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RANK OF THE WORD R A I N A.. = 3! = 6 I. = 3! = 6 N.. = 3! = 6 RAIN = 1 word 6 6 6 1 TOTAL 19 Rank of R A I N is 19 Given word is : "F A T H E R"In alphabetical order:A, E, F, H, R, T Words beginning with A = 5! = 120 Words beginning with E = 5! = 120 Words beginning with F Required Alphabet left A, E, H, R,T Words beginning with FA
Required Alphabet left E, H, R, T Words beginning with FAE = 3! = 6 Words beginning with FAH = 3! = 6 Words beginning with FAR = 3! = 6 Words beginning with FAT..Required Alphabet left E, H, R Words beginning with FATE = 2! = 2 Words beginning with FATH .. Required Alphabet left E, R Words beginning with FATHE .. Required Alphabet
left R Words beginning with FATHER = 1 word Rank of FATHER= 120 + 120 + 6 + 6 + 6 + 2 + 1 = 261 RANK OF THE WORD F A T H E R A .. = 5! = 120 A .. = 5! = 120 FAE . = 3! = 6 FAE . = 3! = 6 FAE . = 3! = 6 FATE = 2! = 2 F A T H E R = 1 120 120 6 6 6 2 1 TOTAL 261 Rank of F A T H E R is 261 Click here for video explanation of the topic
Letters in the ascending order: C, E, E, G, L, L, OLetter C is required so we left with E, E, G, L, L, ONow number of words formed starting with CC E _ _ _ _ _ = 5!/2! = 60 wordsNote: Here letter L repeat twice so we divide by 2!C G _ _ _ _ _ = 5!/(2!*2!) = 30 wordsNote: Here letters L and E repeat twice so we divide by 2!*2!C L _ _ _ _ _ = 5!/2! = 60
wordsC O -------- = Required MathematicsCombinatoricsPermutations Permutations Generator Permutations/Anagrams Calculator In Mathematics, item permutations consist in the list of all possible arrangements (and ordering) of these elements in any order.Example: The three letters A,B,C can be shuffled (anagrams) in 6 ways: A,B,C B,A,C C,A,B
A,C,B B,C,A C,B,APermutations should not be confused with combinations (for which the order has no influence) or with arrangements also called partial permutations (k-permutations of some elements).The best-known method is the Heap algorithm (method used by this dCode's calculator).Here is a pseudo code source : function permute(data, n) { if
(n = 1) print data else { for (i = 0 .. n-2) { permute(data, n-1) if (n % 2) swap(data[0], data[n-1]) else swap(data[i], data[n-1]) permute(data, n-1) } }}Permutations can thus be represented as a tree of permutations: Another algorithm, named JohnsonTrotter, generates all permutations by changing only one pair of adjacent elements at each
step.Counting the total number of permutations of $ n $ distinct elements is given by the factorial: $$ n! = n \times (n1) \times (n2) \times \cdots \times 2 \times 1 $$Example: For $ 4 $ elements, the number of combinations is $ 4! = 24 $When a set contains repeated elements, some permutations are identical. The number of distinct permutations is
then given by the formula: $$ \frac{ n! } { n_1! \times n_2! \times \cdots \times n_i! } $$ with $ n_i $ the number of occurrences of each repeated element.In other words, having a repeated item involves a division of the number of permutations by the number of permutations of these repeated items.Example: DCODE 5 letters have $ 5! = 120 $
permutations but contain the letter D twice (these $ 2 $ letters D have $ 2! $ permutations), so divide the total number of permutations $ 5! $ by $ 2! $: $ 5!/2!=60 $ distinct permutations. dCode retains ownership of the "Permutations" source code. Any algorithm for the "Permutations" algorithm, applet or snippet or script (converter, solver,
encryption / decryption, encoding / decoding, ciphering / deciphering, breaker, translator), or any "Permutations" functions (calculate, convert, solve, decrypt / encrypt, decipher / cipher, decode / encode, translate) written in any informatic language (Python, Java, PHP, C#, Javascript, Matlab, etc.) or any database download or API access for
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bibliographic citation is: Permutations on dCode.fr [online website], retrieved on 2025-05-30, Feedback The below are some of example queries to which users can find how many ways to arrange letters in a word by using this word permutation or letters arrangement calculator: Just give a try the words such as HI, FOX, ICE, LOVE, KIND, PEACE,
KISS, MISS, JOY, LAUGH, LAKES, MATH, STATISTICS, MATHEMATICS, COEFFICIENT, PHONE, COMPUTER, CORPORATION, YELLOW, READ and WRITE to know how many ways are there to order the 2, 3, 4, 5, 6, 7, 8, 9 or 10 letters word. Users also supply any single word such as name of country, place, person, animal, bird, ocean, river,
celebrity, scientist etc. to check how many ways the alphabets of a given word can be arranged by using this letters arrangement or permutation calculator. Below is the reference table to know how many different ways to arrange 2, 3, 4, 5, 6, 7, 8, 9 or 10 letters word can be arranged, where the order of arrangement is important. The n-factorial (n!)
