Q.1. Evaluate the following:

Formula $^{n}C_r = \frac{n!}{(n-r)!.r!}$

i. $^{50}C_{50}$

Sol: $^{50}C_{50} = \frac{50!}{(50-50)!.50!} = \frac{1}{0!} = \frac{1}{1} = 1$

ii. $^{1000}C_0$

Sol: $^{1000}C_0 = \frac{1000!}{(1000-0)!.0!} = \frac{1000!}{1000!.1} = \frac{1}{1} = 1$

iii. $^{10}C_7$

Sol: $^{10}C_7 = \frac{10!}{(10-7)!.7!} = \frac{10!}{3!.7!} = \frac{10.9.8.7!}{3.2.1.7!}$

$= \frac{10.9.8}{6} = 120$

iv. $^{20}C_{17}$

Sol: $^{20}C_{17} = \frac{20!}{(20-17)!.17!} = \frac{20.19.18.17!}{3!.17!}$

$= \frac{20.19.18}{3.2.1} = \frac{20.19.18^{3}}{6_{1}} = 1140$

Q.2. (i) If. $^{3n}C_2 : {}^{n}C_2 = 15:1$, Find n

(ii) If $^{n}P_r = 120$ and $^{n}C_r = 20$, Find r

Sol: $^{3n}C_2 : {}^{n}C_2 = 15:1$

$\frac{^{3n}C_2}{^{n}C_2} = \frac{15}{1} = {}^{3n}C_2 \div {}^{n}C_2 = 15$

$\frac{3n!}{(3n-2)!.2!} \div \frac{n!}{(n-2)!.2!} = 15$

$\frac{3n(3n-1)(3n-2)!}{(3n-2)!.2!} \times \frac{(n-2)!.2!}{n!} = 15$

$\frac{3n(3n-1)}{2!} \times \frac{(n-2)!.2!}{n!} = 15$

$3n(3n-1) \times \frac{(n-2)!}{n(n-1)(n-2)!} = 15$

$\frac{3(3n-1)}{(n-1)} = 15$

$9n-3 = 15(n-1)$

$9n-3 = 15n-15$

$15n-9n = -3+15 = 6n = 12 \Rightarrow n = 2$

Q.3. Find the values of n and r, when

i. $^{n}C_r = 56, {}^{n}P_r = 336$

ii. $^{n-1}C_{r-1} : {}^{n}C_r : {}^{n}C_r = 1:3:7$

i. $^{n}C_r = 56, {}^{n}P_r = 336$

Sol: $^{n}C_r = 56$, $^{n}P_r = 336$

$\frac{n!}{(n-r)!.r!} = 56$ _____(I)

$\frac{n!}{(n-r)!} = 336$ _____(II)

Divide (II) by (I)

$\frac{n!}{(n-r)!} \div \frac{n!}{(n-r)!.r!} = \frac{336}{56}$

$\frac{n!}{(n-r)!} \times \frac{(n-r)!.r!}{n!} = 6$

$r! = 6 \Rightarrow r! = 3! \Rightarrow \boxed{r=3}$

Put $r = 3$ in (II)

$\frac{n!}{(n-3)!} = 336$

$\frac{n(n-1)(n-2)(n-3)!}{(n-3)!} = \frac{336}{56}$

$n(n-1)(n-2) = 8.7.6 \Rightarrow n = 8$

$r = 3$ and $n = 8$

ii. $^{n-1}C_{r-1} : {}^{n}C_r : {}^{n+1}C_{r+1} = 1:3:7$

Sol: $^{n-1}C_{r-1} : {}^{n}C_r : {}^{n+1}C_{r+1} = 1:3:7$

$^{n-1}C_{r-1} : {}^{n}C_r = 1:3$

$^{n-1}C_{r-1} \div {}^{n}C_r = 1 \div 3$

$\frac{(n-1)!}{(n-1-r+1)!(r-1)!} \div \frac{n!}{(n-r)!.r!} = \frac{1}{3}$

$\frac{(n-1)!}{(n-r)!.(r-1)!} \times \frac{(n-r)!.r!}{n!} = \frac{1}{3}$

$\frac{(n-1)!}{(r-1)!} \times \frac{r(r-1)}{n(n-1)!} = \frac{1}{3}$

$\frac{r}{n} = \frac{1}{3} \Rightarrow 3r = n$ ------- I

Now

$${}^{n}C_r : {}^{n+1}C_{r+1} = 3:7$$

$${}^{n}C_r \div {}^{n+1}C_{r+1} = 3 \div 7$$

$$\frac{n!}{r!(n-r)!} \div \frac{(n+1)!}{(r+1)!(n+1-r-1)!} = 3 \div 7$$

$$\frac{n!}{r!(n-r)!} \times \frac{(r+1).r! \times (n-r)!}{(n+1).n!} = \frac{3}{7}$$

