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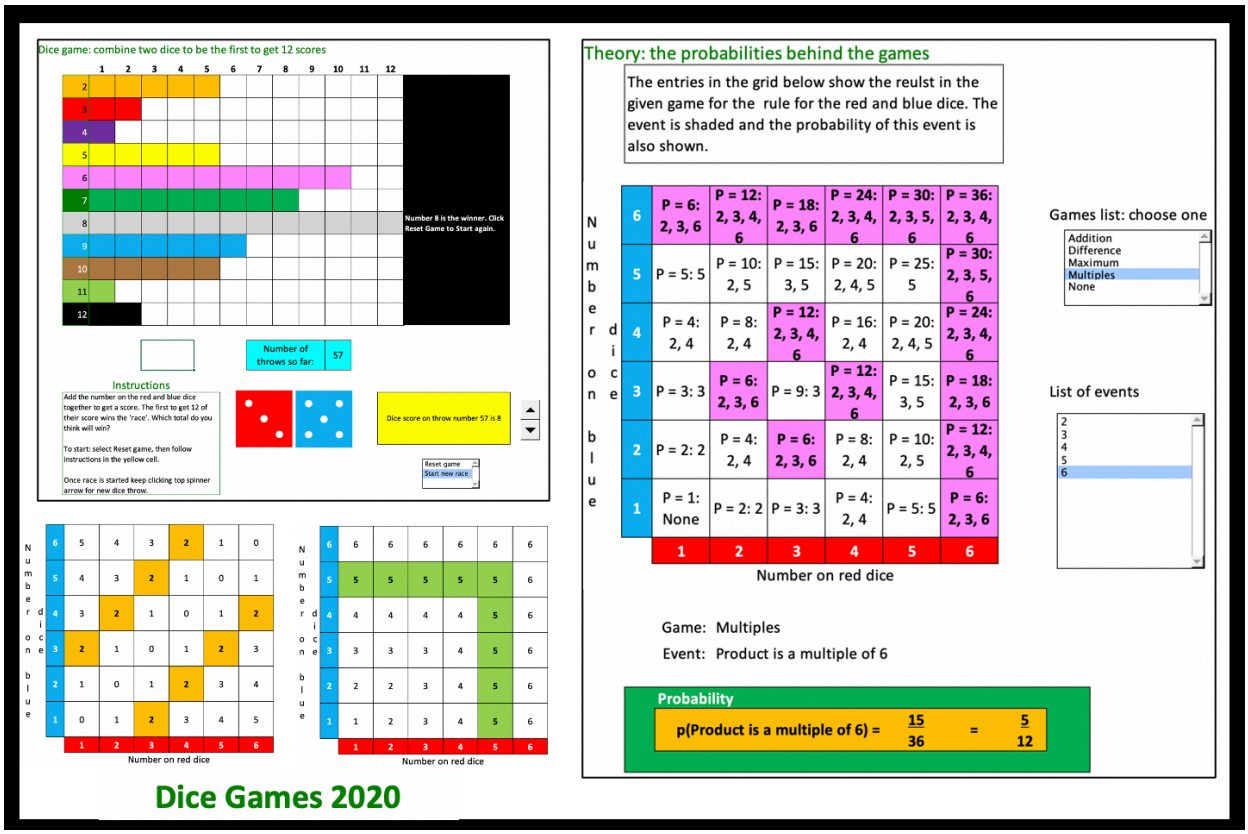
Dice Games



A Spire Maths Resource

https://spiremaths.co.uk/dicegame/

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Overview

Updated October 2020 with addition of 4 Sample Space gifs.

The Excel file replaces the Dice Game flash file used to support S3 Using Probability Computer Games, one of the Standards Unit Resources, which are found at: https://spiremaths.co.uk/ilim/.

ActivInspire and PowerPoint files are also available as well as the original S3 teacher notes.

The excel file includes extra game simulations, results and theoretical probability pages. The worksheets here support use of the excel file and the Standards lesson S3.

Work from S3 could be extended as per ActivInspire and PowerPoint files.

Table of Contents

https://spiremaths.co.uk/dicegame/

The Excel File

Screens from the file are shown on the pages that follow.

