NAME(Print):____

SIGNATURE:____________________________ **SSN:**____________

CIRCLE LECTURER BELOW:

Atkin	9:00	121TH	59047
Starchenko	9:00	117TH	05711
Lin	10:00	204TH	59054
Masur	10:00	215TH	59063
Smith	11:00	204TH	59072
Hamilton	11:00	211TH	59020
Tartakoff	12:00	204TH	59089

There are 12 problems on the exam. Each problem is worth 15 points. SHOW ALL WORK. Please show your university photo ID, if requested to do so. If you do not have this ID with you, you must see your instructor immediately and obtain permission to take the exam.

1 __________
2 __________
3 __________
4 __________
5 __________
6 __________
7 __________
8 __________
9 __________
10 __________
11 __________
12 __________

TOTAL __________

1. Find the angle between the vectors: $3\mathbf{i}+4\mathbf{j}-2\mathbf{k}$ and $\mathbf{i}-3\mathbf{j}+4\mathbf{k}$. You may express your answer in degrees correct to .0001 degree or in exact form.

2. Find parametric equations for the line through $(-1\,,1\,,3)$ and $(2\,,-1\,,4)$ and find the point where it intersects the xy-plane.

3. Let T be the triangle whose vertices are $(1\ ,2\ ,3)$, $(4\ ,-7\ ,2)$ and $(2\ ,2\ ,2)$.

   a) Find the area of T.

   b) Find an equation of the plane which contains T.

4. Find the length of the curve

$$\mathbf{r}(t) =< \cos 3t,\ \sin 3t,\ 4t > \qquad 0 \le t \le \pi/2.$$

5. Suppose z is implicitly defined as a function of x and y by

$$z^3 - 2z^2x + 3zy + 2xy = 72.$$

Find $\dfrac{\partial z}{\partial x}$ and $\dfrac{\partial z}{\partial y}$.

6. Let $w = xy^2 + xz^2 + yz$ and $P = (\,2\ ,-1\ ,1\,)$. Find the directional derivative of w in the direction of $\mathbf{i} - \mathbf{j} + \mathbf{k}$.

7. Find the absolute maximum and absolute minimum of $3x - 2y + 2z + 4$ on the ellipsoid $x^2 + 2y^2 + 3z^2 = 12$. Also find all the points where they occur.

8. Let $f(x,y) = xy - x^2y - xy^2$. Find all critical points and classify (local maxima, local minima, saddle points).

9. Evaluate $\displaystyle\int_0^3 \int_0^{x^2-2x} xy\, dydx.$

10. Evaluate $\int_0^2 \int_0^{\sqrt{4-x^2}} \int_0^{\sqrt{4-x^2-y^2}} z\, dz dy dx.$

11. Find the centroid(center of mass) of the lamina

$$-\pi/2 \leq x \leq \pi/2, \qquad 0 \leq y \leq \cos x,$$

whose density function ρ is constant.

12. Find the surface area of the portion of the paraboloid $x^2 + y^2 = 9 - z$ that lies above the xy-plane.