Name: _____ Math-2320 Prof: Sikes

LAB

Objective : Write a program on a TI -83/84 calculator to perform Euler's method

Supplies: TI-83/84 Calculator

Find the PRGM button above the COS button and press PRGM and press ENTER

Tab to NEW
1: create New ENTER

Name= ← Calculator is already in Alpha mode just type the name (ie E U L E R)

Name=EULER ENTER

You should see a prompt ':' now go back to PRGM – tab to I/O and select the PROMPT option ENTER

:*Prompt X,Y,H,N* ← use the Alpha key to enter the 4 variables that will be used in the program
X is the x coordinate , Y is the y coordinate, H is the step size, and N will
Be how many steps to the next requested X coordinate.
Press ENTER

Go to PRGM and select option 4: For (ENTER

Now type
:For (I,2,N+1) press ENTER for the next prompt

:Y+Y_1H→Y *the → is the STO button above the enter , Y_1 is found under VARS*

:X+H→X

:DISP{X,Y} Press PRGM tab to I/O and select DISP ; be sure to use braces(2^{nd} parenthesis)

:END Press PRMG and press END under the CTL commands

You should now have a program that looks like this:

PROGRAM:EULER
:*Prompt X,Y,H,N*
:For (I,2,N+1)
:Y+Y_1H→Y
:X+H→X
:DISP{X,Y}
:END

Prior to running your program you will need to type in the differential equation in Y_1

To run your program press PRGM and under EXEC select your program (ie EULER) and press ENTER
The program should prompt you for the values of X,Y, H, and N

Solve the following problem using your program

Use Euler's method with a stepsize of .01 to approximate y(1) given $\frac{dy}{dx} = x + y$, $y(0) = 1$ round answers to 8 decimal places.

n	x_n	y_n	$y_{n+1} = y_n + hF(x_n, y_n)$

$y(1) =$

Prof. Sikes **Calculus II** **Due: 2/19/18**
Math 2414 **Lab**

NAME _____

Objective: Write a program on your calculator to estimate the arc length of a curve defined parametrically
Supplies: TI-83/84 Calculator

Find the PRGM button above the COS button and press PRGM and press ENTER

Tab to NEW
1: create New ENTER

Name= ← Calculator is already in Alpha mode type the name (ie A R C L E N T H)
Name=ARCLENTH ENTER

You should see a prompt ':' now go back to PRGM – tab to I/O and select the PROMPT option ENTER

:Prompt A,B,N — use the Alpha key to enter the 3 variables that will be used in the program
A is the x coordinate of left end point and B is the x coordinate of right end point
N is the number of iterations(number of line segments) the larger the N value the better the approximation

: (B-A)/(N)->D — set the value of D (delta) to represent the change in both horizontal and vertical direction to determine length of line segment

:0->L — initialize the variable L which will be a running sum of all the the individual line segments

:A->X — start X at the left endpoint of the arc

:For (I,1,N) — Go to PRGM and select option 4: FOR(ENTER

:$X_{1T}(X+D)-X_{1T}(X)$->H — X_{1T} is located VARS Y-VARS Parametric

:$Y_{1T}(X+D)-Y_{1T}(X)$->V — WHAT DOES THIS LINE OF CODE DO ? _____

: L+$(H^2+V^2)^{.5}$->L — WHAT DOES THIS LINE OF CODE DO ? _____

: X+D->X — increment the X variable by D

:end — Press PRMG and press END under the CTL commands; end the FOR loop

: DISP L — display L the arclength which is the running sum of line segments

Prior to running the program you must put in X_{1T} and Y_{1T} the parametrically defined curve

To run your program go to PRGM and select your program and press ENTER

Example Problem : Using calculus (non-calculator) find the exact length of the arc of the curve $y = x^2 - \frac{1}{8}\ln x$ from $(1,1)$ to $(3, f(3))$.

Exact Answer : _____

Check your work by using your program : $x_1(t) = t$ $y_1(t) = t^2 - \frac{1}{8}\ln t$

Calculator approximation: _____

Prof. Sikes **Calculus II** **Due: 3/24/17**
Math 2414 **Lab**

NAME _____

Objective: Write a program on your calculator to estimate the area under an arc defined parametrically
Supplies: TI-83/84 Calculator

Find the PRGM button above the COS button and press PRGM and press ENTER

Tab to NEW
1: create New ENTER

Name= ← Calculator is already in Alpha mode type the name (ie A R E A P A R M)

Name=AREAPARM ENTER

You should see a prompt ':' now go back to PRGM – tab to I/O and select the PROMPT option ENTER

:Prompt A,B,N ← use the Alpha key to enter the 3 variables that will be used in the program
A is the starting parameter value and B is the ending parameter value and N is the number of iterations the larger the N value the better the approximation

: A+(B-A)/(2N)->T set the parameter T to correct starting location; we will use _____ rule to approximate the area

