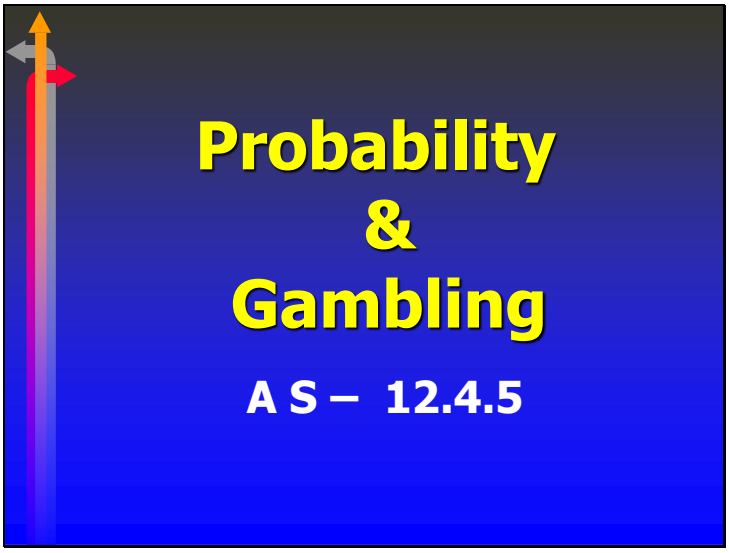
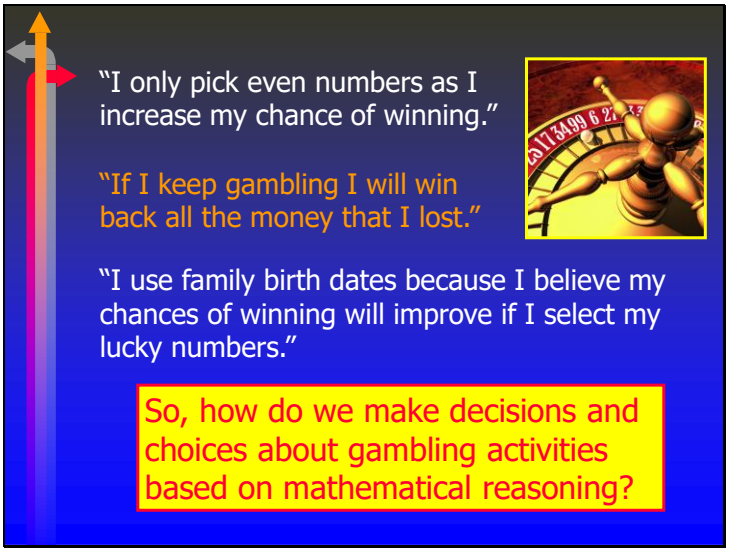
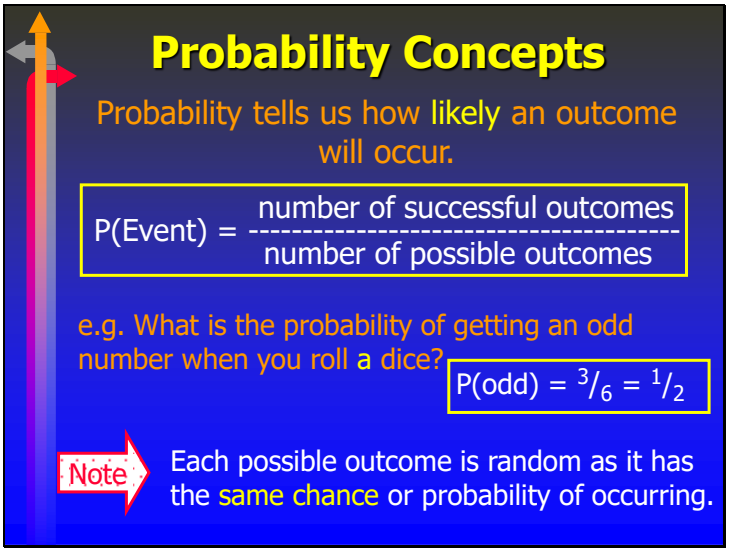
Slide 1



