

# Precalculus · Counting, Permutations, Combinations and Probability · Worksheet

Common Core S-CP.B.8, S-CP.B.9, S-MD.A.1, S-MD.A.2 · mathovore.fr

Name: \_\_\_\_\_ Date: \_\_\_\_/\_\_\_\_/\_\_\_\_ Score: \_\_\_\_\_

This precalculus counting probability worksheet gives 25 problems on counting, permutations, combinations and probability, ordered from easy to hard, with a separate answer key.

These 25 problems practice the counting principle, permutations, combinations, probability with counting, the general multiplication rule and expected value (S-CP.B.8, S-CP.B.9, S-MD.A.1, S-MD.A.2). They move from basic counts to multi-step word problems.

Write each count as a product before evaluating, and keep probabilities as exact fractions.

**Precalculus Common Core: S-CP.B.8 · S-CP.B.9 · S-MD.A.1 · S-MD.A.2**

## Precalculus Counting Probability Worksheet: problems 1-5

### Problem 1: Fundamental counting principle

Find the number of possibilities.

- Ethan can choose from 4 shirts, 3 pairs of pants and 2 pairs of shoes. How many outfits are possible?
- A sandwich shop offers 5 breads, 3 meats and 4 toppings, and a sandwich has one of each. How many sandwiches are possible?

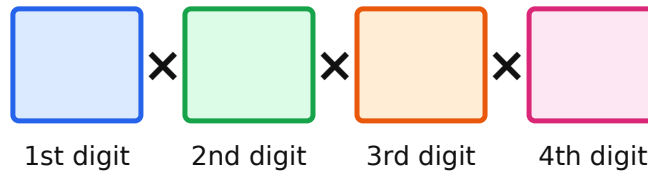
### Problem 2: Factorials

Evaluate each expression.

- $6!$
- $\frac{7!}{5!}$
- $\frac{8!}{3! 5!}$

### Problem 3: PIN codes

A phone PIN has 4 digits chosen from 0 through 9, as in the boxes below.



Four boxes, one per digit.

- a. How many PINs are possible if digits may repeat?
- b. How many PINs are possible if no digit may repeat?

### Problem 4: Permutations

Evaluate each permutation.

- a.  $8P_3$
- b.  $10P_2$

### Problem 5: Combinations

Evaluate each combination.

- a.  $10C_4$
- b.  $12C_{10}$

## Precalculus Counting Probability Worksheet: problems 6-10

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### Problem 6: Arranging letters

Find the number of distinct arrangements of all the letters in each word.

- a. MATH
- b. BANANA
- c. STATISTICS

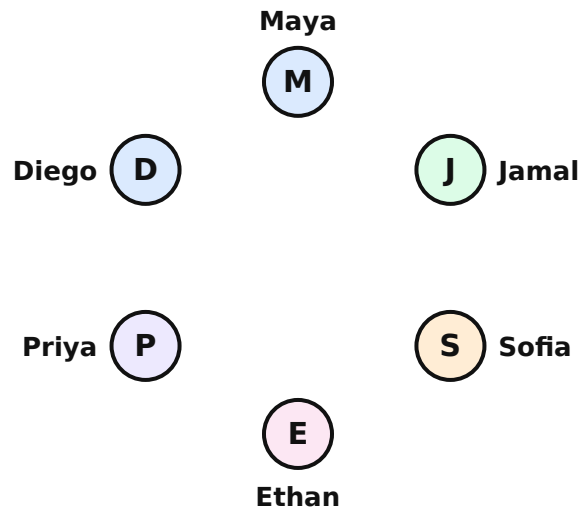
### Problem 7: Order or no order

Decide whether each situation is a permutation or a combination, then calculate.

- a. Choose 3 of 12 students to attend a conference.
- b. Award gold, silver and bronze medals among 12 runners.

### Problem 8: Handshakes

Six friends meet and each person shakes hands once with every other person.



Each pair of people shakes hands once.

How many handshakes happen?

### Problem 9: Probability with two dice

Two fair dice are rolled. The grid shows all sums.

|       |   | Die 1 |   |   |    |    |    |
|-------|---|-------|---|---|----|----|----|
|       |   | 1     | 2 | 3 | 4  | 5  | 6  |
| Die 2 | 1 | 2     | 3 | 4 | 5  | 6  | 7  |
|       | 2 | 3     | 4 | 5 | 6  | 7  | 8  |
|       | 3 | 4     | 5 | 6 | 7  | 8  | 9  |
|       | 4 | 5     | 6 | 7 | 8  | 9  | 10 |
|       | 5 | 6     | 7 | 8 | 9  | 10 | 11 |
|       | 6 | 7     | 8 | 9 | 10 | 11 | 12 |

#### The 36 equally likely sums of two dice

Each cell is one equally likely outcome.

- Find the probability that the sum is 8.
- Find the probability that the sum is at least 10.

### Problem 10: Probability with cards

Two cards are dealt from a standard 52-card deck.

- a. Find the probability that both are hearts.
- b. Find the probability that both are face cards (jack, queen or king).