: (B-A)/(N)->X find delta x used as step size

:0->S initialize the S value the sum of areas of each partition

:For (I,1,N) Go to PRGM and select option 4: FOR(ENTER

:S+Y_{1T}(T)* ((X_{1T}(T+.00001)- X_{1T}(T))/.00001)->S

Y_{1T} (T) is the y-value for each value of T and multiply by the derivative of X_{1T} at T store the results in the running sum S

: T+X->T increment the T parameter by X

:end Press PRMG and press END under the CTL commands; end the FOR loop

: DISP abs(S*X) display the AREA which is the running sum times delta X

Prior to running the program you must put in X_{1T} and Y_{1T} the parametrically defined curve

To run your program go to PRGM and select your program and press ENTER

Prof. Sikes **Calculus III** **Due: 11/7/18**
Math 2414 **Lab**

NAME _____

Objective: Write a program on your calculator to perform the Midpoint rule for double integrals
Supplies: TI-83/84 Calculator

Find the PRGM button above the COS button and press PRGM and press ENTER

Tab to NEW
1: create New ENTER

Name= ← Calculator is already in Alpha mode type the name (ie D B L I N T G L)

Name=DBLINTGL ENTER

You should see a prompt ':' now go back to PRGM – tab to I/O and select the PROMPT option ENTER

:Prompt A,B,C,D,M,N ← use the Alpha key to enter the 2 variables that will be used in the program Press ENTER

:A+(B-A)/(2N)->X press ENTER

:C+(D-C)/(2M)->Y press ENTER

:0->S press ENTER

Go to PRGM and select option 4: For (ENTER

:For (I,1,M) press ENTER for the next prompt

:For (J,1,N) press ENTER for the next prompt

:S+Y1->S Y1 is Vars Y-Vars Function

:X+(B-A)/(N)->X

:End Press PRMG and press END under the CTL commands

:A+(B-A)/(2N)->X press ENTER

:Y+(D-C)/(M)->Y press ENTER

:End Press PRMG and press END under the CTL commands

Press PRGM tab to I/O and select DISP

:Disp S*(B-A)*(D-C)/(N*M)

Your program should now look like this :

```
:Prompt A,B,C,D,M,N
:A+(B-A)/(2N)->X
:C+(D-C)/(2M)->Y
:0->S
:For ( I,1,M)
:For ( J,1,N)
:S+Y1->S
:X+(B-A)/(N)->X
:End
:A+(B-A)/(2N)->X
:Y+(D-C)/(M)->Y
:End
:Disp S*(B-A)*(D-C)/(N*M)
```

Prior to running the program you will need to put your multi-variable function into Y1

'A' is the lower bound of the x interval
'B' is the upper bound of the x interval
'C' is the lower bound of the y interval
'D' is the upper bound of the y interval
'N' is the number of subintervals along the x interval
'M' is the number of subintervals along the y interval

Use your program to approximate the following ; you may use different values of N and M to see how it impacts the accuracy

$$\iint_R x^2 - xy \; dA \qquad R = [-1,5]\text{x}[0,4]$$

Then find the exact value by integrating.

Prof. Sikes **Calculus II** **Due: 6/19/18**
Math 2414 **Lab**

NAME _____

Objective: Write a program on your calculator to simulate a predator – prey system
Supplies: TI-83/84 Calculator

Find the PRGM button above the COS button and press PRGM and press ENTER

Tab to NEW
1: create New ENTER

Name= ← Calculator is already in Alpha mode type the name (ie W O L V E S)

Name=WOLVES ENTER

You should see a prompt ':' now go back to PRGM – tab to I/O and select the PROMPT option ENTER

:Prompt R,W ← use the Alpha key to enter the 2 variables that will be used in the program
R is the number of rabbits, W is the number of wolves Press ENTER

Go to PRGM and select option 4: For (ENTER

:For (I,1,150) press ENTER for the next prompt

:R->L_1(I):W-> L_2(I) press ENTER (the arrow is the STO button above the ON)

:R+Y1->R press ENTER

:W+Y2->W press ENTER

Press PRGM tab to I/O and select DISP

:disp {int(r),int(w)} ← be sure to use braces not parenthesis

:end Press PRMG and press END under the CTL commands

Prior to running the program you must put in Y1 :.08R-.001RW and Y2 : -.02W+.00002RW .

To run your program go to PRGM and select your program and press ENTER

You may turn on STAT PLOT and graph your phase trajectory

On the back side of paper graph several different phase trajectories

The following equations are examples of Lotka-Volterra equations

the .08 represents the growth rate of the rabbits , the -.001 represents a rabbit's demise with an encounter with a wolf, the -.02 represents the decline in growth in the absence of prey, and the .00002 represents the increase in growth rate with a wolf-rabbit 'successful' encounter

(08R-.001RW) and (-.02W+.00002RW)

Prof. Sikes **Calculus III** **Due: 10/04/18**
Math 2414 **Lab**

NAME _____ (round all answers to two decimal places)

In a certain plane region when you are located at coordinates (x, y) your corresponding temperature in degrees (F) is given by the function $T = f(x, y) = x^2 + y^2 - 6x - 4xy + 53$. You are currently located at the point $x = 3$ $y = 6$ and you are cold. You have enough energy to move in any direction 1 unit from your current location and your objective is to move to a new location that puts you at the warmest temperature possible.

