$$\text{denom} = w_1(1-u)^2 + 2w_2(1-u)u + w_3u^2$$

Set $w_1, w_3 = 1 \quad w_2 = w$

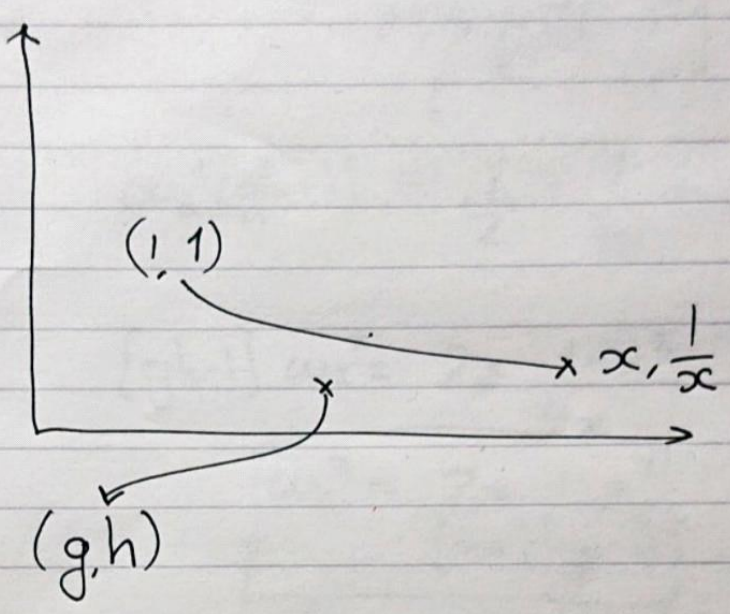
$$\text{denom} = (1-u)^2 + w(1-u) + u^2$$

$\text{denom}^2$

$u(1-u)^3 = 4w_2$

$u^2(1-u)^2 = 4w_2^2 + 2$

$u^3(1-u) = 4w_2$




$$\text{num}(x) = (1-u)^2 + 2gw_2(1-u)u + xu^2$$
$$\text{num}(y) = (1-u)^2 + 2hw_2(1-u)u + \frac{u^2}{x}$$

$$\text{num}(x)\,\text{num}(y) = [\text{denom}]^2$$

$u(1-u)^3$: LHS: $2hw_2 + 2gw_2 = 4w_2$ RHS:

$$\boxed{h+g = 2}$$

LHS $\quad \frac{2gw_2}{x} + 2hxw_2 = 4w_2$

$$\boxed{\frac{g}{x} + hx = 2}$$

$u^2(1-u)^2$ LHS: $4gh(\omega_2)^2 + \frac{1}{x} + x = 4\omega_2^2 + 2$

$$4gh[\omega_2]^2 - 4\omega_2^2 = 2 - \frac{1}{x} - x$$

$$[\omega_2]^2[4gh - 4] = 2 - \frac{1}{x} - x$$

$$\omega_2^2[gh-1] = \frac{1}{2} - \frac{1}{4x} - \frac{x}{4}$$

$$[gh-1]\,\omega_2^2 = \frac{2x - 1 - x^2}{4x}$$

$$\boxed{\omega_2^2 = \frac{2x-1-x^2}{[4x][gh-1]}}$$

Let $x = 10$

$$g + 100h = 20$$
$$g + h = 2$$
$$99h = 18$$
$$h = \frac{18}{99} \qquad g = \frac{20}{11}$$
$$gh = \frac{40}{121}$$

$$\omega_2^2 = \frac{2(10) - 1 - 100}{[40]\left[-1 + \frac{40}{121}\right]}$$

$$\omega_2^2 = \frac{121}{40}$$

$$\omega_2 = \frac{11\sqrt{10}}{20}$$