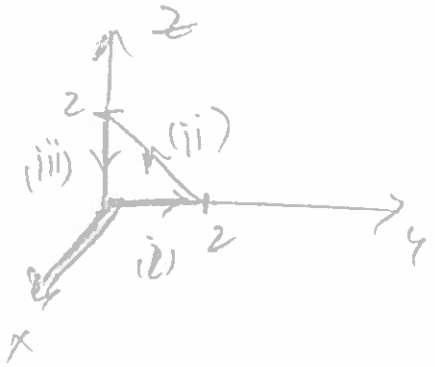
$$\oint \bar{v}\cdot d\bar{l}$$

$$\bar{v}\cdot d\bar{l} = (xy\,\hat{i} + 2yz\,\hat{j} + 3zx\,\hat{k})\cdot(dx\,\hat{i} + dy\,\hat{j} + dz\,\hat{k})$$

$$= xy\,dx + 2yz\,dy + 3zx\,dz$$

$dx = 0$



$$\int_{(i)} \bar{v}\cdot d\bar{l} + \int_{(ii)} \bar{v}\cdot d\bar{l} + \int_{(iii)} \bar{v}\cdot d\bar{l}$$

(i) $x = 0 = z = dx = dz$, $\bar{v}\cdot d\bar{l} = 0$

(ii) $z = 2-y$, $x = 0$, $dx = 0$; $\bar{v}\cdot d\bar{l} = 0 + \underline{\underline{2y(2-y)dy}} + 0$

$$\int_{(ii)} \bar{v}\cdot d\bar{l} = \int_2^0 2y(2-y)\,dy = \frac{2\times 4\,y^2}{\cancel{2}} - \frac{2y^3}{3}\Big|_2^0 = 0 - \left(2\times 4 - \frac{2}{3}\times 8\right)$$

$$= \frac{-8}{3}$$

(iii) $x = 0$, $y = 0$, $dx = 0$, $dy = 0$ $\int_{(iii)} \bar{v}\cdot d\bar{l} = 0 + 0 + 0 = 0$