is the total number of possible ways to arrange a n-distinct letters word or words having n-letters with some repeated letters. Refer permutation formula to know how to find nPr for different scenarios such as:finding word permutation for words having distinct letters,finding word permutation for words having repeated letters. Number of Ways to
Arrance 'n' Letters of a Word'n' Letters WordsWays to Arrange 2 Letters Word2 distinct ways 3 Letters Word6 distinct ways 4 Letters Word24 distinct ways 5 Letters Word120 distinct ways 6 Letters Word720 distinct ways 7 Letters Word5,040 distinct ways 8 Letters Word40,320 distinct ways 9 Letters Word362,880 distinct ways 10 Letters
Word3,628,800 distinct ways Work with Steps: How many Distinct Ways to Arrange the Letters of given WordSupply the word of your preference and hit on FIND button provides the answer along with the complete work with steps to show what are all the parameters and how such parameters and values are being used in the permutation formula to
find how many ways are there to order the letters in a given word. Click on the below words and know how the calculation is getting changed based on the word having distinct letters and words having repeated letters. For other words, use this letters of word permutations calculator.Use this calculator to easily calculate the number of permutations
given a set of objects (types) and the number you need to draw from the set. Quick navigation: A permutation is a way to select a part of a collection, or a set of things in which the order matters and it is exactly these cases in which our permutation calculator can help you. For example, if you have just been invited to the Oscars and you have only 2
tickets for friends and family to bring with you, and you have 10 people to choose from, and it matters who is to your left and who is to your right, then there are exactly 90 possible solutions to choose from. Permutations come a lot when you have a finite selection from a large set and when you need to arrange things in particular order, for example
arranging books, trophies, etc. Calculating permutations is necessary in telecommunication and computer networks, security, statistical analysis. Systems like phone numbers, IP addresses, IBANs, etc. are designed based on the knowledge of the maximum available permutations versus the expected use. A given phone area prefix can only fit in that
many numbers, the IPv4 space can only accommodate that many network nodes with unique public IPs, and an IBAN system can only accommodate that many unique bank accounts. Here is a more visual example of how permutations work. Say you have to choose two out of three activities: cycling, baseball and tennis, and you need to also decide on
the order in which you will perform them. The possible permutations would look like so: Permutation calculations are important in statistics, decision-making algorithms, and others. How to calculate permutations? To calculate the number of possible permutations of r non-repeating elements from a set of n types of elements, the formula is: The above
equation can be said to express the number of ways for picking r unique ordered outcomes from n possibilities. If the elements can repeat in the permutation, the formula is: In both formulas "!" denotes the factorial operation: multiplying the sequence of integers from 1 up to that number. For example, a factorial of 4 is 4! = 4 x 3 x 2 x 1 = 24.
Permutation with repetition In some cases, repetition of the same element is allowed in the permutation. For example, locks allow you to pick the same number for more than one position, e.g. you can have a lock that opens with 1221. Or you can have a PIN code that has the same number in more than one position. The formula for calculating the
number of possible permutations is provided above, but in general it is more convenient to just flip the "with repetition" checkbox in our permutation calculator and let it do the heavy lifting. Another common example concerns dice probabilities. If two six-sided dice are thrown together, one needs to estimate the number of possible ways they may
come up. This a case of randomly drawing two numbers out of a set of six, and since the two may end up being the same (e.g. double sixes) it is a calculation of permutation with repetition. The answer in this case is simply 6 to the power of 2, 6 6 = 36 possible permutations of the two dice rolls. Permutations vs combinations The difference between
combinations and permutations is that permutations have stricter requirements - the order of the elements matters, thus for the same number of things to be selected from a set, the number of possible permutations is always greater than or equal to the number of possible ways to combine them. With combinations we do not care about the order of
the things resulting in fewer combinations. Permutations are for ordered lists, while combinations are for unordered groups. For example, if you are thinking of the number of combinations that open a safe or a briefcase, then these are in fact permutations, since changing the order of the numbers or letters would result in an invalid code. Very often
permutations are mistaken for combinations, at least in common language use. For example, a "combination lock" is in fact a "permutation lock" as the order in which you enter or arrange the secret matters. In computer security, if you want to estimate how strong a password is based on the computing power required to brute force it, you calculate
