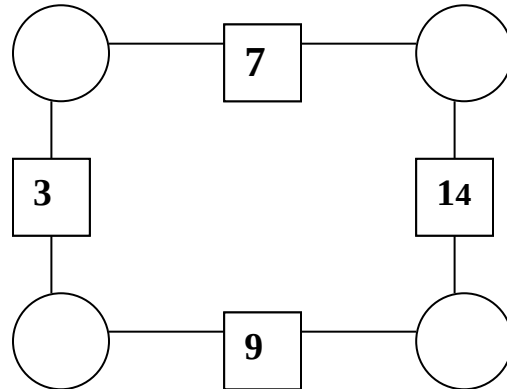


Arithmagons

Find the missing numbers so that they add up to the number between them.

How many different solutions can you find?



Now make up some of your own and try it on a friend.

Are there ones you can make up that are impossible to solve?

Why?

Digit Sums

Choose any number	for example 21
Find the digital sum	$2+1=\underline{3}$
Multiply the original number by 2	42
Find the digital sum	$4+2=\underline{6}$
Multiply the original number by 3	63
Find the digital sum	$6+3=\underline{9}$

If the digital sum doesn't give a single digit answer keep adding the digits until it does

Carry on multiplying by 4,5,6 etc

Can you see when to stop?

Does the number you start with make a difference?

Reversing the digits

Take any two digit number (e.g. 37)

Reverse the order of the digits to give a second number

Subtract the smaller from the larger one (e.g. $73-37=36$)

Choose other numbers and repeat the process.

What do you notice about the answers? Why?

Try the same thing with 3 digit numbers.

Think of a number

Think of a number	e.g. 21
Add 10	31
Subtract 6	25
Multiply by 2	50

Subtract 4	46
Divide by 2	23
Subtract 2	21

(This sequence always returns to the starting number...why?)

Another sequence.... this one converts any starting number to 6

Think of a number	e.g. 7
Double it	14
Add 20	34
Subtract 8	26
Divide by 2	13
Subtract the original number	6

Again... why does it happen?

Making a hundred

Keeping the numbers 1 2 3 4 5 6 7 8 9 in order and using = or - signs try to make a total of 100.

Numbers can be combined to make 2 or 3 digit numbers (e.g. 12, 45, and 89) but the order can't be changed.

What if you're allowed to use all four operations and brackets squares square roots etc.?

Four fours

Can you make all the numbers from 1-20 using up to four 4s and any signs you like?

e.g. $(4+4+4) \div 4 = 3$

What about numbers beyond 20?

1089

Choose a 3 digit number where the hundreds digit is at least 2 more than the units digit.

e.g.	632
reverse it	<u>-236</u>
subtract	396
reverse	<u>+693</u>
add	1089

Try this with similar 3 digit numbers. What do you find? Why? What happens when the hundreds digit is not at least two more than the units digit?

Using adding 9, 99, 999 etc to amaze!

If done as a 'magic trick' (Lewis Carroll used to do this) members of the audience suggest three 2 digit numbers (a, b, d)...the 'magician' suggest two other random numbers(c, e)...she/he can then immediately give the total for the five numbers!

	4	9	a
	3	7	b
	6	2	c
	4	5	d
	5	4	e

The numbers chosen by the 'magician' are not random of course. She/he chooses the number at c to make b up to 99 and the number at e to make d up to 99 so then adds 198 to a by taking 2 from the unit number and putting 2 in the hundreds column.

It works in exactly the same way for single digit, 3 digit, 4 digit, 5 digit numbers etc.... then it really does become impressive!

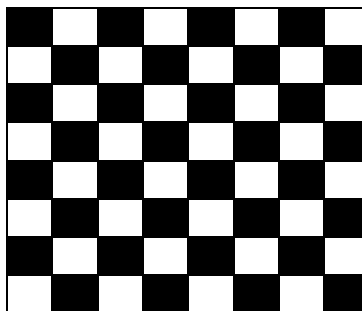
Are there special cases that make you think harder? Try it and see!

2	4	7	
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A five digit example

	4	5	3	8	9
	3	4	2	6	7
	6	5	7	3	2
	3	5	6	2	9
	6	4	3	7	0
2	4	5	3	8	7

Chessboard problem



Once upon a time a slave saved a king's life. The king said he could have anything as a reward. The slave showed the king a chessboard. He put one gold coin on the first square, two coins on the second, four on the third and eight on the fourth. He

explained to the king that he would like all the gold coins he would get if he continued doubling them for every square on the board. The king (who didn't have a very good sense of number!!) thought this would be quite a small amount and agreed. See how far you can get in working out how many gold coins the slave should receive. I'll be impressed if you finish.

