Calculus Summer Assignment 2006/2007

Part 1

1. Graph the following equations. Do it by hand and use your calculator to check your work.

a. $y = -\frac{1}{2}x + 2$	b. $y = \sqrt{9 - x^2}$
c. $y = 4 - x^2$	d. $y = x^3 - x$

2. Find the x and y intercepts

a. $y = x^2 + x - 2$	b. $y^2 = x^3 - 4x$
c. $y = x\sqrt{9 - x^2}$	d. $y = \frac{x^2 + 3x}{(3x + 2)^2}$

3. Check for symmetry with respect to each axis and the origin.

a. $y^2 = x^3 - 4x$	b. $y = \frac{x}{x^2 + 1}$

4. Sketch the Graph of Each Equation. Identify any intercepts and test for symmetry.

a. $y = 1 - x^2$	b. $y = \frac{1}{x}$

5. Use a graphing utility (your calculator for example) to graph each equation. Identify ay intercepts and test for symmetry.

a. $y = \frac{5}{x^2 + 1} - 1$	b. $x^2 + 4y^2 = 4$ (hint: solve for y and graph both positive and negative halves)

6. Find the points of intersection of the graphs of the equations and then solve analytically.

a. $x + y = 2$ $2x - y = 1$	b. $x + y = 7$ $3x - 2y = 11$

7. Use your graphing calculator to graph the following equations and find the points of intersection of the graphs.

a. $y = x^3 - 2x^2 + x - 1$ $y = -x^2 + 3x - 1$	b. $y = x^4 - 2x^2 + 1$ $y = 1 - x^2$

8. Find the sales necessary to break even (R = C) if the cost C of producing x units is: $C = 5.5\sqrt{x} + 100$ and the revenue R for selling x units is $R = 3.29x$

9. The table shows the average number of acres per farm in the United States for selected years.

Year	Average
1950	213
1960	297
1970	374
1980	426
1990	461
1994	478

a) Use the regression capabilities of a graphing calculator to find a mathematical model of the form. $y = at^2 + bt + c$ for the data. Let t=0 correspond to 1950.

b) Use a graphing calculator to graph the model and compare with the data.

c) Use the model to predict the average number of acres per farm in the United States in the year 2000.

Part 2

1. Use the point on the line and the slope of the line to find three mre points on the line. Then write the equation of the line in point-slope form.

a. Point: (2, 1), slope: m =0	b. point: (1, 7) Slope: m= -3

2. The Table gives earnings per share of common stock for General Mills for the years 1987 through 1994. Let t = 0 correspond to 1990 and let y represent earnings per share.

t	y
-3	$1.25
-2	$1.63
-1	$2.53
0	$2.32
1	$2.87
2	$2.99
3	$3.10
4	$2.95

a) Plot the data by hand and connect adjacent points with line segments.

b) Use the slope between each set of adjacent points to determine the years when earnings decreased most rapidly and increased most rapidly.

3. Find the slope and the y-intercept of each line.

a. x + 5y = 20	b. 6x – 5y = 15
c. x = 4	d. y = -1

4. Find an equation of the line that passes through the points or though the given point with the given slope. (use point slope form).

a. (2, 1), (0, -3)	b. (-3, -4), (1, 4)
c. (0, 3), m = 3/4	d. (-2, 4), m = -3/5

5. Find the equation of the vertical line with x-intercept at 3.

6. Write an equation of a line through the point (a) parallel to the given line and (b) perpendicular to the given line.

a. $\left(\frac{7}{8}, \frac{3}{4}\right)$, 5x + 3y = 0	b. (-6, 4), 3x + 4y = 7

7. A company reimburses its sales representatives $150 per day for lodging and meals plus $0.30 per mile driven. Write an equation giving the daily cost C to the company in terms of x, the number of miles driven.

8. An employee has two options for positions in a large corporation. One position pays $12.50 per hour plus an additional unit rate of $.75 per unit produced. The other pays $9.20 per hour plus a unit rate of $1.30.
   a. Find linear equations for the hourly wages W in terms of x, the number of units produced per hour, for each of the options.
   b. Use a graphing utility to graph the linear equations and find the point of intersection.
   c. Interpret the meaning of the point of intersection. How would you use this information to obtain the highest total hourly wage?

9. True or False? The lines represented by $ax + by = c_1$ and $bx – ay = c_2$ are perpendicular. Assume $a \neq 0$ and $b \neq 0$. Justify.

10. True or false? It is possible to have two lines with positive slopes to be perpendicular. Justify.

Part 3

1. Given f(x) = 2x – 3 f(0), f(-3), f(b), f(x-1).

2. Given $f(x)=\begin{cases} x^2+2, & x<0 \\ 2x^2+2, & x\geq 0 \end{cases}$ find f(-2), f(0), f(1), and f(s^2 + 2)

3. Given f(x) = x^3 find $\frac{f(x+h)-f(x)}{h}$

4. Given f(x) = x^3 – x find $\frac{f(x)-f(1)}{x-1}$

5. Sketch a graph of the functions:

a. f(x) = 4 - x	b. $g(x)=\frac{4}{x}$
c. $g(x)=\sqrt{9-x^2}$	d. $h(\theta)=-5\cos\frac{\theta}{2}$

6. Use a graphing calculator to graph the polynomial functions $p_1(x) = x^3 – x + 1$ and $p_2(x) = x^3 – x$. How many zeros does each function have? Is there a cubic polynomial that has no zeros? Explain.