$$\frac{r+1}{n+1} = \frac{3}{7} \Rightarrow 7(r+1) = 3(n+1) - - - - II$$

Put I in II

$$7(r+1) = 3(3r+1) \Rightarrow 7r+7 = 9r+3$$

$$9r - 7r = 7 - 3 \Rightarrow 2r = 4 \Rightarrow \boxed{r=2}$$

Put in I $\Rightarrow n = 3(2) \Rightarrow \boxed{n=6}$

Q.4. Prove that

i. $\mathbf{{}^{n}C_r + {}^{n}C_{r-1} = {}^{n+1}C_r}$

Sol. ${}^{n}C_r + {}^{n}C_{r-1} = {}^{n+1}C_r$

L.H.S $= {}^{n}C_r + {}^{n}C_{r-1}$

$$= \frac{n!}{(n-r)!.r!} + \frac{n!}{(n-r+1)!.(r-1)!}$$

$$= \frac{n!}{(n-r)!.r(r-1)!} + \frac{n!}{(n-r+1)(n-r)!.(r-1)!}$$

$$= \frac{n!}{(n-r)!.(r-1)!}\left[\frac{1}{r} + \frac{1}{n-r+1}\right]$$

$$= \frac{n!}{(n-r)!.(r-1)!}\left[\frac{n-r+1+r}{r(n-r+1)}\right]$$

$$= \frac{(n+1)n!}{(n-r+1)(n-r)!.r(r-1)!} = \frac{(n+1)!}{(n-r+1)!.r!}$$

$$= {}^{n+1}C_r = R.H.S$$

ii. $\mathbf{r.{}^{n}C_r = (n-r+1)\ {}^{n}C_{r-1}}$

Sol. $r.{}^{n}C_r = (n-r+1)\,{}^{n}C_{r-1}$

L.H.S $= r.{}^{n}C_r = r.\dfrac{n!}{(n-r)!.r!}$ ———— (I)

R.H.S $= (n-r+1)\,.{}^{n}C_{r-1}$

$$= (n-r+1).\frac{n!}{(n-r+1)!.(r-1)!}$$

$$= \left\{(n-r+1) \times \frac{(n-r)!}{(n-r)!}\right\}.\left(\frac{n!}{(n-r+1)!.(r-1)!} \times \frac{r}{r}\right)$$

$$= \frac{(n-r+1)!}{(n-r)!} \times \frac{r.n!}{(n-r+1)!.r(r-1)!}$$

$$= r.\frac{n!}{(n-r)!.r!} = r.{}^{n}C_r = \text{L.H.S}$$

Q.5. Prove that product or r consecutive integers is divisible by $r!$.

Sol. Proof:

Let the r consecutive integers be

$(n+1),(n+2),(n+3)......(n+r)$ then, their product

$$= (n+1)(n+2)(n+3)......(n+r)$$

$$= \frac{n!(n+1)(n+2)(n+3)......(n+r)}{n!}$$

(multiply and divide by $n!$)

$$= \frac{(n+r)!}{n!} = \frac{(n+r)!}{n!} \times \frac{r!}{r!} = r!.\frac{(n+r)!}{r!(n+r-r)!}$$

$= r! \times {}^{n+r}C_r$ which is Divisible by $r!$.

Since ${}^{n+r}C_r$ is positive integer.

Q.6. In how many ways can five subjects be selected out of eight subjects to select a course program?

Sol. Total subjects: $= n = 8$

Subjects to be selected: $= r = 5 \Rightarrow r = 5$

Total ways: $= {}^{n}C_r = {}^{8}C_5$

$$= \frac{8!}{(8-5)!.5!} = \frac{8.7.6.5!}{3!.5!} = \frac{8.7.6}{6} = 56$$

Q.7. Find the number of possible arrangements of vowel letters from the English alphabet?

