MDM4U – Sample Test 2 – Counting Methods – October 10, 2023

Name: _____

Knowledge ⚙	Application 💻	Communication ✏	Thinking 📊	Total	Percent
27	22	16	25	90	%

⚙ Knowledge

1. Identify the formula for the following: /4

(a) n! | | (b) n things arranged in a circle | |
(c) P(n, r) | | (d) C(n, r) | |

2. Calculate the following: /10

(a) P(0,199) | (f) 3! x 4!

(b) 5! | (g) C(9,3)

(c) P(5, 5) | (h) C(2,9)

(d) P(51,2) | (i) P(809,0)

(e) 0! | (j) C(678,1)

3. Consider the word "MAILBOX". Fill in the values indicated by the column headings.   /10

	Equation, with factorials	Final Answer
(a) Permutations with all letters.		
(b) Permutations with 4 letters.		
(c) Permutations; M in the front.		
(d) Circular permutations.		
(e) Combinations with 4 letters.		

4. Identify the Excel formula for the following: /3

(a) $_9P_4$

(b) $_7C_5$

(c) 12!

🖳 Application

For each of these problems provide a full solution. Evaluate.

5. Consider the word "OCTOBER". Find out how many things result in each case. /8

   (a)   Permutations using all letters.

   (b)   Permutations of 3 letters, all the same.

   (c)   Permutations of 3 letters where 2 letters the same, one different.

   (d)   Permutations with all letters, OO at the end.

6. A class has 12 right-handed people and 8 left-handed people. Four children are chosen to be in a play. What is the probability that there is an equal number of left and right-handed people chosen? /6

7. Ella Vader wants a good lock for her locker. Which lock is the most secure?
   Prove it to Ella using counting principles. /8

Oria Lock: Each dial has the digits 0-9 on it.	**Master Lock:** The same number can not be used back-to-back. The combination is 3 numbers each between 0 and 39.	**Wordlock Lock:** Each dial has 8 letters on it.

✎ Communication

8. Classify each type of problem using the appropriate letter in the last column.   /10

A. Counting, **B.** Factorial, **C.** Permutations, **D.** Perms with Restrictions, **E.** Perms with Repeats, **F.** Circular Perms, **G.** Combinations

	Problem	Classification
(a)	The number of ways you can choose 5 kittens from a litter of 10 kittens.	
(b)	You choose a group of 4 from a club of 200 to greet the Governor General.	
(c)	The number of license plates in Ontario.	
(d)	From a horse race of 18 horses, there is a first, second and third place finisher.	
(e)	The number of rearrangements of TURKEY with T in the first position.	
(f)	The ways to arrange 20 pearls around a necklace.	
(g)	How many ways you can arrange all the letters in OWLS?	
(h)	From a team of 18 students, you are picking a captain and assistant captain.	
(i)	(Two types) The number of arrangements of SEALS with E in the first position.	
(j)	(Two types) The ways to position 4 red, 6 yellow and 1 pink tulips around a flagpole.	

9. When a guest complains to the wedding planner about their table's seating plan, the planner says, "I know it's not perfect, but it really is the only arrangement that worked." If twelve people are seated around a table, explain why that is unlikely.   /2

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10. (a) Provide one way that permutation and factorial questions are similar, and one that they differ.   /2

Same	
Differ	

(b) Provide one way that permutation and combination questions are similar, and one that they differ.   /2

Same	
Differ	

📈 Thinking

11. Simplify. Do not evaluate.   /6

  (a) $\dfrac{89!}{90!}$ (b) $\dfrac{\left(\dfrac{30 \times 29!}{42!}\right)}{\left(\dfrac{30!}{41!}\right)}$ (c) $\dfrac{C(22,4)}{C(23,4)}$

12. How many arrangements of ALGORITHM begin with a vowel but do **not** end with a consonant?   /4

13. How many 4 letter permutations of "APPELLEE" exist? (Hint: there are 4 cases)   /10

14. Solve for n: $\dfrac{(n+1)!}{(n-1)!} = 20$ /3