1. Find the area of the region that shared between two curves $r =3a cosθ$ and $r=a(1+cosθ)$.
2. Determine the horizontal tangent of the curve $r= cosθ $.
3. For the points A(3,-4,-2) ,B(5,1,-3), C(-2,1,3) :
4. Locate each point in its octant
5. Find area of $∆ $ABC .
6. Find the distance from the (2,1,6) to the plane ABC .
7. Find the center and radius of the sphere $x^{2}+y^{2}+z^{2}+6x-4y-2z=0$
8. Find the center and radius of the sphere $x^{2}+y^{2}+2z^{2}+3x-7z=0$
9. by Applying the Definition of Work find the work done by **F** in acting from *P*

to *Q .*If F=50 N (newtons), and D=6 m

1. Find the angle between **u=2i**$-$**8j+4k** and **v=**$-$**6i+9j**$-$**3k .**
2. Find the angle $θ$ in the triangle ***ABC***determined by the vertices A(0,0) ,B(3,5),C(5,2) as shown in figure. 
3. Prove that the two vectors **u=3i**$-$**2j+k** and **v=2j+4k are** perpendicular**.**
4. Determine the value of **b** so that **a=3i+bj+5 k** and **c=2i-2j-3k** areorthogonal.
5. Find the vector projection of **u=8i+5j+2k** onto **v=i-2j-3k** and the scalar component of **u** in the direction of **v.**
6. write **u** as the sum of a vector parallel to **v** and a vector orthogonal to **v.**

$\rightharpoonaccent{ u}$**=4i+2j-6k**$ , \rightharpoonaccent{v}$**=3i-2j**

1. Find the angle between A=2i+4j+$\sqrt{5}$k and B=$-2i+4j-\sqrt{5}k$.
2. Write the vector B=3j+4k as the sum of a vector $B\_{1}$parallel to A, A=i+j and a vector $B\_{2}$ $⊥$ A .
3. Find the angle between the diagonal of a cube and the diagonal of one of its faces [hint: use a cube whose edges represent i,j,k].
4. Find the distance between the lines 2x+y=2 and 2x+y=4 .
5. Find the distance from the point p(4,3)to the line x+3y=6.
6. Sketch the line.
7. Write the normal to the line N=i+3j .
8. From the point R(0,2),P(4,3)
9. Find **A**$×B and B×A$ if

 **A=i+**$5$**j**$+3$**k** , **B=** $-$**2i+3j**$-$**4k**

1. **For the vertices *P*(1, -1, 0), *Q*(2, 1, -1), *R*( -1, 1, 2).**

 **Find:** 1) a Vector Perpendicular to the Plane.

 2) the area of the triangle with vertices.

 3) a unit vector perpendicular to the plane.

1. Find the length and direction of A$×B$and B$×A$.

 A=$-4i-7j-3k$,B=5i+4j$-2k$

1. Find a vector normal to the plane formed by the three points  **A(1,-3,2), B(4,0,-1), C(7,2,-1)**
* Find the distance from the origin to the plane **ABC,** by projecting $\rightharpoonaccent{OA}$onto **N .**
* Find area of$∆ $**ABC .**
1. Find the parametric equation for the line

through the point(-2,0,4) parallel to the vector $\rightharpoonaccent{v}$=2i+4j-2k .

1. Find the parametric equation for the line segment joining the two points P(-3,2.-3) and Q(1,-1,4) .
2. Find the distance from the point (1,1,5) to the line L :x=1+t, y=3-t, z=2t
3. Find an equation for the plane through $p\_{o}$(-3,0,7) perpendicular to N=5i+2j-k.
4. A:Find an equation for the plane through *A*(0, 0, 1),

 *B*(2, 0, 0), and *C*(0, 3, 0).

B:Find the distance from the point(1,1,3) to the plane 3x+2y+6z=6 .

1. Find the point in which the line : x=$\frac{8}{3}$ +2t ,y=$-2t$, z=1+t ,

meets the plane 3x+2y+6z=6 .

1. a)Find the angle between the planes

 3x-6y-2z=15 and 2x+y-2z=5.

b) Find the vector parallel to the line of intersection .

c) Find parametric equation for line which the two planes intersect.

OOFind parametric equations for the lines in the following problems:.

1. The line through the origin parallel to the vector 3j+k.
2. The line through (1, 1, 1) parallel to the *z*-axis.
3. The line through the point (3,-2,1) parallel to the line x=1+2t , y=2-t, z=3t.
4. The line through(2,4,5) perpendicular to the plane 3x+7y-5z=21.
5. The line through (2,3,0) perpendicular to the vector A=i+2j+3k and B=3i+4j+5k.
6. Find the distance from the point P(0,0,0) to the line :x=5+3t,y=5+4t,z=$-$3$-$5t.

OOFind equations for the plane :

1. the plane through (1,-1,3) parallel to the plane 3x+y+z=7.
2. the plane through $p\_{o}$(2,4,5) perpendicular to the line:x=5+t,y=1+3t,z=4t.
3. the plane through A(1,-2,1) $⊥$the vector from origin to A.
4. Find the particle’s velocity and acceleration vectors .Then find the particle’s speed at the given time, R(t)=3cos t i+3sin t j , t=$\frac{π}{4}$ .
5. R(t) is the position vector. Find the time in the given interval, when the velocity and acceleration vectors are orthogonal:
6. R(t)=(t$-\sin(t)i)+\left(1-cos t\right)j$ $0\leq t\leq 2π$
7. R(t)=i$+5\cos(tj)+3 sin t $k $0\leq t\leq π$
8. R(t) is the position vector. Find the angle between the particles velocity and acceleration vectors when t=0.

