1. $x^2 + y^2 = 5$

$$\frac{d}{dt}(x^2) + \frac{d}{dt}(y^2) = \frac{d}{dt}(5)$$

$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$$

a) $x=2,\ y=1,\ \frac{dx}{dt}=5$

$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$$

$$2(5) + 1\cdot\frac{dy}{dt} = 0$$

$$10 + \frac{dy}{dt} = 0$$

$$\boxed{\frac{dy}{dt} = -10}$$

b) $x=1,\ y=2,\ \frac{dy}{dt} = -3$

$$1\cdot\frac{dx}{dt} + 2(-3) = 0$$

$$\frac{dx}{dt} - 6 = 0$$

$$\boxed{\frac{dx}{dt} = 6}$$

2. $D = \sqrt{(y_2 - y_1)^2 + (x_2 - x_1)^2}$

origin $(0,0)$ (x_1, y_1) moving point $(x, \cos x)$ (x_2, y_2)

$$D = \sqrt{(\cos x - 0)^2 + (x-0)^2}$$

$$D = \sqrt{(\cos x)^2 + x^2}$$

$$D = \left((\cos x)^2 + x^2\right)^{\frac{1}{2}}$$

$$\frac{d}{dt}(D) = \frac{d}{dt}\left[(\cos x)^2 + x^2\right]^{\frac{1}{2}}$$

$$\frac{dD}{dt} = \frac{1}{2}\left[(\cos x)^2 + x^2\right]^{\frac{1}{2}-1}\cdot\frac{d}{dt}\left[(\cos x)^2 + x^2\right]$$

$$\frac{dD}{dt} = \frac{1}{2}\left[(\cos x)^2 + x^2\right]^{-\frac{1}{2}}\cdot\left[2(\cos x)^1\cdot(-\sin x) + 2x\right]\frac{dx}{dt}$$

$$= \frac{-2\cos x \sin x + 2x}{2\left[(\cos x)^2 + x^2\right]^{1/2}}\cdot\frac{dx}{dt}$$

$$= \frac{2\left[-\cos x \sin x + x\right]}{2\left[(\cos x)^2 + x^2\right]^{1/2}}\cdot 5$$

$$= \frac{5(-\cos x \sin x + x)}{\sqrt{\cos^2 x + x^2}}$$