KIDSLEARN MATH · PRACTICE ASSIGNMENT

Combinations & Permutations

Name: Date: Score: / 50

Write each answer as a whole number. For each word problem, first decide: does the order matter? Answers are at the end.

Part A — Warm-up

1. A coin is tossed four times. How many different sequences of heads and tails are possible?

2. Dan has 4 T-shirts and 6 pairs of shorts. How many different outfits of one T-shirt and one pair of shorts can be made?

3. A café offers 7 sandwiches, 4 drinks and 2 desserts. A meal is one of each. How many different meals are there?

4. Nora has 3 T-shirts and 6 pairs of shorts. How many different outfits of one T-shirt and one pair of shorts can be made?

5. Evaluate $\dfrac{12!}{10!}$ without a calculator.

6. Evaluate $6!$.

7. Evaluate $\dfrac{8!}{4!}$ without a calculator.

8. Evaluate $\dfrac{7!}{5!}$ without a calculator.

9. Evaluate ${}_{10}P_2$.

10. Evaluate ${}_4P_3$.

11. Evaluate ${}_5P_3$.

12. Evaluate ${}_9C_2$.

13. Evaluate ${}_9C_3$.

14. Evaluate ${}_6C_2$.

15. You want to pick four toppings from 9 for a pizza. Is this a permutation or a combination?

(A) Permutation — order matters

(B) Combination — order does not matter

16. You want to arrange two of 12 books in a row on a shelf. Is this a permutation or a combination?

(A) Permutation — order matters

(B) Combination — order does not matter

Part B — Core practice

17. In how many different orders can three children sit on a row of three chairs?

18. In how many different orders can five different books are put in a row on a shelf?

19. In how many different orders can six different books are put in a row on a shelf?

20. In how many ways can two of 9 different pictures be hung in a row on a wall?

21. A club of 8 members elects a president and a secretary. No one can hold two posts. In how many ways can this be done?

22. 15 swimmers are in a final. In how many ways can the gold and silver medals be awarded?

23. A club of 15 members elects a president, a secretary and a treasurer. No one can hold two posts. In how many ways can this be done?

24. Kai picks four books to borrow from a shelf of 14. How many different sets of books could be borrowed?

25. A team of four is chosen from 6 students. How many different teams are possible?

26. A pizza can have any four different toppings from a list of 9. How many different pizzas are possible?

27. Milo picks three books to borrow from a shelf of 11. How many different sets of books could be borrowed?

28. In a league of 14 teams, every team plays every other team twice, once at home and once away. How many games are played?

29. In a league of 16 teams, every team plays every other team once. How many games are played?

30. 7 points lie on a circle. How many straight lines can be drawn through two of the points?

31. A 3-character code uses the digits 0 to 9, and no character may be used twice. How many codes are possible?

32. A 3-character code uses the digits 0 to 9. Characters may be repeated. How many codes are possible?

33. A 3-character code uses the letters A, B, C, D, E, and no character may be used twice. How many codes are possible?

34. How many different arrangements of all the letters of the word TIGER are there?

35. How many different arrangements of all the letters of the word JUMP are there?

36. How many different arrangements of all the letters of the word PLANET are there?

37. Evaluate ${}_{22}C_{21}$. (Hint: choosing 21 to take is the same as choosing 1 to leave.)

38. A shop has 5 different flavours. You may take any number of them, from none to all 5. How many different selections are possible?

39. ${}_{14}C_3 = {}_{14}C_k$ and $k \neq 3$. What is k?

Part C — Challenge

40. How many different arrangements of all the letters of the word ACADEMY are there?

41. How many different arrangements of all the letters of the word PUZZLE are there?

42. How many different arrangements of all the letters of the word PEPPER are there?

43. A class has 8 boys and 9 girls. A committee of three boys and three girls is chosen. How many different committees are possible?

44. A class has 5 boys and 9 girls. A team of three is chosen. How many teams include **at least one girl**?

45. A class has 8 boys and 5 girls. A committee of two boys and two girls is chosen. How many different committees are possible?

46. Seven friends, including Nora and Fay, stand in a row. In how many ways can they stand if Nora and Fay must be **next to each other**?

47. Four friends, including Cara and Kai, stand in a row. In how many ways can they stand if Cara and Kai must be **next to each other**?

48. Six friends, including Gus, stand in a row. In how many ways can they stand if Gus must be at one of the two ends?

49. How many **even** 3-digit numbers can be made from the digits 1, 3, 4, 7, 9, using each digit at most once?

50. How many **even** 3-digit numbers can be made from the digits 5, 6, 7, 9, using each digit at most once?

Answer Key — Combinations & Permutations

1. 16
   Each toss has 2 outcomes: $2 \times 2 \times 2 \times 2 = 16$.

2. 24
   $4 \times 6 = 24$ outfits.

3. 56
   One choice from each list: $7 \times 4 \times 2 = 56$.

4. 18
   $3 \times 6 = 18$ outfits.

5. 132
   Everything from 10 down cancels: $12 \times 11 = 132$.

6. 720
   $6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$.

7. 1680
   Everything from 4 down cancels:
   $8 \times 7 \times 6 \times 5 = 1680$.