The file consists of many protected tabs (different pages) that include:

- overview
- a tab for each of the four games (dice addition, dice difference, dice maximum and dice multiple) which allows users to simulate throwing a dice until one outcome has occurred 12 times – on average for the addition game this should take just over 40 – 80 throws as with real dice (fewer for the other games)
- each of these (and the others) explains what you have to do
- a tab for each of the four games that allows instant collection of the results for a single game (allowing you to collect e.g. 50 results to see which outcomes usually win the games)
- single tab showing one set of 50 results (a table and a bar chart) for each of the games, together with another chart for each showing number of throws needed to finish each game
- a tab where pupils could put their results of the games and see the charts for each of the four games: charts are automatically generated
- a tab where the sample space for two dice is shown and each of the four games and the probabilities related to the outcomes can be shown
- tab showing theoretical probabilities for all the outcomes in each of the games in tabular and chart form
- four tables List to List3 which contain generated random numbers for the simulations – do not change these or aspects of file will not work

Notes on Excel

1. Sometimes when you click in a list it may not appear to work, if this happens check that cell A1 is visible at top of file and try again. Same with spinner arrows up/down.
2. Tabs are at the bottom and you probably won't see them all as there are so many. The first is Overview. To see different tabs click one of these two arrows, then click on the tab you want.

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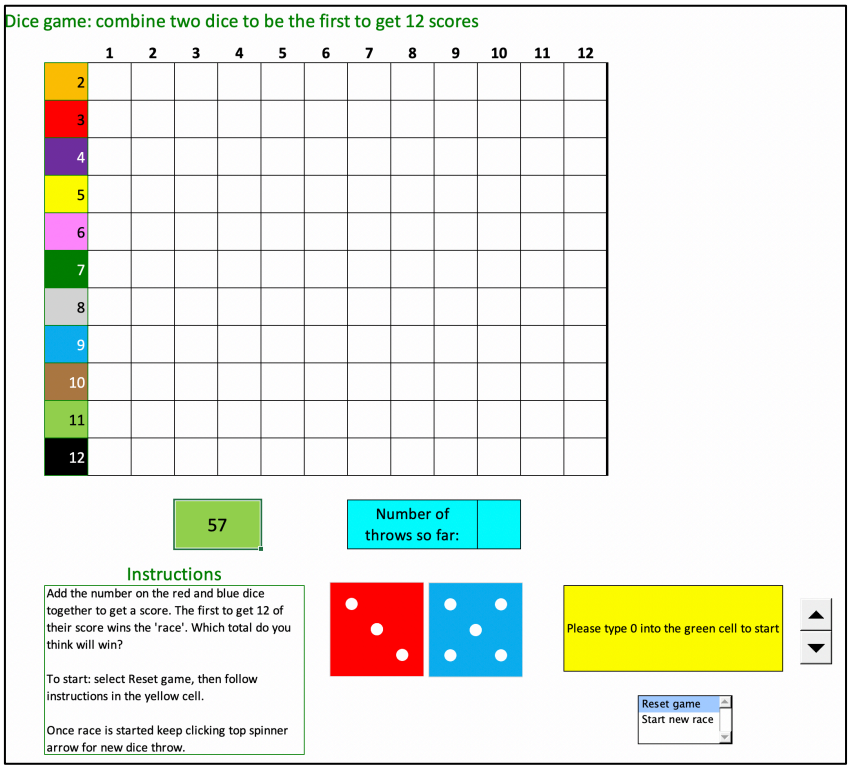
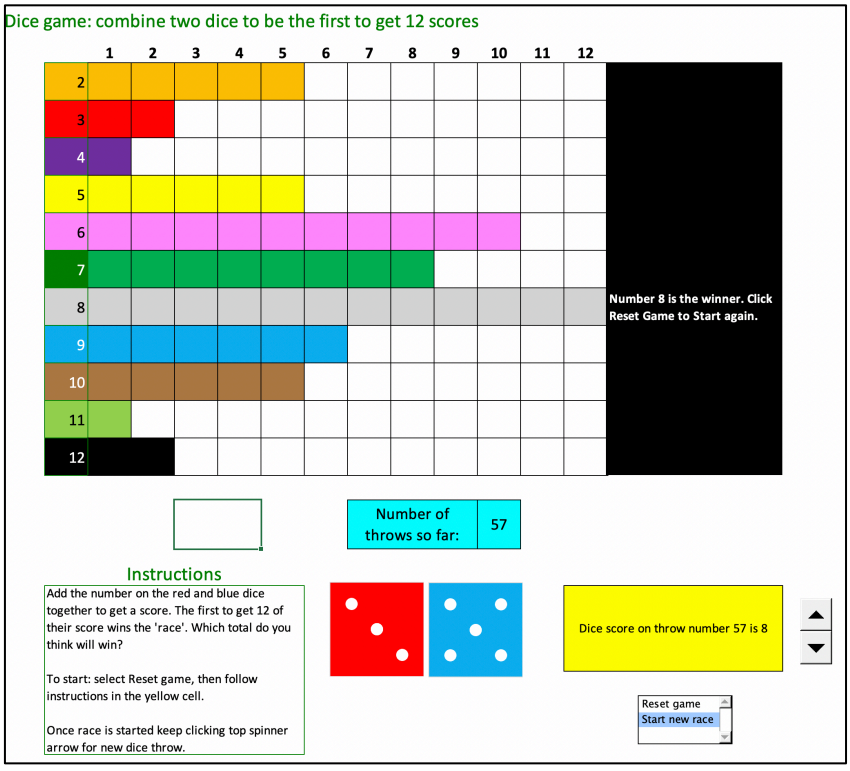
Dice game: Addition

Instructions are given on the spreadsheet. You click one of two items on the list and advance the top spinner arrow to have the dice thrown. These two pictures show Start and Finish game positions.





