Leader of the Pack

52 activities with playing cards to support the learning of Mathematics

Andrew Jeffrey

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52 Card Games for the Mathematics Classroom

Andrew Jeffrey

Welcome to “Leader of the Pack”. This book was written to celebrate my 52nd birthday, but also to support an amazing Charity, SAMI. I have decided to charge just £5 for it and give the profits to SAMI. Thank you so much if you have done so already and got the book free- you are helping to improve the lives of children.

The activities themselves are divided into four sections - clubs, hearts, spades and diamonds.

Broadly, these four suits represent categories as follows:

Clubs - 4 to 7 year olds
Hearts - 7 to 11 year olds
Spades - 10 to 15 year olds
Diamonds - MAGIC TRICKS FOR ALL AGES!

Note that some activities appear in more than one category, but this will be at a harder level. It is worth reading through other levels in case you find something you can adapt for older or younger children. Do not be bound by the age ranges given - they are only meant as a guide.

So - why use playing cards? At their simplest, playing cards can act as a proxy for numbers. Throughout the book, you can assume that Jacks are 11, Queens are 12 and Kings are 13 unless otherwise stated. Also we have used standard nomenclature, so 3S means the three of spades, QD means the queen of diamonds, and so on.

Written numbers cannot easily be moved around as easily as playing cards, thus making cards a versatile way to demonstrate key concepts, for example the commutativity of addition. There is also a psychological advantage in not requiring children to write things down too early in their mathematics. As Dienes told us, sometimes it helps to ‘play’, however serious that play might be before committing to paper, and cards are ideal for that.

Sourcing playing cards is easy - most ‘pound’ type shops sell them, and at the time of writing it was possible to get two packs for £1. Wilko currently sell slightly better quality packs at £1 each (obviously this may change) and the usual online marketplaces such as eBay are also a good source if you are looking for multiple packs.

So, enjoy the activities, let me know of any you really enjoy, and perhaps even send me your favourites!

Finally, and most importantly I must thank the following people for their generous contributions to this book - without them it would still be only half finished! So Liz Gibbs, Rob Eastaway, Grant Whitaker, Liz Woodham, Steve Robert, Stephen Froggatt, Lynwen Barnsley, and Becky Clifford, you are all legends for kindly contributing your ideas to this book. It really is a collaborative effort, and I am grateful to you all.

Cheers,
Andrew
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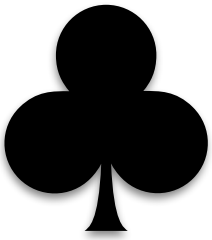
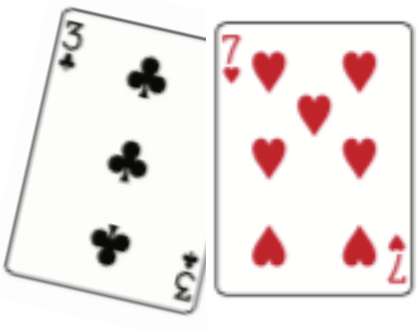


These activities are suitable for ages 4-7

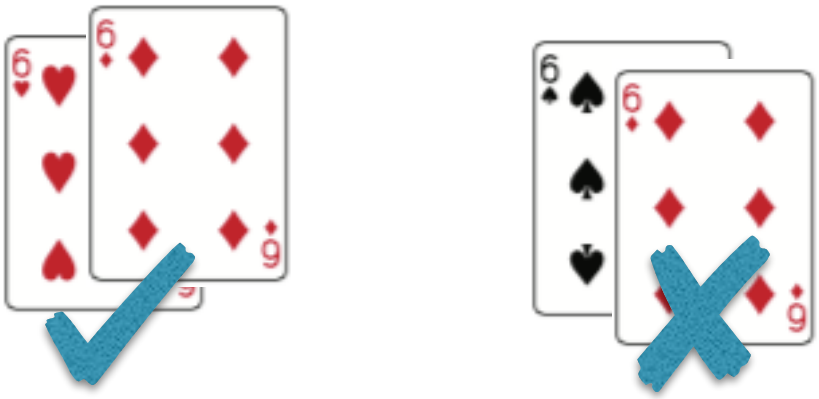
#	Name	Mathematical Ideas
1	**Bonds Snap**	*Number recognition, bonds to 10*
2	**Pelmanism**	*Number recognition, spatial awareness*
3	**Twenty Five up**	*addition, crossing tens boundaries, partitioning*
4	**Twenty Five down**	*Subtraction, crossing tens boundaries, partitioning*
5	**War**	*Relative size, <, >*
6	**Cuckoo**	*Probability, memory, ordering*
7	**Quick Sort**	*Reasoning, inverse operations (+/-)*
8	**I Spy Totals**	*Visualisation, mental +/-*
9	**Target Ten**	*Calculations, asking 'what if'?*
10	**Play Your Cards Right**	*Probability, memory, sequencing*
11	**Spot the Difference**	*Subtraction, subitising*
12	**Largest Number**	*Place Value, Reasoning, <, >*
13	**Speedy Doubles**	*Doubling, mental recall*

Bonds Snap

1

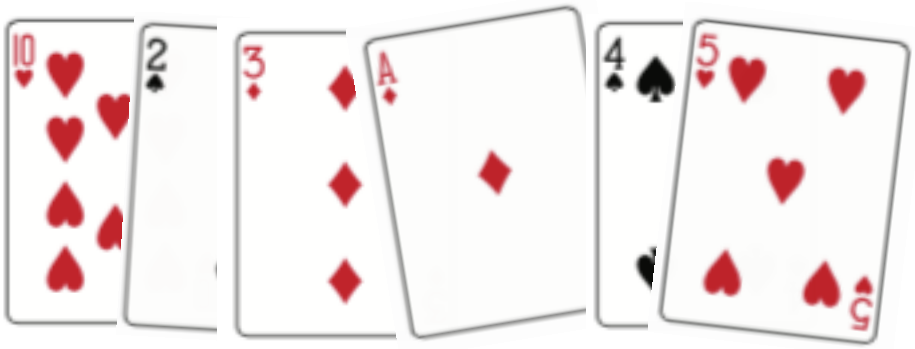
Cards Required: **PACK OF ACES TO NINES**	**Players: any number but this works best in groups of three or four.**
Mathematical Concepts:	*Number recognition, bonds to 10*
How it works:	Deal the cards face down evenly between the players.Working clockwise each player takes it in turn to play a card face up in a pile in front of them.Each player must create their own pile. If at any time the top cards of any two piles add up to ten, the first player to call out ‘SNAP’ wins both piles. The winner should place their ‘won’ cards underneath the cards in their hand and continue the game by dealing a new card on top of their own pile. If their own pile was one of the piles that was won, they simply start a new pile. To pick a winner, simply have a timer and when it goes off the player holding the most cards is declared the winner. If a player runs out of cards they can still call out ‘SNAP’ when they see a suitable pair, so they are never actually ‘out’. 

2 Pelmanism

Cards Required: Full Pack	Players: Any number
Mathematical Concepts:	*Number recognition, spatial awareness*
How it works:	Old but gold. Often known by many other names, this game tests and strengthens memory. Shuffle and deal out a regular pack face down on a table in four rows of 13. Players take it in turns to turn any two cards face up. If they are the same value, that player wins the cards and puts both in his treasure pile. If they are NOT the same value, the player turns both face-down again. Play then passes to the left. Eventually, there will be no cards left and the game is over. Each player counts up their treasure and the player with the most is declared the winner. Variations: You could do this one player at a time and time them; the fastest player to clear the whole pack wins. Or you could insist that pairs only counted if they were the same colour; so 6H and 6D would be fine but 6S and 6D would not. 

