$\boxed{Ex}$ ~~Find~~

1) $$\frac{d}{dx}\left(\lim_{n\to\infty}\left[\left(\left(1+\left(1+2\frac{x}{n}\right)^3+\left(1+2\frac{2x}{n}\right)^3+\left(1+2\cdot\frac{3x}{n}\right)^3+\cdots\cdots+\left(1+2\frac{(n-1)x}{n}\right)^3\right)\frac{x}{n}\right]\right)$$

2) A ~~firm~~ firm makes x units of keys and y units of locks. For some strange reason

$$x^2+10y^2=50 \text{ and } x\geq 0,\ y\geq 0.$$

Selling a key bring \$1 profit and selling a lock brings \$2 profit.

Find x and y to maximise profit.

3) ~~Find~~. Let $f(x)=\begin{cases}\dfrac{k|x|}{1+x^2} & -1<x<1\\ 0 & \text{otherwise}\end{cases}$

For what value of k is f a pdf.

Find $\mathbb{E}(X)$

(4) Is $\sum_{k=1}^{\infty} \frac{k^2}{1+k^3}$ convergent or divergent?