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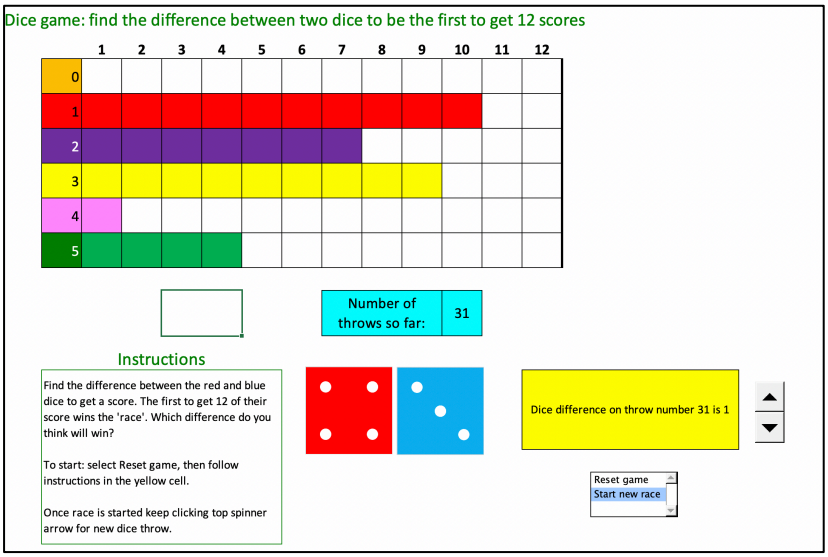
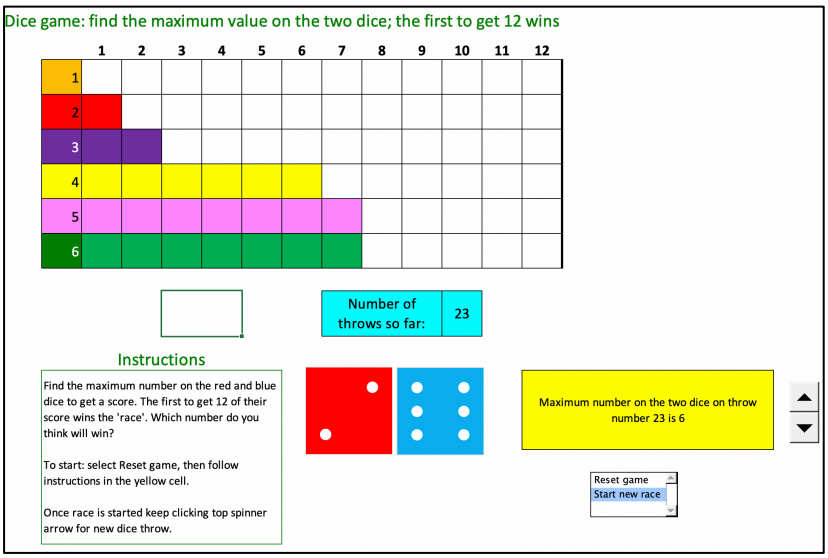
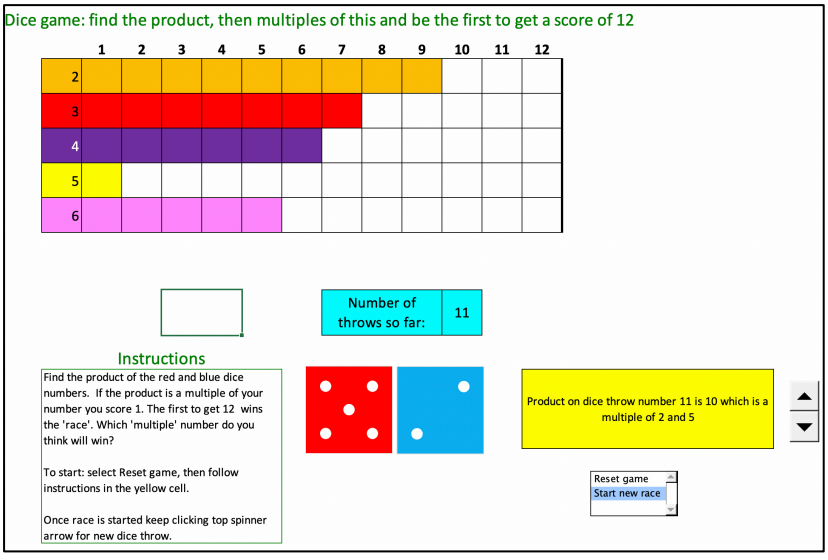
Dice game: Difference, Maximum and Multiple

Works exactly same way as Addition. Only example pages are shown mid-game.