Twenty Five Up

3

Cards Required: **Any ace, 2, 3, 4, 5 and 10.**	**Players:** **Any number**
Mathematical Concepts:	*Mental addition, partitioning, crossing tens boundary, time*
How it works:	Mix the six cards face down so that their values are unknown. Deal the first card face up and cal out it's value. Deal the second card on top of if, but this time, call out the total of the numbers dealt so far. Repeat this until you have dealt all 6 cards - the total should be 25. For example, if these were the cards, you would say: "TEN, TWELVE, FIFTEEN, SIXTEEN, TWENTY, TWENTY-FIVE."  The lovely thing is that the total is of course always 25, so children will know if they have made an error during their calculation. If another person is present they can use a stopwatch. The aim of the game is NOT to beat each other, but to beat your own previous best.

4 Twenty Five Down

Cards Required: **Any ace, 2, 3, 4, 5 and 10.**	**Players** **Any number.**
Mathematical Concepts:	*Mental subtraction, partitioning, crossing tens boundary, time*
How it works:	This game is almost exactly the same as '25 up' except this time you start with a score of 25 and work your way downwards. So before you deal any cards you say "TWENTY-FIVE". Then deal the cards one at a time into a pile. Each time you deal one of the cards you SUBTRACT that card's value keeping a running total until you reach zero. (If you don't reach zero, you know you have gone wrong somewhere, which is very useful!) Again, the important thing is to try and beat your previous best score, rather than simply trying to beat each other - collaboration is the name of the game here. With both this game and the game before, help can be found by looking at the spots on the cards themselves. For example, if you were on 12 and turned over the 5 card, you could see that two of the spots could be thought of separately to the other 3, meaning you could do 12-2=10 (easy) and then 10-3=7 (also easy). Both calculations are probably easier to recall than trying to count backwards from 12 five times. This may need to be pointed out to children after they have played a few times.

War

5

Cards Required: Full Pack	**Players:** Two players
Mathematical Concepts:	*Relative number sizes, greater than, less than*
How it works:	Shuffle and give each player half the pack, face down. Jacks count as 11, Queens count as 12, and Kings count as 13. Suits are irrelevant in this game. Both players turn over their top card. The player who deals the higher of the two cards is the winner, and tales BOTH cards and places them into a 'winnings' pile. If the cards are of equal value, another pair is dealt on top and the winner takes all four cards. If they are STILL equal, continue to deal until one card is higher than the other and then the winner takes both piles. After all cards have been played, players count the number of cards in their winnings pile, and the player with the most cards is declared the winner. **Variation**: to make War slightly more challenging the winner must first say how much greater the value of their card is than their opponent's before they can take the cards. So if one player's QD (12) beat the other player's 8H they would need to say "*I won by 4*" to claim the cards. If they make a mistake their opponent wins the cards instead.

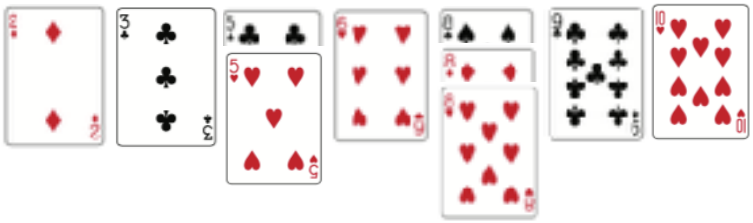
6

Cuckoo

Cards Required: Full Deck	Players: Between 5 and 20 people
Mathematical Concepts:	**Probability, memory, ordering**
How it works:	Give each player three counters and a single card from the shuffled pack. Explain that at the end of the round, the player with the lowest card loses a life and forfeits one of their counters. Player to dealer's left decides whether they wish to switch cards with the person on their left. If they do, that player MUST switch unless they have a king in which case they hold a King in which case they say "KING' and do not have to switch. Play continues clockwise until everyone has had the chance to switch. If the dealer (who goes last) wishes to switch, she can cut the pack at random and take a card from the middle. Finally, everyone turns over their cards and the player with the lowest card loses a life (and a counter). The last player left in is the winner. For the purposes of this game, Aces are worth one (so the lowest card), Jacks 11, Queens 12 and Kings are unbeatable on 13.) If two players both have the lowest number, BOTH lose a counter.

Quick Sort

7

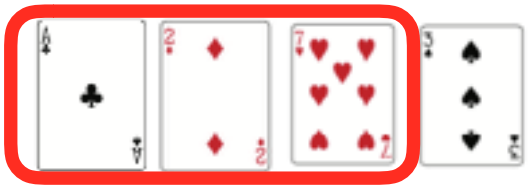
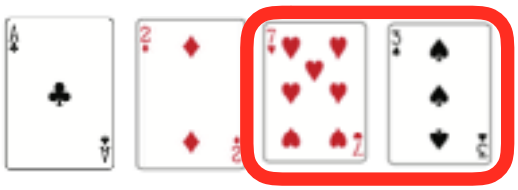
Cards Required: **Ace to Ten pack**	**Players: Any (up to four)**
Mathematical Concepts:	*Ordering, number recognition*
How it works:	Shuffle the pack and deal ten cards face down to each player. Make sure that each player has plenty of table space for this game. Say "1,2,3 go", and each player must look at and then correctly arrange their ten cards in ascending order (from left to right) in a row in front of them. If they have two cards of equal value they should place them in a staggered pile. Here is an example of how a completed hand might look:  The first person to place all ten cards correctly wins the round. Each player then collects up their ten cards, mixes them and passes them to the person on their left. (*This is simply to keep the game from slowing down between rounds*.) The game then starts again. Once everyone has had a go with all the cards they can be collected together, reshuffled and redistributed in tens. You can decide how many rounds are played.

8 I Spy Dice Totals

Cards Required: **Twos to Queens, also two 1-6 dice**	**Players: Any number**
Mathematical Concepts:	*Visualisation, mental addition and recall*
How it works:	Shuffle the cards and lay them out, face up, in an 11 by 4 array. Each player rolls the dice and finds the total. They must then find a card that are matches the total. For the purposes of the game, Jacks are 11s and queens are 12s. So, if the dice rolled are a 5 and a 6, the player must first add to find that the total is 11, then find and pick up an 11 (i.e. a Jack). Play continues in this way until a player cannot make a move, for example if all the eights have been taken and the dice total is 8. They are then eliminated from the game and the last player to be eliminated is the winner. **Variations:** This can be done as a race - players take it in turns to roll the dice, but anyone can try to win a card; the first person to put their hand on a card of the correct value wins it. Alternatively, play as per the original instructions but do not eliminate anyone who can't move - they just miss a turn. At the end, the winner is the person who has taken the most cards once they are all gone.

