

Counting Methods and Probability Rules

Grade 12 – Precalculus math · Worksheet · Standards: S-CP.B.8, S-CP.B.9, S-MD.A.1, S-MD.A.2

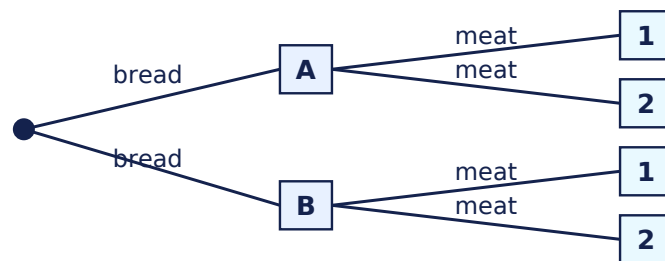
Name: _____ Date: _____ Class: _____

These problems cover the fundamental counting principle, permutations, combinations, probabilities found by counting, the general multiplication rule, and random variables with expected value (S-CP.B.8, S-CP.B.9, S-MD.A.1 and S-MD.A.2).

The last problems use passwords, committees, raffles and quality inspection.

Standards: S-CP.B.8, S-CP.B.9, S-MD.A.1, S-MD.A.2 · **Level:** Grade 12 Precalculus

Problem 1 Sandwich Shop Combinations (easy)



A smaller example: 2 breads $\times$ 2 meats = 4 sandwiches.

A deli lets customers build a sandwich from 5 breads, 4 meats and 3 cheeses, choosing one of each. How many builds are possible?

Problem 2 License Plates (easy)

A plate shows two letters and then three digits, with repeats allowed. How many different plates exist?

Problem 3 Ordered Picks (easy)

Nine sprinters compete in a final. How many different gold-silver-bronze outcomes can occur?

Problem 4 Choosing a Group (easy)

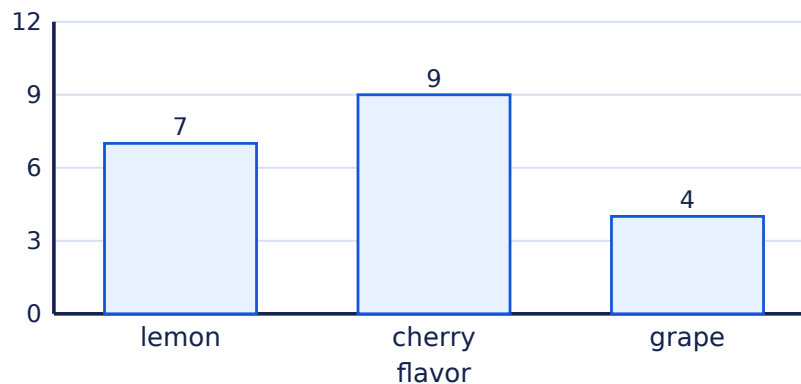
A coach picks 4 players from 10 to serve as team captains for the week. Order does not matter. How many groups can be chosen?

Problem 5 Order or Not? (easy)

A club has 12 members. (a) In how many ways can a president and a vice president be chosen?

(b) In how many ways can 2 delegates be chosen? Explain which counting method applies to each.

Problem 6 Candy Jar Probability (easy)



Probability distribution of the random variable.

A jar holds 7 lemon, 9 cherry and 4 grape candies. One candy is picked at random. Find the probability that it is (a) cherry and (b) not lemon.

Problem 7 Books on a Shelf (medium)

Six different books are placed on a shelf. (a) How many arrangements are there? (b) How many arrangements keep two particular books side by side?

Problem 8 Starting Lineups (medium)

A volleyball coach chooses 5 starters from 12 players. In how many ways can the group of starters be chosen?

Problem 9 Arranging Letters (medium)

How many different arrangements are there of all the letters of the word BANANAS?

Problem 10 All Juniors (medium)

A committee of 4 is chosen at random from 7 sophomores and 5 juniors. Find the probability that all four are juniors.

Problem 11 Two Blue Without Replacement (medium)

An urn has 5 red and 7 blue balls. Two are drawn one after the other without replacement. Find the probability that both are blue.

Problem 12 Red Then Blue (medium)

Using the same urn (5 red, 7 blue) and drawing without replacement, find the probability of drawing red first and blue second.

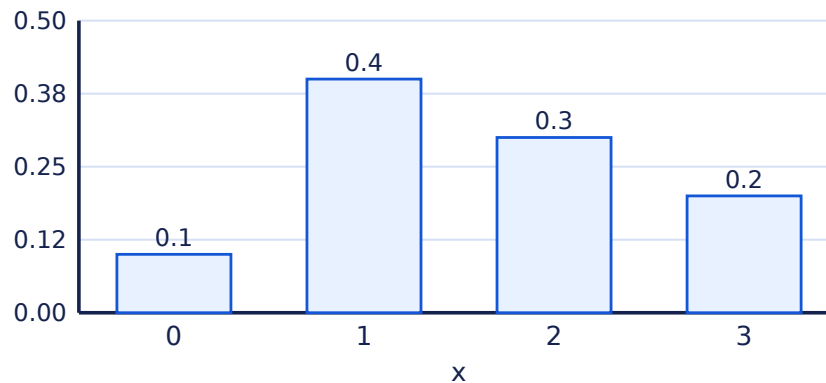
Problem 13 With or Without Replacement (medium)

Using the urn with 5 red and 7 blue balls, find the probability that both draws are blue when the first ball is replaced before the second draw. Compare with the answer without replacement.

Problem 14 Expected Value from a Table (medium)

A random variable X has the distribution below. Find $E(X)$.

x	0	1	2	3
$P(x)$	0.1	0.4	0.3	0.2



Probability distribution of the random variable.

Problem 15 Carnival Spinner (hard)

At a carnival booth, a player pays \$2 to spin. The spinner pays \$10 with probability 0.1, pays \$3 with probability 0.3, and pays nothing otherwise. Find the expected winnings per spin and the expected net gain per spin for the player.

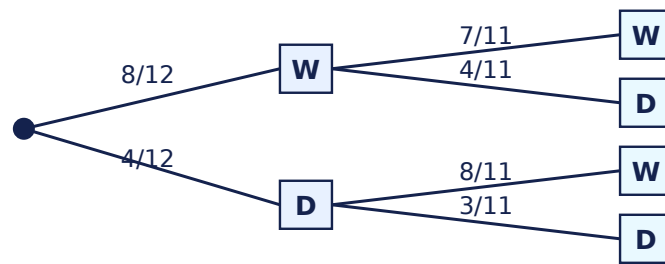
Problem 16 Password Count (hard)

A password has 4 different capital letters followed by 2 digits that may repeat. How many passwords are possible?

Problem 17 Committee with Boys (hard)

A class has 14 girls and 11 boys. A committee of 5 students is chosen at random. Find the probability that it has at least 2 boys.

Problem 18 Light Bulbs (hard)



The first two draws; the third draw continues the same pattern.

A box holds 8 working and 4 defective light bulbs. Three bulbs are drawn one at a time without replacement. Find the probability that all three work.

Problem 19 Raffle Expected Value (hard)

A raffle sells 500 tickets for \$4 each. The prizes are one \$400 prize, three \$100 prizes and ten \$20 prizes. Find the expected winnings and the expected net gain for one ticket.

Problem 20 Defective Phones (hard)

A shipment has 12 phones and 3 are defective. An inspector tests 2 phones chosen at random. Let X be the number of defective phones among the two tested. (a) Find the probability distribution of X . (b) Find $E(X)$.