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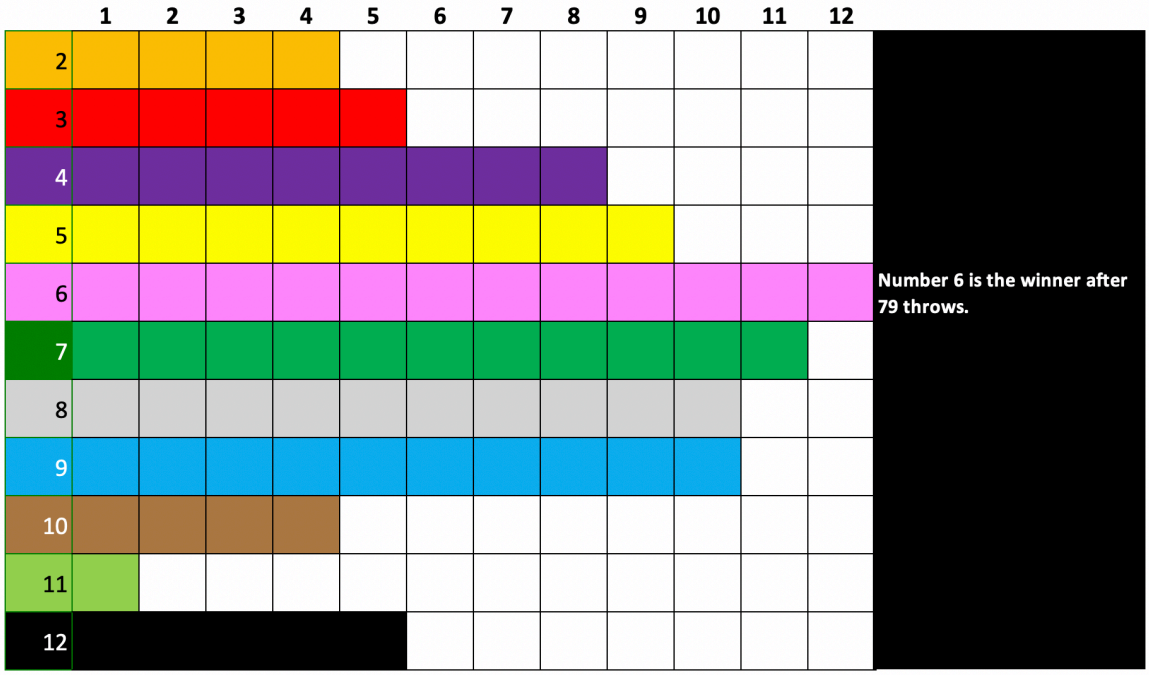
Simulations: Addition, Difference, Maximum and Multiple

All work in the same way and just show a completed game giving the winning number and number of throws needed. Only the example for Addition is shown.

Race game: simulations of the addition version



Number of throws needed	79

Instructions

See simulations of the addition version where you add the number on the red and blue dice together to get a score. Only the results of the game are seen in this version.

Every time you click the up arrow you will see a new simulated result for the race.

Click the up arrow to see another simulation of this version of the race game. Which numbers are usually the winners and how many throws needed?

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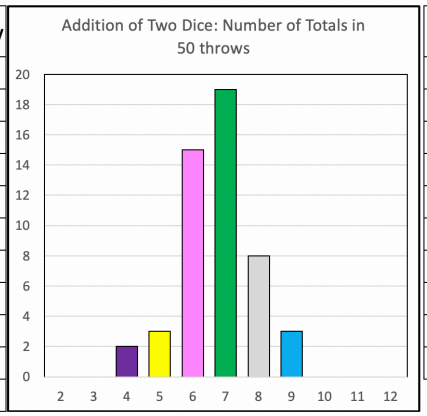
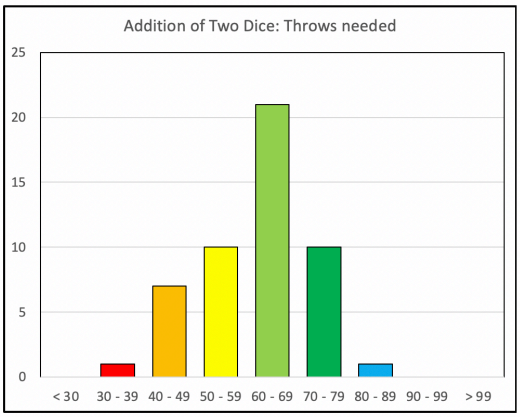
Results after 50 throws: All games