STEP 1: Find the largest value of $T = f(x, y)$ at exactly one unit from your current location, also find your bearing from $x = 3$ $y = 6$ to your new location and find the coordinates of your new location. { hint: you may want to parametrize the circle in terms of theta , and use the single variable method of maximizing a function }.

Largest Temperature :_____ Bearing in degrees from (3,6)

_____ New Location _____

STEP 2: Find the smallest value of $T = f(x,y)$ at exactly one unit from your current location, also find your bearing from $x = 3$ $y = 6$ to your new location and find the coordinates of your new location.

Smallest Temperature :_____ Bearing in degrees from (3,6) _____ New Location _____

STEP 3 Find at what x location(s) it is **impossible** for $T = f(x,y) = x^2 + y^2 - 6x - 4xy + 53$ to produce a temperature of 44 degrees.

STEP 4 The gradient gives you the change in temperature as you begin to move from your point $x = 3$ $y = 6$ in some direction.

If we want to get to the warmest temperature possible then we want to maximize the gradient.

Find the gradient vector of $T = f(x, y) = x^2 + y^2 - 6x - 4xy + 53$

To maximize the gradient at (3,6) we evaluate the gradient at that point (3,6) ; another words $\nabla T(3,6)$ this will give the **direction** you should head to make the biggest impact on your temperature. Find the bearing using your gradient. How does this compare to what you found in Step 1 ?

$\nabla T(3,6) = \langle \quad , \quad \rangle$

Now this gradient is only our direction and that direction may change as we take our first step so we would need to recalibrate and determine our gradient once we started moving in that direction. So each time we take a small step we would need to recalculate the gradient based on our new location. This tedious process can be automated with a calculator program like the one below: Answer the questions about the program

Write a program on your calculator to create a path to the highest temperature within one unit of your starting location :

: PROMPT X,Y,N	ask the user for their beginning x and y location ask the user how many iterations(baby steps) we want to use to travel one unit
: FOR(I,1,N)	
: $X \to L_1(I)$	store the x coordinate in a table entry
: $Y \to L_2(I)$	store the y coordinate in a table entry
: $Y_2 / \sqrt{(Y_2)^2 + (Y_3)^2} \to A$	what does this line of code do? _____
: $Y_3 / \sqrt{(Y_2)^2 + (Y_3)^2} \to B$	
: $(X + (1/N)A) \to X$	what does this line of code do? _____
: $(Y + (1/N)B) \to Y$	
: END	
: $DISP\ X, Y, Y_1$	display the x and y coordinates of your destination (after you have traveled 1 unit) and the corresponding temperature.

What needs to be in place for Y_1 Y_2 Y_3 prior to running this program ?

Run the program with x=3 and y=6 and N=1 and describe your findings; be sure to state the final destination and the corresponding temperature and how this compares to your gradient .

Run the program with x=3 and y=6 and N=50 and describe your findings: be sure to state the final destination and the corresponding temperature and how this compares to your gradient .

Remove the functions from Y_1 Y_2 Y_3 (clear out these entries) . Now turn on the STAT PLOT (2^{nd} Y=) - Scatter Plot option
and use XLIST L_1 and YLIST L_2 and then quit from that screen and press ZOOM STAT (option 9) . You may use the TRACE feature to move along from one point to the next. What does the plot represent? Sketch the plot here:

Name: _____ Math-2414 Due : 5/6/16 Prof: Sikes

LAB

Objective : Write a program on a TI -83/84 calculator to calculate an approximation of a function using a Taylor polynomial.

Supplies: TI-83/84 Calculator

Find the PRGM button above the COS button and press PRGM and press ENTER

Tab to NEW
1: create New ENTER

Name= ← Calculator is already in Alpha mode just type the name (ie T A Y L O R)

Name=TAYLOR ENTER

You should see a prompt ':' now go back to PRGM – tab to I/O and select the INPUT option ENTER

:Input "Angle",X ← use the Alpha key to enter the word ANGLE for which we will find the trig value of
Press ENTER
:Input "Taylor Polynomial Degree of",N

:0→Y (which initializes the variable that will contain the result of the program)

Go back to PRGM and find the FOR command and type

:For(I,1,N)

:((-1)^(i+1))(x^(2i-1)/(2i-1)!) + y sto y

Go back to PRGM and select END

:End

Go back to PRGM and tab to I/O and select DISP

:Disp "SIN",x,"=",y

You should now have a program that looks like this:

PROGRAM:TAYLOR
:*Input "Angle",X*
:Input "Taylor Polynomial Degree of ",N
:0→Y
:For (I,1,N)
: :((-1)^(i+1))(x^(2i-1)/(2i-1)!)→ y
:END
:Disp "SIN",x,"=",y

To run your program press PRGM and under EXEC select your program (ie TAYLOR) and press ENTER
The program should prompt you for the values of X and N

Solve the following problem using your program ; Find the sin(30 degrees)