

Number Knockout

Learning intent(s): To gain fluency in order of operations, forming equations and working backwards.

Players: 2-4 **For students:** Grades 3-9

Game time: 10-30 minutes

EQUIPMENT

- 20 coloured tiles per player
- Numbered tiles (1-10)
- Pen and paper
- Think Square overlay
- Number Knockout board

Diagram 1: Blank 'Number Knockout' game board

20	19	18	17	16	15	14	6	13	20
13	12	11	10	9	8	7	5	12	19
6	5	4	3	2	1	0	4	11	18
14	7	0					3	10	17
15	8	1					2	9	16
16	9	2					1	8	15
17	10	3					0	7	14
18	11	4	0	1	2	3	4	5	6
19	12	5	7	8	9	10	11	12	13
20	13	6	14	15	16	17	18	19	20

AIM

To be the first to 'Knock-out' all numbers from 0-20. This is done by creating equations (using the numbers in the centre) which equal each of the numbers from 0-20.

HOW TO PLAY

Starting the game: Players draw four random tiles numbered 1-10 and put them in the four blank squares in the centre so everyone can see. With pen and paper handy, players must use those numbers once each in an equation to knock-out all the numbers from 1-20.

For example, if the randomly selected numbers were 2, 6, 3 and 8, a player could write the equation $2 + 3 + 6 + 8 = 19$. This means they have knocked out the number 19 and can put a tile over the top of it. Another player might knock-out 19 by writing $8 \times 2 + 6 - 3 = 19$.

Forming equations: Equations can include the use of brackets, square roots, powers and even factorials!! You may NOT combine any of the four random numbers to form two digit numbers for example using a six (6) and three (3) to make 63 or 36.

All equations are to be checked by an opponent at the end of the game. If a mistake has been made the player who noticed the error must show their opponent and explain how to fix it.

For example, if one player has written $2 + 6 \times 3 - 8 = 16$ their opponent should show them that they need brackets around $(2 + 6)$ for the answer to be correct. Without brackets the equation equals 12.

RULE VARIATIONS TO CATER FOR ABILITY

Beginner: Players must use 2 or more numbers in any equation they create.

Intermediate: Players must use 3 or more numbers in any equation they create.

Advanced: Players must use all 4 numbers in any equation they create.

GAME VARIATIONS

Number draft: Instead of selecting random numbers to place in the centre, players' place numbers 1-10 (for 2 players) 1-15 (for 3 players) or 1-20 (for 4 players) face-up and select them one-by-one until each player has four different numbers. Once a number is picked by someone it cannot be chosen by any other player. Make sure your draft system is fair so that everyone gets a turn at picking first.

Class play: The teacher sets a time limit and a class goal for the amount of numbers knocked out. Students work individually and then add the amount of numbers they knocked out to the class total. There's a 5-point penalty for each number claimed incorrectly so be sure to check each other's work.

Table vs Teacher: Agree on a time limit, choose four numbers and then pit your group of four against the teacher. When time runs out, combine all the numbers your team obtained and see if you were able to knock out more numbers than the teacher.

CHALLENGE QUESTIONS

1. Which number do you think is the most useful and why?
2. What is a factorial and why might it be useful to you in this game?
3. What do you think is the worst possible combination of 4 numbers?
4. How does using different operations help you knock out more numbers?
5. Apart from trial and error, what is your strategy for working out some of the trickier numbers?

CHALLENGE ACTIVITIES

1. Using three numbers of your choice knock-out 15 different numbers from 0-20
2. Using three numbers of your choice knock-out all of the numbers from 0-20
3. Choose any combination of four numbers and use them to knock out as many numbers as you can from 0-50.
4. In a team of two, create what you think is the worst possible combination of four numbers. Swap this with another team and use their numbers to attempt to knock out as many numbers as you can from 0-20
5. Choose 10 numbers and using only addition (with as many or few of your chosen numbers) prove that it is possible to knock-out every number from 1-1000
6. Create a fair system to pick numbers, for the Number Draft version? How do you know it is fair?