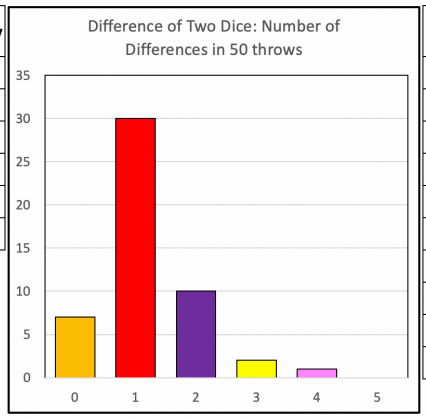
Add Dice	Frequency
2	0
3	0
4	2
5	3
6	15
7	19
8	8
9	3
10	0
11	0
12	0



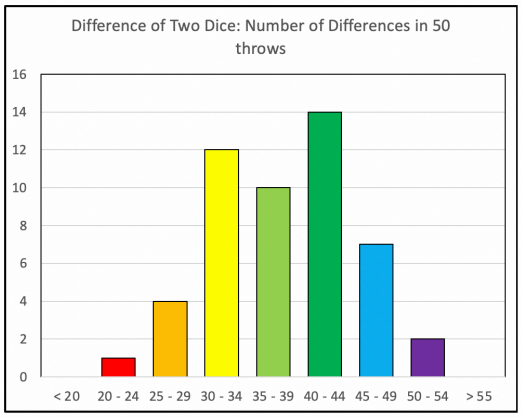
Number of throws	Frequency
< 30	0
30 - 39	1
40 - 49	7
50 - 59	10
60 - 69	21
70 - 79	10
80 - 89	1
90 - 99	0
> 99	0
Total	50



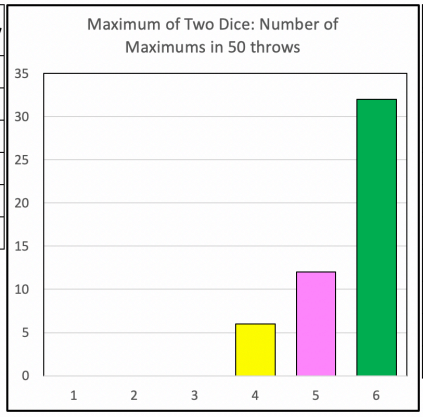
Dice Difference	Frequency
0	7
1	30
2	10
3	2
4	1
5	0



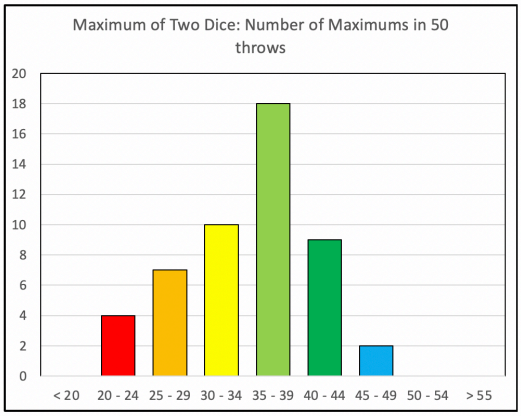
Number of throws	Frequency
< 20	0
20 - 24	1
25 - 29	4
30 - 34	12
35 - 39	10
40 - 44	14
45 - 49	7
50 - 54	2
> 55	0
Total	50



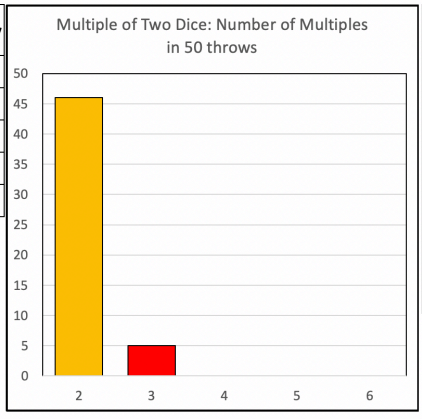
Dice Maximum	Frequency
1	0
2	0
3	0
4	6
5	12
6	32



Number of throws	Frequency
< 20	0
20 - 24	4
25 - 29	7
30 - 34	10
35 - 39	18
40 - 44	9
45 - 49	2
50 - 54	0
> 55	0
Total	50

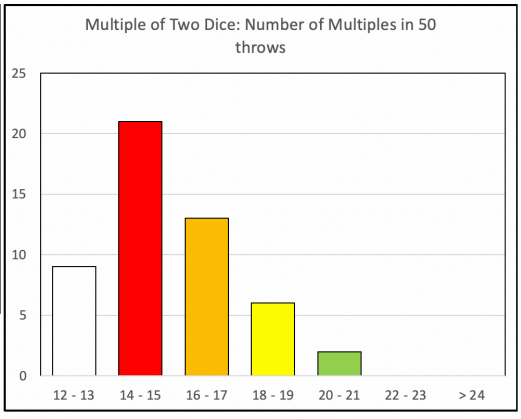


Dice Multiples	Frequency
2	46
3	5
4	0
5	0
6	0



Number of throws	Frequency
12 - 13	9
14 - 15	21
16 - 17	13
18 - 19	6
20 - 21	2
22 - 23	0
> 24	0
Total	51

In one game their were joint winners



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Theory: Addition

This single page gives you all the probabilities related to the four games. In the first three cases the probabilities add to 1, but this is not the case in the Multiple game. Here is addition.

