Mathematics and Culture Test 2

1. Match the items on the left with the appropriate choice on the right to make a true statement. Indicate the match by clearly and legibly copying the letter for the item on the right in the blank on the left.

   1. A set
   2. Although we used to think it was curved
   3. Dihedral groups
   4. Great circles
   5. Group multiplication
   6. Kepler thought the Platonic solids
   7. One proof of the Pythagorean theorem
   8. Regular polyhedra
   9. Salvador Dali
   10. The angle sum of a triangle
   11. The Möbius band
   12. The Pythagorean Theorem
   13. The tetrahedron
   14. There are 16
   15. There are 4
   16. There are eight
   17. There are golden rectangles
   18. There are infinitely many
   19. There are only 5
   20. Victor Klee
   21. The Mandelbrot set

   a) are lines in spherical geometry
   b) are Platonic
   c) can tell us about the curvature of space
   d) cannot be put into one to one correspondence with its power set
   e) determined planetary motion
   f) hidden in the Platonic solids
   g) involve symmetry
   h) involves areas of triangles and squares
   i) is arguably the most influential mathematical result
   j) is famous for his art gallery result
   k) is its own dual
   l) is one sided
   m) is the most famous fractal
   n) isn't always commutative
   o) regular solids
   p) scientists now believe the universe is flat
   q) sizes of infinities
   r) triangular faces on the dual of the cube
   s) used four dimensional concepts
   t) vertices in a hypercube
   u) vertices in a tetrahedron

2. If a pair of standard six-sided fair dice with faces numbered 1-6 are tossed, what is the probability that the resulting sum is five?

   \[ \frac{1}{9} \]

3. Caitlin is five feet tall and standing six feet from a thirteen foot tall vertical pole. How far is the top of the pole from the top of her head?

   \[ 10 \text{ feet} \]

4. Scientists can measure angles to determine the curvature of space because: in planar (ie Euclidean) geometry the sum of the angles in a triangle is 180°; in spherical geometry it is greater than 180°; and in hyperbolic geometry it is less than 180°.

5. How many subsets does the set \( \{ \heartsuit, \diamondsuit, \spadesuit, \clubsuit \} \) have? \( 2^4 = 16 \)

6. Using white as zero and your pen or pencil color as one, color the triangle above right as Pascal’s triangle mod two.

7. If you borrow \$1000 at 20% interest compounded annually and make no payments how much will you owe after four years?

   \[ 1000 \times (1.2)^4 = 1445.8 \]

   \( 1445.8 \)

   \( 1445.8 \)

   Complete the following on Extra Paper provided:

8. Below is a mapping from the elements of \( \{ \heartsuit, \diamondsuit, \spadesuit, \clubsuit \} \) to its subsets. Define the mystery subset to be the set of all elements of \( \{ \heartsuit, \diamondsuit, \spadesuit, \clubsuit \} \) with the property that the element is mapped to a subset that does not contain it. What is the mystery subset? Explain briefly how you know before checking that no element is mapped to it.

   \[ \{ \heartsuit, \spadesuit \} \]

9. What happens if you cut a Möbius strip down the center? You get one large loop w/2 twists and 2 sides.

10. Write an (approximately half page hand written) essay on something you have learned since the last test.

   \( 20 \text{ pts} \)