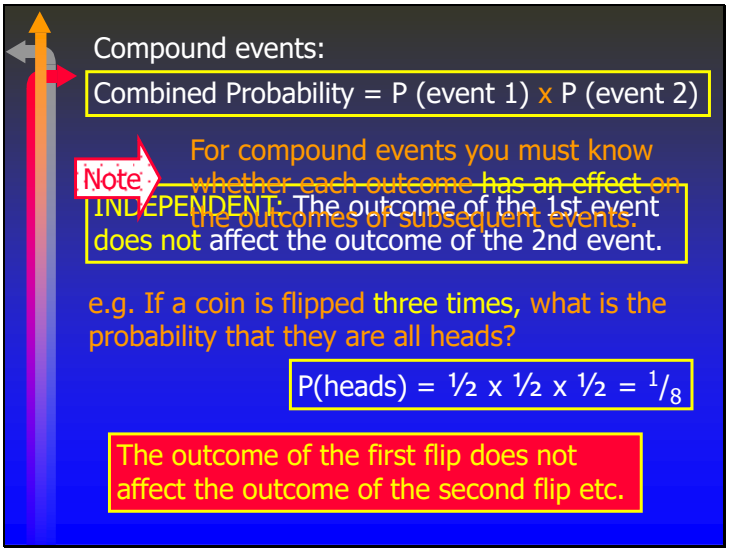
Slide 2


"I only pick even numbers as I increase my chance of winning."
"If I keep gambling I will win back all the money that I lost."
"I use family birth dates because I believe my chances of winning will improve if I select my lucky numbers."
So, how do we make decisions and choices about gambling activities based on mathematical reasoning?

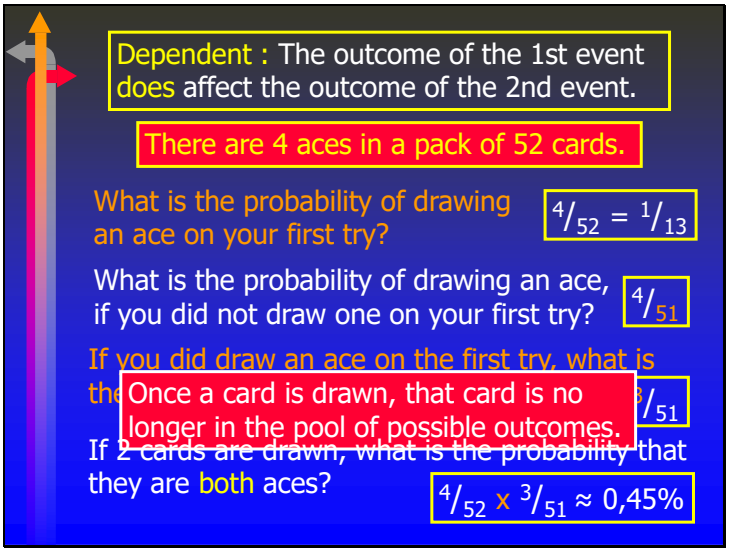
Slide 3


Probability Concepts
Probability tells us how likely an outcome will occur.
P(Event) = number of successful outcomes / number of possible outcomes
e.g. What is the probability of getting an odd number when you roll a dice?
P(odd) = 3/6 = 1/2
Note
Each possible outcome is random as it has the same chance or probability of occurring.

Slide 4


Compound events:
Combined Probability = P (event 1) x P (event 2)
Note
For compound events you must know whether each outcome has an effect on the outcomes of subsequent events.
INDEPENDENT: The outcome of the 1st event does not affect the outcome of the 2nd event.
e.g. If a coin is flipped three times, what is the probability that they are all heads?
P(heads) = ½ x ½ x ½ = 1/8
The outcome of the first flip does not affect the outcome of the second flip etc.

Slide 5


Dependent : The outcome of the 1st event does affect the outcome of the 2nd event.
There are 4 aces in a pack of 52 cards.
What is the probability of drawing an ace on your first try?
4/52 = 1/13
What is the probability of drawing an ace, if you did not draw one on your first try?
4/51
If you did draw an ace on the first try, what is the
/51
Once a card is drawn, that card is no longer in the pool of possible outcomes.
If 2 cards are drawn, what is the probability that they are both aces?
4/52 x 3/51 ≈ 0,45%

Slide 6

Tables and Diagrams

Tree diagrams and tables visually help to determine the probability of compound events.

