Math 233: Test 1B
Spring 2014
Instructor: Linda Green

1. Calculators are allowed.
2. You must show work for full and partial credit, except where otherwise noted.
3. Give exact values instead of decimal approximations, except where otherwise noted.
4. Sign the honor pledge after completing the exam.

   I have neither given nor received unauthorized help on this exam.

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1. (20 pts) Consider the three points $A = (0, 2, 3)$, $B = (-2, 1, 4)$, and $C = (1, 5, 5)$.

   (a) Find parametric equations for the line through A and B.

   (b) Find the area of the triangle with vertices A, B, and C.

   (c) Find an equation for the plane P through A, B, and C.

   (d) Find the angle that the plane P makes with the x-y plane. Give your answer in degrees to the nearest tenth.

2. (10 pts) Find the tangent vector and the unit tangent vector for the curve

$$\vec{r}(t) =< 3t^2, \sin(t) - t\cos(t), \cos(t) + t\sin(t) >$$

at the point $(3\pi^2, \pi, -1)$.

3. (12 pts) Which of the following represent lines in $\mathbb{R}^3$? Circle all correct answers. No work needed.

(a) All (x, y, z) such that $x = -2t$, $y = 3t + 1$, and $z = 4t + 6$ for $t \in \mathbb{R}$.

(b) $< t, t^2, t^3 >$ for $t \in \mathbb{R}$

(c) All (x, y, z) such that $5x + 4y + 3z = 2$ and $x + 4y - 7z = 17$

(d) All (x, y, z) such that $5y + 4 = 8z - 7$

(e) All (x, y, z) such that $5(x - 3) - 6(y + 2) + 3z = 0$

(f) $\vec{r}(t) = t^3\vec{i} + \vec{j} + 2t^3\vec{k}$ for $t \in \mathbb{R}$.

4. (15 pts) Consider the line $x + 5 = \frac{y}{2} = \frac{z}{3} - 1$ and the plane $-x + 2y - z = 7$.

   (a) Prove that the line and the plane do not intersect.

   (b) Pick any point Q on the line and any point P on the plane, and find the scalar projection of $\vec{PQ}$ onto the normal vector of the plane.

   (c) Find the (shortest) distance between the line and the plane.

5. (12 pts) Match the equations with the graphs. No work needed.

(a) $-x^2 + y^2 + z^2 = 0$

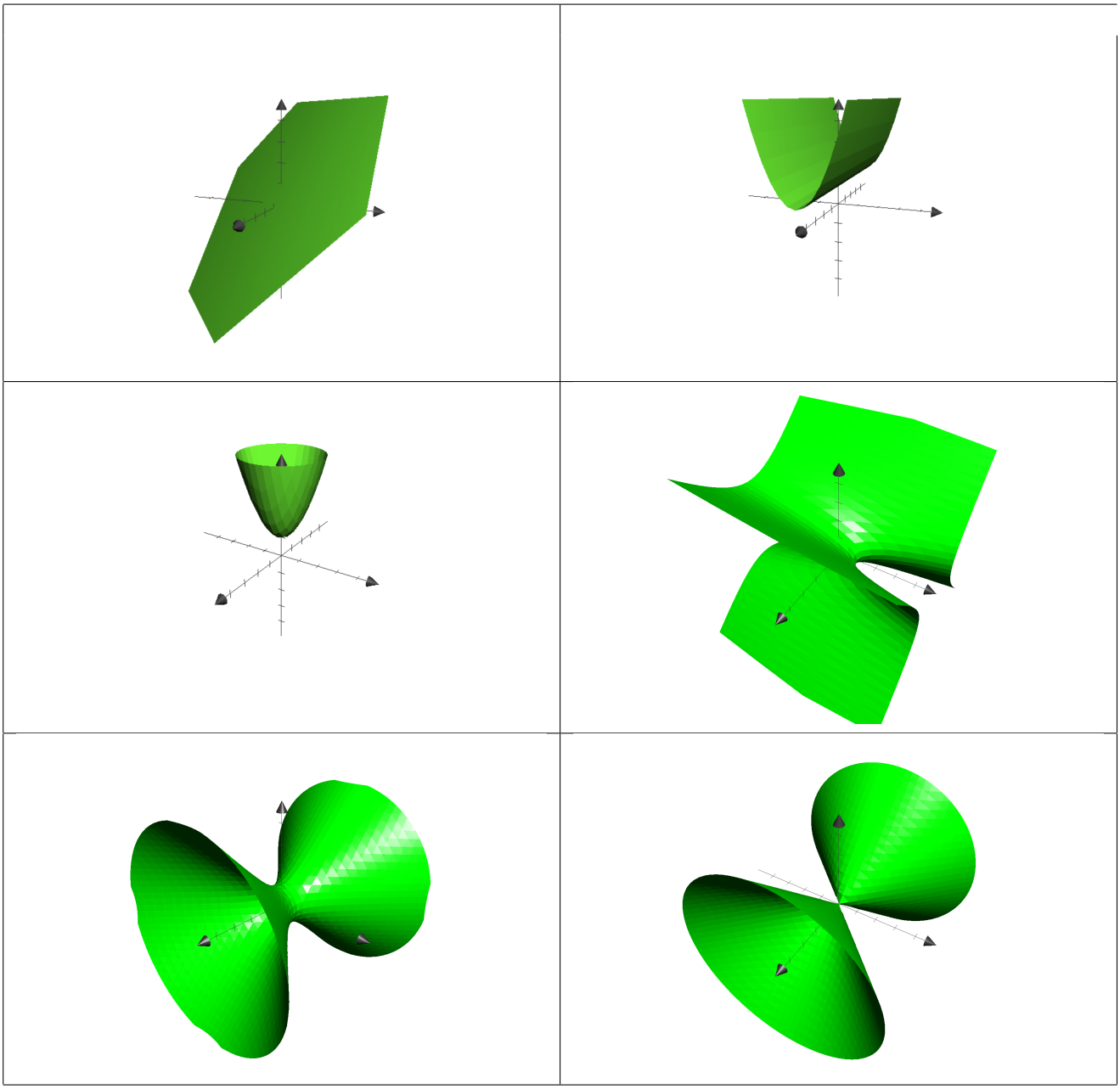
(b) $-x^2 + y + z^2 = 1$

(c) $x - y + z = 1$

(d) $-x^2 + y^2 + z^2 = 1$

(e) $-y^2 + z = 1$

(f) $-x^2 - y^2 + z = 1$



6. (10 pts) True or false. True means always true. False means sometimes or always false. No work needed.

   (a) **T** **F** $\vec{b} \circ (\vec{a} \times \vec{b}) = 0$

   (b) **T** **F** $\vec{a} \circ \vec{a} = 0$

   (c) **T** **F** The cross product of two unit vectors is a unit vector.

   (d) **T** **F** The dot product of two unit vectors is a unit vector.

   (e) **T** **F** $||\vec{a} \times \vec{b}|| \leq ||\vec{a}||\,||\vec{b}||$