

[Home](#)

[Realtor](#)

[Algebra ALEKS Topics](#)

[Algebra Notes](#)

[Algebra Reviews](#)

[MAT0028](#)

[MAC1105](#)

[MGF ALEKS Topics](#)

[MGF Reviews](#)

[MGF Notes](#)

[STA2023](#)

[Stats ALEKS Topics](#)

[Stats Notes](#)

[Stats Reviews](#)

Statistics / Module 8 - Combinatorics

Topic 1: Interpreting a tree diagram

Topic 2: Introduction to the counting principle

Problem 1: You have 3 shirts and 2 pairs of pants. Use the counting principle to find the number of outfits possible.

Answer: Number of outfits = 3 shirts $\times$ 2 pants = 6.

Problem 2: There are 4 books and 3 shelves. Calculate the number of ways to place one book on one shelf using the counting principle.

Answer: Number of ways = 4 books $\times$ 3 shelves = 12.

Topic 3: Counting principle

Problem 1: A menu has 5 appetizers, 4 main courses, and 3 desserts. Find the number of possible meals (one of each).

Answer: Number of meals = 5 $\times$ 4 $\times$ 3 = 60.

Problem 2: You can choose 2 colors from 4 options and 1 size from 3 options for a shirt. Calculate the total combinations.

Answer: Total = 4 colors $\times$ 3 sizes = 12 (assuming order doesn't matter for colors, but counting principle applies to sequential choices).

Topic 4: Introduction to permutations and combinations

Problem 1: Explain the difference between permutations and combinations using arranging 3 books on a shelf (permutation) vs. choosing 3 books from 5 (combination).

Answer: Permutations consider order (e.g., ABC, ACB are different; $P(3,3) = 6$).

Combinations do not (e.g., {A,B,C} is one; $C(5,3) = 10$).

Problem 2: For selecting 2 officers from 4 people, distinguish if order matters (permutation) or not (combination).

Answer: If order matters (president, vice), it's a permutation: $P(4,2) = 4 \times 3 = 12$. If not, combination: $C(4,2) = 6$.

Topic 5: Permutations and combinations: Problem type 1

Problem 1: Calculate the number of permutations of 4 distinct letters: A, B, C, D.

Answer: $P(4,4) = 4! = 24$.

Problem 2: Find the number of ways to arrange 3 people in a line from 5 people.

Answer: $P(5,3) = 5 \times 4 \times 3 = 60$.

Topic 6: Permutations and combinations: Problem type 2

Problem 1: Calculate the number of combinations of 6 items taken 3 at a time.

Answer: $C(6,3) = 6! / (3! (6-3)!) = (720) / (6 \times 6) = 20$.

Problem 2: Find the number of ways to choose 4 books from 7 without regard to order.

Answer: $C(7,4) = 7! / (4! 3!) = (5040) / (24 \times 6) = 35$.

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