MDM4U – 2.2 – Permutation Questions

A. Permutation Definition Questions

1. Evaluate the following:
    a. P(7,4)
    b. P(9,2)
    c. P(7,4) / P(6,3)
    d. P(192,7) / P(191,6)
    e. P(30,6) / P(30, 5)
    f. P(111,12) / P(110,10)
    g. 7! / P(7,5)
    h. 93! / P(93,90)
    i. 9! / 6!
    j. 19! / P(17,14)
2. Express in the form nPr and in the form P(n,r)
    a. 6 x 5 x 4
    b. 9 x 8 x 7 x 6
    c. 20 x 19 x 18 x 17
    d. 101 x 100 x 99 x 98 x 97
    e. 76 x 75 x 74 73 x 72 x 71 x 70

B. Basic Permutations Word Problems

3. How many ways can Hypatia colour 4 adjacent regions on a map if she has a set of 12 coloured pencils?
4. Twelve children line up for a photograph. Only 4 may be in the front row. In how many ways can the children be chosen for the front row?
5. There are 23 people in a math Olympiad contest. In how many ways can the people be chosen for the gold, silver and bronze medals?
6. If you have a standard deck of 52 cards, in how many different ways can you deal out:
    a. 5 cards
    b. 5 red cards
    c. 10 cards
    d. 4 queens
7. Find the number of 4 letter permutations using letters from the following:
    a. WILES
    b. CANTOR
    c. HAILSTONE
8. Find the number of 7 permutations using the letters of each of the following words:
    a. PYRAMIDS
    b. HYPERBOLA
    c. MANDELBROT

C. Basic Permutations with Restrictions on Position

9. Seven children line up for school photographs.
    a. how many arrangements are possible?
    b. how many arrangements are possible if Brenda is in the middle?
    c. how many arrangements are possible if Ahmed is on the far left and Yen is on the far right?
    d. how many arrangements are possible if Hanh and Brian must be together?
10. A 12 volume book about complex numbers is to be placed on a shelf. How many incorrect arrangements are there?
11. In how many ways can the 12 members of a volleyball team line up if the captain and assistant captain must remain together?
12. How many permutations of the numbers 1,2,…,9
    a. start with 1?
    b. end with an odd digit?
    c. start and end with an odd digit?
    d. start and end with 8 and 9?
    e. have 8 and 9 in adjacent positions?
    f. have 8 and 9 separated?
    g. have 5 in the middle position?
    h. have 1, 2, and 3 somewhere in the first 3 positions?
13. A permutation of 6 letters is formed from the letters A, B, C, D, E, F, G, and H. How many permutations:
    a. begin with A?
    b. do not begin with A?
    c. end in a vowel?
    d. contain only consonants?
    e. start with the word "BAD"?
    f. contain the word "BAD"?
14. How many permutations of the number 1, 2, 3, 4, 5, and 6
    a. begin with an even number?
    b. begin with an odd number and end with an even number?
    c. begin with an odd number and end with an odd number?
15. How many permutations of 6 boys and 5 girls are there so that boys are not adjacent to boys and girls are not adjacent to girls?
16. How many permutations of 5 boys and 5 girls are there so that no boys are adjacent to boys and no girls are adjacent to girls?
17. Ten people are to be seated at a rectangular table for dinner. Tanya will sit at the head of the table. Henry must not sit beside either Wilson or Nancy. In how many ways can people be seated for dinner?

D. Circular Tables

18. In how many ways can 4 people sit around a circular table?
19. In how many ways can a circle of the provincial and territorial flags be arranged in a circle around a flowerbed?
20. In how many ways can 14 stones be arranged around a ring?
21. In how many ways can 6 keys be arranged on a key chain if two of the keys have to be next to each other?

22. How many ways can six people be seated around a circular table:
     a. with no restrictions?
     b. if Person #1 and Person #2 must sit together?
     c. if Person #1 and Person #2 must not sit together?
23. In how many ways can four married couples be arranged around a circular table:
     a. if there are no restrictions?
     b. if each man must sit beside his wife?
     c. if men and women alternate?

E. Permutations with Repeats

24. How many permutations of the letters of INSTITUTE
     a. are possible
     b. begin with S and end with S?
     c. do not start with T?
     d. have the 3 T's adjacent to one another?
     e. have N and E adjacent to each other?
     f. begin with S or end with U?
     g. begin with I or end with I?
     h. begin with E or end with E?
     i. begin with T or end with T?
25. In how many ways can the letters of the word EGREGIOUS be arranged?
26. In how many ways can 6 red plastic disks and 20 blue plastic disks be arranged in a row in such a way that there is a red plastic disk at the end of each row?
27. How many 3-permutations are there of the letters AAAABBBCCDD?
28. Find the number of arrangements of the letters in the word MATHEMATICIAN using all letters each arrangement? In how many of these arrangements are the two T's together?
29. How many 4 digit even numbers may be formed using the digits {0,1,2,3,4,5}?
30. How may odd 3 digit numbers, all of the digits different, can be formed form the digits 0 to 5, if there must be a 2 in the number?

Answers
A. 1. a. 840, b. 72, c. 7, d. 192, e. 25, f. 11100, g. 2, h. 6, i. 504, j. 2052.
   2. a. 6P3 P(6,3), b. 9P4 P(9,4), c. 20P4 P(20,4), d. 101P5 P(76,7)
B. 3. 11880, 4. 11880, 5. 10626, 6 a. 311875200, b. 7893600, c. 5.7 x 10^16, d. 24,
   7. a. 120, b. 360, c. 3024, 8 a. 40320, b. 181440, c. 604800
C. 9 a. 5040, b. 720, c. 120, d. 1440, 10. 479001599, 11. 79833600, 12 a. 40320,
   b. 201600, c. 100800, d. 5040, e. 80640, f. 282240, g. 40320, h. 4320, 13. a. 2520
   b. 17640 c. 5040 d. 720 e. 60 f. 240. 14. a. 360, b. 216, c. 144. 15. 86400,
   16. 28800, 17. 211680.
D. 18. 6, 19. 479001600, 20. 6227020800, 21. 48, 22. a. 120, b. 48, c. 72, 23. a. 5040,
   b. 96, c. 144
E. 24. a. 30240, b. 0, c. 20160, d. 2520, e. 6720, f. 6300, g. 12600, h. 6720, i. 17640;
   25. 90720, 26. 10626, 27. 62, 28. 1.297 x 10^8 = 19,958,400, 29. 156, 30. 21