

4. Ten students have been elected to serve on students' council.

a) In how many ways can 4 of these students be chosen to represent the school as ambassadors at the provincial education conference?

$${}_{10}C_4 = 210$$

b) In how many ways can a president, vice-president, secretary, and treasurer be chosen from the ten students?

$${}_{10}P_4 = 5040$$

c) Six of the ten students elected to students' council are girls. In how many different orders can four of the students line up for a photograph if there must be an equal number of boys and girls in the photograph?

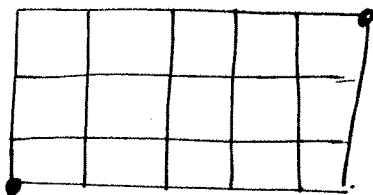
choose 2 from 6 girls
 choose 2 from 4 boys
 arrange the 4 students

5. A town has 6 streets running from north to south and 4 avenues running from west to east. A man wishes to drive from the extreme south-west intersection to the extreme north-east intersection, moving either north or east along one of the streets or avenues.

Tania used the expression $\frac{10!}{6!4!}$ to determine the number of different ways to drive from the extreme south-west intersection to the extreme north-east intersection.

Draw a diagram to illustrate the situation and explain why Tania was incorrect in her reasoning.

N
E
S



He has to drive 5 blks East + 3 blks N

$$\frac{8!}{5!3!} = \underline{\underline{56}}$$

6. How many arrangements are there of the letters of the word **MONOTONOUS** under 10 each condition?

a) without restrictions

$$\frac{10!}{4!2!} = 75600$$

b) if each arrangement begins with a T 40
2N

$$\frac{9!}{4!2!} = 7560$$

c) if each arrangement begins with an O

$$\frac{9!}{3!2!} = 30240$$

d) if the four O's are to be together

$$\frac{0000 | \text{-----} 2N}{7!} = 2520$$

Multiple Choice

7. The number of ways that an executive committee consisting of prime minister, deputy prime minister, treasurer, and secretary can be chosen from 16 student council members

↳ permutation order matters

- A. $4!$ B. $\frac{16!}{4!}$ $16P_4$
- C. $\frac{16!}{12!4!}$ **D.** $\frac{16!}{12!}$ $= \frac{16!}{(16-4)!} = \frac{16!}{12!}$

Use the following information to answer the next question.

A sports store has jerseys representing the seven Canadian NHL teams and the eight Canadian CFL teams. Five of these jerseys have to be chosen for display in a store window. The store owner decides to choose three NHL and two CFL jerseys. These jerseys will be arranged in a row in the store window.

8. The number of displays that can be made by choosing the jerseys and then arranging them in the window is

- A. 4900
- B. 11 760
- C.** 117 600
- D. 1 411 200
- $(7C_3)(8C_2) \times 5!$
 $= 35 \times 28 \times 120$
 $= 117600$

9. A researcher has collected data on families with 3 children, families with 4 children, and families with 5 children. Each family is given a code, reflecting the number, gender, and birth order of the children. For example, the code MMMF is given to a family with 4 children where the first 3 children born are boys and the youngest child is a girl. How many different codes are required in this study?

- A. 32
- B.** 56
- C. 150
- D. 4096
- $2 \cdot 2 \cdot 2$ or $2 \times 2 \times 2 \times 2$ or $2 \times 2 \times 2 \times 2$
 $8 + 16 + 32$
 $= 56$

10. The number of arrangements of the letters of the word PARALLEL in which all the L's are together at the end of the arrangement is

- A.** 60
- B. 120
- C. 180
- D. 360
- -- -- -- LLL 2A.
 $\frac{5!}{2!} = 60$

Use the following information to answer the next question.

A student enrolled in a General Studies program at a particular university must take four courses in the first semester.

The student must take English, either Mathematics or Psychology, and either two courses from Group A or two courses from Group B below.

	Group A	Group B
math	French	Biology
Psych	Spanish	Chemistry
$2C_1$	German	Computing
	History	Geology
	Geography	

11. The number of four-course programs available to the student is

- A. $2C_1 \times (5C_2 \times 4C_2)$ 2 from group A $5C_2$
- B.** $2C_1 \times (5C_2 + 4C_2)$ 2 from group B $4C_2$
- C. $2P_1 \times (5P_2 \times 4P_2)$ "or" means add.
- D. $2P_1 \times (5P_2 + 4P_2)$

12. The area codes in a country all contain three digits from the digits 1 to 9. Which of the following restrictions will result in the most area codes?

