Operational Semantics Practice

1. Using the rules given below, show: $1 + 1 \Rightarrow 2$

$$\frac{}{n \Rightarrow n} \qquad \frac{e_1 \Rightarrow n_1 \quad e_2 \Rightarrow n_2 \quad n_3 \ is \ n_1 + n_2}{e_1 + e_2 \Rightarrow n_3}$$

2. Using the rules given below, show: $1 + (2 + 3) \Rightarrow 6$

$$\frac{}{n \Rightarrow n} \qquad \frac{e_1 \Rightarrow n_1 \quad e_2 \Rightarrow n_2 \quad n_3 \ is \ n_1 + n_2}{e_1 + e_2 \Rightarrow n_3}$$

3. Using the rules given below, show: $A; \ let \ y = 1 \ in \ y \Rightarrow 1$

$$\frac{}{A; \ n \Rightarrow n} \qquad \frac{A(x) = v}{A; \ x \Rightarrow v}$$

$$\frac{A; \ e_1 \Rightarrow v_1 \quad A, x : v_1; \ e_2 \Rightarrow v_2}{A; \ \textbf{let} \ x = e_1 \ \textbf{in} \ e_2 \Rightarrow v_2} \qquad \frac{A; \ e_1 \Rightarrow n_1 \quad A; \ e_2 \Rightarrow n_2 \quad n_3 \ is \ n_1 + n_2}{A; \ e_1 + e_2 \Rightarrow n_3}$$

4. Using the rules given below, show: $A;\ let\ y = 1\ in\ let\ x = 2\ in\ x \Rightarrow 2$

$$\frac{}{A;\ n \Rightarrow n} \qquad\qquad \frac{A(x) = v}{A;\ x \Rightarrow v}$$

$$\frac{A;\ e_1 \Rightarrow v_1 \qquad A, x : v_1;\ e_2 \Rightarrow v_2}{A;\ \textbf{let}\ x = e_1\ \textbf{in}\ e_2 \Rightarrow v_2} \qquad \frac{A;\ e_1 \Rightarrow n_1 \qquad A;\ e_2 \Rightarrow n_2 \qquad n_3\ is\ n_1 + n_2}{A;\ e_1 + e_2 \Rightarrow n_3}$$

5. Translate the following rules into English.

$$\text{identity:} \frac{}{n \Rightarrow n} \qquad \text{addition:} \frac{e_1 \Rightarrow n_1 \qquad e_2 \Rightarrow n_2 \qquad n_3\ is\ n_1 + n_2}{e_1 + e_2 \Rightarrow n_3}$$