Sol: Total letters of English alphabets $= 26$

$\Rightarrow \ n = 26$

Total vowels $= 5 \Rightarrow r = 5$

Total ways $= 5! = 5.4.3.2.1 = 120$

Q.8. In how many ways 3 dishes of Desi food and 2 dishes of Chinese food be selected from 6 dishes of Desi food and 8 dishes of Chinese food?

Sol. Total dishes of Desi food $= 6 \Rightarrow n = 6$

To be selected $= 3 \Rightarrow r = 3$

Total dishes of Chinese food $= 8 \Rightarrow n = 8$

To be selected $= 2 \Rightarrow r = 2$

Total ways $= {}^{6}C_3 . {}^{8}C_2$

$$=\frac{6!}{(6-3)!3!}\cdot\frac{8!}{(8-2)!.2!}=\frac{6.5.4.\cancel{3!}}{3!.\cancel{3!}}\cdot\frac{8.7.\cancel{6!}}{\cancel{6!}.2!}$$

$$=\frac{6.5.4}{6}\times\frac{8.7}{2}=20\times 28=560$$

Q.9. From a standard deck of 52 playing cards, there are 26 black cards and 26 red cards. How many different ways can eight cards be selected if 3 are black and the remaining 5 are red?

Sol. Total black cards $=26$

Total red cards $=26$

To be arranged cards $=8$

To be arranged black cards $=3$

To be arranged red cards $=8-3=5$

Total possible ways $={}^{26}C_3\ .\ {}^{26}C_5$

$$=\frac{26!}{(26-3)!.3!}\cdot\frac{26!}{(26-5)!.5!}$$

$$=\frac{26.25.24.\cancel{23!}}{\cancel{23!}.6}\times\frac{26.25.24.23.22.\cancel{21!}}{\cancel{21}!.120}$$

$$=171,028,00$$

Q.10. A bag contains 8 red balls, 7 green balls. Find the total number of possible ways in which five balls are selected in a way:

Total Red balls $=8$

Total Green balls $=7$

Balls to be selected $=5$

i. 3 red and 2 green

Sol. Total ways $={}^{8}C_3.{}^{7}C_2$

$$=\frac{8!}{(8-3)!.3!}\times\frac{7!}{(7-2)!.2!}=\frac{8!}{5!3!}\cdot\frac{7!}{5!.2!}$$

$$=\frac{8.7.6.\cancel{5!}}{\cancel{5!}.3.2.1}\cdot\frac{7.6.\cancel{5!}}{\cancel{5!}.2.1}=56.21=1176$$

ii. 1 red and 4 green

Sol. Total ways $={}^{8}C_1.{}^{7}C_4$

$$=\frac{8!}{(8-1)!.1!}\times\frac{7!}{(7-4)!.4!}$$

$$=\frac{8.\cancel{7!}}{\cancel{7!}.1!}\times\frac{7.6.5.\cancel{4!}}{3!.\cancel{4!}}$$

$$=8\times\frac{7.\cancel{6}^{3}.5}{\cancel{6}}=8\times 7\times 5=280$$

iii. 4 red and 1 green

Sol. Total ways $={}^{8}C_4.{}^{7}C_1$

$$=\frac{8!}{(8-4)!.4!}\times\frac{7!}{(7-1)!.1!}$$

$$=\frac{8.7.6.5.\cancel{4!}}{4.!\cancel{4!}}\times\frac{7.\cancel{6!}}{\cancel{6!}.1}=\frac{8.7.6.5}{4.3.2.1}\times 7=490$$

iv. All the red balls

Sol. Total ways $={}^{8}C_5$

$$=\frac{8!}{(8-5)!.5!}=\frac{8.7.6.\cancel{5!}}{3!.\cancel{5}!}=\frac{8.7.\cancel{6}}{\cancel{6}}=56$$

Q.11. How many diagonals and triangles can be formed by joining the vertices of the polygon having 15 sides

Sol. For diagonal $={}^{n}C_2-n$

For triangle $={}^{n}C_3$

Total Side of polygon = 15 $\Rightarrow n=15$

Numbers of Diagonals $={}^{15}C_2-15$

$$=\frac{15!}{(15-2)!.2!}-15=\frac{15.\cancel{14}^{7}.\cancel{13!}}{\cancel{13!}.\cancel{2}.1}-15$$

$$=105-15=90$$

Numbers of Triangles $={}^{n}C_3={}^{15}C_3$

$$=\frac{15!}{(15-3)!.3!}=\frac{15.14.13.\cancel{12}!}{\cancel{12}!.3.2.1}=455$$

Q.12. Find the number of sides of a polygon if the number of its diagonals is 104

