11. A research team of 7 people is to be formed from 8 chemists, 4 politicians, 3 economists and 2 biologists. How many teams have:

A) At least 5 chemists? 5 OR 6 OR 7 ${}_8C_5 \times {}_9C_2 + {}_8C_6 \times {}_9C_1 + {}_8C_7 \times {}_9C_0 = 2276$

~~economists~~

B) Exactly three economists ${}_3C_3 \times {}_{14}C_4 = 1001$

C) Four chemists, but no economists ${}_8C_4 \times {}_6C_3 = 1400$

D) At least two biologists ${}_2C_2 \times {}_{15}C_5 = 1 \times 3003 = 3003$

12. Total of 4 positions

If there are 8 boys & 7 girls in a selection pool and a school council of President, VP, treasurer and Secretary to be formed, in how many ways can

A) exactly one boy be on council ${}_8P_1 \times {}_7P_3 = 1680$

B) exactly two girls be on council ${}_7P_2 \times {}_8P_2 = 2352$

C) no boys on council ${}_7P_4 = 840$

13. If a sports team with six unique positions is to be formed from 5 men and 7 women, in how many ways can two positions be filled by men and four positions by women? ${}_5P_2 \times {}_7P_4 = 16800$

14. Simplify:

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

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

15. Solve:

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

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

$n^2-3n=0$

$n(n-3)=0$

~~$n=0$~~ $n=3$

B) $\frac{(n+2)!}{n!} = \frac{12n!}{n!}$

$\frac{(n+2)(n+1)(n)!}{n!} = 12$

$n^2+3n+2-12=0$

$n^2+3n-10=0$

$(n+5)(n-2)=0$

~~$n=-5$~~ $n=2$

16. Solve:

(A) ${}_nC_2 = 15$ $n=6$

(B) ${}_{n+1}C_n = 20$ $n=19$

(C) ${}_{n+1}P_2 = 20$ $n=4$

(D) ${}_nP_6 = 5({}_nP_5)$ $n=10$

(E) ${}_nC_{n-2} = 10$ $n=5$

17. Expand and simplify using the binomial theorem.

a) $(3x-4)^3 = {}_3C_0(3x)^3(-4)^0 + {}_3C_1(3x)^2(-4)^1 + {}_3C_2(3x)^1(-4)^2 + {}_3C_3(3x)^0(-4)^3$

$= 27x^3 - 108x^2 + 144x - 64$

b) $(a-2b)^5 = {}_5C_0(a)^5(-2b)^0 + {}_5C_1(a)^4(-2b)^1 + {}_5C_2(a)^3(-2b)^2 + {}_5C_3(a)^2(-2b)^3 + {}_5C_4(a)^1(-2b)^2 + {}_5C_5(a)^0(-2b)^4$

$= (1)a^5(1) + 5(a^4)(-2b) + 10a^3(4b^2) + 10(a^2)(-8b^3) + 5(a)(4b^2) + (1)(1)(16b^4)$

$= a^5 - 10a^4b + 40a^3b^2 - 80a^2b^3 + 20ab^2 + 16b^4$

18. What is the second term of $(2x-3)^5$?

$= {}_5C_1(2x)^4(-3)^1$

$= 5(16x^4)(-3)$

$= -240x^4$