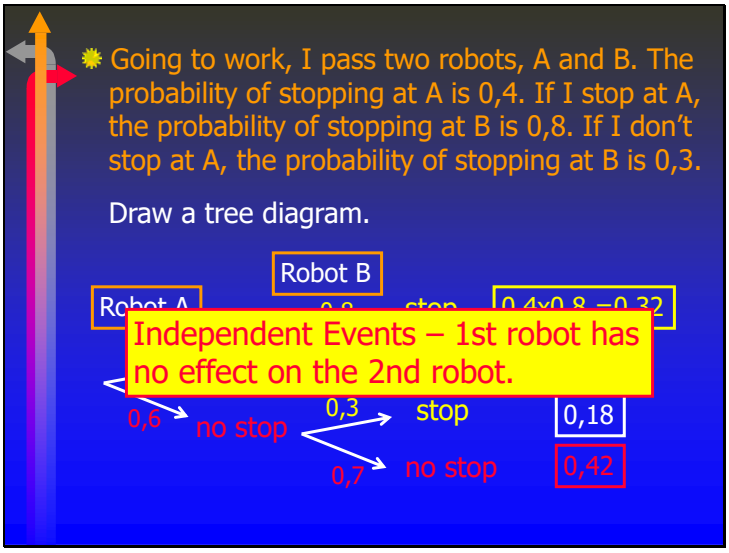
- Two dice are thrown simultaneously. What is the probability that the sum total is 6?

+	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

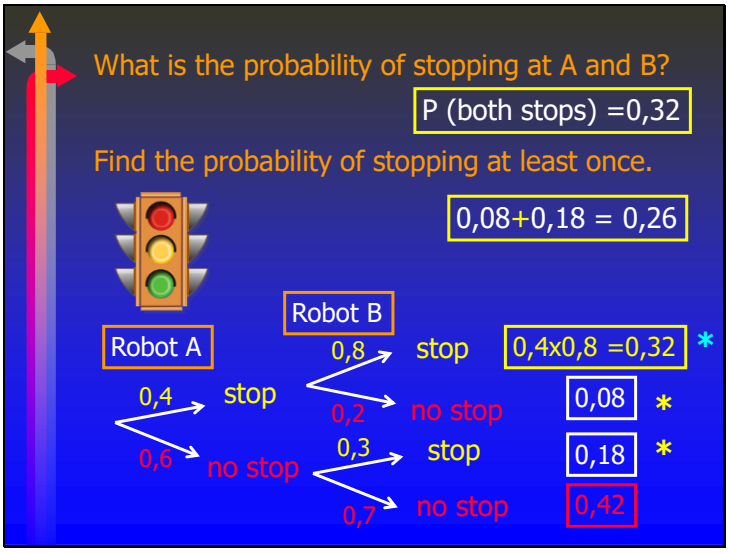
Total possible outcomes = 36

P (sum of 6) = $^{5}/_{36}$

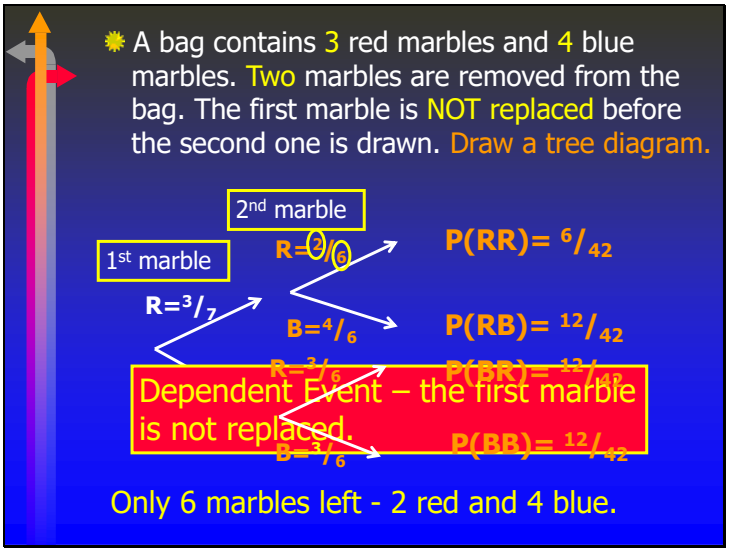
Slide 7


Going to work, I pass two robots, A and B. The probability of stopping at A is 0,4. If I stop at A, the probability of stopping at B is 0,8. If I don't stop at A, the probability of stopping at B is 0,3.
Draw a tree diagram.
Robot B
Independent Events – 1st robot has no effect on the 2nd robot.
0,6
no stop
0,3
stop
0,18
0,7
no stop
0,42

