

Assignment 2

Please write your name and ID on the assignment script. The deadline for submitting the assignment is **23rd July 2020**. Solve **all the problems**. You will receive 5 bonus marks for **submitting your assignment in Latex**.

Any information you need to solve this exam are given in the question.

Watch the videos in this Playlist if you are confused about the assignment process: [All About Assignments Playlist, Click Here](#)

Be creative, use your intuition. Answer the questions by yourself. Cheating and Copying will lead to **50%** deduction from your total marks in the course and a Zero in the assignment. **Total marks is 40**. Each question carries 10 marks. There are **two bonus questions** and each carry 2.5 marks. It's **not mandatory** to attempt bonus questions.

1. Evaluate the following integrals by Integration by Parts

(a) $\int x (\tan^{-1} x) dx$

(b) $\int \sqrt{x} \ln \sqrt{x} dx$

2. Use reduction formula to evaluate:

$$\int_0^{\pi/2} \cos^6 x dx$$

3. Evaluate the integral using appropriate substitution: $\int \frac{\cos 4\theta}{1 + 2\sin 4\theta} d\theta$.

4. Use Gamma Function to evaluate $\int_0^\infty x^5 e^{-x^2} dx$

[BONUS Questions]

5. Prove the Fundamental theorem of Calculus (It cannot be an exact copy from any source. You can use references but it should be properly cited. Also, you cannot copy paste directly. In that case you won't receive any marks).

6. You are asked to integrate the following definite integrals,

(a)

$$\int_0^{2\pi} \sin x \, dx.$$

Does the answer surprise you? Why do you think you got such a solution. If needed plot $\sin x$ for the interval $[0, 2\pi]$.

(b) Now that you have evaluated the integral in [6a](#), try and integrate for a similar function with similar limits, the only difference you are given $|\sin x|$ instead of $\sin x$.

If you are unaware of what $|f(x)|$ is, it is defined as the following

$$|f(x)| = \sqrt{[f(x)]^2}.$$

For which we get the relevant properties

$$|f(x)| = f(x), \text{ and} \\ |-f(x)| = f(x).$$

So, then equipped with the above statements try and solve the following integral

$$\int_0^{2\pi} |\sin x| \, dx.$$

[Hint: Try and graph for the new function that you have been asked to integrate.]