5.2 Factorial Notation and Permutations

$n! = n(n-1)(n-2)\ldots 3 \times 2 \times 1,$
where $n \in N$ and $0! = 1$

Math → PRB

4 : !

Ex.)

a) 5! = 5·4·3·2·1 = 120

b) 3! = 3·2·1 = 6

c) 8! = 8·7·6·5·4·3·2·1 = 40320

May 9-8:30 AM

Ex.) Determine the number of arrangements of the letters in the word ORANGES:

a) with no restrictions

7·6·5·4·3·2·1 = 7! = 5040

b) starting with the letter R

R 1·6·5·4·3·2·1 = 6! = 720

c) with all the vowels together

aeiou

3·2·1·4·3·2·1 = 3!4!×5

= 3!5! = 5!3!

= 720

×5

May 9-8:48 AM

Ex.) Determine the number of arrangements of the letters in the word BRAINS:

a) with no restrictions

$6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 6! = \boxed{720}$

b) with all the vowels together

$2 \cdot 1 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 2!5! = \boxed{240}$ ×5

c) with vowels not together

total arrangements − vowels together = vowels not together

$720 - 240 = \boxed{480}$

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Repetitions: - identical objects, repeating letters

- divide by the repeats

$\frac{n!}{a!b!c!}$ (total → n!; repeats → a!b!c!)

Ex.) KISSING

a) no restrictions

$\frac{7!}{(2!2!)} = \boxed{1260}$

b) SS are first

$\frac{2 \cdot 1 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{2!} = \boxed{60}$

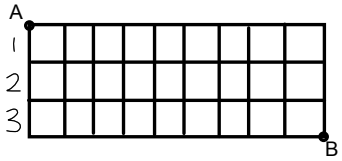
May 9-8:50 AM

Ex.) You have 15 lollipops and an equal amount of red, green, yellow. How many possible arrangements are there?

5 of each colour

$$\frac{15!}{(5!5!5!)} = 756\,756$$

Ex.) How many pathways are there from A to B?

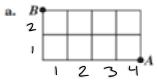


total → $\frac{12!}{3!9!}$ ← horizontal, ↑ vertical

$= 220$

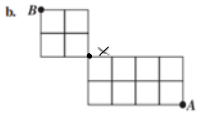
May 9-8:51 AM

Determine the number of different possible routes that Tyler can travel from Point A to Point B if he travels only north or west.

a. 

$\frac{6!}{2!4!} = 15$

and ×
or +

b. 

Pg. 81 # 1, 3-6, 11.

A to X then X to B
and
X

$\frac{6!}{4!2!}$ $\frac{4!}{2!2!}$

$\frac{6 \cdot 5 \cancel{\cdot 4 \cdot 3 \cdot 2 \cdot 1}}{\cancel{4!}\,2!}$ $\frac{\cancel{4} \cdot 3 \cdot 2 \cdot 1}{\cancel{4}}$

$15 \times 6 = 90$

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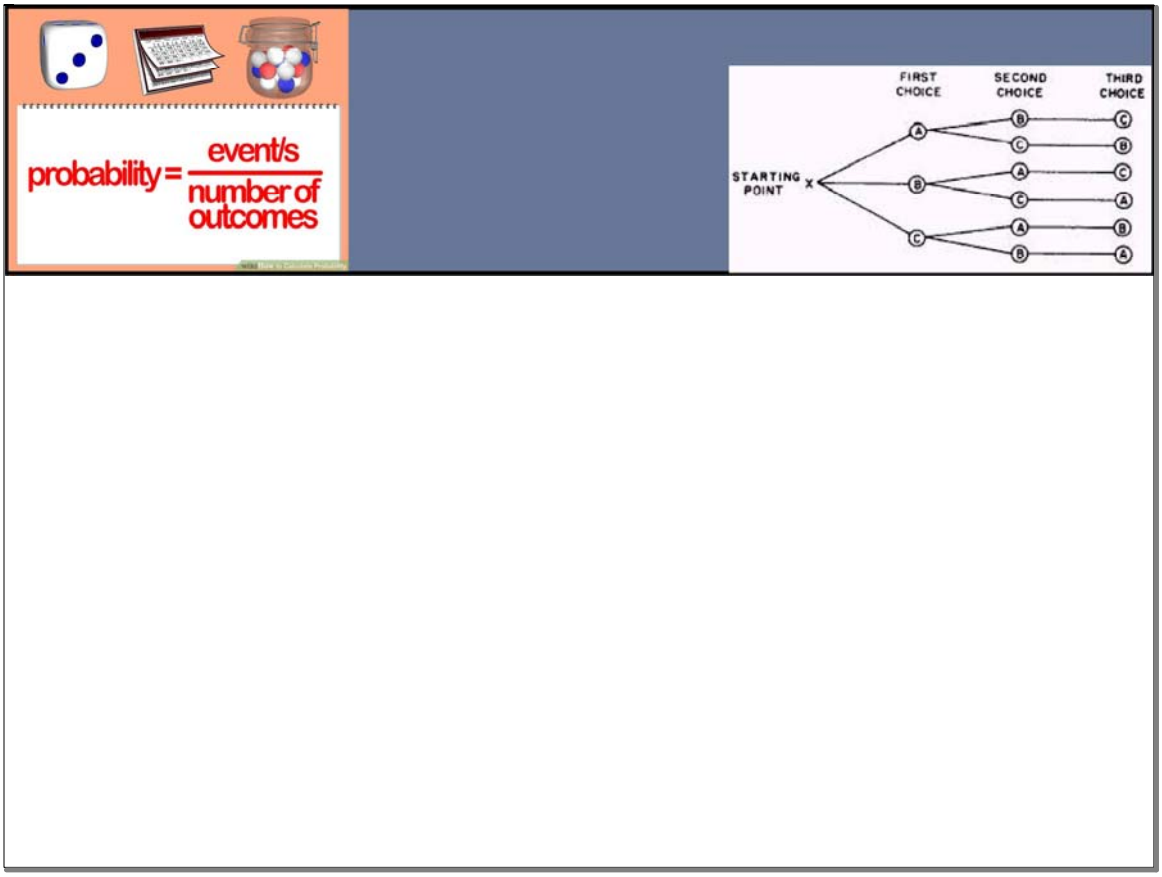
probability = event/s / number of outcomes
FIRST CHOICE
SECOND CHOICE
THIRD CHOICE
STARTING POINT
A
B
C

May 9-8:51 AM