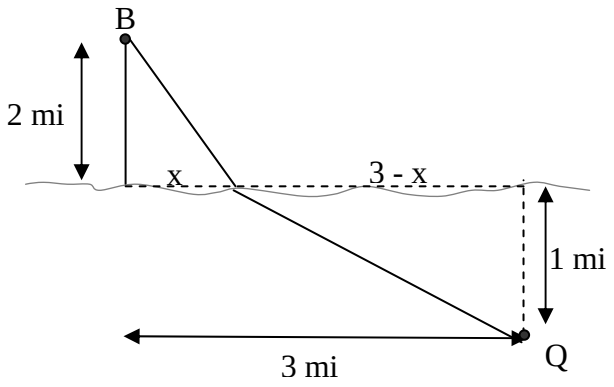
7. A student who commutes 27 miles to attend college remembers after driving a few minutes that a term paper that is due has been forgotten. Driving faster than normal the student returns home, picks up the paper, and then again starts for school. Sketch a possible graph of the students distance from home as a function of time. (Remember that time, an independent variable, should always be graphed on the horizontal axis).

8. Find the composite functions f(g(x)) and g(f(x)). What is the domain of both composite functions?
   f(x) = 1/x g(x) = x^2 + 1.

9. Determine if the function is even, odd, or neither.

a. f(x) = 4 - x	b. $g(x)=x\cos x$

11. You are in a boat 2 miles from the nearest point on the coast. (see the diagram) You are going to point Q, 3 miles down the coast and 1 mile inland. You can row at 2 miles per hour and walk about 4 miles per hour. Express the entire trip T as a function of x.



Part 4

1., The ordered pairs give quiz scores for two consecutive 15 point quizzes for a class of 18 students.

(7, 13), (9, 7), (14, 14), (15, 15), (10, 15), (9, 7), (14, 11), (14, 15), (8, 10), (15, 9), (10, 11), (9, 10), (11, 14), (7, 14), (11, 10), (14, 11), (10, 15), (9, 6).

a. Plot the data. From the graph, does the relationship between the consecutive scores appear approximately linear?
b. If the data appear approximately linear, find a linear model for the data. If not, give some possible explanations.

2. Energy Consumption. The data give the per capita energy usage (in thousands of kilograms of coal equivalent) and the per capita gross national product (in thousands of U.S. dollars) for a sample of countries in 1990.

Country	Energy	GNP	Country	Energy	GNP
Argentina	1.83	3.7	Bangladesh	0.07	0.2
Brazil	0.77	2.6	Canada	10.51	21.5
Denmark	4.70	24.0	Finland	5.93	26.0
France	3.87	20.8	Greece	3.05	6.8
India	0.31	0.3	Italy	3.86	19.4
Japan	4.21	26.2	Mexico	1.75	3.0
Pakistan	0.28	0.4	South Korea	2.47	6.0
Tanzania	0.04	0.1	United States	10.32	23.0

a. Use the regression capabilities of your calculator to find a linear model for the data.
b. Use a graphing calculator to plot the data and graph the model.
c. Interpret the graph in part b. Use the graph to identify any countries that do not fit the linear model.

3. Automotive costs. The data in the table give the variable costs of operating an automobile in the United States for the years 1985 to 1991. The functions y_1, y_2, and y_3 represent the costs in cents per mile for gas, maintenance and tires.

Year	y_1	y_2	y_3
1985	6.16	1.23	0.65
1986	4.48	1.37	0.67
1987	4.80	1.60	0.80
1988	5.20	1.60	0.80
1989	5.20	1.90	0.80
1990	5.40	2.10	0.90
1991	6.70	2.20	0.90

a. Let t be the time in years with t=5 corresponding to 1985. Use the regression capabilities of your calculator to find a quadratic model for y_1 and a linear model for y_2 and y_3.
b. Use a graphing utility to graph y_1, y_2, and y_3, and $y_1 + y_2 + y_3$ in the same viewing window. Use the graph to estimate the total variable cost per mile in 1998.

4. Car Performance. A V-8 car engine is coupled to a dynamometer and the horsepower y is measured at different engine speeds x (in thousands of revolutions per minute). The results are shown in the table.

x	1	2	3	4	5	6
y	40	85	140	200	225	245

a. Use the regression capabilities of your calculator to find a cubic model for the data.

b. Use a graphing utility to plot the data and graph the model.
c. Use the model to approximate the horsepower when the engine is running at 4500 revolutions per minute.