**Please show with steps showing how to arrive at the final answer**

(a) Find the work done by the force $\underline{F} = (y-2x)\underline{i} + (-x)\underline{j}$, as it moves a particle from the point (0,1) to (1,0) along parabola $C_1$ given by $y=1-x^2$, and then return through the 3-quarter unit circle, $C_2$ centre at the origin, from (1,0) to (0,1)

The 3-quarter circle $C_2$ can be parametrized by the equations x= cost, y= −sint where t goes from t=0 to t=$\frac{3\pi}{2}$.

Does the answer remains if $C_2$ is replaced by another part of the circle, $C_3$ in opposite direction parametrized by x= cost, y= sint where t goes from t=0 to t=$\frac{\pi}{2}$?

( 14 marks)

(b) The region *R* in the *xy*-plane is bounded by the lines $x+y=1$, $y-x=1$ and $y=3$.

(i) Sketch the region *R*; (2 marks)

(ii) Find the limits of the integration for

$\iint_R (y^2-2x)dxdy$ and $\iint_R (y^2-2x)dydx$; ( 12 marks)

(iii) Evaluate the integral over *R*. (3 marks)