z = 2 \quad \text{and} \quad 2x + 2y + z = 4.$$

- (10) Find the work done by the force  $\vec{F} = xy\vec{i} + (y - x)\vec{j}$  over the straight line from  $(1, 1)$  to  $(2, 3)$ .