10.3 #2

(2) $r = 3 + 2\sin\theta$; $\theta = \frac{\pi}{6}$

We know $x = r\cos\theta$ and $y = r\sin\theta$, so

$$\frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{r\cos\theta + \sin\theta \frac{dr}{d\theta}}{r(-\sin\theta) + \cos\theta \frac{dr}{d\theta}}$$

$$= \frac{(3 + 2\sin\theta)(\cos\theta) + (\sin\theta)(2\cos\theta)}{(3 + 2\sin\theta)(-\sin\theta) + (\cos\theta)(2\cos\theta)}$$

$$\frac{dy}{dx}\bigg|_{\theta = \frac{\pi}{6}} = \frac{(4)(\frac{\sqrt{3}}{2}) + (\frac{1}{2})(\sqrt{3})}{(4)(-\frac{1}{2}) + (\frac{\sqrt{3}}{2})(\sqrt{3})} = \frac{2\sqrt{3} + \frac{\sqrt{3}}{2}}{-2 + \frac{3}{2}} \cdot \frac{2}{2} = \frac{4\sqrt{3} + \sqrt{3}}{-4 + 3}$$

$$= -5\sqrt{3}$$