16.2

#20. $\vec{F} = \langle x+y^2, \ xz, \ y+z \rangle$

$\vec{r}(t) = \langle t^2, \ t^3, \ -2t \rangle, \quad 0 \le t \le 2$

$\vec{F}(\vec{r}(t)) = \langle t^2 + (t^3)^2, \ t^2 \cdot (-2t), \ t^3 - 2t \rangle$

$= \langle t^2 + t^6, \ -2t^3, \ t^3 - 2t \rangle$

$\vec{r}\,'(t) = \langle 2t, \ 3t^2, \ -2 \rangle$

$\vec{F}(\vec{r}(t)) \cdot \vec{r}\,'(t)$

$= (t^2 + t^6)(2t) + (-2t^3)(3t^2) + (t^3 - 2t)(-2)$

$= \cancel{2t^3} + 2t^7 - 6t^5 - \cancel{2t^3} + 4t$

$= 2t^7 - 6t^5 + 4t$

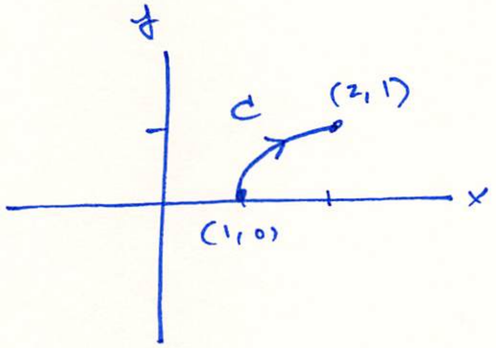
$$\int_C \vec{F} \cdot d\vec{r} = \int_0^2 2t^7 - 6t^5 + 4t \, dt$$

$$= \frac{t^8}{4} - t^6 + 2t^2 \Big]_0^2$$

$$= \cancel{\frac{2^8}{4}} - \cancel{2^6} + 2 \cdot 2^2$$

$$= 8$$

#40. $\vec{F} = \langle x^2, ye^x \rangle$



$$\vec{r}(t) = (t^2+1)\vec{i} + t\vec{j}$$

$$= \langle t^2+1, t \rangle$$

$$0 \le t \le 1$$

$$\vec{F} = \left\langle (t^2+1)^2, \; t \cdot e^{t^2+1} \right\rangle$$

$$\vec{r}\,' = \langle 2t, 1 \rangle$$

$$\vec{F} \cdot \vec{r}\,' = (t^2+1)^2 \cdot 2t + te^{t^2+1}$$

$$\text{work} = \int_C \vec{F} \cdot d\vec{r}$$

$$= \int_0^1 (t^2+1)^2 2t + te^{t^2+1} \, dt$$

$$= \int_0^1 (t^4 + 2t^2 + 1) 2t \, dt + \int_0^1 te^{t^2+1} \, dt$$

$$= 2\int_0^1 t^5 + 2t^3 + t \, dt \quad + \int_0^1 t e^{t^2+1} \, dt$$

$u = t^2 + 1$

$du = 2t\,dt$

$u(0) = 1$

$u(1) = 2$

$$= 2\left[\frac{t^6}{6} + \frac{t^4}{2} + \frac{t^2}{2} \right]_0^1$$

$$+ \int_1^2 e^u \left(\tfrac{1}{2} du \right)$$

$$= \cancel{2}\left[\frac{1}{\cancel{6}_{3}} + \frac{1}{\cancel{2}} + \frac{1}{\cancel{2}} \right] + \frac{1}{2} e^u \Big|_1^2$$

$$= \frac{7}{3} + \frac{1}{2}\left(e^2 - e \right)$$