Stage 4

Daily Grand is a Canadian lottery game. Winning numbers are chosen from five of 49 main numbers and a “Grand Number” from 1 to 7. The Grand Number can also be used to match numbers from the five main numbers. A single board cost $3 and the game’s top prize is an annuity of $1000 a day (with a $7 million lump sum option)

Winning Conditions :

(5/5 main numbers + Grand Number) = $1,000 a day for life ($7 million lump sum)*
(5/5 main numbers) = $25,000 a year for life ($500,000 lump sum)*
(4/5 main numbers + Grand Number) = $1000
(4/5 main numbers) = $500
(3/5 main numbers + Grand Number) = $ 100
(3/5 main numbers) = $ 20
(2/5 main numbers + Grand Number) = $ 10
(1/5 main numbers + Grand Number) = $ 4
(Grand Number) = Free play

Computation :

First let's find out how many different combination for the main numbers only :

$$\frac{n!}{r!(n-r)!} = \frac{49!}{5!(49-5)!} = 1906884$$

So, Here “N” is the total number of main numbers from which we will pick 5 as in “r” and the different combination we will get is 1906884.
So, the probability is 1 out of 1906884

And the combinations for the Grand number is :

$$\frac{n!}{r!(n-r)!} = \frac{7!}{1!(7-1)!} = 7$$

Here the probability is 1 out of 7.

- The probability of winning (5/5 main numbers + Grand Number) is =

Probability for main number $\times$ Probability for grand number

$$\frac{1}{1906884} \times \frac{1}{7} = \frac{1}{13348188}$$

The probability is 1 out of 13348188

- The probability of winning (5/5 main numbers) is :

Probability for main number $\times$ Probability for not choosing grand number

$$\frac{1}{1906884} \times \frac{6}{7} = \frac{6}{13348188} = \frac{1}{2224698}$$

The probability is 1 out of 2224698

- The probability of winning (4/5 main numbers + Grand Number) is =

Probability of getting ⅘ $\times$ Probability for main number $\times$ Probability for grand number

$$\frac{5!}{4!(5-4)!} \times \frac{(49-5)!}{((49-5)-(5-4))!\,(5-4)!} = \frac{5*4!}{4!1!} \times \frac{44!}{(44-1)!\,1!} = \frac{5}{1} \times \frac{44*43!}{(44-1)!\,1!} = 220$$

Now,

$$220 \times \frac{1}{1906884} \times \frac{1}{7} = \frac{1}{60673}$$

The probability is 1 out of 60673

- The probability of winning (4/5 main numbers) is =

Probability of getting ⅘ $\times$ Probability for main number $\times$ Probability for not choosing grand number

$220 \times \frac{1}{1906884} \times \frac{6}{7} = \frac{1}{10112}$

The probability is 1 out of 10112

- The probability of winning (3/5 main numbers + Grand number) is =

Probability of getting ⅗ × Probability for main number × Probability for grand number

$$\frac{5!}{3!(5-3)!} \times \frac{(49-5)!}{((49-5)-(5-3))!\,(5-3)!} = \frac{5*4*3!}{3!2!} \times \frac{44!}{(44-2)!\,2!} = \frac{5*4}{2} \times \frac{44*43*42!}{(44-2)!\,2} = 9460$$

Now,

$9460 \times \frac{1}{1906884} \times \frac{1}{7} = \frac{1}{1411}$

The probability is 1 out of 1411

- The probability of winning (3/5 main numbers) is =

Probability of getting ⅗ × Probability for main number × Probability for not choosing grand number

$9460 \times \frac{1}{1906884} \times \frac{6}{7} = \frac{1}{235}$

The probability is 1 out of 235

- The probability of winning (2/5 main numbers + Grand number) is =

Probability of getting ⅖ × Probability for main number × Probability for grand number

$$\frac{5!}{2!(5-2)!} \times \frac{(49-5)!}{((49-5)-(5-2))!\,(5-2)!} = \frac{5*4*3!}{2!3!} \times \frac{44!}{(44-3)!\,3!} = \frac{5*4}{2} \times \frac{44*43*42*41!}{(44-3)!\,3*2*1} = 132440$$

Now,

$$132440 \times \frac{1}{1906884} \times \frac{1}{7} = \frac{1}{100}$$

The probability is 1 out of 235 .

- The probability of winning (1/5 main numbers + Grand number) is =

Probability of getting ⅕ × Probability for main number × Probability for grand number

$$\frac{5!}{1!(5-1)!} \times \frac{(49-5)!}{((49-5)-(5-1))!\,(5-1)!} = \frac{5*4}{1!4!} \times \frac{44!}{(44-4)!\,4!} = \frac{5}{1} \times \frac{44*43*42*41*40!}{(44-4)!\,4*3*2*1} = 678755$$

And,

$$678755 \times \frac{1}{1906884} \times \frac{1}{7} = \frac{1}{19.66}$$

The probability is 1 out of 19.66.

- The probability of winning only grand number is =

Probability of getting 0/5 × Probability for main number × Probability for grand number

$$\frac{5!}{0!(5-0)!} \times \frac{(49-5)!}{((49-5)-(5-0))!\,(5-0)!} = \frac{5!}{1*5!} \times \frac{44!}{(44-5)!\,5!} = \frac{44*43*42*41*40*39!}{(44-5)!\,5*4*3*2*1} = 1086008$$

And,

$$1086008 \times \frac{1}{1906884} \times \frac{1}{7} = \frac{1}{12.29}$$

The probability is 1 out of 12.29.

Source :
https://en.wikipedia.org/wiki/Daily_Grand