

Section 15-9: Permutations

Factorials

1. 080107a, P.I. A.N.6
The value of $5!$ is
[A] 120 [B] $\frac{1}{5}$ [C] 20 [D] 5
2. 080503a, P.I. A.N.6
The value of $\frac{7!}{3!}$ is
[A] 4 [B] 840 [C] 7 [D] 24
3. 060605a, P.I. A.N.6
What is the value of $\frac{8!}{4!}$?
[A] $4!$ [B] 2 [C] $2!$ [D] 1,680

Representing Permutations

4. 010713a, A2.S.10
Which value is equivalent to ${}_3P_3$?
[A] $3!$ [B] 9 [C] 27 [D] 1
5. 089917a, P.I. A.N.8
How many different 6-letter arrangements can be formed using the letters in the word "ABSENT," if each letter is used only once?
[A] 720 [B] 36 [C] 6 [D] 46,656

6. 010013a, P.I. A.N.8
How many different 4-letter arrangements can be formed using the letters of the word "JUMP," if each letter is used only once?
[A] 4 [B] 12 [C] 24 [D] 16
7. 080616a, P.I. A.N.8
Julia has four different flags that she wants to hang on the wall of her room. How many different ways can the flags be arranged in a row?
[A] 10 [B] 1 [C] 16 [D] 24
8. 010323a, P.I. A.N.8
Six members of a school's varsity tennis team will march in a parade. How many different ways can the players be lined up if Angela, the team captain, is always at the front of the line?

Permutations That Use Some of the Elements

9. 060723a, P.I. A.N.8
What is the total number of different four-letter arrangements that can be formed from the letters in the word "VERTICAL," if each letter is used only once in an arrangement?
[A] 6,720 [B] 1,680
[C] 8 [D] 40,320
10. 060125a, P.I. A.N.8
There were seven students running in a race. How many different arrangements of first, second, and third place are possible?

11. 060016a, P.I. A.N.8
How many different five-digit numbers can be formed from the digits 1, 2, 3, 4, and 5 if each digit is used only once?
[A] 24 [B] 20 [C] 60 [D] 120
12. 010114a, P.I. A.N.8
A locker combination system uses three digits from 0 to 9. How many different three-digit combinations with no digit repeated are possible?
[A] 720 [B] 504 [C] 1,000 [D] 30
13. 060023a, P.I. A.N.8
All seven-digit telephone numbers in a town begin with 245. How many telephone numbers may be assigned in the town if the last four digits do *not* begin or end in a zero?
14. 080034a, P.I. A.N.8
The telephone company has run out of seven-digit telephone numbers for an area code. To fix this problem, the telephone company will introduce a new area code. Find the number of new seven-digit telephone numbers that will be generated for the new area code if both of the following conditions must be met:
o The first digit cannot be a zero or a one.
o The first three digits cannot be the emergency number (911) or the number used for information (411).
15. 010435a, P.I. A.N.8
In Jackson County, Wyoming, license plates are made with two letters (A through Z) followed by three digits (0 through 9). The plates are made according to the following restrictions:
o the first letter must be *J* or *W*, and the second letter can be any of the 26 letters in the alphabet
o no digit can be repeated
How many different license plates can be made with these restrictions?
16. 060329a, P.I. A.N.8
A certain state is considering changing the arrangement of letters and numbers on its license plates. The two options the state is considering are:
Option 1: three letters followed by a four-digit number with repetition of both letters and digits allowed
Option 2: four letters followed by a three-digit number without repetition of either letters or digits
[Zero may be chosen as the first digit of the number in either option.]
Which option will enable the state to issue more license plates? How many *more* different license plates will that option yield?

[1] A

[2] B

[3] D

[4] A

[5] A

[6] C

[7] D

[2] 120, and appropriate work is shown, such as $1 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$.

[1] Appropriate work is shown, but one computational error is made.

or [1] 720 and ${}_6P_6$ or $6!$ is shown.

or [1] 120, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[8] incorrect procedure.

[9] B

[2] 210, and appropriate work is shown, such as $7 \cdot 6 \cdot 5$ or ${}_7P_3$.

[1] Appropriate work is shown, but no answer or an incorrect answer is found.

or [1] 210, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[10] incorrect procedure.

[11] D

[12] A

[2] 8,100 and appropriate work is shown, such as $9 \times 10 \times 10 \times 9$.

[1] 10,000 but appropriate work is shown.

or [1] Appropriate work is shown, but the student multiplies incorrectly.

or [1] An appropriate pattern is shown, such as $9 \times 10 \times 10 \times 9$.

or [1] 8,100 but no work is shown.

[0] 38 is shown.

or [0] The student attempts to use the counting principle, but adds.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

[13]

[4] 7.98×10^6 or 7,980,000 and appropriate work is shown, such as $8 \times 10^6 - 2 \times 10^4$.

[3] Appropriate work is shown, but one computational error is made.

or [3] The student uses 1–9 instead of 0–9 as the number of digits in $8 \times 9^6 - 2 \times 9^4$.

[2] The student correctly produces only one part, 8×10^6 or 2×10^4 , but carries the process to an appropriate result.

or [2] Appropriate work is shown, but more than one error is made.

[1] The student produces only one part, 8×9^6 or 2×9^4 .

or [1] 7,980,000 but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[14] incorrect procedure.

[2] 37,440 and appropriate work is shown, such as $2 \times 26 \times 10 \times 9 \times 8$ or ${}_2P_1 \times {}_{26}P_1 \times {}_{10}P_1 \times {}_9P_3$.

[1] Appropriate work is shown, but one computational or conceptual error is made.

or [1] Appropriate work is shown for at least one restriction, such as 2×26 or $10 \times 9 \times 8$.

or [1] 37,440 but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[15] incorrect procedure.

[3] Option 2 will yield 82,576,000 more possibilities, and appropriate work is shown, such as $26^3 \bullet 10^4$ and ${}_{26}P_4 \bullet {}_{10}P_3$.

[2] Appropriate work is shown, but one computational error is made, but the appropriate option is identified.

or [2] The correct numbers of arrangements are found for both Option 1 and Option 2, but the question of which option will yield more arrangements is not answered or is answered incorrectly.

[1] Appropriate work is shown, but more than one computational error is made, but the appropriate option is identified.

or [1] Appropriate work is shown, but one conceptual error is made, but the appropriate option is identified.

or [1] Either Option 1 or Option 2 is found correctly, but no further correct work is shown.

or [1] Option 2 will yield 82,576,000 more possibilities, but no work is shown.

[0] Option 2, but no work or inappropriate work is shown.

or [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an

[16] obviously incorrect procedure.
