

Precalculus · Expected Value and Decisions · Quiz

Common Core S-MD.A.3, S-MD.A.4, S-MD.B.5 · mathovore.fr

Name: _____ Date: ____/____/____ Score: _____

Ten quick questions on probability distributions, expected value, and decisions with games, insurance, and warranties. Choose the one best answer for each. Some questions include a graph or a spinner. Use scratch paper for the products.

Precalculus Common Core: S-MD.A.3 · S-MD.A.4 · S-MD.B.5

Questions

Question 1

Which list could be a probability distribution for four values of X ?

- A. 0.2, 0.3, 0.4, 0.2
- B. 0.1, 0.4, 0.3, 0.2
- C. 0.5, 0.3, 0.4, -0.2
- D. 0.25, 0.25, 0.25, 0.15

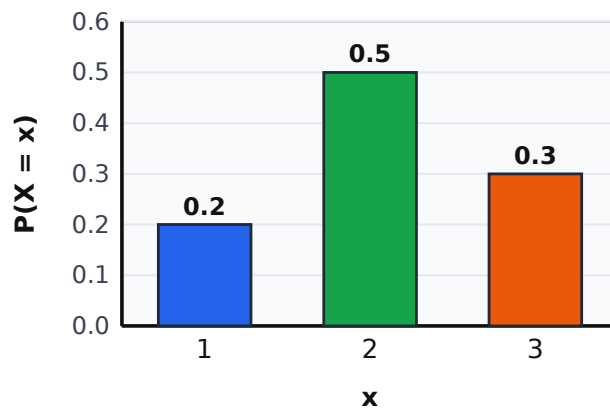
Question 2

The values 1, 2, 3 have probabilities 0.25, 0.45 and p . Find p .

- A. 0.70
- B. 0.20
- C. 0.25
- D. 0.30

Question 3

The graph shows a probability distribution. Find $E(X)$.

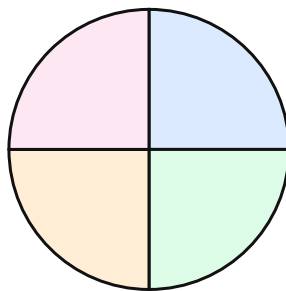


Distribution of X.

- A. 2.0
- B. 2.1
- C. 6.0
- D. 3.0

Question 4

A spinner has four equal sections. Find the expected prize.



Prizes on the spinner.

- A. .00
- B. .33
- C. .00
- D. .00

Question 5

Maya pays to roll a fair die once and wins as many dollars as the number rolled. What price makes the game fair?

- A. .00
- B. .00
- C. .00

D. .50

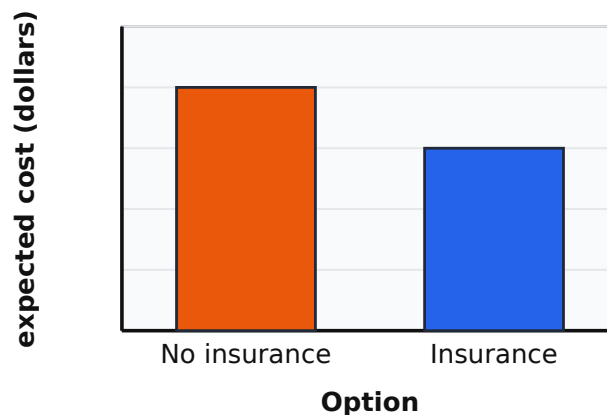
Question 6

A game costs to play and has an expected payout of .60. What is the expected net result per play?

- A. +\$0.40
- B. −\$0.40
- C. \$1.60
- D. −\$3.60

Question 7

A 0 item has a 10% chance of being lost this year. Insurance costs . The graph compares the expected cost of each option. Which is cheaper by expected value?



Expected cost of each option.

- A. Insurance, by
- B. No insurance, by
- C. Insurance, by
- D. They cost the same

Question 8

In 40 games a player scored 0 goals in 6 games, 1 goal in 14 games, and 2 goals in 20 games. What is the expected number of goals per game?

- A. 1.00
- B. 0.65
- C. 54
- D. 1.35

Question 9

An insurer charges 0 per policy. The chance of a ,000 claim is 1%. What is the expected profit

per policy?

- A. 0
- B. 0
- C. 0
- D. $-\$29,500$

Question 10

A warranty covers a 0 repair. At what repair probability do the warranty and the expected repair cost match?

- A. 60%
- B. 5%
- C. 20%
- D. 30%

Answer key

1. **B** - The correct list adds to 1 with no negative value. The others add to 1.1, include a negative probability, or add to only 0.9.
2. **D** - The probabilities must add to 1, so $p = 1 - 0.25 - 0.45 = 0.30$. Adding the two given values gives 0.70, which is a common slip.
3. **B** - $E = 1(0.2) + 2(0.5) + 3(0.3) = 0.2 + 1.0 + 0.9 = 2.1$. Averaging the values 1, 2, 3 gives 2.0 and ignores the probabilities.
4. **A** - $E = \frac{0+2+2+8}{4} = 3$. Averaging only the three different prizes gives .33, and adding all prizes gives .
5. **D** - The expected winnings are $\frac{1+2+3+4+5+6}{6} = 3.5$. A fair price equals that expected value.
6. **B** - Net = expected payout minus cost = $1.60 - 2 = -0.40$. Forgetting the cost gives .60, and reversing the subtraction gives +.40.
7. **A** - The expected loss without insurance is $0.10(200) = 20$, which is more than the premium.
8. **D** - $E = \frac{0(6) + 1(14) + 2(20)}{40} = \frac{54}{40} = 1.35$. Swapping the frequencies gives 0.65, and forgetting to divide by 40 gives 54.
9. **C** - The expected payout is $0.01(30000) = 300$, so the expected profit is $500 - 300 = 200$ dollars. Subtracting the full claim would ignore the 1% chance.
10. **C** - Solve $p(300) = 60$ to get $p = 0.20$. Using $\frac{300}{60}$ or the numbers themselves gives wrong values.

Remember:

- In a probability distribution, every probability is between 0 and 1 and the total is exactly 1.
- Theoretical probabilities come from equally likely outcomes; empirical probabilities are relative frequencies from data.
- Expected value = sum of (value times probability); it need not be a possible outcome.
- A game is fair when its expected net result is 0; negative means a long-run loss for the player.
- To choose between options, compare expected values and also consider the risk of a large loss.