4. In this question you must show all stages of your working. Solutions relying entirely on calculator technology are not acceptable. (a) Express as an integral

$$\lim_{\delta x \to 0} \sum_{x=4}^{12} (1+2x)^{\frac{1}{2}} \, \delta x \tag{1}$$

(b) Using your answer to part (a) show that
$$\lim_{\delta x \to 0} \sum_{x=4}^{12} (1+2x)^{\frac{1}{2}} \delta x = \frac{98}{3}$$

(a) \(\frac{1}{4} \left(1+2x)^{\frac{1}{2}} dx

$$\int_{4}^{12} (1+2x)^{\frac{1}{2}} dx \qquad (1 \text{mark})$$

(b) try y = (1+2x) = (1+2x) =

then
$$\frac{dy}{dx} = \frac{3}{2}(1+2x)^{\frac{3}{2}-1} \times \frac{d(1+2x)}{dx}$$

by Chain Ru

$$= \frac{3}{2} (1+2x)^{\frac{1}{2}} \times 2$$

$$= 3 (1+2x)^{\frac{1}{2}}$$

$$(1+2x)^{\frac{1}{2}} \times \frac{3x}{3x}$$

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

$$= \frac{3}{2} (1+2x)^{\frac{1}{2}} \times 2$$

$$= 3 (1+2x)^{\frac{1}{2}}$$

$$= 3(1+2x)^{2}$$
We want dy = $1(1+2x)^{\frac{1}{2}}$, which is 3 times smaller,

so Integral is y = \frac{1}{3}(1+2x)\frac{3}{2}+c

$$\left[\frac{1}{3}\left(1+2x\right)^{\frac{3}{2}}\right]_{4}^{12} = \left(\frac{1}{3}\left(1+2\left(12\right)\right)^{\frac{3}{2}} - \frac{1}{3}\left(1+2\left(4\right)\right)^{\frac{3}{2}}\right)$$

ntegral is
$$y = \frac{1}{3}(1+2x)^{2} + c$$

 $x)^{\frac{3}{2}} \int_{4}^{12} = (\frac{1}{3}(1+2(12))^{\frac{3}{2}} - \frac{1}{3}(1+2(12))^{\frac{3}{2}} - \frac{1}{$

 $=\frac{1}{3}(25)^{\frac{3}{2}}-\frac{1}{3}(9)^{\frac{3}{2}}$

 $=\frac{48}{2}$

$$(2x)^{\frac{3}{2}} \Big]_{4}^{12} = \left(\frac{1}{3} \left(1 + 2 \left(12\right)\right)^{\frac{3}{2}} - \frac{1}{3} \left(1 + 2 \left(12\right)\right)^{\frac{3}{2}} - \frac{1}{3} \left(1 + 2 \left(12\right)\right)^{\frac{3}{2}} - \frac{1}{3} \left(1 + 2 \left(12\right)\right)^{\frac{3}{2}} + \frac{1}{3} \left(1 + 2$$

 $=\frac{1}{3}(125)-\frac{1}{3}(27)$

$$= \frac{1}{3} (25)^{\frac{3}{2}} - \frac{1}{3}$$

$$-\frac{1}{3}(1+2(4))^{\frac{3}{2}})$$

$$(1+2(4))^{\frac{3}{2}}$$

$$(4))^{\frac{3}{2}}$$

(mark)

(3)

(I mark)