# MA202 Project - Numerical Analysis of a Linear Black-Scholes Model

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Adarsh Golait *19110175*
Hitarth Gandhi *19110087*
Preet Shah *19110195*
Vishal Soni *19110207*

## Problem Statement:

An option is a contract that gives the bearer the right to buy or sell the underlying assets at a predetermined price (this is called a premium) at or before the contract expires. A call option enables the holder to buy the stock, and a put option gives the user the right to sell. It is kind of a down-payment (but not in full) option for a future deal.

Trading stock options is a major part of the financial markets. In the past, there didn't exist an efficient mathematical model to determine the value of an option. Thus, the Black Scholes model provides the analytical framework for options trading. The Black Scholes equation is a popular partial differential equation in financial mathematics. In this project, we discuss the solution methods for the Black Scholes model with European call and put options.

Here, we'll study the weighted average method using different weights for numerical approximations and solve the modified Black Scholes equation pricing option with a discrete dividend. We will use the delta-defining sequence of the generalised *Dirac-delta* function and apply the Mellin transformation to obtain an integral formula.

We will also discuss analytical solutions of the Black-Scholes equation using Fourier Transformation method for European options. We will discuss a finite-difference scheme to approximate the solutions.