Target Ten

9

Cards Required: Aces to 9s.	Players: Any
Mathematical Concepts:	*Calculations, 'what if?' strategy*
How it works:	This is a collaborative activity. First, the pack should be thoroughly shuffled. Next, four cards are dealt out randomly in a straight line. The aim of the game is to find cards in the line that add up to 10. Sometimes it might be 2,3, or very occasionally even 4 cards. (A,2,3,4 or 2,2,3,3 for example). If a 'ten' can be made, pick up those cards, set them aside, and deal new cards from the top of the pack into any empty spaces. The aim of the game is to make as many tens as possible. Sometimes this involves making choices - for example, if the cards are, AC, 2D, 7H, and 3S you could make ten in either of these ways:  

10 Play Your Cards Right

Cards Required: Any complete suit. Ace =1, etc.	Players:2
Mathematical Concepts:	*Probability*, memory, sequencing* **Although probability is not formally tested at primary level, it is a good idea to introduce the idea of 'likelihood' as in this case.*
How it works:	This game is much beloved as a fairground game, and has even had its own television show! There are several versions, but here is the most basic one: Mix the 13 cards face down. Turn the top card face up. Say whether you think the next card will be higher or lower (King is the highest, Ace is the lowest). Turn it over. If you are correct, repeat the process and guess whether the second card will be higher or lower than the second card. Keep going as long as you guess correctly; one you are wrong, mix the cards together and another player has a turn. The winner is the first person who guesses correctly twelve times in a row (i.e. completes the whole suit). Alternatively, play for a set amount of time and the winner is the person who has the longest 'run' of successful guesses.

Spot the Difference

11

Cards Required: Full deck, 1-6 dice.	Players: Any
Mathematical Concepts:	*Subtraction, subtilising*
How it works:	Shuffle the cards thoroughly, and lay them out, face-up, in a 4 by 13 array. One player rolls the dice. The object is to find and remove a pair of cards that DIFFER by that number. For example, if a 3 is rolled, a child might find 3S and 6D, or JH and 8S. This is not a race; the aim is to be collaborative. To encourage mathematical discussion, children must say the number sentence that relates to their selection. For the above example, they might say “Eleven minus eight is three.” Suits are irrelevant here. They could also say ‘The difference between eleven and eight is three”, and so on. Once ever player has found a pair, roll again. The game can be played similarly to solitaire - is it possible to remove every card?

12 Largest Number

Cards Required: Aces to Nines	Players: two
Mathematical Concepts:	*Place value, reasoning*
How it works:	Shuffle the pack and deal half the cards to each player. Both turn over their top two cards. They have to make a two digit number using their cards, with one card representing TENS and the other representing ONES. Each player decided which way round to place their cards. The player with the highest number wins a point. What we hope they will realise is the importance of place value - prioritising the tens is the best strategy, though there is still an element of luck involved due to the random distribution of cards. As a variation, players might decided that the LOWEST 2-digit number wins the point. The winner is the first player to get to ten points.

Speedy Doubles

13

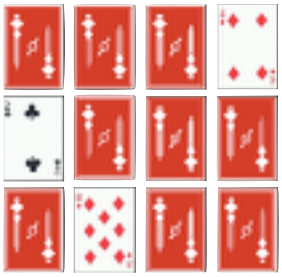
Cards Required: Full pack with Kings removed	**Players: any**
Mathematical Concepts:	*Doubles, mental recall.*
How it works:	Shuffle the cards and deal the top card face-up on the table. Players must quickly work out the number that is double the value of the card and call it out. The first player to call it out wins that card for their 'treasure' pile. Once all the cards are dealt, the player with the most cards in their treasure pile is declared the winner. It is possible to play this game in two or even three teams - players can take it in turns to represent their team, a bit like a penalty shootout. This avoids any one player dominating the game. To take the speed element away altogether, each player could simply write down what they think the double is on their whiteboard, and a point is awarded to everyone who gets the correct answer.

These activities are suitable for ages 7-11

#	Name	Mathematical Ideas
14	**Flip Three**	*Memory, calculation*
15	**Five by Five**	*Number recognition, spatial awareness*
16	**Big Score**	*addition, crossing tens boundaries, partitioning*
17	**Ton Totals**	*Subtraction, crossing tens boundaries, partitioning*
18	**Break the Bank at 27**	*Addition, mental arithmetic*
19	**Tables Shootout**	*Multiplication, tables recall*
20	**Magic Squares**	*Calculation, trial and improvement*
21	**A Thousand and Six**	*Addition, reasoning, trial and improvement*
22	**100 or bust**	*Place value, probability, reasoning, addition*
23	**Wild Boar**	*Memory, addition, reasoning, probability*
24	**I Spy Products**	*Multiplication, tables recall, factors*
25	**Twenty Five from Five**	*Mental addition and subtraction, inverse operations*
26	**Cinquante Cinq**	*Addition, Partitioning, Tables*

Flip Three

14

Cards Required: ACES TO TENS PLUS QUEENS	Players: 2-4 players
Mathematical Concepts:	*Memory*, *calculation*.
How it works:	This game is similar to Pelmanism, but takes it a step further by introducing calculations. Shuffle the pack and deal 12 cards face down in a 3 by 4 array. Players take it in turns to turn any three cards face up. If they are able to say a number sentence using all three cards, they are allowed to keep them. If not, they turn the cards back face down. The number sentence must involve one of the four operations and an equals. In the example below, the player could say 'eight divided by four equals two' or 'four times two equals eight' etc.  Play then passes to the next player, who must do the same thing. Their three cards can, but do not have to, include cards previously turned face up. Continue playing until all players agree that no further moves seem possible. Turn all the cards face up and see if there are any further moves; if not, clear the deck, deal another 12 cards and start a new round. The winner is the person who holds the most cards after an agreed number of rounds.

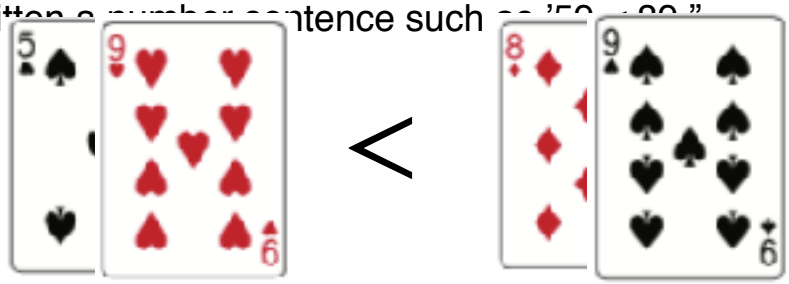
15

Five by Five

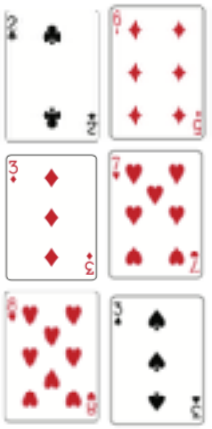
Cards Required: Aces to tens **Also one square 5 by 5 grid per player**	**Players:** **Multiple players**
Mathematical Concepts:	*Reasoning, multiplication as repeated addition, mental arithmetic*
How it works:	One person shuffles the pack and deals 25 cards, unseen, into a face down packet.They then turn over cards singly from the packet, calling out the value (not the suit) of each card, at approximately 3-second intervals. All other players write the number called into one of the squares in their grid. They do this for all 25 cards and fill their grid, one number per square. Next they add up the points scored as follows: only numbers written adjacent to the same number actually score. For example, if the top row read 3 4 4 2 4, the score for that row would be 8, as there are two fours next to each other. If the next row was, for example, 5 5 1 1 5, the score would be 12, since the first two fives count, as do the two 1s, but the final 5 is *not* next to another five so does not count. Once players have added up their points for their rows, they should do the same thing for their columns, using the same rules. Most players tend to do better on their rows than their columns initially, until hopefully they realise this and start to adjust their strategy. This is really good fun and excellent arithmetic practice!

