Find the total derivative

1) $f(x,y) = 9 - x^2 + 3y^2$

2) $\vec{r}(t) = \langle t, \cos t, \sin t \rangle$

3) $f(x,y,z) = xy^2z^3$

4) $f(u,v) = \langle u^2, v^2, u-v \rangle$

5) $F(x,y) = \langle -y, x \rangle$

6) $\phi(r,\theta) = \langle r\cos\theta, r\sin\theta \rangle$

Sol 1) $Df(x,y) \begin{bmatrix} f_x & f_y \end{bmatrix} = \begin{bmatrix} -2x & 6y \end{bmatrix}$

2) $D\vec{r}(t) = \begin{bmatrix} 1 \\ -\sin t \\ \cos t \end{bmatrix}$

3) $Df(x,y,z) = \begin{bmatrix} y^2z^3 & 2xyz^3 & 3xy^2z^2 \end{bmatrix}$

4) $Df(u,v) = \begin{bmatrix} 2u & 0 \\ 0 & 2v \\ 1 & -1 \end{bmatrix}$

5) $DF(x,y) = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$

6) $D\phi(r,\theta) = \begin{bmatrix} \cos\theta & -r\sin\theta \\ \sin\theta & r\cos\theta \end{bmatrix}$