

Chapter 2: Counting Methods

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Formulas:  ${}_nP_r = \frac{n!}{(n-r)!}$        ${}_nC_r = \binom{n}{r} = \frac{n!}{(n-r)!r!}$        $\frac{n!}{a!b!c!...}$

**Part A: Multiple choice.** In the space provided place the letter of the correct answer for each question. Total Value = 10 Marks

\_\_\_\_\_ 1. A parking lot in front of a coffee shop has six parking spaces. How many ways can 5 cars park in the spaces?

- A. 6                      B. 56                      C. 120                      D. 720

\_\_\_\_\_ 2. A license plate consists of 3 letters, followed by 3 numbers. Repetitions are not allowed. If any letter may be used except for U and I, and the allowed digits are 3, 4, 5, 6, 7, 8, and 9, how many different license plates can be produced?

- A. 500 405              B. 900 800              C. 1 059 776              D. 2 550 240

\_\_\_\_\_ 3. Simplify:  $\frac{6!}{4!}$

- A. 2!                      B. 2                      C. 30                      D.  $\left(\frac{3}{2}\right)!$

\_\_\_\_\_ 4. At the ice-cream parlour you can choose from 4 flavours of ice-cream, 2 types of sauce, and 3 different toppings, when ordering a sundae. How many possible sundaes can be ordered?

- A. 24                      B. 9                      C. 8                      D. 12

\_\_\_\_\_ 5. What is the correct restriction for the variable in the expression,  $\frac{n!}{(n-2)!}$ ?

- A.  $n \geq 0$               B.  $n > 0$               C.  $n > 2$               D.  $n \geq 2$

\_\_\_\_\_ 6. How many ways can five different books be arranged on a shelf?

- A. 5                      B. 120                      C. 15                      D. 10

\_\_\_\_\_ 7. Simplify:  $\frac{7!}{3!2!}$

- A. 840                      B. 7                      C. 420                      D. 11

\_\_\_\_\_ 8. Calculate:  ${}_8P_3$

- A. 120                      B. 336                      C. 6720                      D. 8

\_\_\_\_\_ 9. Simplify:  $\frac{(n+1)!}{(n-1)!}$

- A.  $n^2 + n$               B.  $n^2 - n$               C.  $n + 1$               D. 2

\_\_\_\_\_ 10. Courtney goes to Halifax to visit her sister Fallon. She travels 6 blocks north on Barrington Street and 4 blocks west on Robbie Street to reach Fallon. How many different routes can she take if she always walks either north or west?

- A. 151 200              B. 5040                      C. 210                      D. 1

**Part B: Permutation or Combination?** Decide whether a permutation or a combination is described. Total Value = 5 Marks

1. Your computer password. 1. \_\_\_\_\_
2. Choosing 3 colours for your room. 2. \_\_\_\_\_
3. Choosing 3 colours for your room: for the paint colour, the bedding and the curtains. 3. \_\_\_\_\_
4. Selecting a lead and an understudy for a school play. 4. \_\_\_\_\_
5. Selecting three students to attend a conference in St. John's, NL. 5. \_\_\_\_\_

**Part C: Long Answer.** Show all workings in the space provided as full marks will not be given for answers only. Total Value = 30 Marks

1. The top two teams of the St. John's High School Hockey League play a 3 game series for the city championship. Winning at least two out of three games wins the championship.

(3) a. Create a tree diagram, organized list, or outcome table to show all the win-loss possibilities for either team for the 3 game series.

(1) b. In how many ways can a team lose exactly one game but still win the championship?

2. Nick and Renée belong to the drama club at Holy Trinity High School. There are five boys and six girls in the club. For each case below, how many ways can a committee of four be selected to work on a project next Saturday?

(3) a. There must be two boys and two girls.

(4) b. There must be at least two girls.

(2) c. Nick and Renée must be on the committee.

3. Consider the 11 letters in the word MATHEMATICS. How many different arrangements are possible in the following situations?

(2) a. All the letters are used.

(3) b. All the letters are used, but each arrangement must begin with the letter E and end with the letter C.

(4) 4. Solve for  $n$  & state the restrictions on the variable:  $\frac{(n+5)!}{(n+3)!} = 56$

(4) 5. Solve for n:  ${}^nC_2 = 21$

6. Sally, Sarah, and Susan are female triplets. They and their 4 male cousins are posing for a series of photographs. How many ways can the 4 boys and 3 girls be arranged in one row under each of the following conditions?

(2) a. The boys and girls must alternate positions?

(2) b. The triplets must stand next to each other.