Big Score

16

Cards Required: **ACES to NINES**	**Players:** **Multiple players; the more the merrier**
Mathematical Concepts:	*<, >, place value, probability*
How it works:	Players each draw two boxes, then a '<' sign, then another two boxes. The dealer turns one card face up and calls out its value. The players must each write this number in any one of their own four boxes. Once written, they are not allowed to change their mind. This is repeated another three times until the players have written a number sentence such as '59 < 98'.  Once all four cards have been called, and all four numbers written, players check whether they have written a true sentence. If they have (as in this example), they are awarded a number of points equal to the smaller number. In this example they are awarded 59 points. If they have written an untrue sentence (e.g. '98 < 59') they score zero. Continue for an agreed number of rounds. The winner is the person with the greatest points total.

17 Ton Totals

Cards Required: ACES to NINES	Players: ANY
Mathematical Concepts:	*Column addition, place value trial and improvement*
How it works:	Shuffle the pack and deal six cards to each player. Players must arrange their six cards into a 3 by 2 array thus forming 3 2-digit numbers, then find the total of these three numbers. For example, if the cards drawn were 2C, 3D, 7H, 8H, 3S, 6D, they might arrange them like this:  The object of the game is to reach a total as close to 100 as possible. There are many possible variations. For example, how should you arrange the cards to give as large a total as possible? Or the smallest? Or the closest to 80? etc. There is no need to award points for this task, as it is designed to be investigative in nature.

Break The Bank at 27

18

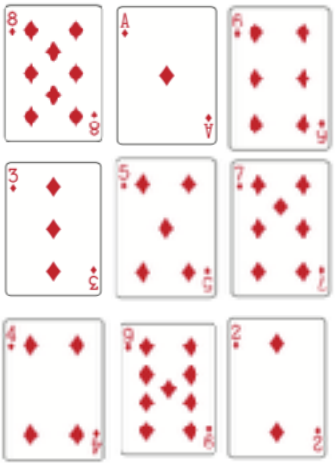
Cards Required: ACES TO TENS	Players: Two players
Mathematical Concepts:	*Addition, mental arithmetic*
How it works:	Shuffle the pack and give half to each player. Each player places their half in a pile in front of them, face down. Players take it in turn to deal a card from the top of their pile into the centre, face up. Each time a new card is played onto the centre pile, the player who dealt it must call out the running total of the cards in the pile. The game continues until the total is 27 or over. The player who played the last card wins all the cards in the centre of the table, and shuffles them into their own pack. The winner starts the next round. The game ends when one player captures all the cards and wins, or after an agreed amount of time, when the player with the greatest number of cards wins.

19 Tables Shootout

Cards Required: ACES TO QUEENS	Players: Two
Mathematical Concepts:	*Multiplication, tables recall*
How it works:	Shuffle the cards, and give half to each player. They put them in a face down pile in front of them. Both players simultaneously turn over their top card. The first player to correctly call out the product of the two values (Jacks are 11, Queens are 12) wins the cards and puts them into a treasure pile. After 24 rounds all the cards will have been played. The winner is the player with the most cards in their treasure pile. In the event of a dispute a calculator can be used to resolve it. If both players call out the product at the same time, the cards are left face up and another two cards are dealt. The first person to call out the product wins all four face-up cards For children who are still learning some of their tables, the game can be modified by removing Jacks, Queens, nines, eights, sevens, etc. as required.

Magic Square

20

Cards Required: Ace to 9 for each player	Players: ANY
Mathematical Concepts:	*Calculation, trial and improvement*
How it works:	Give each player nine cards (an ace to a 9). Challenge them to lay out the cards in three rows of three cards each, so that every row adds up to the same number. Do not tell them that this must be 15, but watch for those children who work out that it must be, as the total of all the cards is 45, and each row is one third of the total. Once they have got all three rows totalling 15, tell them that the next challenge is to make all three columns total 15 as well, without changing the total of each row. One possible solution is below, but there are others. This one is particularly nice because the diagonals also make 15: 

21 A Thousand and Six

Cards Required: **ACES TO NINESs.**	**Players:** **Any number**
Mathematical Concepts:	*Addition, reasoning, trial and improvement*
How it works:	Shuffle the cards and deal six to each player. Each player has to arrange their cards to form two 3-digit numbers (HT1). They must then add these two 3-digit numbers together in order to get a total as close to 1000 as possible. The closest player to 1000 wins a point and the cards are reshuffled and each player is dealt a new hand. The game finishes after an agreed number of rounds, the player with the highest points being declared the winner, or when a player gets to an agreed number of points and is declared the winner. A really interesting variation is for each player to receive nine cards rather than six initially, and to choose the six cards that will get them closest to 1000. This brings in deeper reasoning skills.

100 or bust

22

Cards Required: **ACES TO NINES**	**Players:** **AS MANY AS YOU LIKE**
Mathematical Concepts:	*Place value, probability, reasoning, addition*
How it works:	In this game, players try to be the first to score exactly 100 points without going over (hence 'bust'). The dealer shuffles the pack, turns over the top card, and calls out its value Suits are ignored. Every player has to write down either the number itself, or ten times the number. The dealer deals a second card. The players again have to write down either the number or ten times the number, but this time they must add it to their original number. If they go over 100, they must declare themselves 'bust' and are out of the game. Play continues in this way, the dealer calling out the value of the next card, and players choosing whether to write it as is or ten times it, and add it on to their running total. Tactically, players are often tempted to 'go high' initially but this does not always turn out to be the best strategy. Either way, this is a fantastic opportunity to practise both place value and calculation.

23 Wild Boar

Cards Required: **FULL DECK**	**Players:** **ANY, but works best with players in teams**
Mathematical Concepts:	*Memory, addition, reasoning, probability*
How it works:	Place the deck face down in the middle. Players take it in turn to deal a card from the top, creating a face-up pile next to it. They score the value of the card and keep a running total of all card values shown during their turn. They may choose to continue turning over another card to try to increase their score, or stop at any time. The score is accumulated as the cards are dealt. This score is 'banked' when the player calls a halt, and play passes to the next player. But beware! If a player deals ANY king they lose their entire score for that particular turn. If they deal a BLACK ace they lose their score for the *whole game*, including all points banked in previous rounds. Play continues from player to player until one team has scored 200 or more points. A very exciting game, particularly when played with up to 4 teams and you have players who have memorised the 'bad' cards which are coming up as the pack gets revealed in the same order. It is a very interesting problem to challenge older students with to see if they can come up with, and justify mathematically, an optimum strategy for playing the game. For example, do they stop after a specific number of cards, or after they reach a specific total?

