

Box Principle: If you have more marbles than boxes, and each marble goes in a box, then at least one box has multiple marbles.

1.) If there are three people talking, at least two are of the same gender.

Boxes: 2 Gender
 * Categories *
 Pigeons: 3 People

2.) Thirteen people are attending a "Pi Day" celebration. Show that at least two of them were born in the same month.

Boxes: 12 Months
 Pigeons: 13 People

3.) There are twenty-five students in a class. On the last test, nobody got a grade lower than a "C". Show that there are at least nine students who received the same letter grade.

Boxes: Letter Grades A, B, C
 Pigeons: Students

4.) On Armstrong Basic Cable, there are a total of 66 channels that viewers can watch. How many people subscribing to Armstrong Basic Cable must be watching TV at home to guarantee that at least 500 people are watching the same channel?

Boxes: Channels (66)
 Pigeons: Viewers

Worst case
 (499) (499) (499) (499) (499)
 ABC NBC FOX PBS Food

$(499)(66) + 1 = 32,935$

- 5.) How many people would you need to have in a crowd to be sure that at least three people have the same birthday (month / day)?

Boxes: 366 - Days
 Pigeons: People
 worst case: 2 people per day
 $366(2) + 1 = 733$

- 6.) There are 32 NFL Teams. If 1,000 people are gathered in the CHS Auditorium watching the Super Bowl, at least how many of them must have the same favorite team?

Boxes: Teams (32) Pigeons: People (1000)

$\underbrace{31} \quad \underbrace{31} \quad \underbrace{31} \quad \dots \quad \underbrace{31} \quad \underbrace{31}$
 $+ 1$

$\frac{1000}{32} = 31.25$
 \downarrow
 32

1

- 7.) How many marbles must Mr. Hamilton have given each group for him to guarantee that at least one cup had at least 8 marbles in it? (Remember, you were given 6 cups each.)

Boxes: Cups (6) Pigeons: Marbles

worst case



$$(6)(7) + 1 = \underline{\underline{43}}$$