3. Three problems:

$P(20,3) = \frac{20!}{(20-3)!} = \frac{20 \cdot 19 \cdot 18 \cdot 17!}{17!} = 20 \cdot 19 \cdot 18$

Number of ways to choose 3 persons from 20 if order matters: $P(20,3)$

Number of ways to award gold, silver & bronze medals if 20 athletes compete: $20 \cdot 19 \cdot 18$

4. Three other problems:

$C(20,3) = \frac{20!}{3!\,17!} = \frac{20 \cdot 19 \cdot 18 \cdot 17!}{3 \cdot 2 \cdot 1 \cdot 17!} = \frac{20 \cdot 19 \cdot 18}{3 \cdot 2 \cdot 1}$

Number of ways to choose 3 persons from 20 if order does not matter: $C(20,3)$

Number of ways to award three medals (all gold) if 20 athletes compete: $C(20,3)$

5. Number of ways are there to create a 9-person batting order from a 21-person baseball team:

$21 \cdot 20 \cdot 19 \cdot 18 \cdot 17 \cdot 16 \cdot 15 \cdot 14 \cdot 13 = P(21,9)$

6. Number of ways to choose the starting 5 players from a 13-person basketball team:

$C(13,5) = \frac{13 \cdot 12 \cdot 11 \cdot 10 \cdot 9}{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}$

7. Number of ways to choose a president, vice-president and secretary from 10 persons if

We can choose anyone we want: $C(10,3) \cdot 3! = P(10,3) = 10 \cdot 9 \cdot 8$

James must be president: $1 \cdot 9 \cdot 8 = P(9,2) = C(9,2) \cdot 2!$

James must be one of the three chosen: $1 \cdot 9 \cdot 8 + 9 \cdot 1 \cdot 8 + 9 \cdot 8 \cdot 1$

Or alternatively: $3 \cdot 9 \cdot 8$ ← what position for James

8. Number of ways can we choose a committee of 3 from 10 persons if

We can choose anyone we want: $C(10,3)$

James must be one of the committee members: $1 \cdot C(9,2)$

9. A pizzeria offers 15 different toppings. Number of different pizzas possible:

$C(15,0) + C(15,1) + \cdots + C(15,15)$

OR: 2^{15}

10. Number of ways five Italian books and four novels be placed on a bookshelf if

The books can be placed in any order: $9!$

The Italian books must be kept together: $5 \cdot 5! \cdot 4!$

OR: $5! \cdot 5!$