

6.7 Permutations and Combinations

$$5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$$

↑
Factorial

$$4! = 4 \cdot 3 \cdot 2 \cdot 1 = 24$$

math → PRB #4

$$3! = 3 \cdot 2 \cdot 1 = 6$$

$$2! = 2 \cdot 1 = 2$$

$$1! = 1$$

$$0! = 1 \text{ defined}$$

Permutation: an arrangement of items in a particular order

arranged

ORDER IS IMPORTANT !!

$${}^n P_r = \frac{n!}{(n-r)!}$$

total # of items → n
of items picked → r

3 runners and they finish 1st, 2nd + 3rd.

n = 3 → # of runners
r = 3 → # of places

$${}^3 P_3 = \frac{3!}{(3-3)!} = \frac{3!}{0!} = \frac{6}{1} = 6$$

If n and r are the same then you can also just do 3! (permutation)

7 yachts and 3 finishing places.
 \uparrow \uparrow
 n r

$${}^7P_3 = 210$$

$$= \frac{7!}{(7-3)!} = \frac{7!}{4!} = \frac{7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{4 \cdot 3 \cdot 2 \cdot 1}$$

Combinations - order is NOT important when choosing the items.

$${}^nC_r = \frac{n!}{r!(n-r)!} \quad \begin{array}{l} \text{at random} \\ \text{selected} \\ \text{choose} \end{array}$$

20 books, how many ways can you choose 7 books.

$${}^{20}C_7 = 77520$$

$$= \frac{20!}{7!(20-7)!} = \frac{20!}{7!13!} = \frac{20 \cdot 19 \cdot 18 \cdot 17 \cdot 16 \cdot 15 \cdot 14}{7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}$$

$$\boxed{0.348}$$

$$\textcircled{8} \frac{15!}{10!5!} = \frac{15!}{10!5!}$$

$$15! / (10! * 5!)$$

$$\textcircled{7} \frac{10!}{7!3!} = \textcircled{120}$$

ex 5

"OR" choose
3 or fewer

$${}_{10}C_3 + {}_{10}C_2 + {}_{10}C_1 + {}_{10}C_0$$

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choose 4 or 5

$${}_8C_4 + {}_8C_5 = 126$$