Southern Luzon State University

College of Engineering

Computer Engineering Department

CPE 02 PROGRAMMING AND LOGIC DESIGN

Programming Project No. 1

DESIGN PROJECT

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TITLE: **RATE OF CHANGE (CURVE)**

PROJECT DESCRIPTION:

A rate of change is a rate that describes how one quantity changes in relation to another quantity. If x is the independent variable and y is the dependent variable, then it is equevalent to the change of y over to the change of x.

This program display the solution of rate of change with respect to the points of abscissa of a curve. The ordinate of the curve is express in an equation equal to y and the final rate of change of a curve depend to its given abscissa points. The solution is in integral solution using limits (long method) and getting the derivative of the equation (short method) then subtituting the given points.

The Ordinate of Curve is limited depending to the updated equation.

INPUT:

- Ordinate of the curve (given in a program)
- Abscissa
  - first point
  - second point
- Limits (constant)
- Coefficient of delta x
- Vertex sub 1

OUTPUT:

Display the following:

- ✓ The final value of Rate of Change in units
  - Long method
  - Short method
- ✓ Direction of curve in a graph
- ✓ Cheked the solution

PROBLEM ANALYSIS:

- ✓ Select/search an ordinate of a curve given in program
- ✓ Get the abscissa point of a curve
- ✓ Give the value of limit
- ✓ Determine the direction of a curve in graph

- ✓ Using derevatives, compute the rate of change substituting the abscissa points
- ✓ Output the result (compare the long & short method)