8. 42
   Everything from 5 down cancels: $7 \times 6 = 42$.

9. 90
   $${}_{10}P_2 = \frac{10!}{8!} = 10 \times 9 = 90.$$

10. 24
    $${}_4P_3 = \frac{4!}{1!} = 4 \times 3 \times 2 = 24.$$

11. 60
    $${}_5P_3 = \frac{5!}{2!} = 5 \times 4 \times 3 = 60.$$

12. 36
    $${}_9C_2 = \frac{9!}{2!\,7!} = \frac{9 \times 8}{2 \times 1} = 36.$$

13. 84
    $${}_9C_3 = \frac{9!}{3!\,6!} = \frac{9 \times 8 \times 7}{3 \times 2 \times 1} = 84.$$

14. 15
    $${}_6C_2 = \frac{6!}{2!\,4!} = \frac{6 \times 5}{2 \times 1} = 15.$$

15. **(B) Combination — order does not matter**
    Swapping two of the chosen gives the same group, so order does not matter: a combination.

16. **(A) Permutation — order matters**
    Swapping two of the chosen gives a different result (different roles, places or order), so order matters: a permutation.

17. 6
    3 choices for the first place, 2 for the next, and so on:
    $3! = 3 \times 2 \times 1 = 6$.

18. 120
    5 choices for the first place, 4 for the next, and so on:
    $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$.

19. 720
    6 choices for the first place, 5 for the next, and so on:
    $6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$.

20. 72
    Order matters: ${}_9P_2 = 9 \times 8 = 72$.

21. 56
    Order matters: ${}_8P_2 = 8 \times 7 = 56$.

22. 210
    Order matters: ${}_{15}P_2 = 15 \times 14 = 210$.

23. 2730
    Order matters: ${}_{15}P_3 = 15 \times 14 \times 13 = 2730$.

24. 1001
    Order does not matter:
    $${}_{14}C_4 = \frac{14 \times 13 \times 12 \times 11}{4!} = \frac{24024}{24} = 1001.$$

25. 15
    Order does not matter:
    $${}_6C_4 = \frac{6 \times 5 \times 4 \times 3}{4!} = \frac{360}{24} = 15.$$

26. 126
    Order does not matter:
    $${}_9C_4 = \frac{9 \times 8 \times 7 \times 6}{4!} = \frac{3024}{24} = 126.$$

27. 165
    Order does not matter:
    $${}_{11}C_3 = \frac{11 \times 10 \times 9}{3!} = \frac{990}{6} = 165.$$

28. 182
    Home and away are different games, so order matters: ${}_{14}P_2 = 14 \times 13 = 182$.

29. 120
    Each game is a pair of teams: ${}_{16}C_2 = 120$.

30. 21
    Each line joins a pair of points: ${}_7C_2 = 21$.

31. 720

Order matters, no repeats:
${}_{10}P_3 = 10 \times 9 \times 8 = 720$.

32. 1000

Each place has 10 choices: $10^3 = 1000$.

33. 60

Order matters, no repeats: ${}_5P_3 = 5 \times 4 \times 3 = 60$.

34. 120

5 different letters: $5! = 120$.

35. 24

4 different letters: $4! = 24$.

36. 720

6 different letters: $6! = 720$.

37. 22

${}_{22}C_{21} = {}_{22}C_1 = 22$.

38. 32

Each flavour is either in or out: $2^5 = 32$. (This is also ${}_5C_0 + {}_5C_1 + \cdots + {}_5C_5$.)

39. 11

${}_nC_r = {}_nC_{n-r}$, so $k = 14 - 3 = 11$.

40. 2520

7 letters, with 2 As. Swapping identical letters changes nothing, so divide: $\dfrac{7!}{2!} = 2520$.

41. 360

6 letters, with 2 Zs. Swapping identical letters changes nothing, so divide: $\dfrac{6!}{2!} = 360$.

42. 60

6 letters, with 3 Ps and 2 Es. Swapping identical letters changes nothing, so divide: $\dfrac{6!}{3!\,2!} = 60$.

43. 4704

Choose the boys and the girls separately, then multiply: ${}_8C_3 \times {}_9C_3 = 56 \times 84 = 4704$.

44. 354

All teams minus the all-boy teams:
${}_{14}C_3 - {}_5C_3 = 364 - 10 = 354$.

45. 280

Choose the boys and the girls separately, then multiply: ${}_8C_2 \times {}_5C_2 = 28 \times 10 = 280$.

46. 1440

Bind Nora and Fay into one block: arrange 6 things in $6!$ ways, and the pair inside the block in $2!$ ways: $720 \times 2 = 1440$.

47. 12

Bind Cara and Kai into one block: arrange 3 things in $3!$ ways, and the pair inside the block in $2!$ ways: $6 \times 2 = 12$.

48. 240

Gus has 2 places; the other 5 fill the rest in $5!$ ways: $2 \times 120 = 240$.

49. 12

Last digit even: 1 choices; then 4×3 for the first two: $1 \times 4 \times 3 = 12$.

50. 6

Last digit even: 1 choices; then 3×2 for the first two: $1 \times 3 \times 2 = 6$.