the number of permutations, not the number of combinations. In English we use the word "combination" loosely, without thinking if the order of things is important. In other words: "My fruit salad is a combination of apples, grapes and bananas" We don't care what order the fruits are in, they could also be "bananas, grapes and apples" or "grapes,
apples and bananas", its the same fruit salad. "The combination to the safe is 472". Now we do care about the order. "724" won't work, nor will "247". It has to be exactly 4-7-2. So, in Mathematics we use more precise language: When the order doesn't matter, it is a Combination. When the order does matter it is a Permutation. So, we should really
call this a "Permutation Lock"! In other words: A Permutation is an ordered Combination. To help you to remember, think "Permutation ... Position" Permutations There are basically two types of permutation: Repetition is Allowed: such as the lock above. It could be "333". No Repetition: for example the first three people in a running race. You can't be
first and second. 1. Permutations with Repetition These are the easiest to calculate. When a thing has n different types ... we have n choices each time! For example: choosing 3 of those things, the permutations are: n n n (n multiplied 3 times) More generally: choosing r of something that has n different types, the permutations are: n n ... (r times) (In
other words, there are n possibilities for the first choice, THEN there are n possibilites for the second choice, and so on, multplying each time.) Which is easier to write down using an exponent of r: n n ... (r times) = nr Example: in the lock above, there are 10 numbers to choose from (0,1,2,3,4,5,6,7,8,9) and we choose 3 of them: 10 10 ... (3 times) =
103 = 1,000 permutations So, the formula is simply: nr where n is the number of things to choose from,and we choose r of them,repetition is allowed,and order matters. 2. Permutations without Repetition In this case, we have to reduce the number of available choices each time. Example: what order could 16 pool balls be in? After choosing, say,
number "14" we can't choose it again. So, our first choice has 16 possibilites, and our next choice has 15 possibilities, then 14, 13, 12, 11, ... etc. And the total permutations are: 16 15 14 13 ... = 20,922,789,888,000 But maybe we don't want to choose them all, just 3 of them, and that is then: 16 15 14 = 3,360 In other words, there are 3,360 different
ways that 3 pool balls could be arranged out of 16 balls. Without repetition our choices get reduced each time. But how do we write that mathematically? Answer: we use the "factorial function" ! The factorial function (symbol: !) just means to multiply a series of descending natural numbers. Examples: 4! = 4 3 2 1 = 24 7! = 7 6 5 4 3 2 1 = 5,040 1! =
1 Note: it is generally agreed that 0! = 1. It may seem funny that multiplying no numbers together gets us 1, but it helps simplify a lot of equations. So, when we want to select all of the billiard balls the permutations are: 16! = 20,922,789,888,000 But when we want to select just 3 we don't want to multiply after 14. How do we do that? There is a neat
trick: we divide by 13! 16 15 14 13 12 ...13 12 ... = 16 15 14 That was neat: the 13 12 ... etc gets "cancelled out", leaving only 16 15 14. The formula is written: n!(n r)! where n is the number of things to choose from,and we choose r of them,no repetitions,order matters. 16!(163)! = 16!13! = 20,922,789,888,0006,227,020,800 = 3,360 (which is just the
same as: 16 15 14 = 3,360) 10!(102)! = 10!8! = 3,628,80040,320 = 90 (which is just the same as: 10 9 = 90) Notation Instead of writing the whole formula, people use different notations such as these: P(n,r) = nPr = nPr = n!(nr)! Examples: P(10,2) = 90 10P2 = 90 10P2 = 90 There are also two types of combinations (remember the order does not
matter now): Repetition is Allowed: such as coins in your pocket (5,5,5,10,10) No Repetition: such as lottery numbers (2,14,15,27,30,33) 1. Combinations with Repetition Actually, these are the hardest to explain, so we will come back to this later. 2. Combinations without Repetition This is how lotteries work. The numbers are drawn one at a time, and
if we have the lucky numbers (no matter what order) we win! The easiest way to explain it is to: assume that the order does matter (ie permutations), then alter it so the order does not matter. Going back to our pool ball example, let's say we just want to know which 3 pool balls are chosen, not the order. We already know that 3 out of 16 gave us
3,360 permutations. But many of those are the same to us now, because we don't care what order! For example, let us say balls 1, 2 and 3 are chosen. These are the possibilites: Order does matter Order doesn't matter 1 2 31 3 22 1 32 3 13 1 23 2 1 1 2 3 So, the permutations have 6 times as many possibilites. In fact there is an easy way to work out
how many ways "1 2 3" could be placed in order, and we have already talked about it. The answer is: 3! = 3 2 1 = 6 (Another example: 4 things can be placed in 4! = 4 3 2 1 = 24 different ways, try it for yourself!) So we adjust our permutations formula to reduce it by how many ways the objects could be in order (because we aren't interested in their
order any more): n!(nr)! x 1r! = n!r!(nr)! That formula is so important it is often just written in big parentheses like this: n!r!(nr)! = (nr) where n is the number of things to choose from,and we choose r of them,no repetition,order doesn't matter. It is often called "n choose r" (such as "16 choose 3") And is also known as the Binomial Coefficient.