Sol: Let Number of sides of polygon $=n$

Given Diagonals $=104$

Number of Diagonals $={}^{n}C_2-n$

$$104={}^{n}C_2-n$$

$$104=\frac{n!}{(n-2)!.2!}-n$$

$$104=\frac{n(n-1)\cancel{(n-2)}!}{\cancel{(n-2)}!.2!}-n$$

$$104=\frac{n(n-1)}{2}-n$$

$$104=n\left[\frac{n-1}{2}-1\right]$$

$$104=n\left[\frac{n-1-2}{2}\right]$$

$$104=\frac{n}{2}[n-3]$$

$$2\times104=2\times\frac{n}{2}[n-3]$$

$$208=n^2-3n$$

$$n^2-3n-208=0$$

$$n^2-16n+13n-208=0$$

$$n(n-16)+13(n-16)=0$$

$$(n-16)(n+13)=0$$

$$n-16=0 \quad , n+13=0$$

$$\boxed{n=16} \quad , n=-13 \text{ impossible}$$

Q.13 How many triangles can be formed by joining 15 points, 6 of which lie on the same straight line?

Sol: Total points $=15 \Rightarrow n=15$

Total triangles formed by

15 points $= {}^nC_3 = {}^{15}C_3$

$$\frac{15!}{(15-3)!.3!}=\frac{15.14.13.12!}{12!.3!}=\frac{15.14.13}{6}=455$$

Since 6 points lie on the straight line. Choosing any '3' of these

6 points will not form a triangle. The number of such combinations $={}^6C_3$

$$\frac{6!}{(6-3)!.3!}=\frac{6.5.4.3!}{3!.3!}=\frac{6.5.4}{6}=20$$

Total triangles $=455-20=435$

Q.14. The members of a club are 10 boys and 8 girls. In how many ways can a committee of 6 boys and 3 girls be formed?

Sol. Boys: $n=10 \quad , \quad r=6$

Girls: $n=8 \quad , \quad r=3$

Number of ways of committee $={}^{10}C_6\times{}^8C_3$

$$=\frac{10!}{(10-6)!.6!}\times\frac{8!}{(8-3)!.3!}=\frac{10!}{4!.6!}\times\frac{8!}{5!.3!}$$

$$=\frac{10.9.8.7.6!}{4.3.2.1.6!}\times\frac{8.7.6.5!}{5!.3.2.1}=\frac{10.9.8.7}{4.3.2.1}\times\frac{8.7.6}{3.2.1}$$

$$=210\times56=11760$$

Q.15. How many committees of 7 members can be chosen from a group of 10 persons when each committee must include 2 particular persons?

Sol. $n=10 \quad ; \quad r=7$

For two particular persons

$\Rightarrow \quad n=8 \quad ; \quad r=5$

Total committees $={}^nC_r={}^8C_5$

$$=\frac{8!}{(8-5)!.5!}=\frac{8.7.6.5!}{3!.5!}=\frac{8.7.6}{3.2.1}=56$$

Q.16. In how many ways can a cricket team of 11 players be selected out of 17 players? How many of them will include a particular player?

Sol. Total Players $=17$

To be selected $=11$

$n=17 \quad ; \quad r=11$

Total ways $={}^{17}C_{11}$

$$=\frac{17!}{(17-11)!.11!}$$

$$=\frac{17.16.15.14.13.12.11!}{6.!.11!}$$

$$=\frac{8,910,720}{720}$$

$$=12,376$$

When a particular player is include

$\Rightarrow \quad n=16=17-1 \quad ; \quad r=10=11-1$

Total ways $={}^{16}C_{10}$

$$=\frac{16!}{(16-10)!.10!}$$

$$=\frac{16.15.14.13.12.11.10!}{6!.10!}$$

$$=\frac{5765,760}{720}=8008$$

Q.17. There are 6 men and 8 women members of a club. How many committees of seven can be formed?

