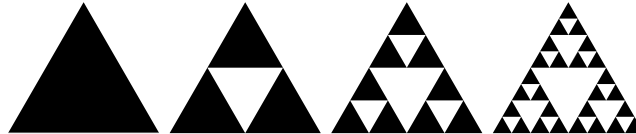


Assignment 1

Show all your work

Name: _____
 Number: _____
 Signature: _____
 Score: ____/10

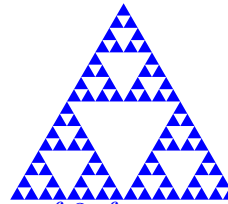
Problem 1: Sierpinski triangle is a fractal: first take an equilateral triangle (stage 0), then draw a middle triangle (stage 1). Below shows the first three stages.



Count the number of *white* triangles (of all sizes) for each stage, and predict according to your pattern the number of *white* triangles of all sizes in the fourth stage.

Stage:	0	1	2	3	4
White triangles:	0	1	4	13	40

$$t_n = 3t_{n-1} + 1$$



Also note that at each stage, you add consecutive powers of 3; for example, stage 1 has $3^0 = 1$ white triangle; stage 2 has $3^0 + 3^1 = 4$ white triangles; stage 3 has $3^0 + 3^1 + 3^2 = 13$ white triangles; thus, stage 4 has $3^0 + 3^1 + 3^2 + 3^3 = 40$ white triangles.

Score: /4

Problem 2: Decide whether each equation is true.

- a. $12 \times 42 = 21 \times 24$
- b. $13 \times 62 = 31 \times 26$
- c. $23 \times 96 = 32 \times 69$

Explain if this allows you to conclude that $37 \times 54 = 73 \times 45$?

No, $37 \times 54 = 1998$ while $73 \times 45 = 3285$, so this is a false pattern.

Indeed, if $(10a + b)(10c + d) = (10b + a)(10d + c)$, then

$100ac + 10ad + 10bc + bd = 100bd + 10bc + 10ab + ac$, so $99ac = 99bd$, so $ac = bd$, so the pattern holds only if the product of the tens-digits equals the product of the ones-digits.

Score: /2

Problem 3: Video game designers seem to have a shorter lifespan than the average Japanese or North Americans. The total life span of Laralyn McWilliams, Yoshitaka Murayama, and Mutsumi Inomata is 176. If Laralyn lived 3 years longer than Yoshitaka, but Laralyn lived 5 years shorter than Mutsumi, how old was Mutsumi Inomata when they died?

If Yoshitaka reached the age of x , then Laralyn reached $x + 3$, and Mutsumi reached $(x + 3) + 5 = x + 8$. The sum of their lifespans is therefore $x + (x + 3) + (x + 8) = 176$, so $3x + 11 = 176$, so $3x = 176 - 11 = 165$, so $x = \frac{165}{3} = 55$.

Therefore Mutsumi Inomata reached the age of $x + 8 = 55 + 8 = 63$.

Score: /4