

More about  $\binom{n+k-1}{k-1}$ , counting plans for  $n$  books on  $k$  shelves.

1) In the textbook, they use a different

formula:  $\left[ \begin{array}{l} n = \text{number of shelves} \\ r = \text{number of books} \\ \text{plans for shelves} = \binom{r+n-1}{r} \end{array} \right]$

Notice: this uses an identity which is always true  $\binom{n}{m} = \binom{n}{n-m}$

Ex:  $\binom{5}{2} = \binom{5}{3} = \frac{5!}{2!3!} = 10$ .

2) This counting of plans for  $n$  books on  $k$  shelves works for other word problems too.

Ex: How many ways can you choose 20 pastries from a bakery that sells 6 types?

"Types" are like "shelves", and your choice of 20 is like a plan for 20.

Answer: The important thing is to decide which number is the types or "shelves". That's the one to subtract 1 from and choose that many "dividers".

$$\binom{20+6-1}{6-1} = \binom{25}{5} = \boxed{53,130} = \binom{25}{20}$$

$$= \frac{25 \cdot 24 \cdot 23 \cdot 22 \cdot 21}{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}$$