Sol. Men $=6$, Women $=8$

Total members $=7$

i. With 3 women

Total committees $={}^{8}C_3\times{}^{6}C_4$

$$=\frac{8!}{(8-3)!.3!}\times\frac{6!}{(6-4)!.4!}=\frac{8.7.6.\cancel{5!}}{\cancel{5!}.3.2.1}\times\frac{6.5.\cancel{4!}}{2!.\cancel{4!}}=\frac{8.7.\cancel{6}}{\cancel{6}}\times\frac{\cancel{6}^{3}.5}{\cancel{2}}=56\times15=840$$

ii. with at most 3 women

Sol. Total committees $=\left({}^{8}C_1\times{}^{6}C_6\right)+\left({}^{8}C_2\times{}^{6}C_5\right)+\left({}^{8}C_3\times{}^{6}C_4\right)$

$$=\frac{8!}{(8-1)!.1!}\times\frac{6!}{(6-6)!.6!}+\frac{8!}{(8-2)!.2!}\times\frac{6!}{(6-5)!.5!}+\frac{8!}{(8-3)!.3!}\times\frac{6!}{(6-4)!.4!}$$

$$=\frac{8.\cancel{7}!}{\cancel{7}!.1!}\times\frac{\cancel{6}!}{(6-6)!.\cancel{6}!}+\frac{8.7.\cancel{6}!}{\cancel{6}!.2!}\times\frac{6.\cancel{5}!}{1!.\cancel{5}!}+\frac{8.7.6.\cancel{5}!}{\cancel{5}!.3!}\times\frac{6.5.\cancel{4}!}{2!.\cancel{4}!}$$

$$=\left(8\times\frac{1}{0!}\right)+\left(\frac{8.7}{2}\times6\right)+\left(\frac{8.7.6}{3.2.1}\times\frac{6.5}{2.1}\right)=8+168+840=1016$$

iii. with at least 5 women

Sol. Total ways $={}^{8}C_5\times{}^{6}C_2+{}^{8}C_6\times{}^{6}C_1+{}^{8}C_7\times{}^{6}C_0$

$$=\left(\frac{8!}{(8-5)!.5!}\times\frac{6!}{(6-2)!.2!}\right)+\left(\frac{8!}{(8-6)!6!}\times\frac{6!}{(6-1)!.1!}\right)+\left(\frac{8!}{(8-7)!.7!}\times\frac{6!}{(6-0)!.0!}\right)$$

$$=\left(\frac{8.7.6.\cancel{5!}}{3!.\cancel{5!}}\times\frac{6.5.\cancel{4!}}{\cancel{4!}.2!}\right)+\left(\frac{8.7.\cancel{6!}}{2!.\cancel{6!}}\times\frac{6.\cancel{5!}}{\cancel{5!}.1!}\right)+\left(\frac{8.\cancel{7!}}{1!.\cancel{7!}}\times\frac{\cancel{6!}}{\cancel{6}!.0!}\right)$$

$$=\left(\frac{8.7.6}{6}\times\frac{6.5}{2}\right)+\left(\frac{8.7}{2}\times6\right)+(8\times1)=840+168+8=1016$$

Q.18. There are three section in a question paper, each section has 3 questions. A student has to solve all 5 questions, choosing at least one question from each section. In how many ways can the student make his choice?

Sol: Total section $=3\Rightarrow$ Total Options $=3!=6$

Each section has questions $=3$

Total number of ways:

(Option – I)

$${}^{3}C_1\times{}^{3}C_1\times{}^{3}C_3=\frac{3!}{(3-1)!.1!}\times\frac{3!}{(3-1)!.1!}\times\frac{3!}{(3-3)!.3!}=\frac{3.\cancel{2!}}{\cancel{2!}.1!}\times\frac{3.\cancel{2!}}{\cancel{2!}.1!}\times\frac{\cancel{3!}}{0!.\cancel{3!}}==3\times3\times1=9$$

(Option – II)

$${}^{3}C_1\times{}^{3}C_2\times{}^{3}C_2=\frac{3!}{(3-1)!.1!}\times\frac{3!}{(3-2)!.2!}\times\frac{3!}{(3-2)!.2!}=\frac{3.\cancel{2!}}{\cancel{2!}.}\times\frac{3.\cancel{2!}}{1!.\cancel{2!}}\times\frac{3.\cancel{2!}}{1!.\cancel{2!}}==3\times3\times3=27$$