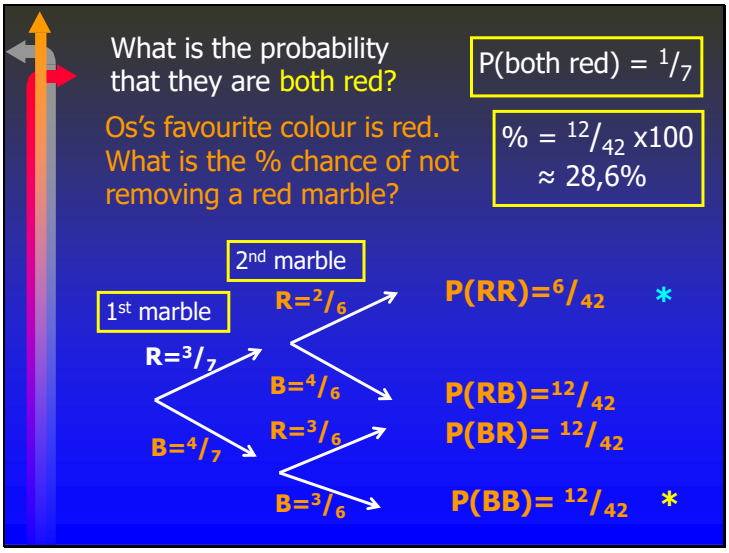
Slide 8


What is the probability of stopping at A and B?
P (both stops) =0,32
Find the probability of stopping at least once.
0,08+0,18 = 0,26
Robot A
Robot B
0,4
stop
0,6
no stop
0,8
stop
0,2
no stop
0,3
stop
0,7
no stop
0,4x0,8 =0,32
*
0,08
*
0,18
*
0,42

Slide 9


A bag contains 3 red marbles and 4 blue marbles. Two marbles are removed from the bag. The first marble is NOT replaced before the second one is drawn. Draw a tree diagram.
2nd marble
1st marble
R=3/7
R=2/6
B=4/6
R=3/6
B=3/6
P(RR)= 6/42
P(RB)= 12/42
P(BR)= 12/42
P(BB)= 12/42
Dependent Event – the first marble is not replaced.
Only 6 marbles left - 2 red and 4 blue.

Slide 10


What is the probability that they are both red?
P(both red) = 1/7
Os's favourite colour is red. What is the % chance of not removing a red marble?
% = 12/42 x100
≈ 28,6%
2nd marble
1st marble
R=2/6
R=3/7
B=4/6
R=3/6
B=4/7
B=3/6
P(RR)=6/42 *
P(RB)=12/42
P(BR)= 12/42
P(BB)= 12/42 *

Slide 11

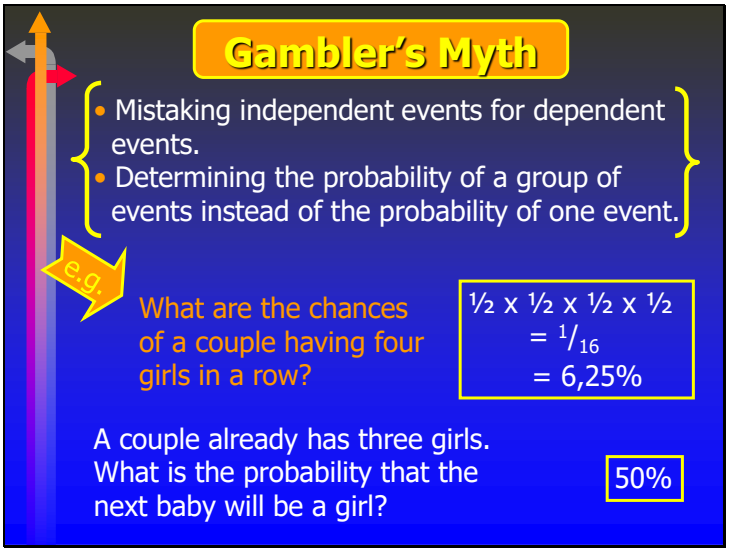
- 80 students play in a mixed sports team. The contingency table table shows the information.

	soccer	hockey	cricket	Total
female	13	6	17	**36**
male	23	13	8	**44**
Total	**36**	**19**	**25**	**80**

