Name_____ **Student ID #** _____

Instructor_____ **Lab Period** _____ **Date Due** _____

Lab 8
Curve Sketching

Objectives

1. To use the computer as a tool in sketching curves.
2. To distinguish the important characteristics of a curve.

Curve sketching (even with the help of a computer) can be difficult. For example, over what interval should you plot a function to observe all its interesting characteristics? No plotting program will simply give you the best interval. However, you can use a plotting program to gain insight into the behavior of the function; and, with some mathematical analysis, you can obtain a graph of the function showing its most interesting characteristics. *TEMATH* provides the following tools to help you find the important characteristics of the graph of a function.

Intercepts

To find an *x*-intercept (root or zero) of a function, click the **Single Root Finder** tool  and click in the **Graph** window near the *x*-intercept. The value of the *x*-intercept will be written into the **Report** window.

To find the *y*-intercept of a function, following these instructions: click the **Rectangular Tracker** tool  , click in the **Domain & Range** window to make it active, enter **0** into the ***x*-cell** in the bottom portion of the window and press the **Enter** key or click the **Enter** button. The value of the *y*-intercept will be written into the *y*-cell in the bottom portion of the Domain & Range window and the Rectangular Tracker's dot will be positioned at the *y*-intercept in the Graph window.

Symmetry

To check if a function is an even function (symmetric about the y-axis), select **Reflections — *y*-axis** from the **Tools** menu. If the graph is its own reflection, then it is symmetric about the *y*-axis (at least on the plotted domain). To check if a function is an odd function (symmetric about the origin), select **Reflections — origin** from the **Tools** menu. If the graph is its own reflection, then it is symmetric about the origin (at least on the plotted domain).

Asymptotes

If **Adaptive Plot** in the **Graph** menu is checked, *TEMATH* will display the vertical asymptotes of the plotted function in the Graph window and it will write the values of

the vertical asymptotes into the Report window. To find horizontal and slant (oblique) asymptotes, select **Other Asymptotes** from the **Tools** menu.

Local Maximum and Minimum Values

To find local maximum and minimum values, click the **Maximum/Minimum Finder** tool  and click in the **Graph** window near the local maximum or minimum. The value and the coordinate location of the local maximum or minimum will be written into the Report window.

Concavity and Points of Inflection

Use the Rectangular Tracker tool  to approximate the points of inflection and the intervals over which the graph of the function is concave up or concave down.

Printing a Graph

To print a copy of a graph, click in the **Graph** window to make it active and select **Print Graph** from the **File** menu.

Exploration 1 Curve Sketching Problems

The purpose of this exploration is for you to gain some experience in examining the properties of a graph, for example, by looking at a graph you should be able to estimate where the graph is increasing or decreasing, where it is concave up or concave down, where it has a local maximum or minimum, and so on. It is also important that you try different plotting domains when graphing the functions in this exploration so that you don't miss any of the important features of the graph. Your goal is to obtain a *complete graph* of each function, that is, a graph that shows all the important features of the graph and the plotted portion of the graph suggests what the entire graph would look like if it were plotted over its entire domain.

In the following problems: select an appropriate domain that will give a complete graph, fill-in all the information that is requested about the graph, and attach to this lab a printed copy of the complete graph for each of the following functions. Note: some points of inflection may be difficult to see (try using *TEMATH*'s Zoom tool). Be sure to think about what the concavity of a function must be when approaching an asymptote. Also, be sure to use parentheses when necessary for entering functions into *TEMATH*.

1. Plot the function $f(x) = \dfrac{2x^3 - 2x^2 + 3}{x^3 + 1}$. The *TEMATH* expression for this function is

(2x^3–2x^2+3)/(x^3+1).

Domain of $f(x)$ ……Range of $f(x)$……

Are there any points in the domain where $f(x)$ is not differentiable? If so, what are they?……

x-intercepts …… *y*-intercept ……

Symmetry……

Asymptotes……

Intervals of increase or decrease ……

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Local maximum and minimum values ……

……

Approximate values of the points of inflection.……

……

Approximate intervals over which $f(x)$ is concave up or concave down……

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2. Plot the function $f(x) = \dfrac{2x^3 + 3x^2 - 10x + 24}{x^2 + 4}$. The *TEMATH* expression for this function is **(2x^3+3x^2–10x+24)/(x^2+4)**.

Domain of $f(x)$ ……Range of $f(x)$……

Are there any points in the domain where $f(x)$ is not differentiable? If so, what are they?……

x-intercepts …… *y*-intercept ……

Symmetry……

Asymptotes……

Intervals of increase or decrease ……

……

Local maximum and minimum values ……

……

Approximate values of the points of inflection.……

……

Approximate intervals over which $f(x)$ is concave up or concave down……

……

3. Plot the function $f(x) = \dfrac{\sqrt{1-x^2}}{x}$. The *TEMATH* expression for this function is **sqrt(1–x^2)/x**.

Domain of $f(x)$ ……Range of $f(x)$……

Are there any points in the domain where $f(x)$ is not differentiable? If so, what are they?……

x-intercepts …… *y*-intercept ……

Symmetry……

Asymptotes……

Intervals of increase or decrease ……

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Local maximum and minimum values ……

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Approximate values of the points of inflection……

……

Approximate intervals over which $f(x)$ is concave up or concave down……

……

4. Plot the function $f(x) = (x+1)^{2/3}(x-2)^{1/3}$. The *TEMATH* expression for this function is **rad(3, (x + 1)^2) rad(3, x – 2)**.

Domain of $f(x)$ ……Range of $f(x)$……

Are there any points in the domain where $f(x)$ is not differentiable? If so, what are they?……

x-intercepts …… *y*-intercept ……

Symmetry……

Asymptotes……

Intervals of increase or decrease ……

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Local maximum and minimum values ……

……

Approximate values of the points of inflection.……

……

Approximate intervals over which $f(x)$ is concave up or concave down……

……

5. Plot the function $f(x) = \frac{x}{\sqrt{x^2+1}}$. The *TEMATH* expression for this function is **x/sqrt(x^2+1)**.

Domain of $f(x)$ ……Range of $f(x)$……

Are there any points in the domain where $f(x)$ is not differentiable? If so, what are they?……

x-intercepts …… *y*-intercept ……

Symmetry……

Asymptotes……

Intervals of increase or decrease ……

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Local maximum and minimum values ……

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Approximate values of the points of inflection.……

……

Approximate intervals over which $f(x)$ is concave up or concave down……

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6. Plot the function $f(x) = \sqrt{x/(x-2)}$. The *TEMATH* expression for this function is **sqrt(x/(x–2)**.

Domain of $f(x)$ ……Range of $f(x)$……

Are there any points in the domain where $f(x)$ is not differentiable? If so, what are they?……

x-intercepts …… *y*-intercept ……

Symmetry……

Asymptotes……

Intervals of increase or decrease ……

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Local maximum and minimum values ……

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Approximate values of the points of inflection.……

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Approximate intervals over which $f(x)$ is concave up or concave down……

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