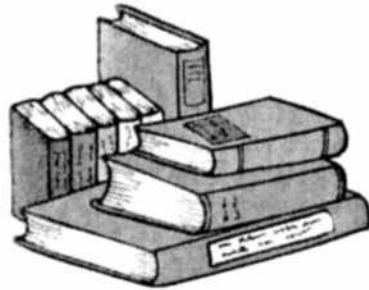
- A. The digits are all different. $9 \times 8 \times 7 = 504$ 9 digits
- B. The middle digit must be odd. $9 \times 5 \times 9 = 405$
- C.** The digit 7 cannot be used. $8 \times 8 \times 8 = 512$
- D. All the digits are even or all the digits are odd. $4 \times 4 \times 4 + 5 \times 5 \times 5 = 64 + 125 = 189$

13. If ${}_nP_r = 11\,880$ and ${}_nC_r = 495$, then the value of n is

- A.** 4 ${}_nP_r = \frac{n!}{(n-r)!r!}$ ${}_nC_r = \frac{{}_nP_r}{r!}$ $495r! = 11880$
- B. 12 $(n-r)!$
- C. 24 ${}_nC_r = \frac{n!}{(n-r)!r!}$ $495 = \frac{11880}{r!}$ $r! = \frac{11880}{495}$
- D. unable to be determined from the given information $r! = 24$ $r = 4$

Use the following information to answer the next two questions.

On the floor of her study, a student has 5 different English books, 2 different Science books, and 2 different Mathematics books.



14. The number of ways in which three of these books can be arranged on a bookshelf is

A. ${}_5P_1 \times {}_2P_1 \times {}_2P_1$

9 different book - arrang 3 from 9

B. ${}_9P_3$

C. ${}_9C_3$

D. $3!$

Numerical Response

15. The number of ways of arranging two English books, two Science books, and a Mathematics book on a bookshelf is _____.

(Record your answer in the numerical response box from left to right.)

2400

$({}^5C_2)({}^2C_2)({}^2C_1)5! = 2400$

16. The number of arrangements of the letters of the word **STUDENT** in which the two T's are not adjacent is _____.

(Record your answer in the numerical response box from left to right.)

1800

#(no restrictions) - #(adjacent)
 $= \frac{7!}{2!} - 6! = 2520 - 720 = 1800$

STTUDEN
 adjacent $\rightarrow 6!$ ways.

17. 35 different quadrilaterals can be formed by connecting points on the circumference of a circle. The number of points on the circle is _____.

(Record your answer in the numerical response box from left to right.)

7

$nC_4 = 35$

18. A basketball team consists of some guards and six forwards. If there are 420 ways to select two guards and three forwards to the starting line-up, then the number of guards on the team is _____.

(Record your answer in the numerical response box from left to right.)

7			
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$$\binom{n}{2} \binom{6}{3} = 420$$

$$\binom{n}{2} (20) = 420$$

$$n C_2 = \frac{420}{20}$$

$$n C_2 = 21 \quad n = 7$$

19. Customer service representatives at a men's designer store must wear company attire. They have a choice of three different shirts, four different ties, and two different pairs of pants. The number of different outfits that a customer service representative could create using these items is _____.

(Record your answer in the numerical response box from left to right.)

2	4		
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$$3 \times 4 \times 2 = 24$$

20. A coach must choose the 5 starters for a basketball team from 6 males and 5 females. If there must be at least two of each gender in the starting line-up, the number of different groups of players that can be chosen is _____.

(Record your answer in the numerical response box from left to right.)

3	5	0	
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$$\begin{aligned} & 2M3F \quad \text{or} \quad 3M2F \\ & - (\binom{6}{2} \binom{5}{3}) + (\binom{6}{3} \binom{5}{2}) \\ & = 15(10) + 20(10) \\ & = 150 + 200 = 350 \end{aligned}$$

Answer Key

1. a) 5005 b) 7371 2. a) 15! b) 14!
 3. a) 30 b) 12 c) 3 d) 9 4. a) 210 b) 5040 c) 2160
 5. He has to drive 5 blocks east and 3 blocks north in any order. So the answer is $\frac{8!}{5!3!} = 56$.

6. a) 75 600 b) 7560 c) 30 240 d) 2520
 7. D 8. C 9. B 10. A 11. B 12. C

15.

2	4	0	0
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16.

1	8	0	0
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17.

7			
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18.

7			
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19.

2	4		
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20.

3	5	0	
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