PROGRAM:

```
package GEYMNA;

import java.util.Scanner;

public class rate_of_change {


   public static void main(String args[])

   {

   Scanner input = new Scanner(System.in);


         System.out.print("CALCULATE THE RATE OF CHANGE OF A CURVE:
\n_____\n");



         System.out.print("\nSelect given ordinate of a curve: \n1. y = x^2 + 2x - 3\n2. y = 3x^2
+ 4\n3. y = 2x + 5 + (-x)^2\n4. \n5. \n6. \n7. \nV\nto be update...\n\nChoose the ordinate of
a curve to be solve: ");

         int RC = input.nextInt();

         switch(RC)

         {

         case 1:

         case 2:

         case 3:

         System.out.print("\nAbscissa points\nEnter the first number: ");

   int a = input.nextInt();


   System.out.print("Enter the second number: ");
```

```
int b = input.nextInt();
System.out.print("\nEnter the value of limit in zero: ");
int k = input.nextInt();

System.out.print("\nEnter the vertex sub 1 of a curve: ");
int u = input.nextInt();

if (b<u)

        System.out.println("\nGraph: \"upward\"");
        else if (b>u)
                System.out.println("\nGraph: \"downward\"");
        else if (b==0&&u==0)
                System.out.println("\nGraph: \"from the origin\"");
       else if (b==u)
                System.out.println("\nGraph: \"upward/downward\"");



    switch(RC)
    {
    case 1:
       System.out.println("\n\nSolution: \ny = (x + dx)^2 + (x +dx) - 3\ny = (x^2 + 2xdx +
dx^2) + (2x +2dx) - 3\n\nSubtact the original equation\ny = (x^2 + 2xdx dx^2) + (2x +2dx) - 3 -
(x^2 - 2x + 3)\n\nSimplify; \ndy = 2xdx + dx^2 + 2dx\n\nEquate to rate of change; \ndy/dx
= 2x + dx + 2");



       System.out.print("Enter the total coefficient of (dx): ");
```

```
int c = input.nextInt();

System.out.print("lim (dx) = " + k + "    so, \nlim (dx) = 2x + " + (k*c) + " + 2 \nRate of Change of a curve: 2x + 2");

System.out.print("\n\nSubtitute the value of subscissa: \ndy/dx = 2(" + (a) + ") + " + k + " + 2\nFINAL RATE OF CHANGE (Curve):\ndy/dx = " + (2*a+2+k) +" units");

break;

case 2:

System.out.println("\n\nSolution: \ny = 3(x + dx)^2 + 4\ny = 3(x^2 + 2xdx + dx^2) + 4\ny = 3x^2 + 6xdx + 3dx^2 + 4\n\nSubtact the original equation\ny = 3x^2 + 6xdx + 3dx^2 + 4 - (3x^2 + 4)\n\nSimplify; \ndy = 6xdx + 3dx^2\n\nEquate to rate of change; \ndy/dx = 6x + 3dx");

System.out.print("Enter the total coefficient of (dx): ");

int cc = input.nextInt();

System.out.print("lim (dx) = " + k + "    so, \nlim (dx) = 6x + " + (k*cc) + " \nRate of Change of a curve: 6x");

System.out.print("\n\nSubtitute the value of subscissa: \ndy/dx = 6(" + (a) + ") + " + k + "\nFINAL RATE OF CHANGE (Curve):\ndy/dx = " + (6*a+k) +" units");

break;

case 3:

System.out.println("\n\nSolution: \ny = 2(x + dx) + 5 + (-x + dx)^2\ny = 2x + 2dx + 5 + (-x + dx)(-x + dx)\ny = 2x + 2dx + 5 + x^2 - 2xdx + dx^2\n\nSubtact the original equation\ny
```

```
= 2x + 2dx + 5 + x^2 - 2xdx + dx^2 - (2x + 5 + (-x)^2)\n\nSimplify; \ndy = 2dx + 2dx^2 - 2xdx\n\nEquate to rate of change; \ndy/dx = -2x + 2dx + 2");



        System.out.print("Enter the total coefficient of (dx): ");

        int ccc = input.nextInt();


        System.out.print("lim (dx) = " + k + "    so, \nlim (dx) = -2x + " + (k*ccc) + " + 2 \nRate of Change of a curve: -2x + 2");


        System.out.print("\n\nSubtitute the value of subscissa: \ndy/dx = -2(" + (a) + ") + " + k + " + 2\nFINAL RATE OF CHANGE (Curve):\ndy/dx = " + (-2*a+k+2) +" units");


        break;

    }

   if (k==0)


        System.out.println("\n\nYou slected the limits in zero, the solution is: \"TRUE\"");

        else if (k!=0)

                System.out.println("\n\nYou selected the non-zero limits, the solution is: \"FALSE\" (Your limit is not in zero value.)");


    System.out.print("\n\nEnter the number of the ordinate you selected to view the \"short method\": ");

    int l = input.nextInt();



    switch(l)

    {

    case 1:
```

```
    case 2:

    case 3:


    if (l!=RC)


        System.out.println("\n\n\"SELECT THE SAME NUMBER OF ORDINATE TO BE
SOLVE!\"\nTHE SHORT METHOD BELOW IS NOT FOR THE ORDINATE YOU
SELECTED.");

        else if (l==RC)

            System.out.println("\n\nCONTINUE!");



    switch(l)

    {

    case 1:

       System.out.print("\nShort method: \ny\' = f\'(x + h)\nyd/dx = x^2 + 2x - 3\nd/dx = 2x
+ 2 - " +k+"\nd/dx = 2("+(a)+") + 2");

       System.out.print("\nRate of Change =  " + (2*a+k+2) +" units");


    break;

    case 2:

        System.out.print("\nShort method: \ny\' = f\'(x + h)\nd/dx = 3x^2 + 4\nd/dx = 6x +
"+k+"\nd/dx = 6("+(a)+")");

        System.out.print("\nRate of Change =  " + (6*a+k) +" units");


    break;

    case 3:

        System.out.print("\nShort method: \ny\' = f\'(x + h)\nd/dx = 2x + 5 +(-x^2)\nd/dx =
-2x + "+k+" + 2\nd/dx = -2("+(a)+") + 2");

        System.out.print("\nRate of Change = " + (-2*a+k+2) +" units");
```

```
    break;
    }
if (k==0)

        System.out.println("\n\nYou slected the limits in zero, the solution is: \"TRUE\"");
        else if (k!=0)
                System.out.println("\n\nYou selected the non-zero limits, the solution is: \"FALSE\" (Your limit is not in zero value.)");
    System.out.print("\n\nIf the short & long method is not the same...\"TRY AGAIN!\"\nIf the short and long method is the same...\"GOOD!\" ");
    break;
        default:
                System.out.print("\n\n\"YOU SELECTED UNAVAILABLE ORDINATE TO VIEW SHORT METHOD!\" ");
        }
    break;
        default:
        System.out.print("\n\"YOU SELECTED UNAVAILABLE EQUATION\"\n\n\"FAILED TO SOLVE YOUR ORDINATE!\"");
   }

}
}
```

CALCULATE THE RATE OF CHANGE OF A CURVE:

Select given ordinate of a curve:

1. y = x^2 + 2x - 3
2. y = 3x^2 + 4
3. y = 2x + 5 + (-x) ^2
4.
5.
6.
7.

to be update...

Choose the ordinate of a curve to be solve: 4

"YOU SELECTED UNAVAILABLE EQUATION"

"FAILED TO SOLVE YOUR ORDINATE!"

CALCULATE THE RATE OF CHANGE OF A CURVE:

Select given ordinate of a curve:

1. y = x^2 + 2x - 3
2. y = 3x^2 + 4
3. y = 2x + 5 + (-x) ^2
4.
5.
6.
7.

to be update...

