

(1) [7] Find an equation of the tangent line to the curve

$$y = \ln(x^2 - 3x - 3)$$

at the point where $x = 4$.

$$\begin{aligned} \text{At } x=4 \quad y &= \ln(4^2 - 3 \cdot 4 - 3) \\ &= \ln(1) \\ &= 0 \end{aligned}$$

$$y' = \frac{1}{x^2 - 3x - 3} \cdot (2x - 3)$$

$$y'|_{x=4} = \frac{1}{1} \cdot 5 = 5$$

$$\begin{aligned} \therefore \text{equation is } y - 0 &= 5(x - 4) \\ \text{or } y &= 5x - 20 \end{aligned}$$

(2) [4] Determine the derivative of

$$f(x) = (x^2 + 1) \ln(2x + 1)$$

$$f'(x) = 2x \ln(2x + 1) + (x^2 + 1) \frac{2}{2x + 1}$$

(3) [4] Solve for x :

$$\ln(-x) = \ln(x^2 - 6)$$

}*

$$\therefore -x = x^2 - 6$$

$$x^2 + x - 6 = 0$$

$$(x-2)(x+3) = 0$$

$$x=2, \quad x=-3$$

* is not defined for $x=2$,

so only solution is $\boxed{x=-3}$.