## Precalculus Counting Probability Worksheet: problems 11-15

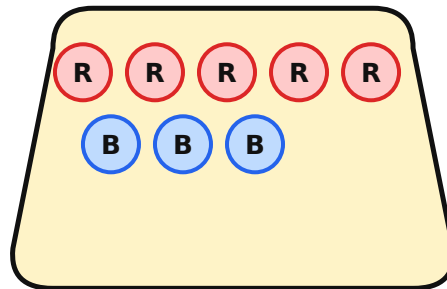
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### Problem 11: Choosing a committee

A class has 10 girls and 8 boys. Four students are chosen at random for a committee. Find the probability that all four are girls.

### Problem 12: Drawing without replacement

Two marbles are drawn, one after the other and without replacement, from the bag below.



**5 R and 3 B**

Marbles in the bag.

- a. Find the probability that both are red.
- b. Find the probability that the first is red and the second is blue.

### Problem 13: Using the multiplication rule

Use the general multiplication rule.

- a.  $P(A)=0.3$  and  $P(B|A)=0.6$ . Find  $P(A \text{ and } B)$ .
- b.  $P(A \text{ and } B)=0.24$  and  $P(A)=0.5$ . Find  $P(B|A)$ .

### Problem 14: At least one

Use the complement to find each probability.

- a. A fair coin is flipped 3 times. Find the probability of at least one head.
- b. A fair die is rolled 3 times. Find the probability of at least one six.

### Problem 15: Probability distribution

Let  $X$  be the number of heads when a fair coin is flipped 3 times. Complete the table, then

find  $E(X)$ .

| $x$        | 0 | 1 | 2 | 3 |
|------------|---|---|---|---|
| $P(X = x)$ | ? | ? | ? | ? |

## Precalculus Counting Probability Worksheet: problems 16-20

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### Problem 16: Missing probability

A random variable  $X$  has the distribution below.

| $x$        | 0   | 1   | 2   | 3   |
|------------|-----|-----|-----|-----|
| $P(X = x)$ | 0.1 | 0.3 | $p$ | 0.2 |

- Find  $p$ .
- Find  $E(X)$ .
- Find  $P(X \geq 2)$ .

### Problem 17: Free throws

Priya makes 80% of her free throws. She shoots two free throws, and the shots are independent.

- Find the probability that she makes both.
- Find the probability that she makes exactly one.
- Find the expected number of shots made.

### Problem 18: Books on a shelf

Noah arranges 5 different books on a shelf.

- How many arrangements are possible?
- How many arrangements keep two particular books next to each other?

### Problem 19: Student council

A school has 6 girls and 7 boys running for a 5-person committee.

- How many committees have exactly 2 girls and 3 boys?
- If the committee is chosen at random from all 13 students, find the probability it has exactly 2 girls and 3 boys.

### Problem 20: License plates

A state plate has 3 letters followed by 3 digits.

- How many plates are possible if letters and digits may repeat?
- How many are possible if no letter and no digit may repeat?

## Precalculus Counting Probability Worksheet: problems 21-25

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### Problem 21: Raffle

A school raffle sells 200 tickets at \$5 each. The prizes are one \$300 prize, three \$50 prizes and six \$10 prizes. Find the expected net result for a person who buys one ticket.

### Problem 22: Insurance

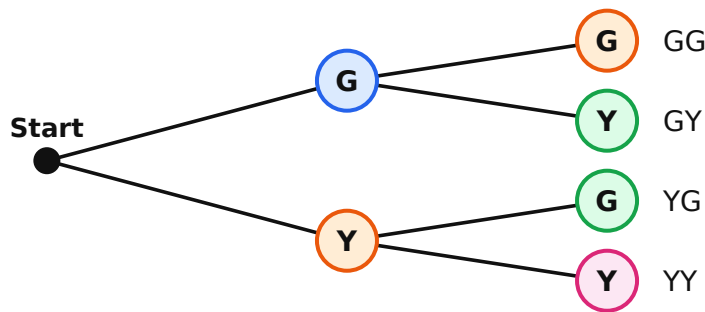
Aisha's company charges a \$250 yearly premium for a policy. There is a 2% chance a customer files a \$5,000 claim. Find the company's expected profit per policy.

### Problem 23: Five hearts

A 5-card hand is dealt from a standard deck. Find the probability that all five cards are hearts, as a fraction in lowest terms and as a decimal rounded to 6 places.

### Problem 24: Two-stage tree

Liam draws two marbles without replacement from a jar with 4 green and 6 yellow marbles. Find the probability that the two marbles are the same color.



Multiply along the branches to get the probability of each outcome.

### Problem 25: A dice game

A carnival game costs \$2.50 to play. Sofia rolls one fair die and wins \$12 for a six, \$3 for a four or five, and nothing otherwise. Find the expected net result and say whether the game favors the player.

## How to use this precalculus counting probability worksheet

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Print this precalculus counting probability worksheet as a PDF, solve every problem on paper,

then compare with the answer key.

