

Pick3 and Pick4 Probability Calculations

How to the Play Pick3 and Pick 4 Game

The Tri-State Lotto game rules describes the pertinent definitions of the game play as:

RULE 1 Definitions:

- "Game Play", "Play" or "Bet" means the players selection or a computer pick of a set of 3-digit numbers, from 000 through 999; or a set of 4-digit numbers, from 0000 through 9999; or a set of 2-digit numbers, reading from left to right, from 00 through 99, either as the first two digits or the last two digits of a winning number to be played for a specific draw.
- "Winning numbers" means the 3 digit numbers from 000 through 999, or the 4 digit numbers from 0000 through 9999, randomly selected at each official drawing to determine winning plays contained on a game ticket on a specific draw date.
- "STRAIGHT" or "STR" means the player's bet shall match the winning number for the game played in exact order.
- "BOX" means the player's bet shall match the winning numbers for the game played in any order.
- "FRONT" means the first two digits of a Pick 3 or Pick 4 number in exact order.
- "BACK" means the last two digits of a Pick 3 or Pick 4 number in exact order.

RULE 2 - TYPES OF BETS:

- The player shall place any or all of the following bet(s) on the number(s) selected:
- All three (3) digits or four (4) digits to be drawn in **exact order**.
- All three (3) digits or four (4) digits to be drawn in **any order**.
- Half of the bet placed on all three (3) digits or four (4) digits drawing the exact order and half of the bet placed on three (3) digits or four (4) digits drawn in any order.
- The first two or last two digits of the three (3) digit Pick 3 number in **exact order**.
- The first two or last two digits of the four (4) digit Pick 4 number in **exact order**.

Probability Calculations

Each of the digits has 10 possible values [0,1,2,..., 9] and can be selected independently of each other. Therefore the Total Ways of Pick 2, Pick 3, and Pick 4 is calculated in the following way:

Pick Games Total Ways		
Term	Calculation	Value
Total Ways Pick 2	10×10	100

Total Ways Pick 3	10*10*10	1,000
Total Ways Pick 4	10*10*10*10	10,000

Box plays for Pick 3 or Pick 4 means that the digits can be arranged in any order. This means that the box play of 123 is identical to 213, which is identical 321, etc. In the same fashion for Pick4, a box play of 1234 is identical to 4321.

The number of permutations of **m** objects consisting of groups of which **d1** objects are alike, **d2** objects are alike, ..., etc. is given by the function:

$$\text{Permutations} = m! / (d1! * d2! * \dots * dk!)$$

Where **m!** is m factorial, is defined as: $m * (m-1) * (m-2) * \dots * 2 * 1$, and by definition $0! = 1$. In like manner $d1!, d2!, \dots, dk!$ is defined. The sum of the $d1, d2, \dots, dk$ is equal to **m**. That is:

$$m = d1 + d2 + d3 + \dots + dk$$

The arrangements of box plays: is a function of repeated digits (like objects).

The reciprocal probability is:

$$1/\text{Probability Pick and Play Type} = \text{Total Ways Pick} / (\text{Permutations of Play Type})$$

For Pick 3 plays, the 1/probabilities are:

PICK 3 PROBABILITY CALCULATIONS			
Straight Play			
Example Number	Formula	Ways	1/Probability
123	1	1	1,000.000
Box Plays			
Example Number	Formula	Ways	1/Probability
123	$3! / (1! * 1! * 1!)$	6	166.667
112	$3! / (2! * 1!)$	3	333.333
Front/Back Pair Plays			
Example Number	Formula	Ways	1/Probability
12*	1	1	100.000
*23	1	1	100.000

For Pick 4 plays, the 1/probabilities are:

PICK 4 PROBABILITY CALCULATIONS			
Straight Play			
Example Number	Formula	Ways	1/Probability

1234	1	1	10,000.000
Box Plays			
Example Number	Formula	Ways	1/Probability
1234	$4! / (1! * 1! * 1! * 1!)$	24	416.667
1123	$4! / (2! * 1! * 1!)$	12	833.333
1122	$4! / (2! * 2!)$	6	1,666.667
1112	$4! / (3! * 1!)$	4	2,500.000
Front/Back Pair Plays			
Example Number	Formula	Ways	1/Probability
12**	1	1	100.000
**34	1	1	100.000

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