A piece of contemporary art consists of a list of 896 consecutive integers, each in a different color. **SCORE: _____ / 4 PTS**

[a] If 1793 is the smallest integer, what is the largest integer ? $n-1793+1=896 \Rightarrow n=896+1793-1=2688$ (2)

[b] If 1793 is the largest integer, what is the smallest integer ? $1793-m+1=896 \Rightarrow m=1793-896+1=898$ (2)

E-mail IDs at a certain school are a sequence of 3 letters (selected from A to Z) followed by 4 digits (selected from 0 to 9). For example, one such ID would be $BSL3075$. **SCORE: _____ / 10 PTS**

[a] How many different e-mail IDs are possible ? $26^3 \times 10^4$ (1)

[b] How many different e-mail IDs do **NOT** contain any repeated letters ? $26 \times 25 \times 24 \times 10^4$ (2)
(A repeated letter is a letter that appears more than once, not necessarily in consecutive positions.)

[c] How many different e-mail IDs contain at least one repeated digit ? $26^3 \times 10^4 - 26^3 \times 10 \times 9 \times 8 \times 7$ (1) (1) (2)

[d] How many different e-mail IDs do **NOT** contain the letter X nor any repeated letters ? $25 \times 24 \times 23 \times 10^4$ (3)

You must arrange the 11 letters of the word $DOCUMENTARY$ in a row. **SCORE: _____ / 13 PTS**
Each letter will appear exactly once in your arrangement.

[a] How many ways can the letters be arranged so that the word $MONEY$ appears ? $7!$ (2)
(That is, the letters $MONEY$ are in consecutive positions in that left-to-right order.)

[b] How many ways can the letters be arranged so that the word $CARD$ does **NOT** appear ? $11!-8!$ (1) (1) (1)

[c] How many ways can the letters be arranged so that the words $MONEY$ and $CARD$ both appear ? $4!$ (3)

[d] How many ways can the letters be arranged so that neither the words $MONEY$ nor $CARD$ appear ? $11!-7!-8!+4!$ (1) (2) (2)
(HINT: This is **NOT** the "complement" of [c].)

The film club has 42 members. 18 of them have seen Holy Motors. 20 of them have seen Skyfall. **SCORE: _____ / 8 PTS**
7 of them have seen both Holy Motors & Skyfall. 12 of them have seen Anna Karenina. 9 of them have seen both Skyfall & Anna Karenina. 4 of them have seen both Holy Motors & Anna Karenina. If 9 of them have not seen any of the three movies, how many have seen all three movies ? Show proper algebraic work, including proper set notation. **Venn diagrams & trial-and-error are NOT acceptable.**

$42=|H \cup S \cup A|+9$ (1)

$|H \cup S \cup A|=33$ (1)

$|H \cup S \cup A|=|H|+|S|+|A|-|H \cap S|-|H \cap A|-|S \cap A|+|H \cap S \cap A|$ (3)

$33=18+20+12-7-4-9+|H \cap S \cap A|$ (2)

$|H \cap S \cap A|=3$ (1)
