

Show all work. Your answers must be fully justified.

1. Find the equation of the tangent line to the function $y = 6\sqrt{x^2 + 3x}$ at the point where $x = 1$.

$$y = 6(x^2 + 3x)^{1/2}$$
$$\frac{dy}{dx} = 3(x^2 + 3x)^{-1/2}$$

$$\text{point : } (1, 12)$$

$$\text{slope : } \frac{3}{2}$$

$$\text{line : } y - 12 = \frac{3}{2}(x - 1)$$

2. Let $f(x)$ and $g(x)$ be differentiable functions such that $f(1) = 7, f'(1) = 4, f'(3) = 5, g(1) = 3, g'(1) = 2$. Let $k(x) = f(g(x)) + (f(x))^2$. Find $k'(1)$.

$$k'(x) = f'(g(x))g'(x) + 2f(x)f'(x)$$

$$k'(1) = f'(3) \cdot 2 + 2 \cdot 7 \cdot 4$$

$$= 5 \cdot 2 + 2 \cdot 7 \cdot 4$$

$$= 66$$