Mathematics 112 Portfolio

To demonstrate mastery of the concepts in the ***Investigating Patterns*** portion of this course, each student must submit a portfolio of assigned work. Each student's submissions must be inserted in 3-hole plastic sleeves and assembled in a standard 3-ring binder. Portfolios will be evaluated on their completeness, quality, accuracy, and originality. Ten percent of the grade will be reserved for the pedagogical appeal of the presentation (make an impact) and ten percent for supplementary investigations (at least 3 distinct topics). Attendance in corresponding classes is compulsory; 1 point will be deducted from the 25 point maximum for each absence. ***Web pages can be accessed from: http://britton.disted.camosun.bc.ca/jbfunpatt.htm***

The individual assignments are as follows:

Topic A:
- Complete the counting regions exercise.
- Prepare a *Get Off the Earth* puzzle and provide details on its solution.

Topic B:
- Complete the "painted faces" table for $12^3 = 1728$ cubes. Provide details.
- Complete the number trick exercise.

Topic C:
- Solve problems 1, 2, 5, 6, 8, 9, 10, 12, 13, 15, 16, 19, 20, 23 and 24 in the problem solving exercise. Then solve at least 5 of the remaining 10 problems. Provide details when the solution does not involve a "trick".

Topic 1:
- Use prime factorization to find the gcd and lcm of 4410 and 10395.
- Show that 496 is a perfect number, and that 1184 and 1210 form an amicable pair. [Use the ***Perfect Number Analyzer*** to find all divisors.]
- Construct a 9^{th} order normal magic square using the diagonal method. Find its magic constant using the formula.
  [Optional grid: ***http://britton.disted.camosun.bc.ca/magicsqgrid.doc***]

Topic 2:
- Using the data in the ***Perpetual Calendar*** web page, determine the day (Sunday to Saturday) of your birth (include date). *SHOW ALL WORK*
- Complete the mod art exercise. Color your design with a paint program.

Topic 3:
- Complete the logarithmic spiral exercise.
- Complete the exercise in the ***Knotty Pentagram*** web page.
- Complete the golden sketch exercise.

Topic 4:
- Using a compass, complete the Fibonacci whirling squares exercise (stripped version). *ACCURACY IS ESSENTIAL / DO NOT "DECORATE"*
- Complete the family tree of a male bee exercise. Count the male/female/total bees in each generation, then comment.

Topic 5:
- Complete the binary light bulb exercise.
- Convert the decimal number 1492 to its binary representation using the technique of repeated division by 2. Verify your result by addition.
- Select two numbers greater than 50 neither of which is a power of 2 (to avoid trivial examples), then multiply them using the doubling method detailed in the ***Multiplying by Doubling*** web page. Multiply the two numbers using traditional multiplication. Compare your two results.

Topic 6
- Complete the binomial expansion and Pascal's Triangle exercise.
- Complete the multiples of 6 visual pattern using mod 6 arithmetic. *INCLUDE TWO SHEETS: THE GRID OF NUMBERS AND THE CORRESPONDING VISUAL PATTERN (COLOR THE "ZERO" CELLS)*

Topic 7:
- Using only straight edge and compass, construct a symmetrical network of 19 circles as per the ***Construction of an Islamic Pattern*** web page.
- Draw an ellipse with pin-and-string. Measure the distance (in mm) between any point on the ellipse and each focus. Add the two results. Join the two vertices, then measure the distance between them. Compare the two measurements.

Topic 8:
- Outline a hyperbola by paper-folding. Measure the distance (in mm) between any point on the hyperbola and each focus. Subtract the two results. Join the two vertices, then measure the distance between them. Compare the two measurements.

Topic 9:
- Complete a "n to 3n mod 72" line design.
- Complete a "n to 2n mod 36" curve stitching diagram. Use minimal chord on the back side. *ENSURE THE BACK SIDE IS ACCESSIBLE*.

Topic 10:
- Complete the Reuleaux triangle with rounded corners exercise. *ACCURACY IS ESSENTIAL / DO NOT "DECORATE" THE CURVE*

Topic 11
- Complete the roulette exercise involving Base Circle (3). *USE THE PUNCHED HOLE - A POINT INSIDE WHEEL (1)*
- Complete the roulette exercise involving Base Circle (5). *USE THE NOTCH - A POINT ON THE RIM OF WHEEL (1)*
- Using prime factorization, find the gcd for each of wheels 36, 50, 64 and 84 with *Spirograph* ring 105. Use these gcds to find the corresponding numbers of cusps.

Topic 12
- Complete the Snowflake Curve.
- Complete the Sierpinski Triangle fractal.
- Complete the pop-up fractal exercise. Glue the pop-up into a folded sheet of colored card so the fractal pops when the card is opened.