

University of Bahrain
Department of Mathematics
MATHS122: Calculus II
Spring 2016
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Worksheet 13: Application of Series

Students' Name: _____

1. Estimate the integral

$$\int_0^{0.2} \sin x^2 dx$$

2. Estimate the integral

$$\int_0^{0.1} e^{x^2} dx$$

3. Use series to evaluate the limit

$$\lim_{\theta \rightarrow 0} \frac{\sin(\theta) - \theta + \frac{\theta^3}{6}}{\theta^5}.$$

Confirm your answer using different method.

4. Use series to evaluate the limit

$$\lim_{x \rightarrow 0} \frac{\sin(x^2) - x^2 \cos(x)}{x^4}.$$

Confirm your answer using different method.

5. Let $f(x) = x^2 \cos(x^3)$. Find $f^{(11)}(0)$.

6. Find the value of the following series

1. $1 - \frac{\pi^2}{2!} + \frac{\pi^4}{4!} - \frac{\pi^6}{6!} + \dots$

2. $\frac{\pi}{3} - \frac{\pi^3}{3^3 3!} + \frac{\pi^5}{3^5 5!} + \dots$

7. The Fresnel¹ integral

$$\int_0^1 \frac{\sin x}{x} dx$$

occurs in Fresnel's theory of diffraction.

1. Evaluate the Fresnel integral as a series.

2. Estimate the Fresnel's integral up to 10^{-3} .

¹Augustin-Jean Fresnel (1788-1827) was an engineer, mathematician and the French commissioner of lighthouses. He is famous for his work in optics, especially the theory of diffraction, and for developing the Fresnel lens. Originally developed for lighthouses, Fresnel lenses are still used today in many consumer items including computer and overhead projectors.