Theory: the probabilities behind the games

The entries in the grid below show the reulst in the given game for the rule for the red and blue dice. The event is shaded and the probability of this event is also shown.

Number on blue dice						
6	7	8	9	10	11	12
5	6	7	8	9	10	11
4	5	6	7	8	9	10
3	**4**	5	6	7	8	9
2	3	**4**	5	6	7	8
1	2	3	**4**	5	6	7
	1	2	3	4	5	6

Number on red dice

Games list: choose one

- Addition
- Difference
- Maximum
- Multiples
- None

List of events

- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12

Game: Addition

Event: Sum is 4

- Hide Probability
- Show Probability

Probability

$$p(\text{Sum is } 4) = \frac{3}{36} = \frac{1}{12}$$

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Theory: Difference

This single page gives you all the probabilities related to the four games. In the first three cases the probabilities add to 1, but this is not the case in the Multiple game. Here is difference.

Theory: the probabilities behind the games

The entries in the grid below show the reulst in the given game for the rule for the red and blue dice. The event is shaded and the probability of this event is also shown.

Number on blue dice	1	2	3	4	5	6
6	5	4	3	**2**	1	0
5	4	3	**2**	1	0	1
4	3	**2**	1	0	1	**2**
3	**2**	1	0	1	**2**	3
2	1	0	1	**2**	3	4
1	0	1	**2**	3	4	5

Number on red dice

Games list: choose one

Addition
Difference
Maximum
Multiples
None

List of events

0
1
2
3
4
5

Game: Difference

Event: Difference is 2

Hide Probability
Show Probability

Probability

$$p(\text{Difference is 2}) = \frac{8}{36} = \frac{2}{9}$$

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Theory: Maximum

This single page gives you all the probabilities related to the four games. In the first three cases the probabilities add to 1, but this is not the case in the Multiple game. Here is maximum.

Theory: the probabilities behind the games

The entries in the grid below show the reulst in the given game for the rule for the red and blue dice. The event is shaded and the probability of this event is also shown.

Number on blue dice

6	6	6	6	6	6	6
5	**5**	**5**	**5**	**5**	**5**	6
4	4	4	4	4	**5**	6
3	3	3	3	4	**5**	6
2	2	2	3	4	**5**	6
1	1	2	3	4	**5**	6
	1	**2**	**3**	**4**	**5**	**6**

Number on red dice

Games list: choose one

Addition
Difference
Maximum
Multiples
None

List of events

1
2
3
4
5
6

Hide Probability
Show Probability

Game: Maximum

Event: Maximum throw is 5

Probability

$$p(\text{Maximum throw is 5}) = \frac{9}{36} = \frac{1}{4}$$

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Theory: Multiple

This single page gives you all the probabilities related to the four games. In the first three cases the probabilities add to 1, but this is not the case in the Multiple game. Here is Multiple.

Theory: the probabilities behind the games

The sample space shows the product as P = ??: then it shows whether this product is a multiple of 2, 3, 4, 5, 6

Number on blue dice	Number on red dice 1	2	3	4	5	6
6	**P = 6: 2, 3, 6**	**P = 12: 2, 3, 4, 6**	**P = 18: 2, 3, 6**	**P = 24: 2, 3, 4, 6**	**P = 30: 2, 3, 5, 6**	**P = 36: 2, 3, 4, 6**
5	P = 5: 5	P = 10: 2, 5	P = 15: 3, 5	P = 20: 2, 4, 5	P = 25: 5	**P = 30: 2, 3, 5, 6**
4	P = 4: 2, 4	P = 8: 2, 4	**P = 12: 2, 3, 4, 6**	P = 16: 2, 4	P = 20: 2, 4, 5	**P = 24: 2, 3, 4, 6**
3	P = 3: 3	**P = 6: 2, 3, 6**	P = 9: 3	**P = 12: 2, 3, 4, 6**	P = 15: 3, 5	**P = 18: 2, 3, 6**
2	P = 2: 2	P = 4: 2, 4	**P = 6: 2, 3, 6**	P = 8: 2, 4	P = 10: 2, 5	**P = 12: 2, 3, 4, 6**
1	P = 1: None	P = 2: 2	P = 3: 3	P = 4: 2, 4	P = 5: 5	**P = 6: 2, 3, 6**

