Convexity – 2nd derivative of bond's Price with respect to "i" – interest rate. or just take derivatre of Modified duration (MD)

$$MD = \frac{1}{(1+i)}\left[\sum_{t=1}^{n} -t \cdot \frac{C_t}{(1+i)^t}\right] \quad \text{rewrite as:}$$

$$MD = (1+i)^{-1}\left[\sum_{t=1}^{n} -t \cdot C_t (1+i)^{-t}\right]$$

Using product rle & chain rle

* we can just take the 1st derivation of MD since it's already a derivatre

$$\frac{\partial^2 P}{\partial i^2} = (1+i)^{-1}\left[\sum_{t=1}^{n} t^2 \cdot C_t (1+i)^{-t-1} \cdot 1\right] +$$

$$\sum_{t=1}^{n} -t \cdot C_t (1+i)^{-t} \cdot -1 (1+i)^{-2} \cdot 1$$

pull out $(1+i)^{-1}$ & rewrite as $\frac{1}{(1+i)}$

$$= \frac{1}{(1+i)}\left[\sum_{t=1}^{n} t^2 \cdot \frac{C_t}{(1+i)^{t+1}}\right] + \sum_{t=1}^{n} -t \cdot \frac{C_t}{(1+i)^t}\left[\frac{-1}{(1+i)^2}\right]$$

$$= \sum_{t=1}^{n} t^2 \cdot \frac{C_t}{(1+i)^{t+2}} + t \cdot \frac{C_t}{(1+i)^{t+2}}$$