The function $w(x)$ is defined implicitly by the equation

$$(w(x) + 1) \cdot e^{w(x)} = x.$$

Use a linear approximation to estimate $w(3/2)$.

$\left(\text{Hint}: w(1) = 0. \right)$

$$(w(x) + 1) e^{w(x)} = x$$

$$\frac{d}{dx}\left((w(x)+1)e^{w(x)}\right) = \frac{d}{dx} x$$

$$w'(x)e^{w(x)} + (w(x)+1)\, w'(x)e^{w(x)} = 1$$

$$w'(x) = \frac{1}{w(x)+2}\, e^{-w(x)}$$

$$w(x) \approx w(x_0) + w'(x_0)(x - x_0)$$

$$\Rightarrow w(3/2) \approx w(1) + \left(\frac{e^{-w(1)}}{w(1)+2}\right)(1.5-1)$$

$$= 0 + \left(\frac{1}{0+2}\right) 0.5$$

$$= 0.25$$