Notation All these notations mean "n choose r": C(n,r) = nCr = nCr = (nr) = n!r!(nr)! Just remember the formula: n!r!(n r)! So, our pool ball example (now without order) is: 16!3!(163)! = 16!3! 13! = 20,922,789,888,0006 6,227,020,800 = 560 Notice the formula 16!3! 13! gives the same answer as 16!13! 3! So choosing 3 balls out of 16, or choosing
13 balls out of 16, have the same number of combinations: 16!3!(163)! = 16!13!(1613)! = 16!3! 13! = 560 In fact the formula is nice and symmetrical: n!r!(nr)! = (nr) = (nnr) Also, knowing that 16!/13! reduces to 161514, we can save lots of calculation by doing it this way: 161514321 = 33606 = 560 Pascal's Triangle We can also use Pascal's Triangle
to find the values. Go down to row "n" (the top row is 0), and then along "r" places and the value there is our answer. Here is an extract showing row 16: 1 14 91 364 ...1 15 105 455 1365 ...1 16 120 560 1820 4368 ... 1. Combinations with Repetition OK, now we can tackle this one ... Let us say there are five flavors of icecream: banana, chocolate,
lemon, strawberry and vanilla. We can have three scoops. How many variations will there be? Let's use letters for the flavors: {b, c, l, s, v}. Example selections include {c, c, c} (3 scoops of chocolate) {b, l, v} (one each of banana, lemon and vanilla) {b, v, v} (one of banana, two of vanilla) (And just to be clear: There are n=5 things to choose from, we
choose r=3 of them,order does not matter, and we can repeat!) Now, I can't describe directly to you how to calculate this, but I can show you a special technique that lets you work it out. Think about the ice cream being in boxes, we could say "move past the first box, then take 3 scoops, then move along 3 more boxes to the end" and we will have 3
scoops of chocolate! So it is like we are ordering a robot to get our ice cream, but it doesn't change anything, we still get what we want. We can write this down as (arrow means move, circle means scoop). In fact the three examples above can be written like this: {c, c, c} (3 scoops of chocolate): {b, l, v} (one each of banana, lemon and vanilla): {b, v,
v} (one of banana, two of vanilla): So instead of worrying about different flavors, we have a simpler question: "how many different ways can we arrange arrows and circles?" Notice that there are always 3 circles (3 scoops of ice cream) and 4 arrows (we need to move 4 times to go from the 1st to 5th container). So (being general here) there are r +
(n1) positions, and we want to choose r of them to have circles. This is like saying "we have r + (n1) pool balls and want to choose r of them". In other words it is now like the pool balls question, but with slightly changed numbers. And we can write it like this: (r + n 1)!r!(n 1)! = (r + n 1r) where n is the number of things to choose from,and we choose
r of themrepetition allowed,order doesn't matter. Interestingly, we can look at the arrows instead of the circles, and say "we have r + (n1) positions and want to choose (n1) of them to have arrows", and the answer is the same: (r + n 1)!r!(n 1)! = (r + n 1r) = (r + n 1n 1)So, what about our example, what is the answer? (3+51)!3!(51)! = 7!3!4! =
5040624 = 35 There are 35 ways of having 3 scoops from five flavors of icecream. In Conclusion Phew, that was a lot to absorb, so maybe you could read it again to be sure! But knowing how these formulas work is only half the battle. Figuring out how to interpret a real world situation can be quite hard. But at least you now know the 4 variations of
"Order does/does not matter" and "Repeats are/are not allowed": Repeats allowed No Repeats Permutations (order matters): nr n!(n r)! Combinations (order doesn't matter): (r + n 1)!r!(n 1)! n!r!(n r)! 708, 1482, 709, 1483, 747, 1484, 748, 749, 1485, 750 Copyright 2025 Rod Pierce In this section you will learn to Count the number of possible
permutations (ordered arrangement) of n items taken r at a time Count the number of possible permutations when there are conditions imposed on the arrangements Perform calculations using factorials In Example 7.2.6 of section 7.2, we were asked to find the word sequences formed by using the letters { A, B, C } if no letter is to be repeated. The
tree diagram gave us the following six arrangements. ABC, ACB, BAC, BCA, CAB, and CBA. Arrangements like these, where order is important and no element is repeated, are called permutations. A permutation of a set of elements is an ordered arrangement where each element is used once. How many three-letter word sequences can be formed
using the letters { A, B, C, D }? Solution There are four choices for the first letter of our word, three choices for the second letter, and two choices for the third. Applying the multiplication axiom, we get \(4 \cdot 3 \cdot 2 = 24\) different arrangements. How many permutations of the letters of the word ARTICLE have consonants in the first and last
positions? Solution In the word ARTICLE, there are 4 consonants. Since the first letter must be a consonant, we have four choices for the first position, and once we use up a consonant, there are only three consonants left for the last spot. We show as follows: Since there are no more restrictions, we can go ahead and make the choices for the rest of
the positions. So far we have used up 2 letters, therefore, five remain. So for the next position there are five choices, for the position after that there are four choices, and so on. We get So the total permutations are \(4 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \cdot 3 = 1440\). Given five letters { A, B, C, D, E }. Find the following: The number of four-