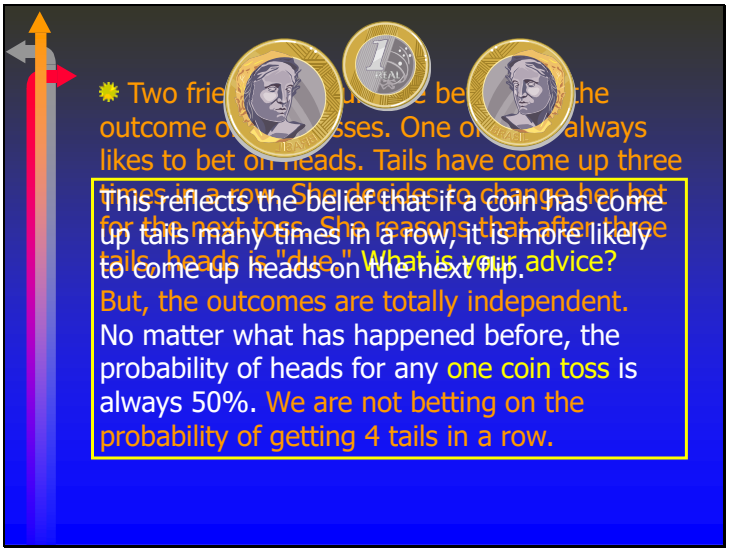
If a student is chosen at random, what is the probability that the student will

- Play soccer $^{36}/_{80} = 0{,}45$
- Be a male $^{44}/_{80} = 0{,}55$
- Be a female who plays cricket $^{17}/_{80} = 0{,}21$
- Play hockey and soccer $^{55}/_{80} = 0{,}69$

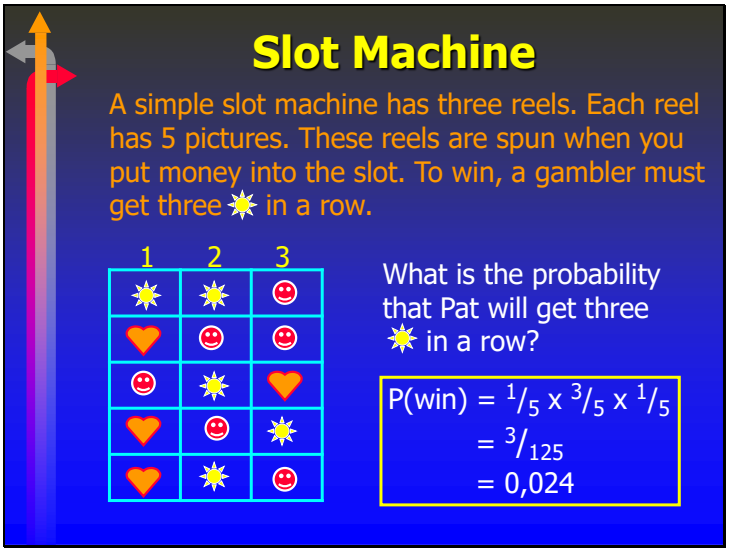
Slide 12


Gambler's Myth
• Mistaking independent events for dependent events.
• Determining the probability of a group of events instead of the probability of one event.
e.g.
What are the chances of a couple having four girls in a row?
½ x ½ x ½ x ½
= 1/16
= 6,25%
A couple already has three girls. What is the probability that the next baby will be a girl?
50%

