

(1) [15 points] Use the definition of the derivative to find an equation of the tangent line to $y = \frac{2}{x+3}$ at the point $(-1, 1)$.

$$f(x) = \frac{2}{x+3}$$

$$f'(-1) = \lim_{h \rightarrow 0} \frac{f(-1+h) - f(-1)}{h}$$

$$= \lim_{h \rightarrow 0} \frac{1}{h} \left[\frac{2}{-1+h+3} - \frac{2}{-1+3} \right]$$

$$= \lim_{h \rightarrow 0} \frac{1}{h} \left[\frac{2}{2+h} - \frac{2}{2} \right]$$

$$= \lim_{h \rightarrow 0} \frac{1}{h} \left[\frac{2 - 2h}{2+h} \right]$$

$$= \frac{-1}{2}$$

∴ $y - y_0 = m(x - x_0)$

$$y - 1 = \frac{-1}{2}(x + 1)$$