LAB EXERCISES

MATHEMATICS LABORATORY EXERCISES

Lab 1: **Buffon's Needle Problem**

Draw five equidistant parallel lines on a piece of cardboard where the distance between lines is D. From a standing position, drop N needles of length L on the floor. Record the number of times T that the needle crosses a line. Compute:

$$2LN/DT$$

The theory says that your result should approach the value of pi = 3.14159… with the result getting better as N gets large. Have each member of your group (three or four members) carry out a dropping of the needles and record your results on the result sheet. Add the values of N and T for all members of your group to get a grand value of N and T. Use these to compute the value of pi from the formula. How close to pi did you get? Record the total value of T and N for your group in the table of the Results Section. We will then pool all of the values from the other groups to see if the value of pi improves.

Lab 2: **Least and greatest Area to volume ratio**

Take 4 cubes and arrange them so that the exposed area is as small as possible for the given volume (4 cubic units). What is the value of the exposed area (in square units)? What is the largest area that you can get by arranging the cubes? Assume that the area beneath the cubes is not exposed. Compute the ratio of Area/ volume. Do this problem again for 32 cubes, 108 cubes, 64 cubes. What answers do you get?

Lab 3 : The largest tray problem

Take a piece of 8'' x 10'' graph paper and cut four squares from its corners. Find the size of the cut (in graph paper boxes) such that the volume of the tray that you get by folding up the edges is the largest possible. What should the size of the cut be to get the smallest volume?

Lab 4: Pi

Draw a series of three circles with radii equal to 5, 10, and 15 box lengths on a piece of graph paper. For each circle count the greatest number of boxes entirely within the circle and then find the least number of boxes that entirely enclose the circle (Note: You can make the work of counting squares easier if you just count the squares in one quarter of a circle and then multiply your result by 4). In each case divide the number of boxes by the square of the radius. Your result should be an estimate of pi. Why? Discuss your results.

Lab 5: Number mania

Each member of your group arbitrarily picks two numbers between 1 and 10. Add the two numbers to form a sequence of three numbers. Take the result and add it to the previous number.

Add that result to the previous number to get a fourth number in the sequence. Continue until you have created a sequence of 20 numbers. Divide the 20th number of your sequence by the 19^{th}. What is the value? Compare your result to the result gotten by other members of your group. How do you explain the results? What is the meaning of the number that you obtained?

Lab 6: Finding square roots

Pick a positive integer. Make a guess of the square root of your number. Compute a new guess as follows:

New guess = 1/2 [(Your number/ guess) + guess]

Repeat this for the new guess. Notice that if you just happened to guess the correct square root then your new guess would equal your old guess. After about three iterations of this procedure your new guess should be close to the square root of your number. Check this out? How many iterations do you need to get within four decimal point agreement with the square root? Check your result with a hand calculator.

Lab 7: Pizza and pennies

Place 100 pennies face up in an empty pizza box. Shake the box and remove all of the tails and record the number of heads. Repeat this again and again until there are no more face up coins recording the number of face up coins each time. What kind of number pattern do you observe?

Lab 8: Shortest distance between two points via the paper's edge

For the given piece of paper with two marks on it, use a ruler or any other device to find the shortest distance from one mark to the other that goes through one point on the marked edge of your paper.

Lab 9: Pendulum problem

Take a length L of string and measure it. Place a key or some other heavy object on the end, displace the end and let it swing. The amount of displacement is referred to as the amplitude of the swing. Record the exact number N of swings it makes in 60 seconds. Note that if the amplitude is not too large, the value of N will not depend on the amplitude. Try two different swing amplitudes with small displacements to confirm this. However the value of N does depend on the length of the string. Cut the length in half and again find the number of swings in 60 sec. Cut the length again in half and repeat. Record the value of L and the time in seconds, T, for one complete swing (the *period* of the motion), i.e. T = 60/N. Sketch the graph of T vs L.

Name _____

Results:

Lab 1: **L = ____ , D = _____ , N = _____**

Trial number	N	T	2LN/DT
1			
2			
3			
4			
Total			

Lab 2:

No. of cubes = V(vol.)	Min. Area (A = no. of exposed faces)	Max. Area (A = no. of exposed faces)	A/V for min. area
4			
32			
108			
64			

Lab 3:

Trial Number	Cut size (in graph paper boxes)	Volume
1		
2		
3		
4		

Lab 4:

Radius R (box lengths)	(Max. no. of enclosed boxes)/ R^2	(Min. no. of enclosing boxes)/R^2
5		
10		
15		

Lab 5:

Group member	Starting numbers	20^{th} no./19^{th} no.
1		
2		
3		
4		
5		

Lab 6: Your number N = _____
Initial guess for square root of N = _____
1 st updated guess =
2 nd updated guess =
3 rd updated guess =
Actual square root (using a calculator) =

Lab 7: Trial number Number of heads

0	100
1	
2	
3	
4	
5	
6	

Lab 8: Shortest distance between the marks via the marked edge of the paper = _____

Lab 9: Trial number String length (cm.) L T = 60/N

1		
2		
3		