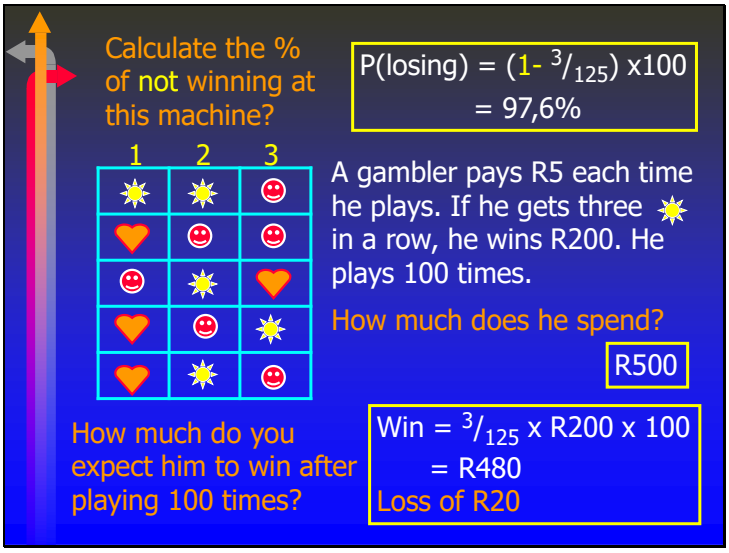
Slide 13


Two frie
outcome o
sses. One o
always
likes to bet on heads. Tails have come up three
times in a row. She decides to change her bet
for the next toss. She reasons that after three
tails, heads is "due." What is your advice?
But, the outcomes are totally independent.
No matter what has happened before, the
probability of heads for any one coin toss is
always 50%. We are not betting on the
probability of getting 4 tails in a row.
This reflects the belief that if a coin has come
up tails many times in a row, it is more likely
to come up heads on the next flip.

Slide 14


Slot Machine
A simple slot machine has three reels. Each reel has 5 pictures. These reels are spun when you put money into the slot. To win, a gambler must get three in a row.
1 2 3
What is the probability that Pat will get three in a row?
P(win) = 1/5 x 3/5 x 1/5
= 3/125
= 0,024

Slide 15


Calculate the % of not winning at this machine?
P(losing) = (1- 3/125) x100
= 97,6%
1 2 3
A gambler pays R5 each time he plays. If he gets three in a row, he wins R200. He plays 100 times.
How much does he spend?
R500
How much do you expect him to win after playing 100 times?
Win = 3/125 x R200 x 100
= R480
Loss of R20

Slide 16

Lottery Maths

A simple lottery is played where you must choose three numbers from a 5-number pool.

What is the probability of matching all three numbers in the same order as the lottery?

P(1st no.) = $^1/_5$ (5 possible outcomes)

P(2nd no.) = $^1/_4$ (4 remaining outcomes)

P(3rd no.) = $^1/_3$ (3 remaining outcomes)

P (all three) = $^1/_5 \times {}^1/_4 \times {}^1/_3$

= $^1/_{60}$

≈ 1,7%

Slide 17

National Lottery

The lottery selects 6 balls numbered from 1 to 49. To win you need to have 6 correct numbers. Once a ball is drawn it is not replaced.

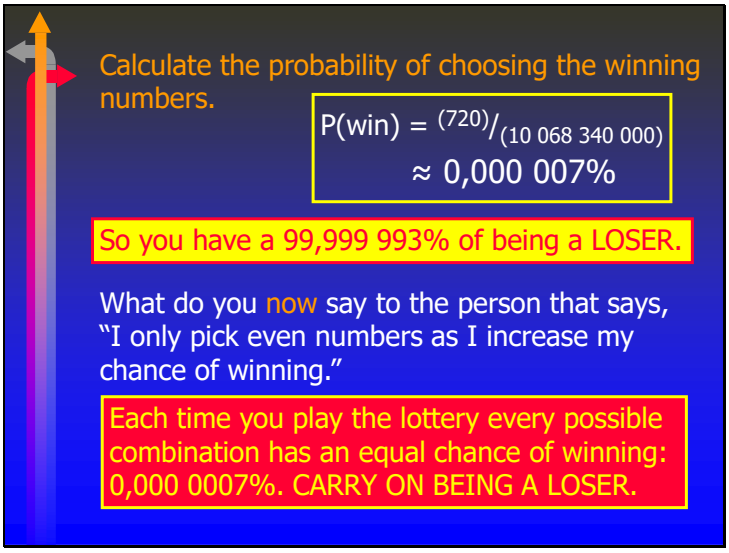
Find the total number of possible outcomes?

no. = 49 x 48 x 47 x 46 x 45 x 44
= 10 068 347 520

The combination of the 6 numbers can be in any order. Calculate the total number of successful outcomes.

no. = 6 x 5 x 4 x 3 x 2 x 1
= 720

Slide 18


Calculate the probability of choosing the winning numbers.
P(win) = (720)/(10 068 340 000)
≈ 0,000 007%
So you have a 99,999 993% of being a LOSER.
What do you now say to the person that says, "I only pick even numbers as I increase my chance of winning."
Each time you play the lottery every possible combination has an equal chance of winning: 0,000 0007%. CARRY ON BEING A LOSER.