

Expected Value and Smart Decisions

Grade 12 – Precalculus math · Worksheet · Standards: S-MD.A.3, S-MD.A.4, S-MD.B.5

Name: _____ Date: _____ Class: _____

These problems build probability distributions from theory and data, compute expected value, and use it to weigh decisions about insurance, warranties, raffles and games (S-MD.A.3, S-MD.A.4 and S-MD.B.5).

The last problems compare business choices and find expected profit. Always subtract the cost when finding a net gain.

Standards: S-MD.A.3, S-MD.A.4, S-MD.B.5 · **Level:** Grade 12 Precalculus

Problem 1 Valid Distributions (easy)

Decide whether each table is a valid probability distribution. Explain.

x	1	2	3	4
(a) $P(x)$	0.2	0.3	0.4	0.2
(b) $P(x)$	0.25	0.25	0.30	0.20

Problem 2 Missing Probability (easy)

A distribution has $P(0) = 0.15$, $P(1) = 0.35$, $P(3) = 0.20$, and an unknown $P(2)$. Find $P(2)$.

Problem 3 A Labeled Die (easy)

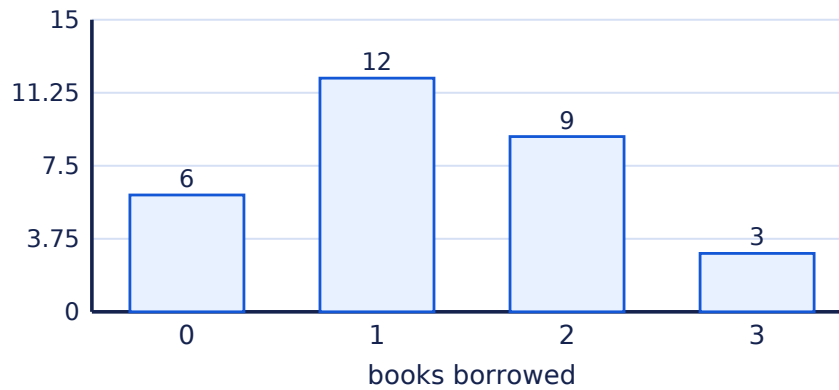
A fair cube has its six faces marked 0, 0, 1, 1, 1 and 4. Let X be the number on the top face. Write the distribution and find $E(X)$.

Problem 4 Expected Value from a Table (easy)

Find $E(X)$.

x	2	4	6	8
$P(x)$	0.4	0.3	0.2	0.1

Problem 5 Library Survey (easy)



Bar chart.

Thirty students reported how many library books they borrowed last month: 0 books (6 students), 1 book (12), 2 books (9), 3 books (3). Build the empirical distribution and find the expected number of books.

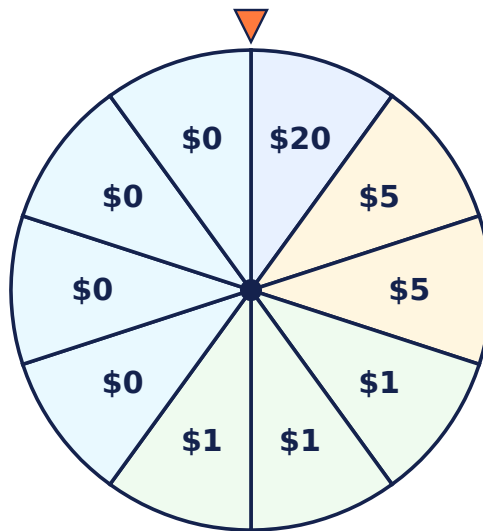
Problem 6 Is It Fair? (easy)

A player pays \$3 to play a game. With probability $\frac{1}{4}$ the player wins \$12, and otherwise wins nothing. Is the game fair?

Problem 7 School Raffle (medium)

A raffle sells 200 tickets at \$5 each. The prizes are one \$300 prize and two \$50 prizes. Find the expected winnings and the expected net gain for one ticket.

Problem 8 Ten-Sector Spinner (medium)



A 10-sector spinner.

The spinner costs \$3 per spin and pays the amount in the sector it lands on. Write the distribution of the payout and find the expected net gain per spin.

Problem 9 Free Throws (medium)

A basketball player makes 70% of free throws, and two shots are independent. Let X be the number made. Find the distribution of X and $E(X)$.

Problem 10 Insurance Policy (medium)

A policy costs \$120 per year. There is a 3% chance of a \$2,500 loss that the policy would cover. Find the expected loss without insurance and the expected net result of buying the policy.

