

Lab02 – Mathematics for Computer Graphics

Task 1

- 1) A straight line segment starts at $p_1(5, 11)$ and ends at $p_2(13, 8)$.
 - a) Draw it in the Cartesian co-ordinate system on a sheet of paper.
 - b) Calculate its length.
 - c) Calculate its gradient.
- 2) For two vectors $\mathbf{p} = 10\mathbf{i} + 7\mathbf{j}$ and $\mathbf{q} = 2\mathbf{i} - 5\mathbf{j}$
 - a) Calculate the magnitude of \mathbf{p} and \mathbf{q} respectively.
 - b) Calculate $\mathbf{p} - \mathbf{q}$.
 - c) Calculate the dot product of \mathbf{p} and \mathbf{q} , $\mathbf{p} \cdot \mathbf{q}$.
 - d) Find the angle between \mathbf{p} and \mathbf{q} .
- 3) For matrices, explain the following
 - a) Square matrices
 - b) Identity matrices
 - c) Inverse matrices
- 4) For matrix multiplication,
 - a) Explain the rule for matrix multiplication.
 - b) If the rule is satisfied for matrices for both \mathbf{AB} and \mathbf{BA} , would $\mathbf{AB} = \mathbf{BA}$?
 - c) For two matrices, $\mathbf{A} = \begin{bmatrix} 1 & 2 & 3 & 4 \end{bmatrix}$ and $\mathbf{B} = \begin{bmatrix} 5 \\ 6 \\ 7 \\ 8 \end{bmatrix}$, would the rule be satisfied for \mathbf{AB} and \mathbf{BA} ? If yes, work out the resultant matrices; if not, explain the reason.

Task 2

- 1) Try to read and understand the following code, and then run it in MS VS.

```
// File ID: Lab02.cpp
// Title: Interactive program for calculating area of a circle

#include <iostream>
#include <math.h>

using namespace std;           // directive in C++ allows access to all members of
the std namespace without explicitly prefixing them with std::. While it simplifies code, it can lead to
potential issues like name conflicts and reduced code clarity.

int main()                     // Define function of int type
{
    float r, area;             // Declare variables for radius and area

    cout << "Please enter radius of circle: "; // Prompt user to enter value of radius
    cin >> r;                   // Read in value of radius

    area = 3.14 * r * r;        // Calculate area

    cout << "Area of circle is: " << area << endl; // Print on screen a message and area of circle

    return 0;                   // Return an integer to indicate successful
                                // completion of function call
}
```

- 2) Write a simple program in VC++, which
 - a) takes in x and y co-ordinate values for two points P_1 and P_2 in turn from the user,
 - b) calculates the length of Line P_1P_2 ,
 - c) calculates the gradient of Line P_1P_2 , and
 - d) prints out the results on screen.