Games list: choose one

Addition
Difference
Maximum
Multiples
None

List of events

2
3
4
5
6

Hide Probability
Show Probability

Game: Multiples

Event: Product is a multiple of 6

Probability

p(Product is a multiple of 6) = $\frac{15}{36}$ = $\frac{5}{12}$

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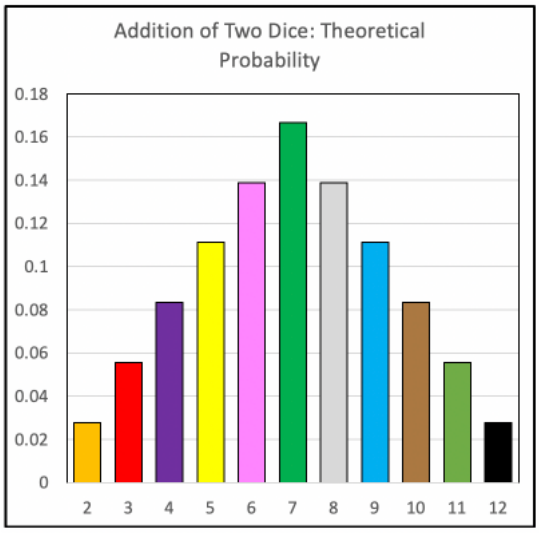
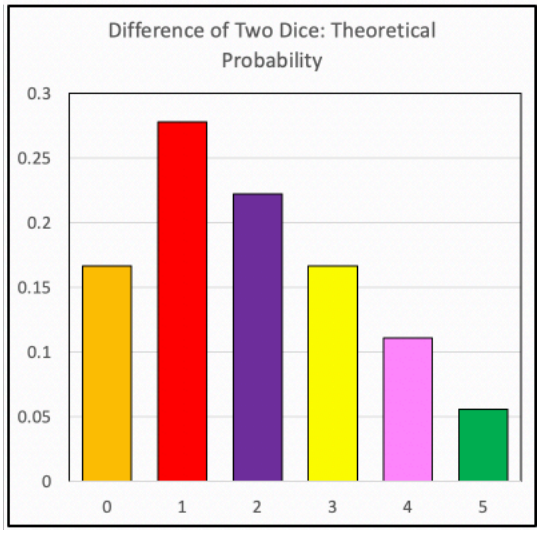
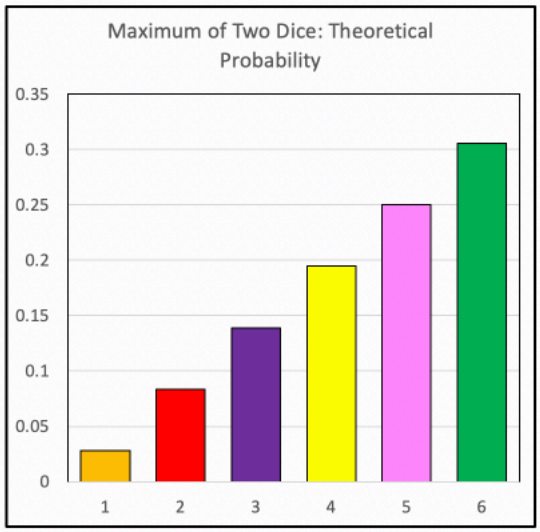
Theoretical Probability: All Games

Add Dice	
2	$\frac{1}{36}$
3	$\frac{2}{36} = \frac{1}{18}$
4	$\frac{3}{36} = \frac{1}{12}$
5	$\frac{4}{36} = \frac{1}{9}$
6	$\frac{5}{36}$
7	$\frac{6}{36} = \frac{1}{6}$
8	$\frac{5}{36}$
9	$\frac{4}{36} = \frac{1}{9}$
10	$\frac{3}{36} = \frac{1}{12}$
11	$\frac{2}{36} = \frac{1}{18}$
12	$\frac{1}{36}$
All	1



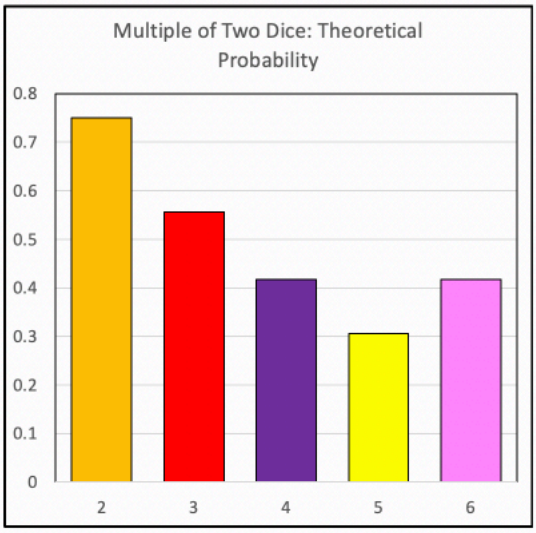


Dice Maximum	
1	$\frac{6}{36} = \frac{1}{6}$
2	$\frac{10}{36} = \frac{5}{18}$
3	$\frac{8}{36} = \frac{2}{9}$
4	$\frac{6}{36} = \frac{1}{6}$
5	$\frac{4}{36} = \frac{1}{9}$
6	$\frac{2}{36} = \frac{1}{18}$
All	1