Heads and Feet

Farmer Fred keeps sheep and chickens. Every morning to check they were all there he would count their heads and their feet. If he counts 20 heads and 44 feet how many sheep has he got and how many chickens has he got?

Number trails

start	2	18	11
	14	3	9
	6	18	17
			end

You can move horizontally, vertically or diagonally through the above numbers to get from the starting point to the end.

What is the largest total you can get by visiting six numbers?

What is the smallest total you can get by visiting seven numbers?
Can you make a total of 40?

SOME GAMES FOR PRACTISING NUMBER RELATED SKILLS/ KNOWLEDGE.

Each player needs a set of cards numbered 0-9; each set should be a different colour to match a coloured base board.

Thousands	Hundreds	tens	ones

Three to six players produce the best game.

The players shuffle the sets of cards together and put them face down on the table. Initially the aim is to finish with the highest number possible on your own board. Each player takes a card in turn and places it on their board (the colour doesn't matter at the moment). For the first four rounds cards have to be placed on empty columns after that they can be placed on top of existing numbers. Play continues until all the cards have been used and the player with the highest score wins. Strategies are worked out through playing!

Then the real Nasty Game can be played!!

It is played with the same rules except that the card picked up must be placed on the correct colour board, which obviously may well be that of an opponent. It is not your job to help them of course!!

There are several variations to the game. Apart from the complexity of the base board the target can be changed to the smallest number or the number nearest to 500, 100 etc.

Card Games

These games can be played with an ordinary pack of cards, aces count as one and the pictures are removed leaving a pack of 40 cards.

Adding

A game for at least 3 players.

The dealer turns over two cards and whoever gives the correct total first wins the cards. This is repeated until all the cards have been won. She/he becomes the dealer for the next game.

Times

As above but the cards are multiplied instead of being added.

Odd & Even

A game for two to six players.

Each player is dealt 6 cards.

They each choose a card and place it face down in front of them.

When everyone has done this they turn the cards over.

They are all added up and the total is agreed.

If the total is even the players who put down an even numbered card get a point. If the total is odd the people with odd cards get a point. These cards are discarded.

The game continues for six rounds and the winner is the person who gets most points. You could have a player to be the scorer if you wish.

Making 10

A game for 2-5 players.

The cards are dealt to give every player the same number and any cards not used are put to one side.

Each player keeps his/her cards in a heap face down.

Starting from the dealer's left each player turns over his or her top card. As play continues anybody who spots a card that will add to their own top card to make 10, shouts 10. He/she then picks up both piles and adds them to the bottom of his/her remaining pile.

When a player loses all of his/her cards they can shout whenever they see two cards that make ten, this can get them back into the game. The winner is the person who wins all of the cards.

Hitting The Mark

A game for any number of players.

The pack is shuffled and the top two cards are turned over.

These give the target. the first card is the tens digit and the second the ones digit (you decide what to do if a 10 is turned over).

The next five cards are turned over and each player has set time (egg timer, stop watch etc) to try and get as near to the target figure as possible using any operations and as many of the cards as necessary. They don't all have to be used although you could make this a variation.

Making 24

For any number of players

Each player is dealt five cards

The idea is to try to make all of the cards in your hand add up to 24

The player to the left of the dealer picks up the top card from the pack and adds it to her/his hand and throws another card on to the discard pile, face up.

The next player can pick from the pack or the discard pile.

Once your hand adds up to 24.....you shout "24" and win the round.

Play can continue for a number of rounds or a set time.

A variation would be to choose a different target for each round. They obviously can't be too small! Why? How small or large could they be?

Making Eleven

For one player but could be played as a pair to help checking.

Turn over the top eight cards and put them face up on the table.
Look for pairs that make 11.

When you find a pair cover them with two new cards from the pack.

Keep going until you use all the cards...you win.

If you can't go...you lose!

Dice Games

Multiples game

A game for two players

3	4	5	6
8	9	10	12
14	15	16	18
20	24	25	36

How to play

You will need some counters in two colours, a dice and a grid like the one above (although the numbers can be written in any order in the boxes). Take it in turns to throw the dice and put a counter on a multiple of the number rolled. However if you throw a 1, or no multiple is left you have to miss a turn. The winner is the first person to get three of their counters in a row (horizontal, vertical or diagonal).

Number 1 and bust

This is an easy to play dice game for a maximum of four players. Each player takes it in turns to throw the dice. They can throw it as many times as they wish keeping a running total of the score they achieve. However if they throw a number 1 they lose their score. The winner is the first player to reach 100 or above.