Choose the ordinate of a curve to be solve: 1

Abscissa points

Enter the first number: 2

Enter the second number: 3

Enter the value of limit in zero: 0

Enter the vertex sub 1 of a curve: 5

Graph: "upward"

Solution:

y = (x + dx) ^2 + (x +dx) - 3

y = (x^2 + 2xdx + dx^2) + (2x +2dx) - 3

Subtact the original equation

y = (x^2 + 2xdx dx^2) + (2x +2dx) - 3 - (x^2 - 2x + 3)

Simplify;

dy = 2xdx + dx^2 + 2dx

Equate to rate of change;

dy/dx = 2x + dx + 2

Enter the total coefficient of (dx): 1

lim (dx) = 0 so,

lim (dx) = 2x + 0 + 2

Rate of Change of a curve: 2x + 2

Subtitute the value of subscissa:

dy/dx = 2(2) + 0 + 2

FINAL RATE OF CHANGE (Curve):

dy/dx = 6 units

You selected the limits in zero, the solution is: "TRUE"

Enter the number of the ordinate you selected to view the "short method": 1

CONTINUE!

Short method:

y' = f'(x + h)

yd/dx = x^2 + 2x - 3

d/dx = 2x + 2 - 0

d/dx = 2(2) + 2

Rate of Change = 6 units

The solution is: "TRUE"

If the short & long method is not the same..."TRY AGAIN!"

If the short and long method is the same..."GOOD!"

CALCULATE THE RATE OF CHANGE OF A CURVE:

Select given ordinate of a curve:

1. y = x^2 + 2x - 3
2. y = 3x^2 + 4
3. y = 2x + 5 + (-x) ^2
4.
5.
6.
7.

to be update...

Choose the ordinate of a curve to be solve: 1

Abscissa points

Enter the first number: 2

Enter the second number: 3

Enter the value of limit in zero: 0

Enter the vertex sub 1 of a curve: 7

Graph: "upward"

Solution:

y = (x + dx) ^2 + (x +dx) - 3

y = (x^2 + 2xdx + dx^2) + (2x +2dx) - 3

Subtact the original equation

y = (x^2 + 2xdx dx^2) + (2x +2dx) - 3 - (x^2 - 2x + 3)

Simplify;

dy = 2xdx + dx^2 + 2dx

Equate to rate of change;

dy/dx = 2x + dx + 2

Enter the total coefficient of (dx): 1

lim (dx) = 0 so,

lim (dx) = 2x + 0 + 2

Rate of Change of a curve: 2x + 2

Subtitute the value of subscissa:

dy/dx = 2(2) + 0 + 2

FINAL RATE OF CHANGE (Curve):

dy/dx = 6 units

You slected the limits in zero, the solution is: "TRUE"

Enter the number of the ordinate you selected to view the "short method": 2

"SELECT THE SAME NUMBER OR ORDINATE TO BE SOLVE!"

THE SHORT METHOD BELOW IS NOT FOR THE ORDINATE YOU SELECTED.

Short method:

y' = f'(x + h)

d/dx = 3x^2 + 4

$d/dx = 6x + 0$

$d/dx = 6(2)$

Rate of Change = 12 units

The solution is: "TRUE"

If the short & long method is not the same..."TRY AGAIN!"

If the short and long method is the same..."GOOD!"

CALCULATE THE RATE OF CHANGE OF A CURVE:

Select given ordinate of a curve:

1. y = x^2 + 2x - 3
2. y = 3x^2 + 4
3. y = 2x + 5 + (-x) ^2
4.
5.
6.
7.

to be update...

Choose the ordinate of a curve to be solve: 2

Abscissa points

Enter the first number: 9

Enter the second number: 6

Enter the value of limit in zero: 9

Enter the vertex sub 1 of a curve: 5

Graph: "downward"

Solution:

y = 3(x + dx)^2 + 4

y = 3(x^2 + 2xdx + dx^2) + 4

y = 3x^2 + 6xdx + 3dx^2 + 4

Subtact the original equation

y = 3x^2 + 6xdx + 3dx^2 + 4 - (3x^2 + 4)

Simplify;

dy = 6xdx + 3dx^2

Equate to rate of change;

dy/dx = 6x + 3dx

Enter the total coefficient of (dx): 3

lim (dx) = 9 so,

lim (dx) = 6x + 27

Rate of Change of a curve: 6x

Subtitute the value of subscissa:

dy/dx = 6(9) + 9

FINAL RATE OF CHANGE (Curve):

dy/dx = 63 units

You selected the non-zero limits, the solution is: "FALSE" (Your limit is not in zero value.)

Enter the number of the ordinate you selected to view the "short method": 9

"YOU SELECTED UNAVAILABLE ORDINATE TO VIEW SHORT METHOD!"