I Spy Products

24

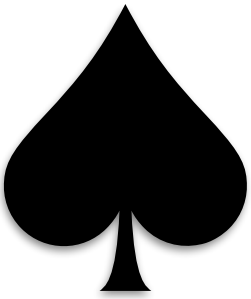
Cards Required: **ACES TO QUEENS**	**Players:** **2 to 4 players works best**
Mathematical Concepts:	*Multiplication, tables recall, factors*
How it works:	Shuffle the cards and deal them out face up in an 8 by 6 array. Player 1 looks for a pair of cards that are either horizontally or vertically adjacent, multiplies them together in her head and says “I spy a product of 24”. The other players have to race each other to spot two adjacent cards that produce that product, for example 2S and QD, or perhaps 6H and 4H. As soon as they spot an adjacent pair that fits, they must put their hands on the two cards and say "I spy factors of 24.” The first person to do so wins the cards for their treasure pile. Bear in mind that there may well be two or more possible correct pairs, particularly with numbers such as 24 which have many factors. For this game, Jacks are worth 11 and queens are worth 12. Play then passes to the next player who mentally chooses then announces a different product, and so on round the group so that everyone gets a turn. Continue until there are no more possible pairs on the table. The player with the most treasure is the winner.

25 Twenty Five from Five

Cards Required: FULL PACK, J=11, Q=12, K=13	Players: BETWEEN 2 AND 5 PLAYERS
Mathematical Concepts:	*Mental addition and subtraction, inverse operations*
How it works:	Shuffle the cards and give 5 to each player. Place the rest of the cards face down as a 'bank.' Turn over the top card of the bank. Players have to try and make the number 25 by adding all the cards in their hand. The first player picks up the face up card, and discards one card of their choice face up onto a discount pile. The new top card of the bank is also turned face up. Play continues which each player picking up either a) the top card of the bank or b) the top card of the discard pile, and then discarding one of their own onto the discard pile. The winner of the round is the first player to say "25" and show that their 5 cards total exactly 25. They get a point, and the round is ended. Play continues for a set amount of time or an agreed number of rounds.

Cinquante Cinq

Cards Required: **A SET OF ACE TO TEN, ANY SUIT**	**Players:** **ANY NUMBER**
Mathematical Concepts:	*Addition, Partitioning strategies, subtraction, times tables*
How it works:	Shuffle the ten cards. Turn the first one face up and call out its value. Turn over the remaining cards one by one but this time call out the running total. If you do not make any errors the finishing total will be 55. There are lots of variations with this one. For example, why not start at 55 and try to get to zero as fast as possible without any mistakes? Another popular alternative is to choose a times table you wish to practise. If you choose for example the sevens, when you turn over each card, say out loud the multiple of 7 and the number shown. Repeat for the whole set. Tiing yourself is a very good idea. Encourage children to try to beat their own previous best score rather than the people near them. '***Yesterday's you***' is the only person to beat!



These activities are suitable for ages 11-16

#	Name	Mathematical Ideas
27	**Product Partners**	*Calculations, multiplicative reasoning*
28	**Averages**	*Mean, Mode, Median, Range*
29	**Make it Fair**	*Odd and even, probability*
30	**Fraction addition**	*Err- fraction addition*
31	**Fractions to 1**	*Four rules of fractions*
32	**Bigger Than Yours**	*<., >, equivalent fractions*
33	**Exponent Battle**	*Indices*
34	**4,3,2…**	*Place Value, reasoning*
35	**The Snake**	*Number bonds, multiplication as repeated addition*
36	**Twenty Four**	*Four operations, reasoning*
37	**Factor Snap!**	*Factors, multiples*
38	**Countdown**	*Four operations, reasoning, trial and improvement*
39	**Closest to 50**	*Multiplication, addition, reasoning*

Product Partners

Cards Required: **ACES TO NINES**	**Players:** **Any - pairs or small groups is best**
Mathematical Concepts:	*Calculations, multiplicative reasoning,*
How it works:	This is a really rich collaborative activity. Shuffle the pack and deal 6 cards face up in the centre of the table. Each player has to select three of the values to create a 2-digit numbers and a single digit numbers, and multiply them together. They repeat the process with the other three cards, and add together the two products. The aim of the exercise is to find the largest possible total once the two products are added. This is not as simple as it sounds, and the real value, apart from increasing fluency, is the reasoning that is involved in deciding whether a different possible re-arrangement would yield a higher total. Give pupils plenty of time to discuss this - there is benefit in them trying different combinations, forming and testing hypotheses, etc.

28 Averages

Cards Required: FULL PACK (J=11 etc)	Players: Any
Mathematical Concepts:	*Mean, mode, median, range*
How it works:	A great way to cement pupils' understanding of the different kinds of average. Shuffle the cards and deal e in a row. Calculate the mean by adding them and dividing by three, the mode if there is one, the median by finding the middle card, and the range by subtracting the smaller from the larger. Once this is checked, they should deal a new row but with four cards, and repeat. This time of course the median will be the average of the two centre cards, but all the other processes are the same. Next they deal a row of 5 cards, then 6, then 7, and so on, each time finding the various types of average and the range. If you wish to make this a race, the first team to do all their calculations correctly up to 10 cards wins the game. Alternatively, the teacher could deal the cards and all groups could work on them simultaneously.

Make it Fair

29

Cards Required: **2 SETS OF ACE TO SIX, ANY SUIT**	**Players: TWO**
Mathematical Concepts:	*Odd and even, probability*
How it works:	Each player has an ace to a six. One player chooses to be 'ODD', the other is "EVEN'. Both players mix their own cards face down, then turn over their top cards simultaneously. If they are a match, the cards are replaced and the packs reshuffled. If the two cards differ by an odd number, the player who is 'ODD' wins a point; if the difference is even, then the player who is 'EVEN' wins a point. The first player to five points wins the game. After a few games, ask the players if they think the game is fair or not (it isn't!) and ask them to explain why. What new rule can they think of to make it fair? This game 'feels' fair but is actually weighted slightly in favour of the 'ODD' player. It is interesting for pupils to work out why this is the case.

30 Fraction Addition

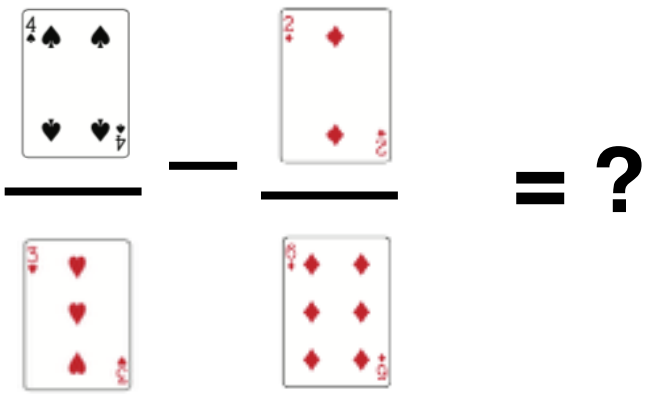
Cards Required: **FULL PACK**	**Players:** **Any**
Mathematical Concepts:	*Fraction addition*
How it works:	Shuffle the pack and deal four at random to each person. They have to rearrange their cards to make two fractions (make numerator < denominator). Finally, they have to add their fractions together. This provides plenty of self-generated practice, and allows for many obvious variations. For example, once they have finished they could switch the numerators around and investigate what happens to the total. Does it change? Which way? Why? Can you predict? Repeat with another set of four cards. This time they might also choose to subtract, for example.

