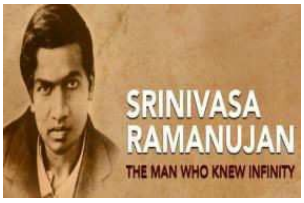
	SRM Institute of Science and Technology **Kattankulathur**	
	DEPARTMENT OF MATHEMATICS	
	18MAB102T Advanced Calculus and Complex Analysis	
	UNIT –II Vector Calculus	

Sl.No.	Tutorial Sheet -1	Answers
	Part – A	
1	**Find grad φ for the following functions.** **(i) $\varphi=3x^2y-y^3z^2$ at the point (1,-2,1)** **(ii) $\varphi=\log(x^2+y^2+z^2)$ at the point (1,2,1)**	**(i) -12i-9j+16k** **(ii) (1/3)(i+2j+k)**
2	**Find the directional derivative of the following functions** **(i) $\varphi=x^2yz+4xz^2$ at the point (1,-2,-1) in the direction 2i-j-2k** **(ii) $\varphi=x^2-2y^2+4z^2$ at the point (1,1,-1) in the direction 2i-j-k**	**(i)37/3** **(ii) $16/\sqrt{6}$**
3	**Find a unit normal vector to the following surfaces** **(i) $x^3+y^3+3xyz=3$ at the point (1,2,-1)** **(ii) $xy^2z^3=1$ at the point (1,1,1)**	**(i)$(1/\sqrt{126})(-3i+9j+6k)$** **(ii)$(1/\sqrt{14})(i+2j+3k)$**
4	**Find the maximum directional derivative of the following functions** **(i)$\varphi=x^3yz$ at the point (1,4,1)** **(ii)$\varphi=xyz^2$ at the point (1,0,3)**	**(i)$\sqrt{161}$** **(ii)9**
5	**In what direction from (3,1,-2) is the directional derivative of $\varphi=x^2y^2z^4$ maximum? Find also the magnitude of this maximum.**	**(96)(i+3j-3k)** **$96\sqrt{19}$**
6	**Find the angle between the following surfaces** **(i) $x^2+y^2+z^2=9$ and $x^2+y^2-z=3$ at the point (2,-1,2)** **(ii) $x^2+yz=2$ and x+2y-z=2 at the point (1,1,1)**	**(i)$\cos^{-1}(8/3\sqrt{21})$** **(ii) $\pi/3$**
7	**If $\vec{r}$ is the position vector of (x,y,z) w.r.to origin, then prove that** **(i) div $\vec{r}$ =3** **(ii) curl $\vec{r}$ =0** **(iii) grad$(r^n)=nr^{n-2}\vec{r}$**	
	Part – B	
8	**Show that the vector field $F=(x^2-yz)i+(y^2-xz)j+(z^2-xy)k$ is irrotational. Find a scalar φ such that F= grad φ**	**$\varphi=(1/3)(x^3+y^3+z^3)-xyz+C$**
9	**Find the constants a,b and c so that $F=(x+2y+az)i+(bx-3y-z)j+(4x+cy+2z)k$ may be irrotational. Also, find the scalar potential?**	**a=4, b=2, c=-1** **$\varphi=(x^2/2-3y^2/2+z^2)+2xy+4zx-yz+C$**
10	**Show that $F=(y^2-z^2+3yz-2x)i+(3xz+2xy)j+(3xy-2xz+2z)k$ is irrotational and solenoidal.**	