

$$(15) F(x,y,z) = \langle yz, xz, xy+2z \rangle \quad (1,0,-2) \quad (4,6,3)$$

$$a.) F(x,y,z) = \int P dx = \int yz dx = xyz + g(y,z) + C$$

$$F(x,y,z) = \int Q dy = \int xz dy = xyz + g(x,z)$$

$$f(x,y,z) = \int R dz = \int xy+2z dz = xyz + z^2 + g(x,y)$$

$$\boxed{F(x,y,z) = xyz + z^2}$$

$$b) \int_C F dr = F(4,6,3) - F(1,0,-2) = (24(3) + 9 + C) - (0 + 4 + C) \\ = 24(3) + 5 = \boxed{77}$$

$$(19) \int_C zxe^{-y} dx + (2y - x^2e^{-y}) dy \quad (1,0) \quad (2,1)$$

$$F_x = P = 2xe^{-y} \quad F_y = Q = 2y - x^2e^{-y}$$

$$P_y = -2xe^{-y} \quad Q_x = -2xe^{-y} \quad P_y = Q_x \quad \text{conservative}$$

$$f(x,y) = \int (2y - x^2e^{-y}) dy = y^2 + x^2e^{-y} + C$$

$$\int_C F dr = f(2,1) - f(1,0) = \left(1 + \frac{4}{e} + C\right) - (0 + 1 + C) = \boxed{\frac{4}{e}}$$