Fractions to 1

31

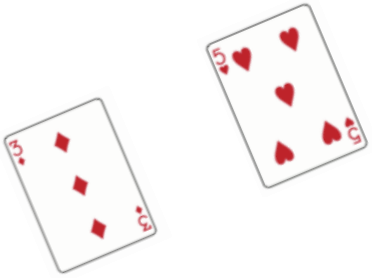
Cards Required: **FULL PACK**	**Players:** **ANY**
Mathematical Concepts:	*Fractions, four operations*
How it works:	This is an ideal follow-up to the previous activity. As before, take a random selection of four cards. The aim is to arrange them into two fractions, whose total is 1. Easier said than done, and of course most of the time it will not be possible to get exactly one, so the real aim is to think about which fractions would yield a total as near to 1 as possible. For an added twist, you could allow subtraction - does this make it easier? What about multiplication or division? It is a good idea for this task to remove the restriction that the fraction may not be improper; a bit of improper every now and then is fine…

32 Bigger Than Yours

Cards Required: FULL DECK	Players: Pairs
Mathematical Concepts:	*<., >, equivalent fractions*
How it works:	Each player draws two random cards from a shuffled pack and arranges them into a fraction, so that the smaller card is the numerator, and the larger is the denominator. They must then decide who has the larger fraction. If they cannot agree, a calculator can be used to adjudicate (by dividing). The player who has the larger fraction wins a point, and the game continues until the pack runs out. The winner is the player with the most wins. Of course, in terms of who wins, this is a game of luck rather than skill, but there is still value in the discussion as they reason about the relative size of each fraction. 

Exponent Battle

33

Cards Required: ACES TO FIVES	Players: Any
Mathematical Concepts:	*Indices*
How it works:	Each player takes two cards at random from the shuffled pack. They arrange them in one of two ways: Each player does the same, then they have to evaluate their expression, treating the card on the right as an exponent (so in the example above, the left hand pairing is worth 3^2, and the right hand pairing is worth 2^3. The player with the LOWEST value wins. This will really make them think about exponents and the effect that they have on numbers. For example, the player with 3D and 5H has to decide which is less; 3 to the power of 5, or 5 to the power of 3. 

34 4,3,2...

Cards Required: ACES TO NINES	Players: 2 - 4
Mathematical Concepts:	*Place Value, reasoning*
How it works:	Shuffle and deal nine cards to all players. Get the players to hold the cards in their hands and fan them out in numerical order. The players then have to make three numbers using their cards - a two-digit number, a three-digit number and a four-digit number but trying to make the BIGGEST number each time. The cards are then put down on the table face down - two-digit, three-digit and four-digit. Players then reveal their numbers one at a time to see who has won that particular round. The highest two-digit number receives 2 points, the three-digit number 3 points and the four-digit 4 points. If there is a tie the points are shared. This games works well when played for three or four rounds. Shuffle the cards after each round. Some nice tactics here if a player has small numbers - ditch the 1's in the first round and save the bigger ones for later rounds.

The Snake

35

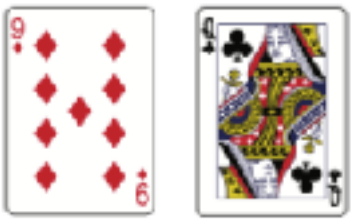
Cards Required: **FULL PACK**	**Players:** **Any**
Mathematical Concepts:	*Number bonds, multiplication as repeated addition*
How it works:	From a shuffled pack deal ten cards face up on the table. The aim of the activity is to find the total of all the cards (J=11 etc) without writing anything down. One way to do this is to simply work from left to right (or along a line of your choosing if the cards are not in a straight line, hence 'the snake'), but there are two other beneficial strategies to be encouraged. The first is to look for repeated cards. For example, if there are 3 sevens, they could be thought of as 3x7, or 21, saving a fair amount of work. The second is to look for number bonds to either 10 or 20. For example, if you spot 3C and 7S, they could be thought of as '10', or if you spot QH and 8D they could be thought of as a '20'. The object of the activity is to find as efficient a way to total the cards as possible. Encourage pupils to explain their own methods so that they have a chance to learn from each other, as some methods are more useful in certain situations, but may not occur to all children unless they have a chance to talk about their ideas. The huge benefit of doing this with cards is that they can move the cards around to help with their thinking and explanations.

36 Twenty Four

Cards Required: **ACES TO NINES**	**Players:** **Any**
Mathematical Concepts:	*Four operations, reasoning*
How it works:	There is a popular commercially-available card game called '24'. Each card has four single-digit numbers around the outside, and the aim is to combine them using calculations in order to get an answer of exactly 24. However it is perfectly possible to play even if you don't have access to the cards. Use a shuffled pack of cards, and deal the top four onto the table. Now try to combine them using, addition, subtraction, multiplication and division to arrive at 24. The only rule is that each number must be used exactly once. This can be done as a collaborative activity or as a race (as in the original version of the game). If the latter, the first person to say a calculation that is agreed by the other players wins the four cards for their treasure pile. You will be able to play nine rounds if using the whole pack once.

Factor Snap

37

Cards Required: **FULL PACK**	**Players:** **TWO**
Mathematical Concepts:	*Factors, multiples*
How it works:	It might feel a bit odd to play SNAP with secondary-age children, but this version will really make them think. Shuffle the cards and give half to each player. Both players turn over their top card simultaneously. They can say SNAP if and only if one card is a factor of the other, or if the cards share a common factor. For example, if these two cards are turned over it is possible to correctly call 'snap', as they share a common factor of 3.  The player who correctly calls SNAP first wins the cards. If the cards do not share a common factor, play continues with each player dealing a new card. After a set amount of time, the player with the most cards is declared the winner.

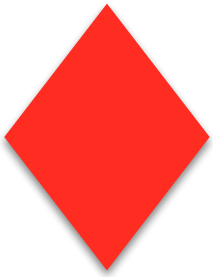
38 Countdown

Cards Required: **ACES TO TENS**	**Players:** **ANY, IN SMALL GROUPS OR WHOLE CLASS.**
Mathematical Concepts:	*Four operations, reasoning, trial and improvement*
How it works:	Similar to the popular TV show: Shuffle the cards and deal out 7 face up on the table. Now choose a random 3 digit number by dealing out three further cards to create a 3-digit number. The object of the game is to reach the 3-digit total by combining some or all of the original 7 cards using the four operations. Of course this is not always possible, so you might wish to award points to the person who gets closest to the number. Repeat as required, but always take time to work through various players' solutions to the problem.

Closest to 50

39

Cards Required: **ACE TO QUEEN (Q=12)**	**Players:** **MANY**
Mathematical Concepts:	*Multiplication, addition, reasoning*
How it works:	Having removed the kings, shuffle the cards and deal 6 to each player. Every player has to arrange their cards into three pairs and then multiply each pair together. They then add the three totals together and see who is closest to 50. The ideal outcome is that the three totals add up to exactly 50. In reality this rarely happens of course, so the challenge for each player is to arrange their cards in such a way as to get as close to 50 as possible. For example, if dealt QD, 3H, 2S, 5S, 7C and 3D, you might lay them out to give the following calculations: 12 x 2 (24) 7 x 3 (21) 3 x 5 (25), which gives 60, off by just 10. Is there a better arrangement?

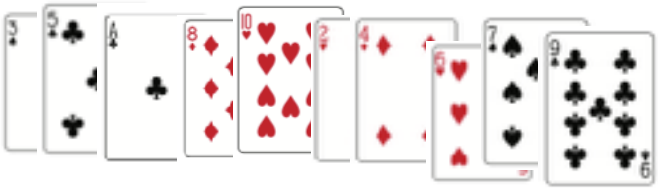


Finally, a few MAGICAL activities!

