(a)

$$\frac{\langle e_1, E, S\rangle \Downarrow \langle v_1, S'\rangle \quad \langle e_2, E, S'\rangle \Downarrow \langle v_2, S''\rangle}{\langle \texttt{(before } e_1 \ e_2\texttt{)}, E, S\rangle \Downarrow \langle v_1, S''\rangle} \text{ (Before)}$$

(b)

$$\frac{\langle e, E + \{x_1 \mapsto E(x_2)\}, S\rangle \Downarrow \langle v, S'\rangle}{\langle \texttt{(alias } x_1 \ x_2 \ e\texttt{)}, E, S\rangle \Downarrow \langle v, S'\rangle} \text{ (Alias)}$$

(c) To save space and avoid repetition, we write:

E_x for $\{x \mapsto L_1\}$
E_{xy} for $\{x \mapsto L_1, y \mapsto L_1\}$

Then the tree looks like this:

$$\dfrac{\dfrac{}{\langle 1, \emptyset, \emptyset\rangle \Downarrow \langle 1, \emptyset\rangle}\text{(Int)} \quad \dfrac{\dfrac{\dfrac{}{\langle 3, E_{xy}, \{L_1 \mapsto 1\}\rangle \Downarrow \langle 3, \{L_1 \mapsto 1\}\rangle}\text{(Int)}}{\langle \texttt{(:= y 3)}, E_{xy}, \{L_1 \mapsto 1\}\rangle \Downarrow \langle 3, \{L_1 \mapsto 3\}\rangle}\text{(Assgn)} \quad \dfrac{\dfrac{\dfrac{}{\langle \texttt{x}, E_{xy}, \{L_1 \mapsto 3\}\rangle \Downarrow \langle 3, \{L_1 \mapsto 3\}\rangle}\text{(Var)} \quad \dfrac{}{\langle \texttt{5}, E_{xy}, \{L_1 \mapsto 3\}\rangle \Downarrow \langle 5, \{L_1 \mapsto 3\}\rangle}\text{(Int)}}{\langle \texttt{(+ x 5)}, E_{xy}, \{L_1 \mapsto 3\}\rangle \Downarrow \langle 8, \{L_1 \mapsto 3\}\rangle}\text{(Add)}}{\langle \texttt{(:= x (+ x 5))}, E_{xy}, \{L_1 \mapsto 3\}\rangle \Downarrow \langle 8, \{L_1 \mapsto 8\}\rangle}\text{(Assgn)}}{\langle \texttt{(before (:= y 3) (:= x (+ x 5)))}, E_{xy}, \{L_1 \mapsto 1\}\rangle \Downarrow \langle 3, \{L_1 \mapsto 8\}\rangle}\text{(Before)} \quad \dfrac{}{\langle \texttt{x}, E_x, \{L_1 \mapsto 8\}\rangle \Downarrow \langle 8, \{L_1 \mapsto 8\}\rangle}\text{(Var)} \quad \dfrac{}{\langle \texttt{1}, E_x, \{L_1 \mapsto 1\}\rangle \Downarrow \langle 1, \{L_1 \mapsto 1\}\rangle}\text{(Int)}}{\langle \texttt{(alias y x (before (:= y 3) (:= x (+ x 5))))}, E_x, \{L_1 \mapsto 1\}\rangle \Downarrow \langle 3, \{L_1 \mapsto 8\}\rangle}\text{(Alias)} \quad \dfrac{}{\langle \texttt{x}, E_x, \{L_1 \mapsto 8\}\rangle \Downarrow \langle 8, \{L_1 \mapsto 8\}\rangle}\text{(Var)}}{\langle \texttt{(+ (alias y x (before (:= y 3) (:= x (+ x 5)))) x)}, E_x, \{L_1 \mapsto 1\}\rangle \Downarrow \langle 11, \{L_1 \mapsto 8\}\rangle}\text{(Add)}}{\langle \texttt{(let x 1 (+ (alias y x (before (:= y 3) (:= x (+ x 5)))) x))}, \emptyset, \emptyset\rangle \Downarrow \langle 11, \emptyset\rangle}\text{(Let)}$$