

Name: _____

VIP ID: _____

- Write your name and VIP ID in the space provided above.
- The test has five (5) pages, including this one.
- You have seventy-five (75) minutes to complete the test.
- Enter your answer in the box(es) provided.
- You must show sufficient work to justify all answers unless otherwise stated in the problem. Correct answers with inconsistent work may not be given credit.
- Credit for each problem is given in parentheses at the right of the problem number.
- No books, notes or calculators may be used on this test.

Page	Max. points	Your points
2	40	
3	25	
4	10	
5	25	
Total	100	

Problem 1 (15 pts—5 pts each part). Find the distances from the point $(3, 7, -5)$ to the three coordinate axes.

to the x -axis

to the y -axis

to the z -axis

Problem 2 (5 pts). Find an exact expression of $\cos \theta$ for the angle θ between the vectors $\mathbf{v} = \langle 3, -1, 5 \rangle$ and $\mathbf{w} = \langle -6, 2, -15 \rangle$.

$\cos \theta =$

Problem 3 (10 pts). Find a unit vector \mathbf{v} that is orthogonal to both $\mathbf{i} + \mathbf{j}$ and $\mathbf{i} - \mathbf{j} + \mathbf{k}$.

$\mathbf{v} =$

Problem 4 (5 pts). Determine whether the points $A = (0, -5, 5)$, $B = (1, -2, 4)$ and $C = (3, 4, 2)$ lie on a straight line.

☐ Yes

☐ No

Problem 5 (5 pts). Determine whether the points $A = (0, -5, 5)$, $B = (1, -2, 4)$, $C = (0, 0, 0)$ and $D = (3, 4, 2)$ are coplanar.

☐ Yes

☐ No

Problem 6 (10 pts). Consider the sphere that goes through the origin, and whose center is the point $P = (1, 3, 2)$. Find the equation of the circle of intersection of this sphere with the xy -plane.

circle:

Problem 7 (15 pts—5 pts each part). Consider the point $P = (0, 1, 1)$ and the line ℓ with parametric equations

$$\begin{cases} x = 3 + t \\ y = 2t \\ z = 1 - t \end{cases}$$

(a) Find the equation of a plane that goes through P and is perpendicular to ℓ .

plane:

(b) Compute the intersection of the line ℓ with that plane.

point:

(c) Compute the distance d from P to ℓ .

 $d =$

Problem 8 (10 pts—5 pts each part). Find parametric equations for the line of intersection of the planes $x + y + z = 1$ and $x + 2y + 2z = 1$. Find the cosine of the angle θ between the two planes.

line:

$$\begin{cases} x &= \\ y &= \\ z &= \end{cases}$$

 $\cos \theta =$

Problem 9 (15 pts—5 pts each part). The position of a particle in the xy -plane at time t is given by the following vector function:

$$\mathbf{r}(t) = \langle t + 3, t^2 - 3 \rangle.$$

Find an equation in x and y whose graph is the path of the particle. Find the velocity and acceleration vectors at $t = 5$.

equation:

velocity:

acceleration:

Problem 10 (10 pts). Find the curvature $\kappa(t)$ for the vector function $\mathbf{r}(t) = \langle 12 \sin t, 12 \cos t, 5t \rangle$.

$\kappa(t) =$