1. Find $\frac{\mathrm{d} w}{\mathrm{~d} t}$ at $t=\pi / 4$ if $w=x y+y z+z x$ and $x=\cos t, y=\sin t$ and $z=\cos 2 t$
2. A cylindrical can of radius $r$ and height $h$ is heated. The radius increases at a rate of 0.0015 $\mathrm{cm} / \mathrm{min}$ and the height increases at a rate of $0.0025 \mathrm{~cm} / \mathrm{min}$.
(a) Find the rate of increase of the volume of the can when $\mathrm{r}=2 \mathrm{~cm}$ and $\mathrm{h}=6 \mathrm{~cm}$.
(b) Find the rate of increase of the surface area of the can when $\mathrm{r}=2 \mathrm{~cm}$ and $\mathrm{h}=6 \mathrm{~cm}$.
3. A charged particle moves along a path given by $x=5 \cos t-3$ and $y=4 \sin t$ in the presence of a potential, $V=-\frac{1}{\sqrt{x^{2}+y^{2}}}$
(a) Find the rate of change in the potential when $t=\pi / 2$
(b) Find the maximum and minimum value of the potential along the particle path.
