Exam 1 details:

- 1 question with a multiple choice and/or select-all questions (no partial credit)
- 2 questions where work is required (each will be similar to one page of an old exam).
- A TI 30X-IIs calculator is allowed (no graphing or calculus calculators, no other calculating resources)
- Allowed one **hand-written** 8.5 by 11 inch page of notes (double-sided)
- You MUST upload work on questions 2 and 3.
- Covers 12.1-12.6. You should know all the facts and concepts covered in lecture and in homework.
- You have 55 minutes to complete the exam. No excuse will be accepted for not typing in final answer, so make sure to do this well before time is out. Ideally you will finish in 40 minutes and use the last 15 minutes for upload.

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: $ax^2 + by^2 - cz^2 = -1$.