

Math 252 Exam 1 Review (Problems)

- Find the center and radius of the sphere given by $x^2 + y^2 + z^2 - 8x + 6y = 0$
- Using $\mathbf{u} = \langle 8, 3, -5 \rangle$, $\mathbf{v} = \langle 4, -4, -2 \rangle$,
 - Find $3\mathbf{u} - 4\mathbf{v}$.
 - Find $\|\mathbf{u}\|$, $\|\mathbf{v}\|$.
- Using $\mathbf{u} = \langle 8, -4, 1 \rangle$ and $\mathbf{v} = \langle -4, 4, 2 \rangle$,
 - Find $\|\mathbf{u}\|$ and $\|\mathbf{v}\|$.
 - Find $\mathbf{u} \cdot \mathbf{v}$.
 - Find the angle θ between \mathbf{u} and \mathbf{v} .
 - Find $\text{proj}_{\mathbf{v}} \mathbf{u}$.
 - Find $\mathbf{u} \times \mathbf{v}$.
- Using $P(-2, 0, 3)$, $Q(1, 2, 4)$, $R(-3, 1, 0)$,
 - Find a vector orthogonal to the plane determined by P , Q and R .
 - Find an equation of the plane passing through P , Q and R .
 - Find the set of parametric equations for the line through Q and parallel to $\mathbf{a} = \langle 4, -3, -2 \rangle$.
 - Find the distance from the point $(-4, -1, 5)$ to the plane passing through P , Q and R .
- Identify via cross-sections the surface defined by $3x^2 - y^2 + 3z^2 + 9 = 0$.
- Identify via cross-sections the surface defined by $x = 3y^2 + 5z^2$.
- Identify via cross-sections the surface defined by $y = x^2$.
- Identify via cross-sections the surface defined by $2y^2 = 3z^2 = 12$.
- Using $\mathbf{r}(t) = \langle \cos t, \sin t, t^2 \rangle$, $t = \frac{\pi}{2}$:
 - Find the velocity vector.
 - Find the acceleration vector.
- A projectile is fired at a speed of 448 feet per second at an angle of 30 degrees from a tower 512 feet above the ground.
 - Give the position vector for any time t .
 - How far away will the object strike?
- Using $\mathbf{r}(t) = \langle 4 \cos(2t), 4 \sin(2t), 6t \rangle$,
 - Find $\mathbf{T}(t)$
 - Find $\mathbf{N}(t)$
 - Find the curvature
- Find the tangential and normal components of acceleration for the curve $\mathbf{r}(t) = \langle 3t^2, 4t^2, 10t \rangle$ at $t = 2$ and express a in terms of T and N .
- Using $\mathbf{u} = \langle -4, 6, 5 \rangle$ and $\mathbf{v} = \langle 2, -3, 1 \rangle$,
 - Find $\|\mathbf{u}\|$ and $\|\mathbf{v}\|$.
 - Find $\mathbf{u} \cdot \mathbf{v}$.
 - Find the angle θ between \mathbf{u} and \mathbf{v} .
 - Find $\text{proj}_{\mathbf{v}} \mathbf{u}$.
 - Find $\mathbf{u} \times \mathbf{v}$.
- Using $P(-4, 1, 2)$, $Q(1, -3, 4)$, $R(-1, 0, 2)$,
 - Find an equation of the plane passing through the points.
 - Find parametric equations for the line through P and parallel to $\mathbf{a} = \langle 2, -1, 4 \rangle$.
 - Find the distance from the point $(5, -3, 2)$ to the plane.
 - Find the area of the parallelogram determined by P , Q , and R .
- Identify the surface $x = y^2$.
- Identify the surface $4x^2 + 4y^2 + z^2 = 4$.
- Identify the surface $2x^2 - 3y^2 + 6z^2 = 6$.
- Identify the surface $x^2 - 6y + 5z^2 = 0$.
- A baseball is thrown from the stands 128 feet above the field at an angle of 30 degrees up from the horizontal with an initial speed of 64 feet per second.
 - Give the position vector for any time t .
 - When will the ball strike the ground?
 - How far away will the ball strike the ground?
 - What is the speed of the ball when it strikes the ground?
- Using $\mathbf{r}(t) = \langle t \cos t, t \sin t, t^2 \rangle$ at $t = 0$,
 - Find \mathbf{v} and \mathbf{a} .
 - Find \mathbf{T} and \mathbf{N} .
 - Find K .
 - By first finding $a_{\mathbf{T}}$ and $a_{\mathbf{N}}$, express $a = a_{\mathbf{T}}\mathbf{T} + a_{\mathbf{N}}\mathbf{N}$.

