Question 2

Let u = x^2, therefore du = 2x dx, therefore $\frac{1}{2}$du = x dx

Therefore (u)($\frac{1}{2}$ du) = (x^2)(x dx), therefore $\frac{1}{2}$ u du = x^3 dx

Therefore $\int x^3 cos(x^2)dx = \frac{1}{2} \int ucos(u)du$

Let v = u, and dw = cos(u) du, therefore dv = du, and w = sin(u)

Therefore $\int ucos(u)du = \int vdw$ = vw - $\int wdv$ (By integration by parts)

Therefore $\int ucos(u)du$ = usin(u) - $\int sin(u)du$ = usin(u) - (-cos(u)) + C_1

= usin(u) + cos(u) + C_1 = x^2sin(x^2) + cos(x^2) + C_1

Therefore $\frac{1}{2} \int ucos(u)du = \frac{1}{2}$ (x^2sin(x^2) + cos(x^2) + C_1)

= $\frac{1}{2}$ x^2sin(x^2) + $\frac{1}{2}$ cos(x^2) + $\frac{1}{2}$ C_1 = $\frac{1}{2}$ x^2sin(x^2) + $\frac{1}{2}$ cos(x^2) + C

Therefore $\int x^3 cos(x^2)dx = \frac{1}{2}$ x^2sin(x^2) + $\frac{1}{2}$ cos(x^2) + C, QED