letter word sequences. The number of three-letter word sequences. The number of two-letter word sequences. Solution The problem is easily solved by the multiplication axiom, and answers are as follows: The number of four-letter word sequences is \(5 \cdot 4 \cdot 3 \cdot 2 = 120\). The number of three-letter word sequences is \(5 \cdot 4 \cdot 3 =
60\). The number of two-letter word sequences is \(5 \cdot 4 = 20\). We often encounter situations where we have a set of n objects and we are selecting r objects to form permutations. We refer to this as permutations of n objects taken r at a time, and we write it as nPr. Therefore, the above example can also be answered as listed below. The number
of four-letter word sequences is 5P4 = 120. The number of three-letter word sequences is 5P3 = 60. The number of two-letter word sequences is 5P2 = 20. Before we give a formula for nPr, we'd like to introduce a symbol that we will use a great deal in this as well as in the next chapter. \[\mathrm{n} !=\mathrm{n}(\mathrm{n}-1)(\mathrm{n}-2)
(\mathrm{n}-3) \cdots 3 \cdot 2 \cdot 1 onumber \] where \(n\) is a natural number. \[0! = 1 onumber \] Now we define nPr. The Number of Permutations of n Objects Taken r at a Time \[\mathrm{nPr}=\mathrm{n}(\mathrm{n}-1)(\mathrm{n}-2)(\mathrm{n}-3) \cdots(\mathrm{n}-\mathrm{r}+1) onumber \] or \[\mathrm{nPr}=\frac{\mathrm{n} !}
{(\mathrm{n}-\mathrm{r}) !} onumber \] where \(n\) and \(r\) are natural numbers. The reader should become familiar with both formulas and should feel comfortable in applying either. Compute the following using both formulas. SolutionWe will identify \(n\) and \(r\) in each case and solve using the formulas provided. a. 6P3 = \(6 \cdot 5 \cdot 4 =
120\), alternately \[6 \mathrm{P} 3=\frac{6 !}{(6-3) !}=\frac{6 !}{3 !}=\frac{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{3 \cdot 2 \cdot 1}=120 onumber \] b. 7P2 = \(7 \cdot 6 = 42\), or \[7 \mathrm{P} 2=\frac{7 !}{5 !}=\frac{7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}=42 onumber \] Next we consider some
more permutation problems to get further insight into these concepts. In how many different ways can 4 people be seated in a straight line if two of them insist on sitting next to each other? SolutionLet us suppose we have four people A, B, C, and D. Further suppose that A and B want to sit together. For the sake of argument, we tie A and B together
and treat them as one person. The four people are \(\boxed{AB}\) CD. Since \(\boxed{AB}\) is treated as one person, we have the following possible arrangements. \[\boxed{AB} CD, \boxed{AB} DC, C \boxed{AB}D, D\boxed{AB}C, CD \boxed{AB}, DC\boxed{AB} onumber \] Note that there are six more such permutations because A and B could
also be tied in the order BA. And they are \[\boxed{BA}CD, \boxed{BA} DC, C\boxed{BA}D, D\boxed{BA}C, CD\boxed{BA}, DC \boxed{BA} onumber \] So altogether there are 12 different permutations. Let us now do the problem using the multiplication axiom. After we tie two of the people together and treat them as one person, we can say we
have only three people. The multiplication axiom tells us that three people can be seated in 3! ways. Since two people can be tied together 2! ways, there are 3! 2! = 12 different arrangements You have 4 math books and 5 history books to put on a shelf that has 5 slots. In how many ways can the books be shelved if the first three slots are filled with
math books and the next two slots are filled with history books? Solution We first do the problem using the multiplication axiom. Since the math books go in the first three slots, there are 4 choices for the first slot,3 choices for the second and 2 choices for the third. The fourth slot requires a history book, and has five choices. Once that choice is made,
there are 4 history books left, and therefore, 4 choices for the last slot. The choices are shown below. Therefore, the number of permutations are \(4 \cdot 3 \cdot 2 \cdot 5 \cdot 4 = 480\). Alternately, we can see that \(4 \cdot 3 \cdot 2\) is really same as 4P3, and \(5 \cdot 4\) is 5P2. So the answer can be written as (4P3) (5P2) = 480. Clearly, this
makes sense. For every permutation of three math books placed in the first three slots, there are 5P2 permutations of history books that can be placed in the last two slots. Hence the multiplication axiom applies, and we have the answer (4P3) (5P2). We summarize the concepts of this section: 1. Permutations A permutation of a set of elements is an
ordered arrangement where each element is used once. 2. Factorial \[\mathrm{n} !=\mathrm{n}(\mathrm{n}-1)(\mathrm{n}-2)(\mathrm{n}-3) \cdots 3 \cdot 2 \cdot 1 onumber \] Where \(n\) is a natural number. \[0! = 1 onumber \] 3. Permutations of n Objects Taken r at a Time \[\mathrm{nPr}=\mathrm{n}(\mathrm{n}-1)(\mathrm{n}-2)
(\mathrm{n}-3) \cdots(\mathrm{n}-\mathrm{r}+1) onumber \] or \[\mathrm{nPr}=\frac{\mathrm{n} !}{(\mathrm{n}-\mathrm{r}) !} onumber \] where \(n\) and \(r\) are natural numbers. The permutation formula is used to find the different number of arrangements that can be formed by taking r things from the n available things. Permutations are
useful to form different words, number arrangements, seating arrangements, and for all the situations involving different arrangements. As per the permutation formula, the permutation of 'r' objects taken from 'n' objects is equal to the factorial of n divided by the factorial of difference of n and r.What is Permutation Formula?In the below formula of
permutations, the total number of things are 'n' and 'r' number of things can be selected and arranged. Before applying the permutation formula, we need to clearly know the concept of factorial. The factorial of any number is the product of the consecutive numbers starting from 1, and till that number. i.e., n! = 1 2 3 4 .... n.Permutation
