

Ex Find a

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

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

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

Selling a key brings \$1 profit

and selling a lock brings \$2 profit.

Find x and y to maximize profit.

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

For what value of k is f a pdf.

Find $E(X)$

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

$$\lim_{k \rightarrow \infty} \left(\frac{k^2}{1+k^3} \right) = \lim_{k \rightarrow \infty} \frac{k^2}{k^3} = \lim_{k \rightarrow \infty} \frac{1}{k} = 0$$

$$\lim_{k \rightarrow \infty} \left(\frac{k^2}{1+k^3} \right) = 0$$

Since $\lim_{k \rightarrow \infty} \frac{k^2}{1+k^3} = 0$, the series converges.

By the ratio test, $\lim_{k \rightarrow \infty} \frac{(k+1)^2}{1+(k+1)^3} \cdot \frac{1+k^3}{k^2} = \lim_{k \rightarrow \infty} \frac{(k+1)^2(1+k^3)}{k^2(1+(k+1)^3)}$

$$= \lim_{k \rightarrow \infty} \frac{(k+1)^2(1+k^3)}{k^2(1+k^3+3k^2+3k+1)}$$

Since $\lim_{k \rightarrow \infty} \frac{(k+1)^2(1+k^3)}{k^2(1+k^3+3k^2+3k+1)} = \lim_{k \rightarrow \infty} \frac{k^2+k^3}{k^2+k^3+3k^2+3k+1} = \lim_{k \rightarrow \infty} \frac{1+k}{1+k+3+\frac{3}{k}+\frac{1}{k^2}} = 1$

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