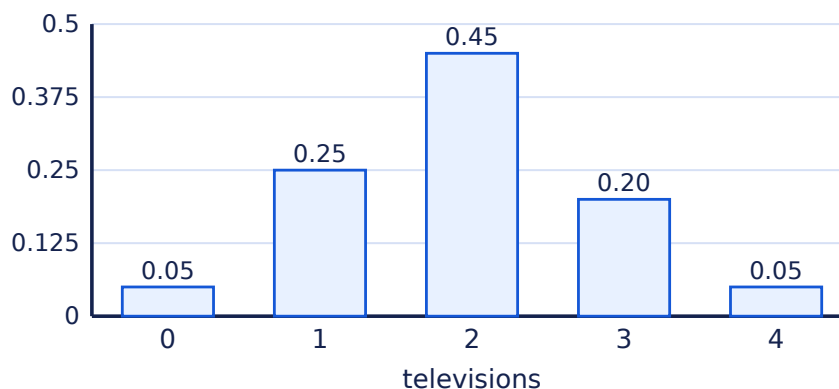
Problem 11 Speaker Warranty (medium)

A \$55 extended warranty on a speaker covers a repair that costs \$180. The chance the speaker needs that repair is 12%. Compare the warranty price with the expected repair cost.

Problem 12 Comparing Two Games (medium)

Both games cost \$2. Game A pays \$5 with probability 0.3 and nothing otherwise. Game B pays \$3 with probability 0.6 and nothing otherwise. Find the expected net gain of each and say which is better.

Problem 13 Televisions per Household (medium)



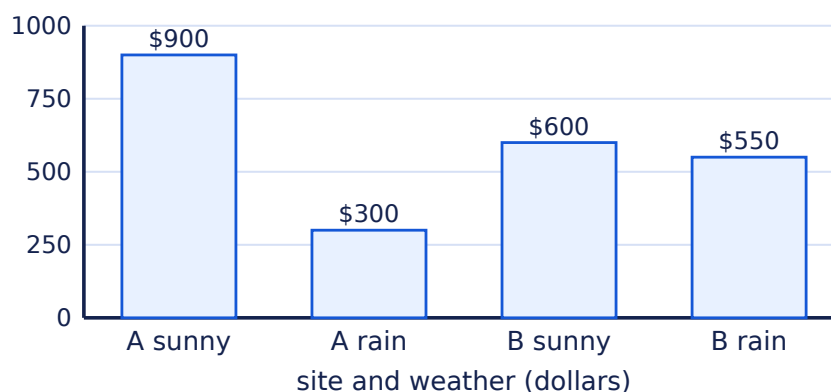
Bar chart.

The chart shows the relative frequencies from a survey of 60 households. Find the expected number of televisions per household.

Problem 14 Two Four-Sided Dice (medium)

Two fair four-sided dice (numbered 1 to 4) are rolled, and X is the sum. Write the distribution and find $E(X)$ and $P(X \geq 6)$.

Problem 15 Food Truck Location (hard)



Bar chart.

A food truck owner expects sunny weather with probability 0.6 and rain otherwise. At Park A (open air) the truck earns \$900 on a sunny day and \$300 on a rainy day. At Plaza B (covered) it earns \$600 on a sunny day and \$550 on a rainy day. Find the expected earnings at each site and recommend one.

Problem 16 Insurer's Profit (hard)

An insurer sells 5,000 policies at \$90 each. Each policy has a 2% chance of a \$3,000 claim. Find the expected claim cost per policy, the expected profit per policy and the expected total profit.

Problem 17 Guessing on a Quiz (hard)

A five-choice multiple-choice question scores +4 for a correct answer and -1 for a wrong answer. (a) Find the expected score when guessing at random. (b) After eliminating two choices, find the expected score when guessing among the other three. Should a student guess in each case?

Problem 18 Screening Parts (hard)

A factory ships parts that are defective 4% of the time. Each defective part shipped costs \$25 in refunds. Screening each part costs \$0.50 and finds every defective part. Compare the expected cost per part with and without screening and recommend an option.

Problem 19 Coin Flip Game (hard)

A game costs \$4. The player flips three fair coins and wins \$2 for each head. Write the distribution of the winnings and find the expected net gain.

Problem 20 Fundraiser Drawing (hard)

A fundraiser sells 400 tickets at \$10 each. The prizes are one \$1,000 prize, four \$150 prizes and twenty \$25 prizes. (a) Find the expected winnings and expected net gain for one ticket. (b) Find the fundraiser's profit after paying all prizes.