Math 252 Exam 1 Review (Answers)

1. $C(4, -3, 0), \rho = 5$
2. a. $\langle 8, 25, -7 \rangle$.
b. $\|\mathbf{u}\| = 7\sqrt{2}, \|\mathbf{v}\| = 6$.
3. a. $\|\mathbf{u}\| = 9, \|\mathbf{v}\| = 6$
b. $\mathbf{u} \cdot \mathbf{v} = -46$
c. $\theta = \arccos\left(-\frac{23}{27}\right) = 148.4^\circ$
d. $\text{proj}_{\mathbf{v}} \mathbf{u} = \left(-\frac{23}{18}\right) \langle -4, 4, 2 \rangle = \left\langle -\frac{46}{9}, -\frac{46}{9}, -\frac{23}{9} \right\rangle$
e. $\mathbf{u} \times \mathbf{v} = \langle -12, -20, 16 \rangle$
4. a. $\mathbf{n} = \mathbf{PQ} \times \mathbf{PR} = \langle -7, 8, 5 \rangle$
b. $-7x + 8y + 5z = 29$
c. $x = 1 + 4t, y = 2 - 3t, z = 4 - 2t; t \in \mathbb{R}$
d. $D = \frac{16}{\sqrt{138}}$
5. Circular hyperboloid of two sheets
6. Elliptical paraboloid
7. Parabolic cylinder
8. Elliptical cylinder
9. a. $\mathbf{v}(t) = \langle -\sin t, \cos t, 2t \rangle, \mathbf{v}\left(\frac{\pi}{2}\right) = \langle -1, 0, \pi \rangle$
b. $\mathbf{a}(t) = \langle -\cos t, -\sin t, 2 \rangle, \mathbf{a}\left(\frac{\pi}{2}\right) = \langle 0, -1, 2 \rangle$
10. a. $\mathbf{r}(t) = \langle 224\sqrt{3}t, -16t^2 + 224t + 512 \rangle$
b. $T = 16, x(16) = 224\sqrt{3}(16) \doteq 6207.7$ feet
11. a. $\mathbf{T}(t) = \left\langle -\frac{4}{5}\sin(2t), \frac{4}{5}\cos(2t), \frac{3}{5} \right\rangle$
b. $\mathbf{N}(t) = \langle -\cos(2t), \sin(2t), 0 \rangle$
c. $k = \frac{4}{25}$
12. $\mathbf{a} = 4\sqrt{5}\mathbf{T} + 2\sqrt{5}\mathbf{N}$
13. a. $\|\mathbf{u}\| = \sqrt{77}$
 $\|\mathbf{v}\| = \sqrt{14}$
b. $\mathbf{u} \cdot \mathbf{v} = -21$
c. $\theta = \arccos\left(\frac{-21}{7\sqrt{22}}\right)$
14. a. $2x + 6y + 7z - 12 = 0$
b. $x = 2t - 4, y = -t + 1, z = 4t + 2$
c. $D = \frac{6}{\sqrt{89}}$
d. $A = \sqrt{89}$
15. Parabolic cylinder
16. ANSWER
17. ANSWER
18. ANSWER
19. ANSWER
20. a. $\mathbf{v} = \langle -t \sin t + \cos t, t \cos t + \sin t, 2t \rangle$
 $\mathbf{a} = \langle -t \cos t - 2 \sin t, -t \sin t + 2 \cos t, 2 \rangle$
b. $\|\mathbf{v}\| =$
 $\mathbf{T} =$
 $\mathbf{N} =$