

Precalculus · Counting, Permutations, Combinations and Probability · Worksheet Answer Key

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

This precalculus counting probability worksheet answer key solves all 25 problems of the counting, permutations, combinations and probability worksheet step by step.

Each solution names the counting method, shows the arithmetic and gives the final answer in bold. If a count looks too large, check whether order really matters and whether items can repeat.

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

Precalculus Counting Probability Worksheet Answer Key: problems 1-5

Problem 1: Fundamental counting principle

- a. $4 \times 3 \times 2 = \mathbf{24}$ outfits
- b. $5 \times 3 \times 4 = \mathbf{60}$ sandwiches

Problem 2: Factorials

- a. $6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = \mathbf{720}$
- b. $\frac{7 \cdot 6 \cdot 5!}{5!} = 7 \cdot 6 = \mathbf{42}$
- c. $\frac{8 \cdot 7 \cdot 6}{3 \cdot 2 \cdot 1} = \frac{336}{6} = \mathbf{56}$

Problem 3: PIN codes

Fill each box with the number of choices.

$$\boxed{10} \times \boxed{9} \times \boxed{8} \times \boxed{7} = 5,040$$

1st digit 2nd digit 3rd digit 4th digit

One box per decision; multiply the number of choices.

a. $10 \cdot 10 \cdot 10 \cdot 10 = \mathbf{10,000}$

b. $10 \cdot 9 \cdot 8 \cdot 7 = \mathbf{5,040}$

Problem 4: Permutations

a. $8 \cdot 7 \cdot 6 = \mathbf{336}$

b. $10 \cdot 9 = \mathbf{90}$

Problem 5: Combinations

a. $\frac{10 \cdot 9 \cdot 8 \cdot 7}{4 \cdot 3 \cdot 2 \cdot 1} = \frac{5040}{24} = \mathbf{210}$

b. ${}_{12}C_{10} = {}_{12}C_2 = \frac{12 \cdot 11}{2} = \mathbf{66}$

Precalculus Counting Probability Worksheet Answer Key: problems 6-10

Problem 6: Arranging letters

a. $4! = \mathbf{24}$

b. 6 letters with A three times and N twice: $\frac{6!}{3! 2!} = \frac{720}{12} = \mathbf{60}$

c. 10 letters with S three times, T three times, I twice: $\frac{10!}{3! 3! 2!} = \frac{3628800}{72} = \mathbf{50,400}$

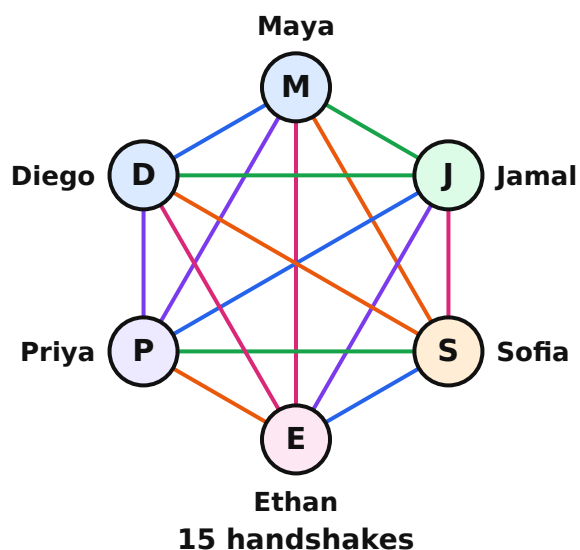
Problem 7: Order or no order

a. Order does not matter, so a combination: ${}_{12}C_3 = \frac{12 \cdot 11 \cdot 10}{6} = \mathbf{220}$

b. Order matters, so a permutation: ${}_{12}P_3 = 12 \cdot 11 \cdot 10 = \mathbf{1,320}$

Problem 8: Handshakes

Each handshake is a pair, and order does not matter: ${}_6C_2 = \frac{6 \cdot 5}{2} = 15$.



Each line joins one pair of people.

15 handshakes

Problem 9: Probability with two dice

- a. Pairs (2,6), (3,5), (4,4), (5,3), (6,2) give 5 of 36 outcomes: **5/36**
- b. Sum 10 has 3 outcomes, sum 11 has 2, sum 12 has 1, a total of 6: $\frac{6}{36} = \mathbf{1/6}$

Problem 10: Probability with cards

- a. $\frac{{}^{13}C_2}{{}^{52}C_2} = \frac{78}{1326} = \mathbf{1/17}$
- b. There are 12 face cards: $\frac{{}^{12}C_2}{{}^{52}C_2} = \frac{66}{1326} = \mathbf{11/221}$

Precalculus Counting Probability Worksheet Answer Key: problems 11-15

Problem 11: Choosing a committee

Total committees: ${}_{18}C_4 = 3060$. All girls: ${}_{10}C_4 = 210$.

$$\frac{210}{3060} = \mathbf{7/102}$$

Problem 12: Drawing without replacement

- a. $\frac{{}_5P_4}{{}_8P_4} = \frac{20}{56} = \mathbf{5/14}$
- b. $\frac{{}_5C_4}{{}_8C_4} = \mathbf{15/56}$

