

$$5. \vec{r}(t) = 3\sqrt{t} \vec{i} + t \vec{j} - e^t \vec{k}$$

$$\begin{aligned} \|\vec{r}(t)\| &= \sqrt{(3\sqrt{t})^2 + t^2 + (-e^t)^2} \\ &= \sqrt{9t + t^2 + e^{2t}} \end{aligned}$$

$$6. \quad P(\underbrace{2}_{x_1}, \underbrace{1}_{y_1}, \underbrace{-3}_{z_1}) \quad Q(\underbrace{4}_{x_2}, \underbrace{7}_{y_2}, \underbrace{-5}_{z_2})$$

$$\vec{v} = \langle 4-2, 7-1, -5-(-3) \rangle = \langle \underbrace{2}_a, \underbrace{6}_b, \underbrace{-2}_c \rangle$$

$$\vec{r}(t) = (x_1 + at) \vec{i} + (y_1 + bt) \vec{j} + (z_1 + ct) \vec{k}$$

$$\vec{r}(t) = (2 + 2t) \vec{i} + (1 + 6t) \vec{j} + (-3 - 2t) \vec{k}$$

$$x = 2 + 2t \quad y = 1 + 6t \quad z = -3 - 2t$$

$$7. \vec{r}(t) = (5t) \vec{i} + \frac{t}{4} \vec{j} - 5t \vec{k}$$

$$\vec{u}(t) = (9t^3) \vec{i} + t \vec{j} - 7t \vec{k}$$

$$\vec{r}(t) \cdot \vec{u}(t) = 5t(9t^3) + \left(\frac{t}{4}\right)(t) + (-5)(-7t)$$

$$= 45t^4 + \frac{1}{4}t^2 + 35t$$