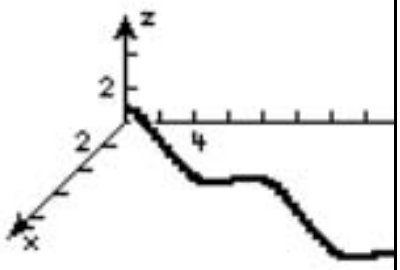
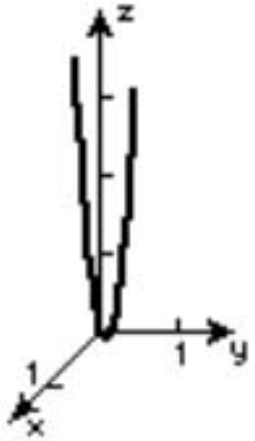
Sec 9.1

3.



11. $x = t,\ y = t,\ z = t^2 + t^2 = 2t^2;\ \ \mathrm{r}(t) = t\mathrm{i} + t$



25. $\mathrm{r}(t) = t\mathrm{i} + \frac{1}{2}t^2\mathrm{j} + \frac{1}{3}t^3\mathrm{k};\ \ \mathrm{r}(2) = 2\mathrm{i} + 2\mathrm{j} + \frac{8}{3}\mathrm{k};\ \ \mathrm{r}'(t) = \mathrm{i} + t\mathrm{j} + t^2\mathrm{k};\ \ \mathrm{r}'(2) = \mathrm{i} + 2\mathrm{j} + 4\mathrm{k}$

Using the point $(2, 2, 8/3)$ and the direction vector $\mathrm{r}'(2)$, we have $x = 2 + t$, $y = 2 + 2t$, $z = 8/3 + 4t$.

28. $$\frac{d}{dt}[\mathrm{r}(t)\cdot(t\mathrm{r}(t))] = \mathrm{r}(t)\cdot\frac{d}{dt}(t\mathrm{r}(t)) + \mathrm{r}'(t)\cdot(t\mathrm{r}(t)) = \mathrm{r}(t)\cdot(t\mathrm{r}'(t) + \mathrm{r}(t)) + \mathrm{r}'(t)\cdot(t\mathrm{r}(t))$$
$$= \mathrm{r}(t)\cdot(t\mathrm{r}'(t)) + \mathrm{r}(t)\cdot\mathrm{r}(t) + \mathrm{r}'(t)\cdot(t\mathrm{r}(t)) = 2t(\mathrm{r}(t)\cdot\mathrm{r}'(t)) + \mathrm{r}(t)\cdot\mathrm{r}(t)$$

41. $\mathrm{r}'(t) = -a\sin t\mathrm{i} + a\cos t\mathrm{j} + c\mathrm{k};\ \ \|\mathrm{r}'(t)\| = \sqrt{(-a\sin t)^2 + (a\cos t)^2 + c^2} = \sqrt{a^2 + c^2}$

$$s = \int_0^{2\pi}\sqrt{a^2 + c^2}\,dt = \sqrt{a^2 + c^2}\,t\,\Big|_0^{2\pi} = 2\pi\sqrt{a^2 + c^2}$$