Problem 13: Using the multiplication rule

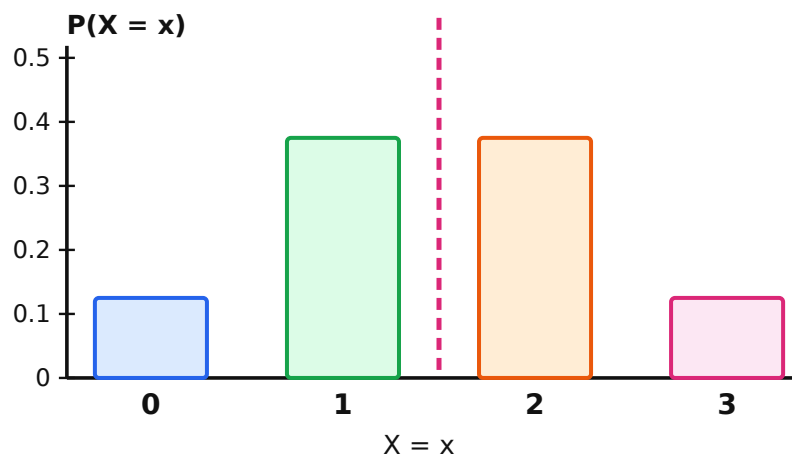
- a. $0.3 \times 0.6 = \mathbf{0.18}$
- b. $P(B|A) = \frac{0.24}{0.5} = \mathbf{0.48}$

Problem 14: At least one

- a. $1 - \left(\frac{1}{2}\right)^3 = 1 - \frac{1}{8} = \mathbf{7/8}$
- b. $1 - \left(\frac{5}{6}\right)^3 = 1 - \frac{125}{216} = \mathbf{91/216}$

Problem 15: Probability distribution

The 8 equally likely outcomes give 1, 3, 3, 1 outcomes with 0, 1, 2, 3 heads, so the probabilities are $\frac{1}{8}, \frac{3}{8}, \frac{3}{8}, \frac{1}{8}$.



Bar heights are probabilities and add to 1.

$$E(X) = 0 \cdot \frac{1}{8} + 1 \cdot \frac{3}{8} + 2 \cdot \frac{3}{8} + 3 \cdot \frac{1}{8} = \frac{12}{8} = 1.5$$

Precalculus Counting Probability Worksheet Answer Key: problems 16-20

Problem 16: Missing probability

- Probabilities sum to 1: $p = 1 - 0.1 - 0.3 - 0.2 = 0.4$
- $0(0.1) + 1(0.3) + 2(0.4) + 3(0.2) = 0.3 + 0.8 + 0.6 = 1.7$
- $0.4 + 0.2 = 0.6$

Problem 17: Free throws

- $0.8 \cdot 0.8 = 0.64$
- $2 \cdot 0.8 \cdot 0.2 = 0.32$
- $P(0) = 0.04$, so $E = 0(0.04) + 1(0.32) + 2(0.64) = 1.6$

Problem 18: Books on a shelf

- $5! = 120$
- Treat the pair as one item: $4!$ arrangements, times 2 orders inside the pair: $24 \cdot 2 = 48$

Problem 19: Student council

- ${}_6C_2 \cdot {}_7C_3 = 15 \cdot 35 = 525$
- ${}_{13}C_5 = 1287$, so $\frac{525}{1287} = 175/429$

Problem 20: License plates

- $26^3 \cdot 10^3 = 17576 \cdot 1000 = 17,576,000$
- $26 \cdot 25 \cdot 24 \cdot 10 \cdot 9 \cdot 8 = 15600 \cdot 720 = 11,232,000$

Precalculus Counting Probability Worksheet Answer Key: problems 21-25

Problem 21: Raffle

Total prize money: $300 + 3(50) + 6(10) = 510$. Expected winnings per ticket: $\frac{510}{200} = 2.55$.

Net: $2.55 - 5 = -\$2.45$ per ticket.

Problem 22: Insurance

Expected claim cost: $0.02 \cdot 5000 = 100$.

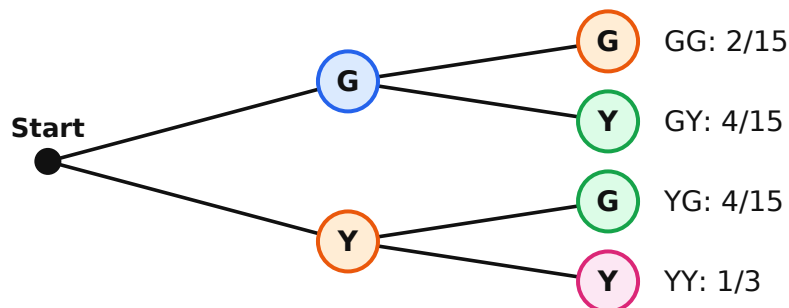
Expected profit: $250 - 100 = \$150$ per policy.

Problem 23: Five hearts

$\frac{{}_{13}C_5}{{}_{52}C_5} = \frac{1287}{2598960} = 33/66640$, which is about **0.000495**.

Problem 24: Two-stage tree

First draw: $P(G) = \frac{4}{10}$, $P(Y) = \frac{6}{10}$. After a green, 3 of 9 are green; after a yellow, 5 of 9 are yellow.



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

$$P(\text{same}) = \frac{4}{10} \cdot \frac{3}{9} + \frac{6}{10} \cdot \frac{5}{9} = \frac{12}{90} + \frac{30}{90} = \frac{42}{90} = \mathbf{7/15}$$

Problem 25: A dice game

Expected winnings: $12 \cdot \frac{1}{6} + 3 \cdot \frac{2}{6} = \frac{18}{6} = 3$.

Expected net: $3 - 2.50 = +\$0.50$. The game favors the player by 50 cents per play.

How to use this precalculus counting probability worksheet answer key

Read this precalculus counting probability worksheet answer key after trying each problem yourself, and redo any problem you missed.

