1. Find the distance from $(3, 7, -5)$ to
(a) the x-axis.
(b) the xz-plane.

2. Show that the equation $x^2 + y^2 + z^2 = 4x - 2y$ represents a sphere. Find the center and radius.

3. Determine whether the vectors are orthogonal, parallel, or neither.
(a) $\mathbf{u} = \langle -3, 9, 6 \rangle$ and $\mathbf{v} = \langle 4, -12, -8 \rangle$.
(b) $\mathbf{u} = \mathbf{i} - \mathbf{j} + 2\,\mathbf{k}$ and $\mathbf{v} = 2\,\mathbf{i} - \mathbf{j} + \mathbf{k}$.
(c) $\mathbf{u} = \langle a, b, c \rangle$ and $\mathbf{v} = \langle -b, a, 0 \rangle$.

4. Find a unit vector that is orthogonal to $\mathbf{i} + \mathbf{j}$ and $\mathbf{i} - \mathbf{k}$.

5. Find the equation of the plane passing through the point $(1, -1, 1)$ and containing the line $x = 2y = 3z$.

6. A batter hits a baseball 1 meter above the ground. The ball leaves the bat with a speed of 40 m/s at an angle of elevation of $\frac{\pi}{3}$ radians, and heads toward the center field fence. The fence is 140 meters away, and 3 meters high. Does the ball clear the fence?

7. Determine the domain and range of $f(x, y, z) = e^{\sqrt{z - x^2 - y^2}}$.

8.Sketch five level curves of $f(x, y) = \sqrt{x + y}$. Clearly label each curve with the corresponding z-value.

9. Compute the first partial derivatives of $f(x, y, z) = xy\tan(yz)$.

10. Compute the linearization of $f(x, y) = \sqrt{x + e^{4y}}$ at $(3, 0)$, and use it to approximate $f(2.9, -0.1)$.

11. When is the tangent plane to the paraboloid $z = x^2 + 4y^2$ parallel to the plane $2x + y - z = 0$?

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1. Given a function $f(x, y)$ define $g(r, s) = f(2r - s, s^2 - 4r)$. Use the table below to compute $g_r(1, 2)$ and $g_s(1, 2)$.

	f	g	f_x	f_y
(0,0)	3	6	4	8
(1,2)	6	3	2	5

2. Find the maximum rate of change of $f(x, y, z) = \ln(xy^2z^3)$ at $(1, -2, -3)$ and the direction in which it occurs.

3. Find the points on the ellipsoid $3x^2 + 2y^2 + z^2 = 9$ where the tangent plane is parallel to the plane $3x - y + 3z = 1$.

4. Suppose $(0, 2)$ is a critical point of $g(x, y)$. In each case, what can you say about g?

(a) $g_{xx}(0, 2) = -1,\quad g_{xy}(0, 2) = 6,\quad g_{yy}(0, 2) = 1$

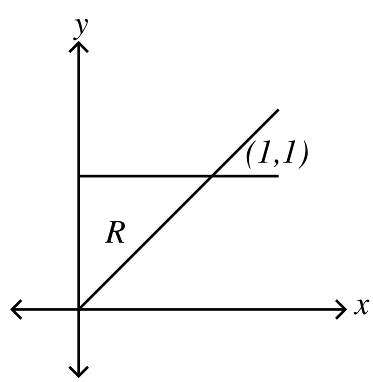
(b) $g_{xx}(0, 2) = -1,\quad g_{xy}(0, 2) = 2,\quad g_{yy}(0, 2) = -8$

(c) $g_{xx}(0, 2) = 4,\quad g_{xy}(0, 2) = 6,\quad g_{yy}(0, 2) = 9$

5. Find the volume of the largest rectangular box in the first octant with three faces in the coordinate planes and one vertex in the plane $x + 2y + 3z = 6$.

6. Sketch the region of integration for $\displaystyle\int_0^3 \int_0^{-\sqrt{9-y}} f(x, y)\, dx\, dy$.

7. Integrate the function e^{y^2} over the region



8. Given the information

$$-15 \leq f(x, y) \leq 6 \quad \text{and} \quad \text{Area}(R) = \tfrac{2}{3}$$

obtain upper and lower bounds for the integral $\displaystyle\iint_R f(x, y) dA$.