4 Differentiate:

a) $\dfrac{\sqrt{x} - 2}{\sqrt{x} + 1}$

- Note that $\sqrt{x} = x^{1/2}$, which is more tractable for differentiation. Hence, rewrite a) as:

$$\frac{(x)^{1/2} - 2}{(x)^{1/2} + 1}$$

- We will be using several rules:

$$\left(\frac{a}{b}\right)' = \frac{a'b - a \cdot b'}{b^2} \quad (1)$$

$$(a^b)' = b \cdot a^{b-1} \quad (2)$$

$$(\text{constant})' = 0 \quad (3)$$

- Step 1: Applying (1) together with (2) and (3), we get:

$$\left(\frac{(x)^{1/2} - 2}{(x)^{1/2} + 1}\right)' = \frac{\left((1/2) \cdot x^{-1/2} - 0\right) \cdot \left(x^{1/2} + 1\right) - \left(x^{1/2} - 2\right)\left((1/2) \cdot x^{-1/2} + 0\right)}{\left((x)^{1/2} + 1\right)^2}$$

- Step 2: Noting that $(1/2)(x^{-1/2})$ is in both elements of the numerator, and taking it as a common factor, we get:

$$= \frac{\left[(1/2)(x^{-1/2})\right] \cdot \left[\left(x^{1/2} + 1 - x^{1/2} - (-2)\right)\right]}{\left((x)^{1/2} + 1\right)^2}$$

- Step 3: Eliminating $x^{1/2} - x^{1/2}$ $(= 0)$, and noting that $1 - (-2) = 3$, we can rewrite it as:

$$= \frac{(1/2)(x^{-1/2}) \cdot 3}{\left((x^{1/2}) + 1\right)^2}$$

- Step 4: Using $x^{-a} = \frac{1}{a}$ and $\frac{a}{b} \cdot c = \frac{a \cdot c}{b}$ $\left(\frac{1}{2} \cdot 3 = \frac{3}{2}\right)$,