Name:

Read Me First: Show all essential work very neatly. Use correct notation when presenting your computations. Write using complete sentences. Remember this: "=" denotes "equals" , "⇒" denotes "implies" , and "⇔" denotes "is equivalent to". *Vector objects must be denoted by using arrows.* Since a correct answer really consists of all the magic transformations, do not "box" your final results. Show me all the magic on the page clearly.

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1. (5 pts.) Obtain parametric equations for the line through the points (4,4,0) and (1,0,-1).

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2. (5 pts.) Obtain a vector equation for the line through (-1,-2, 3) and parallel to the line defined by <x,y,z> = <2π,-π,3π> + t<-6,0,-10>, where t is any real number.

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3. (5 pts.) Obtain parametric equations for the line obtained when the two planes defined by x + 3y + 2z = 5 and x + 2y + z = 10 intersect.

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4. (5 pts.) Where does the line defined by the vector equation <x,y,z> = <12,-12,6> + t·<4,3,2> intersect the yz-plane??

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5. (5 pts.) What point (x_0,y_0) is seven-tenths of the way from P = (-2,-3) to Q = (48,7) ??

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6. (5 pts.) Suppose **v** = <-3,-2, 1> and **w** = <-1,2,4>. Then

v•**w** =

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7. (5 pts.) Suppose **v** = <-3,-2, 1> and **w** = <-2,2,1>. Then

v × **w** =

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8. (5 pts.) Suppose **v** = <-3,-2, 1> and **w** = <-1,2,4>. Then

$\text{proj}_{\mathbf{w}}(\mathbf{v})$ = ,

and the component of **v** perpendicular to **w** is

$\mathbf{w}_2$ = .

9. (5 pts.) Suppose **v** = <-3,-2, 1> and **w** = <-2,2,1>.
If α, β, and γ are the direction angles of **w**, then

$\cos(\alpha)$ = ,

$\cos(\beta)$ = ,and

$\cos(\gamma)$ = .

10. (5 pts.) Suppose **v** = <-3,-2, 1> and **w** = <-1,2,4>. What is the exact value of the angle θ between **v** and **w** ??

θ =

11. (5 pts.) Write a point-normal equation for the plane perpendicular to **v** = <-3,-2,1> and containing the point $(3\pi,2\pi,\pi)$.

12. (5 pts.) Write an equation for the plane passing through the point (4,-5, 6) and perpendicular to the line defined by the vector equation $\langle x,y,z\rangle = \langle 4e,25,2\pi\rangle + t\langle 2,-3,-3\rangle$.

13. (5 pts.) Find the exact value of the acute angle θ of intersection of the two planes defined by the two equations

$$x - 2y = -55 \quad \text{and} \quad 3y - 4z = 75.$$

θ =

14. (5 pts.) Write an equation for the plane which contains the line defined by <x,y,z> = <1,2,3> + t<3, -2, 1> and is perpendicular to the plane defined by x - 2y + z = 0.

15. (5 pts.) What is the radius of the sphere centered at (1, 0, 0) and tangent to the plane defined by x + 2y + z = 10?

16. (5 pts.) The equation

$$z = 3r^2 \cdot \cos^2(\theta)$$

is in cylindrical coordinates. Obtain an equivalent equation in terms of rectangular coordinates (x,y,z).

17. (5 pts.) The point $(5,-5\sqrt{3},10)$ is in rectangular coordinates. Convert this to spherical coordinates (ρ,θ,ϕ).

$(\rho,\theta,\phi) =$.

18. (5 pts.) Do the lines defined by the equations

$$\langle x,y,z\rangle = \langle 3,1,2\rangle + t\langle 2,-1,-2\rangle$$

and

$$\langle x,y,z\rangle = \langle 10,8,-5\rangle + t\langle 1,3,-1\rangle$$

intersect? If they do intersect, what is the point of intersection??

19. (5 pts.) What is the area of the triangle in three space with vertices at P = (1, 0, 0), Q = (0, 2, 0), and R = (0 , 0, 3).

20. (5 pts.) Do the three 2-space sketches of the traces in each of the coordinate planes of the surface defined by $y = 1 - x^2 - z^2$. Work below and label carefully. Then attempt to do a 3 - space sketch in the plane of the surface on the back of page 4.