(Option – III)

$${}^{3}C_1\times{}^{3}C_3\times{}^{3}C_1=\frac{3!}{(3-1)!.1!}\times\frac{3!}{(3-3)!.3!}\times\frac{3!}{(3-1)!.1!}=3\times1\times3=9$$

(Option – IV)

$$^3C_2\times{}^3C_1\times{}^3C_2=\frac{3!}{(3-2)!.2!}\times\frac{3!}{(3-1)!.1!}\times\frac{3!}{(3-2)!.2!}=\frac{3.\cancel{2!}}{1!.\cancel{2!}}\times\frac{3.\cancel{2!}}{\cancel{2!}.1!}\times\frac{3.\cancel{2!}}{1!.\cancel{2!}}==3\times3\times3=27$$

(Option – V)

$$^3C_3\times{}^3C_1\times{}^3C_1=\frac{3!}{(3-3)!.3!}\times\frac{3!}{(3-1)!.1!}\times\frac{3!}{(3-1)!.1!}=\frac{\cancel{3!}}{0!.\cancel{3!}}\times\frac{3.\cancel{2!}}{\cancel{2!}.1!}\times\frac{3.\cancel{2!}}{\cancel{2!}.1!}==1\times3\times3=9$$

Total Ways: $9+27+9+27+9=108$

Q.19. Consider a cryptographic system that generates an 8 characters password. Each character in the password can be either a lowercase letter (a – f) or a digit (0 – 5). How many passwords can be generated if each password must contain exactly 5 lowercase letters and 3 digits?

a. with repetition allowed

Sol. Lower case letters $= a-f$

Total options $=6$

Digits $=(0-5)$

Total options $=6$

Letters to be selected $=5$

Digits to be selected $=3$

Total Characters in Password $=8$

Options for letters $={}^8C_5$

$$=\frac{8!}{(8-5)!.5!}=\frac{8.7.6.\cancel{5!}}{3!.\cancel{5!}}=\frac{8.7.\cancel{6}}{\cancel{6}}=56$$

Options for digits $={}^8C_3$

$$=\frac{8!}{(8-3)!.3!}=\frac{8.7.6.\cancel{5!}}{\cancel{5!}.3!}=\frac{8.7.\cancel{6}}{\cancel{6}}=56\Rightarrow {}^8C_5={}^8C_3=56$$

For each of '5' letters there are 6 options so,

Number of Password $=56\times6^5\times6^3=56\times7776\times216$

$=56\times1679616=94018596$

b. Without repetition

Sol. $56\times{}^6C_5\ .\ {}^6C_3$

$$=56\times\frac{6!}{(6-5)!}\times\frac{6!}{(6-3)!}=56\times\frac{6.5.4.3.2.1}{1!}\times\frac{6.5.4.\cancel{3!}}{\cancel{3!}}=56\times72\times120=4838400$$

Q.20. On Defense Day, Teacher I compiles a list of 10 distinct national songs, while Teacher II prepares a separate list of 10 different national songs (with no overlap between the two lists). The principal needs to select 3 songs from Teacher I's list, and 3 songs from Teacher II's list.

Determine the number of possible selection methods when:

i. The order/sequence of the selected songs is important.

Sol. Teachers I one prepares songs $=10$

To be selected by principle $=3$

Teacher II prepares songs $=10$

To be selected by principle $=3$

Total ways $= {}^{10}P_3 \ . \ {}^{10}P_3$

$$= \frac{10!}{(10-3)!} \cdot \frac{10!}{(10-3)!} = \frac{10.9.8.\cancel{7!}}{\cancel{7!}} \times \frac{10.9.8.\cancel{7!}}{\cancel{7!}} = 10 \times 9 \times 8 \times 10 \times 9 \times 8 = 518,400$$

ii. The order/sequence of the selected songs is not important.

Sol. Teachers I one prepares songs $= 10$

To be selected by principle $= 3$

Teacher II prepares songs $= 10$

To be selected by principle $= 3$

Total ways when the sequence of the selected songs does not matter

$$= {}^{10}C_3 \ . \ {}^{10}C_3 = \frac{10!}{(10-3)!.3!} \cdot \frac{10!}{(10-3)!.3!} = \frac{10.9.8.\cancel{7!}}{\cancel{7!}.3.2.1} \times \frac{10.9.8.\cancel{7!}}{\cancel{7!}.3.2.1} = 720 + 720 = 1440$$