

Name: Key

**Directions:** Show all work. No credit for answers without work. Unless specifically asked for a numerical answer, you may leave your answers in terms of factorials.

1. [3 points] Evaluate  $P(7, 3)$  numerically.

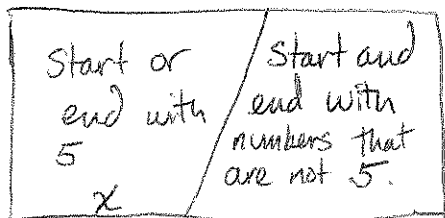
$$P(7, 3) = 7 \cdot 6 \cdot 5 = \boxed{210}$$

2. [3 points] A bag of marbles contains 3 red marbles, 4 blue marbles, 1 yellow marble, and 6 green marbles. One by one, a marble is removed from the bag, its color is recorded on a list, and the marble is discarded; the process repeats until the bag is empty. How many lists of colors are possible?

Arrange RRR BBBB Y GGGGGG :

$$\frac{(14)!}{3! \cdot 4! \cdot 1! \cdot 6!}$$

3. [4 points] How many 4-digit ATM pins start or end with a 5? For example, 5289, 3125, and 5555 count, but 1556 does not.



All ATM pins

$$\begin{aligned} \# \text{ pins not} \\ \text{starting or} \\ \text{ending with 5} \end{aligned} = 9 \cdot 10 \cdot 10 \cdot 9$$

$$= 8100$$

$$x + 8100 = 10000 ;$$

$$\boxed{x = 1900}$$