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Multinomial Coefficients Video

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- Hi again. So until now, we talked about counting binary sequences. Specifically, binary sequences of length n with k ones. And now we want to grow up a little bit and instead of binary sequences, we're going to move to sequences of a larger



4.7 Multinomials

POLL

What is the coefficient of xy in the expansion of $(x+y+2)^4$?

RESULTS

- | | |
|----------------------------------------------------|-----|
| <input type="radio"/> 48 | 48% |
| <input type="radio"/> 24 | 27% |
| <input type="radio"/> 12 | 14% |
| <input checked="" type="radio"/> None of the above | 11% |

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Results gathered from 262 respondents.

FEEDBACK

The answer is 48. The number of ways to have 2 "2"s, 1 "x", 1 "y" is 12 (using multinomial coefficient). Then we multiply it with $2^2 = 4$ and get the answer.

1

3.0/3.0 points (graded)

In how many ways can you give three baseball tickets, three soccer tickets, and three opera tickets, all general admission, to nine friend so each gets one ticket?

✓ Answer: 1680

Explanation

Using the multinomial coefficient, we get the answer $\binom{9}{3,3,3} = 1680$.

Submit

You have used 3 of 4 attempts

i Answers are displayed within the problem

2

0 points possible (ungraded)

How many ways can we divide 12 people into:

- three labeled groups evenly

✗ Answer: 34650

Explanation

$$\binom{12}{4,4,4} = 34650.$$

- three unlabeled groups evenly

✗ Answer: 5775

Explanation

Since the groups are unlabeled, every permutation of the three group counts the same, hence the number of ways is $\binom{12}{4,4,4}/3! = 11550$.

- three labeled groups with 3, 4 and 5 people

✗ Answer: 27720

Explanation

$$\binom{12}{3,4,5} = 27720.$$

- three unlabeled groups with 3, 4 and 5 people

✗ Answer: 27720

Explanation

Since the groups have different sizes, they are distinct regardless of label, hence answer stays $\binom{12}{3,4,5} = 27720$.

- three unordered groups with 3, 3 and 6 people

✗ Answer: 9240

Explanation

Since the groups are unlabeled, every permutation of the two groups that have 3 people counts the same, hence the number of ways is $\binom{12}{3,3,6}/2! = 9240$.

Submit

You have used 4 of 4 attempts

i Answers are displayed within the problem

3

4.0/4.0 points (graded)

- What is the coefficient of x^3y^2 in expansion of $(x + 2y + 1)^{10}$?

10080

✓ Answer: 10080

10080

Explanation

$$(x + 2y + 1)^{10} = \underbrace{(x + 2y + 1) \cdots (x + 2y + 1)}_{10 (x+2y+1)s}.$$

To form x^3y^2 , we need to pick three x 's, two $2y$'s, and five 1's. The number of ways is $\binom{10}{3,2,5}$.

The resulting term of x^3y^2 is $\binom{10}{3,2,5} (x^3(2y)^2 1^5)$. Hence the coefficient is $\binom{10}{3,2,5} 2^2 = 10080$.

- What is the coefficient of x^3 in expansion of $(x^2 - x + 2)^{10}$?

-38400

✓ Answer: -38400

-38400

Explanation

$$(x^2 - x + 2)^{10} = \underbrace{(x^2 - x + 2) \cdots (x^2 - x + 2)}_{10 (x^2-x+2)s}.$$

To form x^3 , we can pick one x^2 's, one $-x$'s, and eight 2's. The number of ways is $\binom{10}{1,1,8}$.

Or we can pick zero x^2 's, three $-x$'s, and seven 2's. The number of ways is $\binom{10}{0,3,7}$.

The resulting term of x^3 is $\binom{10}{1,1,8} (x^2 (-x) 2^8) + \binom{10}{0,3,7} ((x^2)^0 (-x)^3 2^7)$. Hence the coefficient is $\binom{10}{1,1,8} (-1) 2^8 + \binom{10}{0,3,7} (-1)^3 2^7 = -38400$

Submit

You have used 3 of 4 attempts

i Answers are displayed within the problem

4

0 points possible (ungraded)

How many terms are there in the expansion of $(x + y + z)^{10} + (x - y + z)^{10}$?

45

✗ Answer: 36

45

Explanation

All the terms where y has odd power will be cancelled out. We only need to consider the number of terms where the power of y is 0, 2, 4, 6, 8, 10 (i.e., $y^0, y^2, y^4, y^6, y^8, y^{10}$), which is $1 + 3 + 5 + \dots + 11 = 36$

Submit

You have used 4 of 4 attempts

i Answers are displayed within the problem

5

0 points possible (ungraded)

How many anagrams, with or without meaning, does "REFEREE" have such that:

- there is no constraint

20

✗ Answer: 105

20

Explanation

We have 4 "E"s, 2 "R"s, and 1 "F". The answer is $\binom{7}{1,2,4} = 105$.

- two "R"s are separated

✖ Answer: 75

Explanation

Suppose the 2 "R"s are not separated. Then we have 4 "E"s, 1 "RR", 1 "F". The number of them is $\binom{6}{1,1,4}$.

The number of anagrams where two "R"s are separated $105 - \binom{6}{1,1,4} = 75$.

- it contains subword "EE"

✖ Answer: 102

Explanation

There are only 3 words that do not contain "EE" (i.e. "EREREFE", "EREFERE", "EFERERE").

$105 - \binom{3}{1} = 102$.

- it begins with letter "R"

✖ Answer: 30

Explanation

Fixing "R" in the first positions, we now have 4 "E"s, 1 "R", 1 "F". The number of them $\binom{6}{1,1,4} = 30$.

Submit

You have used 4 of 4 attempts

i Answers are displayed within the problem

6

0 points possible (ungraded)

How many anagrams, with or without meaning, do the following words have?

- CHAIR

120

✓ Answer: 120

120

Explanation

Permutation of 5 letters.

- INDIA

60

✓ Answer: 60

60

ExplanationThere are two "I"s, so there are $\binom{5}{2,1,1,1} = 60$ anagrams.

- SWIMMING

10080

✓ Answer: 10080

10080

ExplanationThere are two "I"s and two "M"s, so $\binom{8}{2,2,1,1,1,1} = 10080$ anagrams.

Submit

You have used 2 of 4 attempts

i Answers are displayed within the problem

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Staff

Problem 3

8/7/2019

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