**Haigazian University**
MATH 201 Quiz 6

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**Find the Taylor polynomial of degree 4 at x = 0 for the function f (x) = $x^2 \cos 2x$**

$\cos x \approx 1 - \frac{x^2}{2} + \frac{x^4}{24}$ Taylor polynomial of degree 4 for the function $\cos x$

we replace $x$ by $2x$

$\cos 2x \approx 1 - \frac{(2x)^2}{2} + \frac{(2x)^4}{24}$ Taylor polynomial for the function $\cos 2x$

$\boxed{x^2 \cos 2x \approx x^2 - 2x^4}$ ✓ Taylor polynomial for the function $f(x) = x^2 \cos 2x$ at $x=0$ of degree 4

**For what values of x can we replace cos x by $1 - \frac{x^2}{2} + \frac{x^4}{24}$ with an error $\leq 3 \times 10^{-5}$ ?**

$$\cos x \approx 1 - \frac{x^2}{2} + \frac{x^4}{24}$$

$$|\text{error}| \leq \frac{|x|^6}{6!}$$

$$\frac{|x|^6}{6!} \leq 3 \times 10^{-5}$$

$$|x|^6 \leq (3 \times 10^{-5}) \cdot 6!$$

$$|x| \leq \sqrt[6]{(3 \times 10^{-5}) \cdot 6!}$$

$$|x| \leq \sqrt[6]{216 \cdot 10^{-4}} \approx 0.527$$

$$\boxed{|x| \leq 0.527}$$