Permutations and Combinations

Name: ____________	Date: ____________	Score: ______ / 18

Quick Review and Helpful Hints

A *permutation* counts arrangements where order matters: ${}_nP_r = \frac{n!}{(n-r)!}$. A *combination* counts selections where order does *not* matter: ${}_nC_r = \frac{n!}{r!\,(n-r)!}$. Remember that $n!$ (factorial) means multiply every whole number from n down to 1.

▷ **Example:** In how many ways can you arrange 3 of 5 books on a shelf (order matters)? **Work:** Order matters, so use a permutation: ${}_5P_3 = \frac{5!}{(5-3)!} = \frac{5!}{2!} = \frac{120}{2}$. ★ **Answer:** 60

Practice Problems

Evaluate each expression.

1. $4!$ ______

2. $5!$ ______

3. $3!$ ______

4. ${}_5P_2$ ______

5. ${}_6P_3$ ______

6. ${}_4P_4$ ______

7. ${}_5C_2$ ______

8. ${}_6C_2$ ______

9. ${}_7C_3$ ______

10. ${}_4C_1$ ______

11. ${}_6P_2$ ______

12. ${}_5C_5$ ______

13. ${}_8C_2$ ______

14. ${}_7P_2$ ______

Word Problems

15. In how many ways can a president and a vice-president be chosen from a club of 6 members (order matters)? ______

16. How many ways can you choose 2 toppings from 5 available toppings (order does not matter)? ______

17. How many different 3-letter arrangements can be made from the letters A, B, C, D with no repeats (order matters)? ______

18. A team of 3 is chosen from 8 players (order does not matter). How many different teams are possible? ______

Answer Keys

1. 24	**7.** 10	**13.** 28
2. 120	**8.** 15	**14.** 42
3. 6	**9.** 35	**15.** 30
4. 20	**10.** 4	**16.** 10
5. 120	**11.** 30	**17.** 24
6. 24	**12.** 1	**18.** 56

Step-by-Step Explanations

1. Start by naming the process: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is A factorial multiplies down to 1: $4! = 4 \times 3 \times 2 \times 1 = 24$. So the final answer is 24.

2. A good way to think about this is: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$. So the final answer is 120.

3. Step by step: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is $3! = 3 \times 2 \times 1 = 6$. So the final answer is 6.

4. Take it one move at a time: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is Permutations count ordered choices: ${}_5P_2 = 5 \times 4 = 20$. So the final answer is 20.

5. Start by naming the process: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is ${}_6P_3 = 6 \times 5 \times 4 = 120$. So the final answer is 120.

6. A good way to think about this is: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is ${}_4P_4 = 4! = 24$ – every arrangement of all four items. So the final answer is 24.

7. Step by step: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is Combinations ignore order: ${}_5C_2 = \frac{5\times4}{2\times1} = 10$. So the final answer is 10.

8. Take it one move at a time: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is ${}_6C_2 = \frac{6\times5}{2} = 15$. So the final answer is 15.

9. Start by naming the process: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is ${}_7C_3 = \frac{7\times6\times5}{3\times2\times1} = 35$. So the final answer is 35.

10. A good way to think about this is: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is Choosing 1 from 4 can be done in 4 ways. So the final answer is 4.

11. Step by step: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is ${}_6P_2 = 6\times5 = 30$. So the final answer is 30.

12. Take it one move at a time: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is There is exactly one way to choose all 5, so ${}_5C_5 = 1$. So the final answer is 1.

13. Start by naming the process: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is ${}_8C_2 = \frac{8\times7}{2} = 28$. So the final answer is 28.

14. A good way to think about this is: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is ${}_7P_2 = 7 \times 6 = 42$. So the final answer is 42.

15. Step by step: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is Order matters (president vs. vice-president), so ${}_6P_2 = 6 \times 5 = 30$. So the final answer is 30.

16. Take it one move at a time: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is Order doesn't matter for toppings, so ${}_5C_2 = \frac{5\times4}{2} = 10$. So the final answer is 10.

17. Start by naming the process: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is Arrangements care about order: ${}_4P_3 = 4 \times 3 \times 2 = 24$. So the final answer is 24.

18. A good way to think about this is: Decide whether order matters, then use the counting rule, permutation rule, or combination rule that fits. The setup/work is A team ignores order, so ${}_8C_3 = \frac{8\times7\times6}{3\times2\times1} = 56$. So the final answer is 56.

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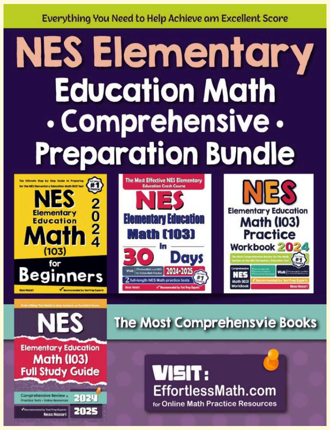

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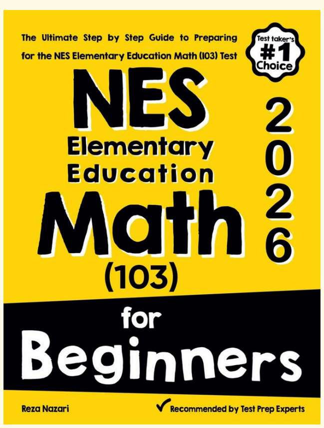

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