Dice Difference	
0	$\frac{6}{36} = \frac{1}{6}$
1	$\frac{10}{36} = \frac{5}{18}$
2	$\frac{8}{36} = \frac{2}{9}$
3	$\frac{6}{36} = \frac{1}{6}$
4	$\frac{4}{36} = \frac{1}{9}$
5	$\frac{2}{36} = \frac{1}{18}$
All	1

Dice Multiples	
2	$\frac{27}{36} = \frac{3}{4}$
3	$\frac{20}{36} = \frac{5}{9}$
4	$\frac{15}{36} = \frac{5}{12}$
5	$\frac{11}{36}$
6	$\frac{15}{36} = \frac{5}{12}$
All	$\frac{88}{36} = 2\frac{4}{9}$



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Dice game: Addition Worksheet

Roll the dice, add them and put a cross in the correct row. The winner is the first to get to 12. To count the number of throws cross off the next number in the 1 to 10 rows.

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

Number of throws

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

Winning total: _____

Total number of throws: _____

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Dice game: Difference Worksheet

Roll the dice, find the difference and put a cross in the correct row. The winner is the first to get to 12. To count the number of throws cross off the next number in the 1 to 10 rows.

	1	2	3	4	5	6	7	8	9	10	11	12
0												
1												
2												
3												
4												
5												

Number of throws

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

Winning difference number: ____________________

Total number of throws: ____________________

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Dice game: Maximum Worksheet

Roll the dice, find the maximum number thrown and put a cross in the correct row. The winner is the first to get to 12. To count the number of throws cross off the next number in the 1 to 10 rows.

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

Number of throws

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

Winning maximum number: ____________________

Total number of throws: ____________________

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Dice game: Multiple Worksheet

Roll the dice, find the product and put a cross in all the rows where the product is a multiple of that number. The winner is the first to get to 12. Sometimes you will put a cross in more than one row, at other times you might not put a cross in any row.

To count the number of throws cross off the next number in the 1 to 10 rows.

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

Number of throws

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

Winning multiple: _____

Total number of throws: _____

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Simulations: Addition Worksheet

On Simulations Additions tab of Excel file place a tally of the winning number in the top table and for the number of throws needed in the bottom table here. Then click the top spinner arrow for another simulation.

Sum of dice	Tally	Frequency
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
	Total	

Number of throws in game	Tally	Frequency
< 30		
30 - 39		
40 - 49		
50 - 59		
60 - 69		
70 - 79		
80 - 89		
90 - 99		
> 99		
	Total	

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Simulations: Difference Worksheet

On Simulations Difference tab of Excel file place a tally of the winning number in the top table and for the number of throws needed in the bottom table here. Then click the top spinner arrow for another simulation.

Difference of dice	Tally	Frequency
0		
1		
2		
3		
4		
5		
	Total	

Number of throws in game	Tally	Frequency
< 20		
20 - 24		
25 - 29		
30 - 34		
35 - 39		
40 - 44		
45 - 49		
50 - 54		
55 - 59		
> 59		
	Total	

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Simulations: Maximum Worksheet

On Simulations Maximum tab of Excel file place a tally of the maximum number in the top table and for the number of throws needed in the bottom table here. Then click the top spinner arrow for another simulation.

Maximum number on dice	Tally	Frequency
1		
2		
3		
4		
5		
6		
	Total	

Number of throws in game	Tally	Frequency
< 20		
20 - 24		
25 - 29		
30 - 34		
35 - 39		
40 - 44		
45 - 49		
50 - 54		
> 54		
	Total	

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Simulations: Multiples Worksheet

On Simulations Multiples tab of Excel file place a tally of the multiple number(s) in the top table and for the number of throws needed in the bottom table here. Then click the top spinner arrow for another simulation. Note that there might be two or more winning numbers, so Totals may not match.

Multiples of dice product	Tally	Frequency
2		
3		
4		
5		
6		
	Total	

Number of throws in game	Tally	Frequency
12 - 13		
14 - 15		
16 – 17		
18 – 19		
20 – 21		
22 – 23		
24 - 25		
> 26		
	Total	