#	Name	Mathematical Ideas
40	**Ace Speller**	*Spelling, reasoning*
41	**Piano Trick**	*Odd and Even, Commutativite multiplication*
42	**Massive Memory**	*Bonds to ten, modulo arithmetic, reasoning*
43	**Parity Trick**	*Parity, odd and even numbers*
44	**The Bus to Euston Square**	*Addition, reasoning, commutativity*
45	**The Trick that fooled Einstein**	*equivalence, inverse*
46	**Your Card, My Card**	*Algebraic reasoning, mental arithmetic*
47	**Thirty Seven**	*Division, factorising, algebra*
48	**Deal or Switch**	*equivalence, pattern*
49	**Heaps of Aces**	*Inverse operations*
50	**The Tenth Card**	*Addition and subtraction*
51	**Twenty One Card Trick**	*Iteration*
52	**Tell The Truth**	*??????!*

Ace Speller

40

Cards Required: SINGLE SET OF ACE TO TEN	Skill Level: Medium
Mathematical Concepts:	*Spelling, reasoning*
How it works:	The magician (that's you) takes a packet of cards. They spell 'A-C-E', moving a card from top to bottom. On the final letter, E, instead of putting the card on the bottom, they turn it face up. Lo and behold, it is the Ace. You place the Ace aside. Your cynical students are mildly surprised but not overly impressed. But then you spell 'T-W-O', turning over the new third card - it turns out to be the Two. You place it on the table. Now they are a bit impressed, but trying not to show it. Sure enough, you repeat this all the way to TEN and each time the correct card appears. Their challenge - can they work out the order of the cards? Give each pair of children a set of 1-10 cards and let them work on the problem. 

41 Piano Trick

Cards Required: ANY 15 CARDS.	Skill Level: BASIC
Mathematical Concepts:	*Odd and even numbers, commutativity of multiplication*
How it works:	Ask someone to place their hands in 'piano playing' position. Starting with their left hand, place two cards between each pair of fingers saying 'Pair, Pair" etc. each time. You will deal four pairs in total. (8 cards). Move onto the right hand. Do exactly the same apart thing three times, but in the final gap deal the odd card saying "and an ODD card." Stress that the odd card has gone to their right hand. Next take out each pair of cards in the same order they were placed, and as you take them out say "Pair" and split them into two even piles on the table. Explain that both piles are even size as you are placing a card on both. Repeat for all seven pairs and then take the odd card and say "And which pile would you like the ODD card to go on?" Place the odd card on whichever hand they say. Make a magical wave, then claim that you have made the odd card move. When they express doubt, pick up whichever pile they asked for the odd card to go in, and deal the cards in 2s saying "PAIR, PAIR, PAIR, PAIR." There will be an even number. Pick up the other pile and say as you deal "PAIR, PAIR, PAIR, ODD CARD." Sure enough there will be three pairs and an odd card! But how does it work?!

Massive Memory!

42

Cards Required: 1 full pack	Skill Level: ADVANCED
Mathematical Concepts:	*Bonds to ten, modulo arithmetic, reasoning*
How it works:	The magician asks the spectator to shuffle the pack and take out any spot card but not show the magician. She then claims that by looking at each card just twice she will be able to spot the missing one. She deals through the remaining 51 cards slowly once. The second time she seems to race through the cards - halfway through she correctly announces the name of the missing card! Here's the secret - it's known as 'casting out tens'. Four sets of 1-10 add up to 220, so if all the cards were present, and the magician kept a running total, this is what she should get. Therefore if she gets to the end of the pack and the total is 217, she knows that a 3 must be missing. Court cards can be ignored, as the spectator was asked to take a spot card initially. BUT: this takes a lot of concentration and is prone to error. There is a better way. In her head, the magician keeps a running total but every time the total goes over 10, she simply subtracts 10 and this way keeps her calculations to single digit numbers. For example, suppose the first 4 non-court cards are a 9, a 7, a 5 and another 9. The running total would be 9, 16 (so 6), 11 (so 1), 10 (so zero). Once she gets to the end, let's say she is on 4. She knows the missing card must be a six (bonds to 10). The second run through is to spot 6H, 6C, 6S and 6D. As soon as she spots three of the sixes, she simply names the missing one! Don't dismiss this - it will make you look as though you have an impressive memory! Also, more importantly, it is fantastic mental calculation practice.

43 Parity Trick

Cards Required: 1 full pack	Skil Level: INTERMEDIATE
Mathematical Concepts:	*Parity, odd and even*
How it works:	You will need an accomplice for this one. Lay out 16 cards in a 4 by 4 array. Ask your accomplice to leave the room, or to turn their back. Ask a volunteer to turn any 8 cards face up. You then mix the cards around so that each row contains both face up and face down cards. Invite the volunteer to turn over a single card. Your accomplice turns round and immediately correctly indicates the card that the volunteer turned over! The secret lies in the rows and columns. When you mix the cards, make sure that every row and column has an even number of face up cards (zero, 2 or 4). Whichever card they then turn over, when your accomplice turns round, they will find exactly one row and one column with an *odd* number of face up cards. The card at the intersection of this row and this column MUST be the card that was turned! It's worth practising this a few times so that you are fluent when you perform it. Better still, why not get students to work it out and invite them to perform it?

The Bus to Euston Square

44

Cards Required: **16 - see below**	**Skil Level:** **BASIC**
Mathematical Concepts:	*Addition, reasoning, commutativity*
How it works:	Set out a grid of sixteen cards, 4 cards by 4 cards, using any suits but with these values: 5 3 6 4 4 2 5 3 6 4 7 5 7 5 8 6 Invite four spectators forwards. The first person places 50p on any card face, then turns face down the other cards in its row and in its column. Once this is done, the next spectator is invited to place their coin on any face up card, then similarly turn face down the cards in its row and column (if not already face down). This is repeated for the third spectator (who has a choice of four cards) and finally the fourth spectator is left to place her 50p on the last card. You display a picture of the Number 20 Bus, Destination Euston Square, Ticket price £2. Add up the money that has been placed down - £2 Add up the values of the face-up cards - 20. All aboard! So: why is the total always 20? What is the secret of the grid? If each number in the grid is the sum of its (invisible) column header and row header, what were they?

45 The Trick that Fooled Einstein

Cards Required: 1 full pack	**Skil Level:** BASIC
Mathematical Concepts:	*equivalence, inverse*
How it works:	This is fiendish! Ask a spectator to cut a small packet from the top of a face-down pack. The number isn't important, but explain that they will need to count so not take more than around a dozen. Meanwhile you also take a packet - make sure that you take roughly 9 or 10 more cards than them. Now instruct your spectator to count their cards secretly while you do the same. Say that even though you couldn't know how many they have, you are confident enough to make not one but three predictions! here's how: if you find you have **20** cards, say: "I have the same number as you, plus **4** plus enough to make your number add up to **16**." Note that the two bold numbers can be anything as long as they add up to the number of cards in your hand. So, if you cut off 23 cards, you could change the numbers in your prediction to (say) **5** and **18**. Ask the spectator to count their cards, one at a time, face down onto the table. Deal yours to match, then another 4, and finally starting with the number one larger than theirs, count on and you will run out at exactly 16 - your prediction was correct! There is some very clever algebra at work here. But what?!

