$$-4\pi\left(\frac{\sin x}{1}+\frac{\sin 2x}{2}+\frac{\sin 3x}{3}+\cdots\right)$$

2. $f(x) = x$ in $-\pi < x < \pi$

✓ NOTE $f(x)$ is ODD & INTERVAL FROM $-l$ to l

$$a_0 = a_n = 0 \quad \& \quad b_n = \frac{2}{l}\int_0^l f(x)\sin\left(\frac{n\pi x}{l}\right)dx$$

$f(x)$ is EVEN & Interval from $-l$ to l

$$a_0 = \frac{2}{l}\int_0^l f(x)\,dx$$

$$a_n = \frac{2}{l}\int_0^l f(x)\cos\left(\frac{n\pi x}{l}\right)dx$$

$$b_n = 0$$

pdf- PART 2

Here $f(x) = x$ is an odd function

and the interval is from $-\pi$ to π

$$2l = \pi - (-\pi)$$

ie. $\cancel{2}l = \cancel{2}\pi$

$\therefore l = \pi$

$\therefore a_0 = a_n = 0$

$$b_n = \frac{2}{\pi} \int_0^{\pi} f(x) \sin\left(\frac{n\pi x}{\cancel{\pi}}\right) dx$$

$$\text{ie. } b_n = \frac{2}{\pi} \int_0^{\pi} x \sin nx \, dx$$

$$\text{ie. } b_n = \frac{2}{\pi} \left[\left\{ x \left(\frac{-\cos nx}{n} \right) \right\}_0^{\pi} - \left\{ 1 \left(-\frac{\sin nx}{n^2} \right) \right\}_0^{\pi} \right]$$

$$\text{ie. } b_n = \frac{2}{\pi} \left[-\frac{1}{n} \left\{ x \cos nx \right\}_0^{\pi} + \frac{1}{n^2} \left\{ \sin nx \right\}_0^{\pi} \right]$$

$$\text{ie. } b_n = \frac{2}{\pi} \left[\frac{-1}{n} \left\{ \pi (-1)^n - 0 \right\} + \frac{1}{n^2} \left\{ 0 - 0 \right\} \right]$$

$$\text{ie. } b_n = -\frac{2}{\cancel{\pi}} \frac{1}{n} \cancel{\pi} (-1)^n$$

$$b_n = \frac{2}{n} (-1)^{n+1}$$

Now, $f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos \frac{n\pi x}{l} + \sum_{n=1}^{\infty} b_n \sin \frac{n\pi x}{l}$

ie. $x = 0 + 0 + \sum_{n=1}^{\infty} \frac{2}{n}(-1)^{n+1} \sin\left(\frac{n\pi x}{\pi}\right)$

ie. $x = 2 \sum_{n=1}^{\infty} (-1)^{n+1} \frac{\sin nx}{n}$

$$x = 2\left(\frac{\sin x}{1} - \frac{\sin 2x}{2} + \frac{\sin 3x}{3} - \cdots\right)$$