FormulaBelow is the permutation formula. This is used to find the number of ways of selecting and arranging 'r' different things from 'n' different things:nPr (or) P(n, r) = (n!) / (n - r)!Here:'n' is the total number of things.'r' is the number of things to be selected and then arranged.Formula 1: Factorial of a natural number n.n! = 1 2 3 4 .... nFormula
2: Permutation Formula or NPR formula for r things taken from n things.nPr = (n!) / (n - r)!Formula 3: The relationship between permutations and combinations for r things taken from n things.nPr = r! nCrDerivation of Permutations FormulaSince a permutation involves selecting r distinct items without replacement from n items and order is
important, by the fundamental counting principle, we haveP (n, r) = n . (n-1) . (n-2) . (n-3) (n-(r-1)) ways.This can be written as:P (n, r) = n.(n-1).(n-2). (n-3) . (n-r+1) ... (1)Multiplying and Dividing (1) by (n-r) (n-r-1) (n-r-2)........... 3. 2. 1, we getP (n, r) = [n.(n-1).(n-2). (n-3) . (n-r+1)[(n-r) (n-r-1) (n-r-2)-------- 3. 2. 1] / [(n-r) (n-r-1) (n-r-2)------3. 2. 1]P (n, r)
= (n!) / (n - r)!Hence, the permutations formula is derived.Different Permutations FormulasThere are five different types of permutations formulas. Let us learn each of them one by one along with examples.Permutations Formula WITHOUT RepetitionThe permutations formula used when 'r' things from 'n' things have to be arranged without
repetitions is nothing but the nPr formula which we have already seen. i.e.,nPr (or) P(n, r) = (n!) / (n - r)!Example: Find the number 3 letter words that can be formed from the letters a, b, c, d, and e in which the letters should not be repeated.Solution:The number of letters available is, n = 5.The number of letters in each word is, r = 3.Since there
should be no repetition of letters,the possible number of words is, 5P3 = (5!) / (5 - 3)! = 5! / 2! = 120/2 = 60.Permutations Formula WITH RepetitionThe permutations formula used when 'r' things from 'n' things have to be arranged with repetitions is just nr. This is because each of the 'r' things can be selected in 'n' different ways, thus givining nnn
.... n (r times) = nr.Example: Find the number 3 letter words that can be formed from the letters a, b, c, d, and e in which the letters are allowed to be repeated.Solution:The number of letters available isn, n = 5.The number of letters in each word is, r = 3.Since there can be the repetition of letters,the possible number of words is, 53 =
125.Permutations Formula Taken All at a TimeThe number of ways of arranging 'n' different things among themselves is nothing but arranging 'n' things out of 'n' things and is given by:nPn = n! / (n-n)! = n!/0! = n!/1 = n!Thus, we can arrange 'n' different things among themselves in n! ways.Example: There are 5 different books in a bookshelf. In how
many ways we can arrange them?Solution:5 books can be arranged in 5! = 5 4 3 2 1 = 120 ways.Permutations Formula with Same Sets of DataWe have just seen that the number of ways of arranging 'n' different things is n!. What if all of n things are NOT different and some of them are same? Say, among 'n' things. 's1' objects are of one type, 's2'
objects belong to the second type, ... , 'sn' objects belong to the nth type then the number of possible arrangements is n! / (s1! s2! ... sn!).Example: Find the number of arrangements of the letters of the word PETER.Solution:The number of letters in the given word = 5Among them, 'E' is repeated 2 times.So the possible number of arrangements = 5! /
2! = (120)/2 = 60.Circular Permutations FormulaAll the previous formulas refer to the arrangements in a line. But the number of ways of arranging 'n' different number of things in a circle is (n - 1)!.Example: Find the number of ways of arranging 10 people around a round table.Solution:The required number of ways = (10-1)! = 9!.Let us see the
application of the permutation formula in the following solved examples.Examples Using Permutation FormulaExample 1: Find the number of ways in which a three-digit code can be formed, using the numbers from the digits 4, 5, 7, 8, 9.Solution:The given digits are 4, 5, 7, 8, 9. Total number of digits = n = 5 The number of digits in the code = r = 3
Applying the permutation formula we have: The number of ways of forming a 3 digit code = 5P3 = (5!) / (5 - 3)! = 5!/2! = (5 4 3 2 1)/(2 1) = 5 4 3 = 60Answer: Hence, there are 60 ways of forming a three-digit code.Example 2: How many different words with or without meaning, can be formed using any 4 letters from a word containing 10 different
letters?Solution:Total number of letters = n = 10 Number of letters to form the new word = r = 4 Using the permutations formula we have: Total number of 4 letter words which can be formed = 10P410P4 = (10!) / (10-4)! = 10!/6! = (10 9 8 7 6!)/6! = 10 9 8 7 = 5040Answer: Hence a total of 5040 four-letter words can be formed.Breakdown tough
concepts through simple visualsMath will no longer be a tough subject, especially when you understand the concepts through visualizations.Book a Free Trial Class There are different permutations formulas. For r n:The number of permutations without repetitions is: nPr = (n!) / (n - r)!.The number of permutations with repetitions is: nr.The number of
permutations around a circle is (n - 1)!.The number of permutations if there are 'r' same things, 's' same things, and 'p' same things out of 'n' total things is: n! / (r! s! p!).What are the Applications of Permutations Formulas in Real-life?For arranging the numbers, allocating the PIN codes, setting up passwords, and so on we use permutations formulas.