Your Card, My Card

Cards Required: **ACES TO NINES**	**Skill Level:** **BASIC**
Mathematical Concepts:	*Algebraic reasoning, mental arithmetic*
How it works:	Invite everyone in the class to take a card from the pack, without you knowing its value. Take any 8-spot (8C, 8H, 8S, or 8D) for yourself but do not reveal its value yet. Now ask everyone to do the following steps: **Double your number…** **Add 2 to the total…** **Multiply by 10…** **Halve…** **Subtract 2…** Now announce "You are now thinking of a 2-digit number. This number was predicted ahead of time. The first digit…is in your hand!" Ask them to take a look. And then announce: "But more amazingly, the second digit…is in MY hand!" Slowly turn your card around to show them the 8; this works every time! Next, ask them to consider how this works - the algebra is quite simple as follows. Suppose their number is 'n': Starting with n, the steps lead to: 2n, 2n+2, 20n+20, 10n+10, and finally 10n+8.

47 Mean Thirty Seven

Cards Required: **ACES TO NINES**	**Skill Level:** **BASIC**
Mathematical Concepts:	*Division, factorising, algebra*
How it works:	Ask the pupils to take any 3 cards and ask them to investigate how many ways they could arrange them to create a 3-digit number. There are 6. Once they have found all six, ask them to write down and calculate the mean average of the six 3-digit numbers. Finally, they should divide this average by the total of the 3 digits that make up their original choice. Without knowing anything, you announce that the answer is - THIRTY SEVEN? So - how? Algebra provides the solution here; if the three digits are a, b, and c the total of all 6 numbers will always be 200(a+b+c) plus 20(a+b+c) plus 2(a+b+c), i.e. 222(a+b+c). Dividing this by 6 to find the mean gives 37(a+b+c). Divide this by (a+b+c)…et voila! *(Thanks SDTF - I had never seen it done like this!)*

Deal or Switch?

Cards Required: **ONE SET OF ACE TO TEN, ANY SUIT**	**Skill Level:** **BASIC**
Mathematical Concepts:	*Equivalence, pattern*
How it works:	Hold the packet of ten cards face down. Explain that you will mix them according to your spectator's wishes. If they say 'deal', you deal the top card, still face down, onto the table. If they say 'switch', however, you *first switch the position of the two top cards* and *then* put them down as a pair on the table. During the whole procedure, keep all of the cards face-down. Ask them to say 'deal' or 'switch' again, and continue until all the cards are dealt into a pile. Explain that it is important to look for patterns in maths, and turn over the cards one by one. Amazingly, they are in perfect A-2-3-4-5-6-7-8-9-10 order? How? Before the trick starts, have the cards in 10-9-8-7-6-5-4-3-2-A order, (10 on the top of the face-down packet) but do not reveal this fact. Now perform the trick exactly as described and it will work automatically! Why? Because dealing and switching changes nothing; but that's for them to work out with their own set of cards, so have plenty of sets ready! Warning- you will likely fool yourself the first time you try this!

49 Heaps of Aces

Cards Required: FULL PACK	Skill Level: BASIC
Mathematical Concepts:	*Inverse operations*
How it works:	Secretly have the aces on top of the face-down pack. Ask the spectator to cut the pack into four roughly equal piles, Keep the cards face-down throughout the trick. Put the piles in a row across the table. Keep track of the pile with the aces on top, and make sure it goes at the end of the row. We will refer to it as pile 4. Pick up the pile at the opposite end (pile 1). Explain how the cards are going to be mixed. Deal the top three cards, one at a time, face down into the space just vacated by pile 1. Next, deal a single card onto each of the other three piles in any order, chosen by the spectator. Ask them to do exactly the same procedure with pile 2; pick it up, deal three cards into the space, then one card on top of each of the other piles. Ask them to do the same with pile 3, and finally with pile 4. (Secretly the aces pile). Finally, ask them to turn over the top card of each pile - they will be staring at the four aces! How - this is to do with inverse operations. The first three deals ADD A SINGLE CARD on top of the aces. The final deal REMOVES THREE CARDS - this precisely 'undoes' the addition and leave the aces to be spread out across the four piles - genius and certainly one of my favourite card tricks!

Tenth Card Prediction

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Cards Required: **FULL PACK**	**Skill Level:** **BASIC**
Mathematical Concepts:	*Addition and subtraction*
How it works:	Secretly note and write down the name of the tenth card from the top of a pack. Now ask someone for a number between ten and twenty (I explain that we don't need to use the whole pack for this trick, so how many would you like me to use, etc. to make it feel a random choice.) Deal this many cards off the top, keeping everything face-down. Put the rest of the pack out of the way, as we do not need them again. Now say you will select one of the cards at random. Ask the spectator to add together the digits of their number (for example if they had chosen 16 the total would be 7. Ask them to deal down to the 7th card in the pile and loo kat it. Reveal your written prediction - it is exactly the card they are looking at! How? I invite you to try this in private first, but with the tenth card turned face-up. Hopefully this will help you to see how the trick works. Clue: the higher the number called, the further down in the pack the original tenth card will be…

51 Twenty One Card Trick

Cards Required: **ANY 21 CARDS**	**Skill Level:** **BASIC**
Mathematical Concepts:	*Iteration*
How it works:	No book of mathematical card tricks would be complete without this old chestnut - just don't ever show it to a magician or they will groan! Deal 21 cards into 3 piles of 7, making sure each card is visible. Ask the spectator just to think of any card, and to indicate which pile it is in. Gather up the piles, ensuring that the chosen pile goes between the other two, Now quickly re-deal the cards, dealing across rather than down, so deal a card to pile A, a card to pile B, a card to pile C, then another card to pile A, etc. Again, ask the spectator which pile their card is in. Again, as you gather up the cards, place this pile between the other two. Do this a third time and finally gather up the cards. Explain that you will find their card by magical spelling. Spell and say 'Y-O-U-R C-A-R-D I-S', dealing a single card for each letter. Pause dramatically, then turn over the next card. It will be theirs! This procedure always guarantees that their card will be in eleventh position, so you can spell anything that fits!

Tell The Truth!

52

Cards Required: ANY NINE CARDS	Skill Level: BASIC
Mathematical Concepts:	*WHO KNOWS??!!!*
How it works:	Ask the spectator to shuffle the cards, then place the 9 cards face down in 3 piles of 3. Next they should lift up a pile, look at the card on the face, and replace that pile on top of either of the other two, then put this larger pile on top of the third pile to reassemble the pack. You can have your back turned if you trust them! Now pick up the pack and tell them that you are going to spell to their card, but that they are allowed to lie when answering your questions. Ask for the value of the card. Whatever they say, deal cards one at a time, from the top of the packet, into a pile on the table. When you finish, drop all the cards in your hand on top to reassemble the packet. Now spell 'OF", and do the same procedure (i.e. deal two cards face down, then drop the remainder on top.) Next ask for the suit of their card, reminding that that they can lie if they wish. Repeat the dealing process. Finally, spell MATHS. Turn over the card dealt on the letter 'S'; it will be their card!

So there we are; 52 cool things to do with a pack of cards in maths classrooms.

I hope that you find at least some of them really useful and enjoyable to develop your pupils' mathematics skills.

Andrew Jeffrey, 52, 1st July 2018