Exam 1 - Ch. 12 Review Overheads

Exam 1 details:

- 2 questions where you will show work (could have one or two multiple choice, no work needed on those)
- A basic scientific calculator allowed (no graphing or calculus calculator)
- Allowed one **hand-written** 8.5 by 11 inch page of notes (double-sided)
- You MUST show your work on the handwritten problems.
- Covers 12.1-12.6. You should know all the facts and concepts covered in lecture and in homework for those sections.
- You have 40 minutes to complete the exam and enter your final answers. Then you have 10 minutes to upload your work.

Studying Advice:

- Spend time reviewing all homework.
- Spend time flipping through all the old exams (pages 1 and 2 of old exams).
- Spend several hours working through several old exams in detail.
- Practice managing your time, never spend more than 15 minutes on a page!

Exam 1 Basic Facts

1. Vector Operations: Sums, scalar multiples, dot products, cross products.

2. Vector Facts: checking orthogonality, checking parallel, angle between, area of parallelogram/triangle, projections.

3. Finding Line and Plane Equations.

4. Knowing basics of traces and knowing the 7 basic shapes and their names.

Basic Vector Facts:

1. $\mathbf{u} \cdot \mathbf{v} = u_1v_1 + u_2v_2 + u_3v_3$.

2. $\mathbf{u} \times \mathbf{v} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$.

3. $\mathbf{u} \cdot \mathbf{v} = |\mathbf{u}||\mathbf{v}| \cos(\theta)$.

4. $\mathbf{u} \cdot \mathbf{v} = 0$ means orthogonal.

5. $|\mathbf{u} \times \mathbf{v}| = |\mathbf{u}||\mathbf{v}| \sin(\theta)$.

6. $\mathbf{u} \times \mathbf{v}$ is orthogonal to both $\mathbf{u}$ and $\mathbf{v}$.

7. $|\mathbf{u} \times \mathbf{v}|$ = parallelogram area.

8. $\text{comp}_{\mathbf{a}}(\mathbf{b}) = \frac{\mathbf{a} \cdot \mathbf{b}}{|\mathbf{a}|}$.

9. $\mathbf{proj}_{\mathbf{a}}(\mathbf{b}) = \frac{\mathbf{a} \cdot \mathbf{b}}{|\mathbf{a}|^2}\mathbf{a}$.

Basic Lines, Planes and Surfaces:

1. Lines: $x = x_0 + at$, $y = y_0 + bt$, $z = z_0 + ct$
   (x_0, y_0, z_0) = a point on the line
   $\langle a, b, c \rangle$ = a direction vector

2. Planes: $a(x - x_0) + b(y - y_0) + c(z - z_0) = 0$
   (x_0, y_0, z_0) = a point on the plane
   $\langle a, b, c \rangle$ = a normal vector

3. Cylinder: One variable 'missing'
   (Assume a,b,c positive below)

4. Elliptical/Circular Paraboloid: $z = ax^2 + by^2$

5. Hyperbolic Paraboloid: $z = ax^2 - by^2$.

6. Ellipsoid/Sphere: $ax^2 + by^2 + cz^2 = 1$.

7. Elliptical/Circular Cone: $z^2 = ax^2 + by^2$.

8. Hyperboloid of One Sheet: $ax^2 + by^2 - cz^2 = 1$.

9. Hyperboloid of Two Sheets: $ax^2 + by^2 - cz^2 = -1$.