1.a) Let $f$ be a function with domain $[5, \infty)$ and define $g(x) = \frac{1}{x+1}$. Then find the domain of the function $f \circ g$.

$$D(f \circ g) = \{x \mid x \in D(g) \text{ and } g(x) \in D(f)\}$$
$$= \{x \mid x \neq -1 \text{ and } \frac{1}{|x+1|} \geq 5\}$$
$$= \{x \mid x \neq -1 \text{ and } |x+1| \leq \frac{1}{5}\}$$
$$= \{x \mid x \neq -1 \text{ and } x \in [-\frac{6}{5}, -\frac{4}{5}]\}$$
$$= [-\frac{6}{5}, -1) \cup (-1, -\frac{4}{5}]$$.

b) The point $P(a, b)$ is on the line $L$ whose equation is $2x - y - 3 = 0$. If the line $L_1$ passes through $P$ and perpendicular to $L$ intersects the $x$-axis at the point where its abscissa (x-coordinate) is 4, then find $a$ and $b$, and write an equation of the line $L_1$.

$L: y = 2x - 3$, $m = 2$

$L_1: \ ? \quad m_1 = -\frac{1}{2}$ and $P_1(4, 0) \in L_1$

$L_1: y - 0 = -\frac{1}{2}(x-4)$ or $L_1: x + 2y = 4$

$p \in L$ and $P_1 \in L_1 \iff 2a - b = 3 \text{ and } a + 2b = 4 \implies \boxed{a = 2, b = 1}$

Hence $P(a, b) = P(2, 1)$

OR

$p(a, b) \in L$ means that $P(a, 2a - 3)$. Then

$L_1: y -(2a-3) = -\frac{1}{2}(x-a)$

$P_1(4, 0) \in L_1 \iff -(2a-3) = -\frac{1}{2}(4-a)$

$\iff a = 2$

If $a = 2$, then $b = 2a - 3 = 1$. Hence $P(a, b) = P(2, 1)$.