1) A) If the bunny goes right

	# of ways
- First boundary	2
- Second boundary	3
- Third boundary	1
- Fourth boundary	4
- fifth boundary	2

$2 \times 3 \times 1 \times 4 \times 2 = 48$ ways

B) If the bunny goes down

	# of ways
- First boundary	2
- Second boundary	1

$2 \times 1 = 2$ ways

Total ways = 48 ways + 2 ways =

$\boxed{50 \text{ ways}}$

2)

$\underset{\#}{\_}\ \underset{\#}{\_}\ \underset{\text{letter}}{\_}\ \underset{\#}{\_}$

$\downarrow$ $\downarrow$ $\downarrow$ $\downarrow$

9 ways, 10 ways, 26 ways, 10 ways

(u can use 0) (all alphabets)

• can't start with 0

$\underbrace{0, 1, 2, 3, 4, 5, 6, 7, 8, 9}_{\text{10 digits}}$

$\underbrace{A \rightarrow Z}_{\text{26 letters}}$

$9 \times 10 \times 26 \times 10 = \boxed{23400 \text{ ways}}$

* no overcount as $98Z7 \neq 89Z7$ etc

3) • 561 points on a circumference

• 1 chord requires 2 points

• Chord (A,B) and (B,A) are the same so divide by 2 cause overcount

• $\binom{n}{k} = \frac{n!}{k!(n-k)!}$

Out of 561 points, you are choosing 2

$$\binom{561}{2} = \frac{561!}{2!(561-2)!} = \boxed{157080}$$

4) • 1 lottery ticket = 60 numbers
- To buy ticket = choose 5 out of 60 numbers
- Each lottery ticket cost \$1

$n = 60$ and out of 60, you choose 5

$$\binom{n}{k} = \binom{60}{5}$$

n choose k formula = $\dfrac{n!}{k!(n-k)!}$

$$= \frac{60!}{5!(60-5)!}$$

$$= \frac{60!}{5!(55!)}$$

$$= \boxed{5461512}$$

5) If you are choosing powerball first:

_ _ _ _ _ _

powerball can be here

$\binom{60}{1}$

Since you already chose 1 out of 60 for powerball, 60-1=59 You are choosing 5 out of 59 now so $\binom{59}{5}$

If you are choosing numbers first:

_ _ _ _ _ _

You're choosing 5 numbers out of 60

$\binom{60}{5}$

for this you chose 5 already so you're choosing out of 55 and you're choosing one so $\binom{55}{1}$

50

$$\boxed{\begin{aligned} \binom{60}{5} \cdot \binom{55}{1} &= \binom{60}{1} \cdot \binom{59}{5} \\ \binom{n}{k} \cdot \binom{n-k}{1} &= \binom{n}{1} \cdot \binom{n-1}{k} \end{aligned}}$$

6) • $S = \{1, 2, 3, \ldots, n\}$

• 2^n = amount of subsets in a set

Set = n

Subset = 2^n

1 2 3...

Choose or no = $\underbrace{\begin{matrix} \bullet & \circ & \circ \\ \circ & \bullet & \bullet \end{matrix}}_{n \text{ times}}$ $\underbrace{\begin{matrix} \bullet = \text{on} \\ \circ = \text{off} \end{matrix}}_{2 \text{ options}}$

2 options, either you include it or dont include it, and you

do this for n times

so 2^n

Out of 2 choices, we want the choice where the number 1 is on (included) so

$$2^n \div 2 = \frac{2^n}{2} \quad 2^n \cdot 2^{-1} = \boxed{2^{n-1}}$$

7) • Alphabet has 26 letters
• Repetition allowed

$$\underbrace{\_\ \ \_\ \ \_\ \ \_\ \ \_\ \ \_\ \ \_}$$

each 7 spaces
have 26 options

$$26 \times 26 \times 26 \times 26 \times 26 \times 26 \times 26$$

$$\downarrow$$

$$26^7$$

$$\downarrow$$

$$\boxed{8031810176}$$

8) It's the same. N and K are just variables and K people on N chairs is same as N people on K chairs.

n = people, k = chairs | k = people, n = chairs

$$\binom{n}{k} = \frac{n!}{k!(n-k)!} \qquad \binom{n}{k} = \frac{n!}{k!(n-k)!}$$

equal

# of ways we can seat n people on k chairs is equivalent to the # of ways we can seat k people on n chairs so they are $\boxed{\text{equal}}$

9a)

1. $\binom{n}{2} \rightarrow$ n choose 2 ways

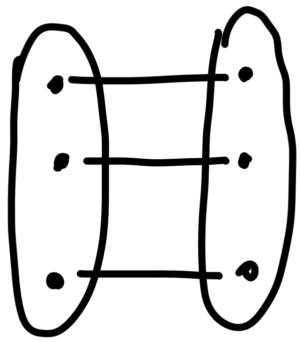
2. 1 way, obj 1 before n

3. $(n-2)!$

$$\binom{n}{2} \cdot 1 \cdot (n-2)! = \frac{n!\,\cancel{(n-2)!}}{2\,\cancel{(n-2)!}}$$

$$= \boxed{\frac{2!}{n}}$$

9b)



good = bad becase thre has to be bijection from bad to good switch 7 and 1 to go from bad to good

9c)

Gloves = $\binom{n}{2}$] 2! ways

Socks = $\binom{n}{2}$] ordeed — 1! ways

Boots = $\binom{n}{2}$ — 1! ways

2! + 1! + 1! ways

$\boxed{4 \text{ ways}}$