

# C++ Programming - Advanced - Assignment

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## Introduction

In SmartCar image processing, you probably need to store the coordinates of certain points in the image. Here you are going to develop a coordinate class for it. There is **NO** provided header.

## Requirements

- Include the  $x$  and  $y$  coordinates with generic type, default is `uint16_t`
- Implement the  $x$ ,  $y$  and coordinate setters & getters
- Overload the following operators
  - `a+b`
  - `a-b`
  - `a+=b`
  - `a-=b`
  - `std::cout << a` (or technically `std::ostream << a`)
- Implement the following arithmetic functions
  - prefix `++x`
  - prefix `++y`
  - prefix `--x`
  - prefix `--y`
  - postfix `x++`
  - postfix `y++`
  - postfix `x--`
  - postfix `y--`
- Implement the following mathematical functions
  - Distance ( $d = \sqrt{(\Delta x)^2 + (\Delta y)^2}$ )
  - Manhattan Distance ( $d = |\Delta x| + |\Delta y|$ )
  - Slope ( $m = \frac{\Delta y}{\Delta x}$ )
  - Triangle Area enclosed by three points  $A, B, C$  ( $a = \left| \frac{A_x(B_y - C_y) + B_x(C_y - A_y) + C_x(A_y - B_y)}{2} \right|$ )
  - Radius of Circle generated by three points  $A, B, C$  ( $\frac{AB \cdot BC \cdot CA}{4[ABC]}$ , where  $[ABC]$  is the triangle area of  $ABC$ )
- Bonus
  - Figure(Find) a less resource-intensive (in return of less accuracy) implementation of square root and use it in calculating distance.

*Google is your friend when it comes to problems that you encounter in C++ programming.*

## Submission

In this assignment, three aspects will be examined.

- Correctness

The correctness of your implementations.

- Readability

The readability of your codes, including the presence of documentations.

- Coding Practice

The coding style that you have, including OOP practices.

Try your best in achieving fully in all three aspects. Deadline of this assignment would be ???/??/??.