For selecting the team members, choosing food menu, drawing lottery and so on. we use combinations formulas.What are Permutation and Combination Formulas?Here are the permutations and combinations formulas. If 'n' represents the total number of things and 'r' is less than or equal to n, thenPermutations formula is, nPr = (n!) / (n -
r)!.Combinations formula is,nCr = (n!) / [r! (n - r)!].How Do You Calculate Permutations Formulas?The permutation formula is, nPr = (n!) / (n - r)!. Thus, this formula involves factorials. To apply this formula:Identify the total number of things and denote it by 'n'.Identify the number of things to be selected and arranged and denote it by 'r'.Substitute
these values in the above formula and simplify.AnswerVerifiedHint:In order to evaluate the above, count the number of letters in the word if all are distinct simply calculate and if some are repetitive then use $\dfrac{{n!}}{{{m_a}!{m_b}!...{m_z}!}}$to calculate the permutations.Complete step by step solution:There are two possible situations on
which the answer of the above depends:1.If all the letters in the word are distinct or non-repetitive.To calculate the number of permutations of a word, simply evaluate $n!$ where n is the no of letters in the word.For example: permutations of word HELPHere number of letters in the word is equal to 4Therefore, the number of permutations$= 4! \\= 4
\times 3 \times 2 \times 1 \\= 24 \\$2. .If some letters in the word are repetitive or the same.To calculate the number of permutations of a word, evaluate$\dfrac{{n!}}{{{m_a}!{m_b}!...{m_z}!}}$Where n is the number of letters in the word and ${m_a},{m_b}...{m_z}$are the occurrences of therepeated letters in the word.For example: permutations
of word COOKHere number of letters in the word is equal to 4 and O is repeating 2 timesTherefore, the number of permutations$= \dfrac{{4!}}{{2!}} \\= \dfrac{{4 \times 3 \times 2 \times 1}}{{2 \times 1}} \\= 12 \\$Formula:$C(n,r)\, = {\,^n}{C_r} = \dfrac{{n!}}{{r!(n - r)!}}$$p(n,r)\, = {\,^n}{P_r} = \dfrac{{n!}}{{(n - r)!}}$Additional
Information:1.Factorial: The continued product of first n natural numbers is called the n factorial and denotedby $n!$.2.Permutation: Each of the arrangements which can be made by taking some or all of number ofthings are called permutations.If n and r are positive integers such that $1 \leqslant r \leqslant n$, then the number of allpermutations of
n distinct or different things, taken r at one time is denoted by the symbol$p(n,r)\,or{\,^n}{P_r}$.$p(n,r)\, = {\,^n}{P_r} = \dfrac{{n!}}{{(n - r)!}}$3.Combinations: Each of the different selections made by taking some or all of a number of objectsirrespective of their arrangement is called a combination.The combinations number of n objects, taken
r at one time is generally denoted by$C(n,r)\,or{\,^n}{C_r}$Thus, $C(n,r)\,or{\,^n}{C_r}$= Number of ways of selecting r objects from n objects.$C(n,r)\, = {\,^n}{C_r} = \dfrac{{n!}}{{r!(n - r)!}}$Note:1. Factorials of proper fractions or negative integers are not defined. Factorial n defined only for whole numbers.2.Meaning of Zero factorial is
senseless to define it as the product of integers from 1 to zero. So, wedefine it as $0! = 1$. Download Article Calculate permutations with and without repetition Download Article If you're working with combinatorics and probability, you may need to find the number of permutations possible for an ordered set of items. A permutation is an
arrangement of objects in which the order is important[1] (unlike combinations, which are groups of items where order doesn't matter[2]). You can use a simple mathematical formula to find the number of different possible ways to order the items. To start off, you just need to know whether repetition is allowed in your problem or not, and then pick
your method and formula accordingly. The formula for computing permutations is n P r = n ! (n r) ! {\displaystyle {}_{n}P_{r}={\frac {n!}{(n-r)!}}} . n {\displaystyle n} is the total number of options to choose from and r {\displaystyle r} is how many items you need to choose. 1Start with an example problem where you'll need a number of
permutations without repetition. This kind of problem refers to a situation where order matters, but repetition is not allowed; once one of the options has been used once, it can't be used again (so your options are reduced each time).[3]For instance, you might be selecting 3 representatives for student government for 3 different positions from a set of
10 students. No student can be used in more than one position (no repetition), but the order still matters, since the student government positions are not interchangeable (a permutation where the first student is President is different from a permutation where they're Vice President).This kind of problem is often labeled as n P r {\displaystyle
{}_{n}P_{r}} or P (n , r) {\displaystyle P(n,r)} , where n {\displaystyle n} is the number of total options you have to choose from and r {\displaystyle r} is how many items you need to choose. 2Know the formula: n P r = n ! (n r) ! {\displaystyle {}_{n}P_{r}={\frac {n!}{(n-r)!}}} . In the formula, n {\displaystyle n} is the number of total options
you have to choose from and r {\displaystyle r} is how many items you need to choose, where order matters and repetition is not allowed.In this example, n {\displaystyle n} would be the total number of students, so n {\displaystyle n} would be 10, and r {\displaystyle r} would be the number of people chosen, so r {\displaystyle r} would be 3.
