Q2) Evaluate $\int F \cdot dr$ for $\vec{F} = (2x+y)i + (3y-x)j$

a) the straight line joining the point $(0,0) \rightarrow (3,2)$

$$\frac{x-0}{3-0} = t = \frac{y-0}{2-0}$$

$x = 3t \quad y = 2t$

$$\boxed{dx = 3 \cdot dt \mid dy = 2 \cdot dt}$$

$w = (2x+y) \cdot dx + (3y-x) \cdot dy$

$w = (2 \times 3t + 2t) \cdot 3 \cdot dt + (3 \times 2t - 3t) \cdot 2 \cdot dt$

$= 24t \cdot dt + 6t \cdot dt$

$= 30t \cdot dt \quad 30 \left(\frac{t^2}{2}\right)_0^1 = \underline{\underline{15}}$

Q2)

b) Along the path joining (0, 0) to (2, 0) and then from (2, 0) to (0, 3)

$$W = \int_{(0,0)}^{(0,3)} F \cdot d\bar{r}$$

$$W = \underbrace{\int_{(0,0)}^{(2,0)} \bar{F} \cdot d\bar{r}}_{W_1} + \underbrace{\int_{(2,0)}^{(0,3)} \bar{F} \cdot d\bar{r}}_{W_2}$$

$$W_1 = \int_{(0,0)}^{(2,0)} \bar{F} \cdot dr$$

$(0,0) \to (2,0)$

$$\frac{x-0}{2-0} = \frac{y-0}{0-0} = t$$

$x = 2t \quad y = 0$

$\boxed{dx = 2 \cdot dt} \quad \boxed{dy = 0}$

$$W = \int (2x+y) \cdot dx + (3y - x) \cdot dy$$

$$= \int 2 \cdot 2t \cdot 2 \cdot dt + 0$$

$$= \int 8t \cdot dt$$

$$W = 8\left(\frac{t^2}{2}\right)_0^1 \quad \boxed{W_1 = 4}$$

$$W_2 = \int_{(2,0)}^{(0,3)} F \cdot dr$$

$(2,0) \to (0,3)$

$$\frac{x-2}{0-2} = \frac{y-0}{3-0} = t$$

$x = 2 - 2t \quad y = 3t$

$\boxed{dx = -2dt} \quad \boxed{y = 3dt}$

$$W_2 = \int_0^1 [2(2-2t) + 3t](-2)dt + [3(3t) - (2-2t)] \cdot 3dt$$

$$W_2 = \int_0^1 (-8 + 8t - 6t) \cdot dt + (27t - 6 + 6t) \cdot dt$$

$$W_2 = \int_0^1 2t - 8 + 33t - 6$$

$$W_2 = \left[\frac{2t^2}{2} - 8t + \frac{33t^2}{2} - 6t\right]_0^1$$

$$W_2 = 2 - 8 + \frac{33}{2} - 6$$

$$W_2 = \frac{7}{2}$$

$$W = W_1 + W_2 = 4 + \frac{7}{2}$$

$$= 15/2.$$