A)R(t)= $e^{t}$i+ $e^{t}$sin t j+ $e^{t}$cos t k

B)R(t)= $ln⁡(t^{2}$+1)i+ $tan^{-1}$t j+ $\sqrt{t^{2}+1}$ k

1. Find the R(t) from given *acceleration vector and initial condition. A(t)=3ti+4j+k v(0)=4i ,R(0)=5j.*
2. Find the length of one turn of the helix R(t)=$\cos(ti)+sin tj$ +t k
3. prove that $\rightharpoonaccent{A}$=6i$-10j$ and $\rightharpoonaccent{B}$=$\frac{6}{5}$i$-2j have the same direction$.
4. prove that $\rightharpoonaccent{A}$=3i$-4j$ and $\rightharpoonaccent{B}$=$-$i$+\frac{4}{3}j are in the 0pposite direction$.
5. Find unit vectors tangent and normal to the curve y=$\frac{x^{5}}{2}+\frac{1}{3}$ at (1,1) .
6. prove that the line segment joining the midpoints of two sides of triangle is parallel to and half as long as the third side .

OO In the following problems, express each of the vectors in the form $ai+bj$ :

1. $\rightharpoonaccent{p\_{1}p\_{2}}$ where $p\_{1}$(1,3) and $p\_{2}\left(2,-2\right).$
2. $\rightharpoonaccent{op\_{3}}$ ,o(0,0) ,$p\_{3}$ is the midpoint of the $p\_{1}$(2,-1) and $p\_{2}\left(-4,3\right).$
3. $\rightharpoonaccent{AB }$+$\rightharpoonaccent{CD}$ ,A(1,-4) ,B(3,0), C(-2,5), D(6,-6)
4. A unit vector making an angle of $30^{o}$with the positive y-axis .
5. A unit vector making an angle of $60^{o}$with the negative x-axis .
6. Unit vector obtained by rotating J=$120^{o}$ in the clockwise direction .

OO Find the length, the direction and the angle of a vector with the positive x-axis.

$53. \rightharpoonaccent{v}$ =i+j

$54. \rightharpoonaccent{v}$ =$\sqrt{3}$i+j

$55. \rightharpoonaccent{v}$ =2i$-3$j

OO A person on a hang glider is spiraling upward due to rapidly rising air on a path having position vector R(t)=(3 cos t)i+(3 sin t)j +$t^{2}$k The path is similar to that of a helix(although it’s *not* a helix) for 0$\leq t\leq 4π$.

 Find:

**56.** the velocity and acceleration vectors,

**57.** the glider’s speed at any time *t*,

**58.** the times, if any, when the glider’s acceleration is orthogonal to its velocity

**59.** Find $\frac{dF}{ds}$ as a function of s, if F(t)=i+ sin(t+1)j+$\sqrt{t}$k and t=$s^{2}-1$.

**60.** show that v(t)=sin ti+ cos tj+$\sqrt{3}$k has a constant length and is orthogonal to its derivative.

**61.** The acceleration of a particle is a=$\frac{d^{2}R}{dt^{2}}$=cos ti+sin tj .Find the particles position on a function of t if v(0)=j and R(0)=i.

**62.** Find the value of $\frac{∂f}{∂x}$ , $\frac{∂f}{∂y}$ if f(x,$y$)=4$x^{3}y^{2}-3xy-y^{4}$+$x^{2}$+6x$-$7y$-$2 .

 63. Find the partial derivatives of f with respect to each variable:f(x,$y,z$)=1+x$y^{2}-2z^{2}$

OO Find the value of $\frac{∂f}{∂x}$ , $\frac{∂f}{∂y}$ if:

64. F(x,y)=$x^{2}$ $(y+2)$

65. F(x,y)=($x^{2}$ $-1)(y+2)$

66. F(x,y)=$e^{-x}\sin((x+y))$

$67. cos^{2}$(3x$-y^{2}$)

**OO** Find the partial derivative of the function with respect to each variable.

 68. F(x,y,z)=1+$y^{2}$+2$z^{2}$x .

69. F(t,$α)=\cos(\left(2πt-α\right))$

70. G(u,v)=$v^{2}e^{(2u/v)}$

71. H($ρ,∅,θ)=ρ sin∅ cosθ$

72. G(r,$θ,z)=r\left(1-cosθ\right)-z$

73. W(p,k,$δ,v,g)=pk+\frac{kδv^{2}}{2g}$

74. A(c,h,n,m,q)= $\frac{nm}{q}$ + cm+ $\frac{hq}{2}$

**75.** assume that the equation xy+$z^{3}$x$-2yz=0$ defines z as a differentiable function of the two independent variables x and y. find the value of $\frac{∂z}{∂x}$ at the point (x,y,z)=(1,3,1).

**76.** assume that the equation xZ+$y ln$x$+x^{2}+4=0$ defines x as a differentiable function of the two independent variables y and z. find the value of $\frac{∂x}{∂z}$ at the point (x,y,z)=(1,$-$3,$-$1).

OO Find the partial derivative of the function with respect to each variable.

77. F(x,y,z)=1+$y^{2}$+2$z^{2}$x .

78. F(t,$α)=\cos(\left(2πt-α\right))$

79. G(u,v)=$v^{2}e^{(2u/v)}$

80. H($ρ,∅,θ)=ρ sin∅ cosθ$