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$$1. F = x^2 i + (3x+2)j + \sin x k$$

$$a. \frac{\partial F}{\partial x} = 2xi + 3j + \cos x k$$

$$b. \frac{\partial^2 F}{\partial x^2} = 2i - \sin x k$$

$$c. \left| \frac{\partial F}{\partial x} \right| = \sqrt{2^2 + 3^2 + 1^2} \quad \text{at } x = \left| \frac{dF}{dx} \right| = 2i + 3j + k$$
$$= \sqrt{13}$$

$$F \cdot F = [x^2 i + (3x+2)j + \sin x k] \cdot [x^2 i + (3x+2)j + \sin x k]$$

$$= x^4 + (3x+2)^2 + \sin^2 x \quad [i \cdot i = j \cdot j = k \cdot k = 1]$$

$$\frac{\partial(F \cdot F)}{\partial x} = 4x^3 + 2(3)(3x+2) + 2 \cos x$$
$$= 4x^3 + 6(3x+2) + 2 \cos x$$

$$\text{at } x = 1$$

$$= 4 + 6(5) + 2(1) = 36$$

$$z \cdot r = (e^{3t} + 3e^{3t})i - 2\sin 3tj + 3e^{3t}k$$

$$a. \frac{dr}{dt} = (2e + 3)i - 6\cos 3tj + 9e^{3t}k$$

$$b. \frac{d^2r}{dt^2} = 2i + 18\sin 3tj + 27e^{3t}k$$

$$c. \text{at } t=0$$

$$\left. \frac{d^2r}{dt^2} \right|_{t=0} = 2i + 0 + 27k$$

$$\left| \frac{d^2r}{dt^2} \right| = \sqrt{2^2 + 27^2} = 27.07$$