Advertisement 3Plug your numbers in for n {\displaystyle n} and r {\displaystyle r} .In this case you'd have 10 P 3 = 10 ! (10 3) ! {\displaystyle {}_{10}P_{3}={\frac {10!}{(10-3)!}}} .4Solve the equation to find the number of permutations.If you have a calculator handy, find the factorial setting and use that to calculate the number of
permutations. If you're using Google Calculator, click on the x! button each time after entering the necessary digits.If you have to solve by hand, remember that, for each factorial, you start with the main number given and then multiply it by the next smallest number, and so on until you get down to 0.For example, you would calculate 10! by doing (10
* 9 * 8 * 7 * 6 * 5 * 4 * 3 * 2 * 1), which gives you 3,628,800 as a result. 7! would be (7 * 6 * 5 * 4 * 3 * 2 * 1), which would equal 5,040. You'd then calculate 3,628,800/5,040.In the example, you should get 720. That number means that, if you're picking from 10 different students for 3 student government positions, where order matters and there is no
repetition, there are 720 possibilities. Advertisement 1Start with an example problem where you'll need a number of permutations where repetition is allowed.For example, if you have 10 digits to choose from for a combination lock with 6 numbers to enter, and you're allowed to repeat all the digits, you're looking to find the number of permutations
with repetition.A permutation with repetition of n chosen elements is also known as an "n-tuple".[4]2Know the formula: n r {\displaystyle n^{r}} . In this formula, n is the number of items you have to choose from, and r is how many items you need to choose, in a situation where repetition is allowed and order matters.[5][6]In the example, n
{\displaystyle n} is 10 {\displaystyle 10} , and r {\displaystyle r} is 6 {\displaystyle 6} .3Plug in n {\displaystyle n} and r {\displaystyle r} .In the example, you'll get the equation 10 6 {\displaystyle 10^{6}} .4Solve for the number of permutations. If you have a calculator handy, this part is easy: Just hit 10 and then the exponent key (often marked xy
or ^), and then hit 6.In the example, your answer would be 10 6 = 1 , 000 , 000 {\displaystyle 10^{6}=1,000,000} . This means that, if you have a lock that requires the person to enter 6 different digits from a choice of 10 digits, and repetition is okay but order matters, there are 1,000,000 possible permutations. Advertisement Add New Question
Question Is there an easy way in order to memorize the formula for this? Yes. Think of it like this: subtract the total amount by the total items. For example 7 and 4. Then, find 7! to 4, so 7x6x5 and then find the answer, and youll get the permutations. Question How many ways can the letters in the name "Tyler" be arranged? Since there are five
different letters in that name, the answer is 5! = (5)(4)(3)(2)(1) = 120 different letter arrangements. If the name were something like "Betty," where there are only four different letters, it would be 4! = 24 different arrangements. In the case of "Bobby," with only three different letters, it would be 3! = 6 different arrangements. Question A
combination lock requires three selections of numbers, each from 1 through 30. How many combinations are possible? It's 30 = 27,000. Ask a Question Advertisement Thanks Advertisement This article was reviewed by Joseph Meyer. Joseph Meyer is a High School Math Teacher based in Pittsburgh, Pennsylvania. He is an educator at City Charter
High School, where he has been teaching for over 7 years. Joseph is also the founder of Sandbox Math, an online learning community dedicated to helping students succeed in Algebra. His site is set apart by its focus on fostering genuine comprehension through step-by-step understanding (instead of just getting the correct final answer), enabling
learners to identify and overcome misunderstandings and confidently take on any test they face. He received his MA in Physics from Case Western Reserve University and his BA in Physics from Baldwin Wallace University. This article has been viewed 87,441 times. Co-authors: 8 Updated: December 13, 2024 Views:87,441 Categories: Mathematics
PrintSend fan mail to authors Thanks to all authors for creating a page that has been read 87,441 times.

How to calculate permutations. How to find permutations of a word. Permutations of word. How to find number of permutations in a word.