Problem Statement 2

$y_1 = 2x + 1$ — I_1 ①

$y_2 = \dfrac{2x}{1+0.2x}$ — I_2 ②

* The problem asks to calculate integral I_1 & I_2 wrt dy_1.
* Therefore first evaluate $\left(\dfrac{1}{y_1+y_2}\right)$ and $\left(\dfrac{1}{y_1-y_2}\right)$ in terms of y_1 and then integrate the result.
* for $\left(\dfrac{1}{y_1+y_2}\right)$; the sum came to be unbounded from 0 to 15.

from ① :→ $x = \dfrac{y_1-1}{2}$ — ③

Use value of x from ③ in ②

$$\therefore\ y_2 = \frac{2\left(\frac{y_1-1}{2}\right)}{1+\frac{2}{10}\left[\frac{y_1-1}{2}\right]} = \frac{y_1-1}{1+\frac{y_1-1}{10}} = \frac{10y_1-10}{y_1+9}$$

(a) $$\frac{1}{y_1+y_2} = \frac{1}{y_1 + \left[\frac{10(y_1-1)}{y_1+9}\right]}$$

$$\frac{1}{y_1+y_2} = \frac{y_1+9}{y_1^2+19y_1-10}$$

(b) $$\therefore \frac{1}{y_1-y_2} = \frac{1}{y_1 - \left[\frac{10(y_1-1)}{y_1+9}\right]}$$

$$\frac{1}{y_1-y_2} = \frac{y_1+9}{y_1^2-y_1+10}$$

Now solving $I_1 = \int_0^{15} \frac{1}{y_1+y_2}\,dy$ is challenging as integral do not exists among the given bounds, due to its $\underbrace{\text{pole nature near } x=0.6}_{\text{i.e. } I_1 \text{ is not bounded in the given limits.}}$