

Sample problems for Exam 1 for Math 233

This sample exam has many more questions than the actual exam will have.

- Let $\vec{a} = \langle 4, -3, -1 \rangle$ and $\vec{b} = \langle -2, -3, 5 \rangle$. Find (a) $\vec{a} + \vec{b}$ (b) $2\vec{a} - 3\vec{b}$
(c) $|\vec{a}|$ (d) $|\vec{b}|$ (e) $|\vec{a} + \vec{b}|$ (f) $\vec{a} \cdot \vec{b}$ (g) $\vec{a} \times \vec{b}$ (h) $\text{proj}_{\vec{a}}\vec{b}$ (i) $\text{proj}_{\vec{b}}\vec{a}$
- Find the angle between the vectors $\vec{a} = -4\vec{i} + 2\vec{j} + 3\vec{k}$ and $\vec{b} = 2\vec{i} + \vec{j} + 5\vec{k}$.
Find the angle that \vec{a} makes with the z -axis. (Note this is its ϕ in spherical coordinates.)
- Express the vector $\vec{u} = \langle 2, 4, 5 \rangle$ as a sum of vector \vec{m} parallel to $\vec{v} = \langle 2, -1, -2 \rangle$, and a vector \vec{n} perpendicular to \vec{v} .
- Find the area of the triangle with vertices $(1, 2, 3)$, $(3, 1, 5)$ and $(4, 5, 6)$.
- Find the area of the parallelogram with vertices $(-1, 2, 0)$, $(1, 0, 1)$, $(-2, 0, 0)$ and $(0, -2, 1)$.
- Find unit vectors perpendicular to the plane passing through the points $(1, 3, 5)$, $(3, -1, 2)$ and $(4, 0, 1)$.
- Find the parametric and symmetric equations of the line passing through the points $(4, 5, 6)$ and $(3, 2, 1)$.
- Find the parametric and symmetric equations of the line at the intersection of the planes, $3x - 3y - 7z = -4$ and $x - y + 2z = 3$.
- Find the equation of the plane passing through the points $(1, 3, 2)$, $(0, 3, 0)$ and $(2, 4, 3)$.
- Find the equation of a plane passing through point $(2, 1, 0)$ and containing the line $\frac{x-3}{2} = y = \frac{-8-z}{1}$.
- Find the equation of a plane perpendicular to the line $x = 2 + 3t$, $y = -t$, $z = -1 + t$ and passing through point $(0, 1, -1)$.
- Determine whether the points $(1, 1, 2)$, $(0, 1, 0)$ and $(1, 2, 3)$ are collinear.
- Determine whether the points $(0, 2, 1)$, $(0, 1, 0)$, $(1, 1, 0)$ and $(1, 2, 3)$ are coplanar.
- Find the equation of the plane perpendicular to the line $x = 1 + 2t$, $y = -3 + 4t$, $z = -1 - t$ and passing through the point $(-1, -1, 5)$.
- Find the distance between the parallel planes $3x + 3y - 9z = 4$ and $x + y - 3z = 1$.
- Describe and sketch the surface $z = x^2 - 4y^2$.
- Describe and sketch the surface $x^2 - y^2 - z^2 - 4 = 0$.
- Find the cylindrical and spherical coordinates for the point $P(\sqrt{3}, 1, 2\sqrt{3})$.
- Describe and sketch the surface given in spherical coordinates by $\phi = \pi/3$. Find the equations in cylindrical and cartesian coordinates for this surface.