

Precalculus · Expected Value and Decisions · Worksheet Answer Key

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

This precalculus expected value worksheet answer key solves all 24 problems of the expected value and decisions worksheet step by step.

Every solution below shows the table of values and probabilities, each product, and the final sum, with the answer in bold. Check that the probabilities add to 1 before computing, and compare your decisions with the reasoning given for each option.

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

Precalculus Expected Value Worksheet Answer Key: problems 1-5

Problem 1: Valid distributions

- a. The sum is $0.20+0.35+0.15+0.30=1.00$ and every value is between 0 and 1. **Valid.**
- b. The sum is 1.10, which is greater than 1. **Not valid.**
- c. One probability is negative (-0.10). **Not valid**, even though the sum is 1.
- d. $\frac{2}{8}+\frac{4}{8}+\frac{1}{8}+\frac{1}{8}=\frac{8}{8}=1$. **Valid.**

Problem 2: Find the missing probability

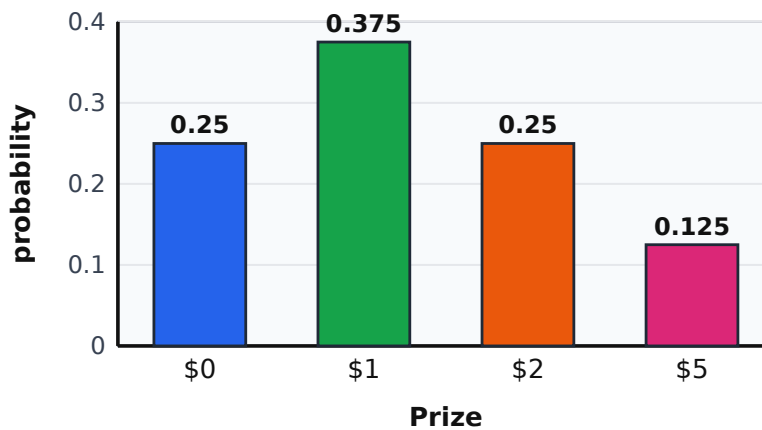
- a. $P(3)=1-0.10-0.30-0.20=0.40$. $P(3)=0.40$
- b. $P(X \geq 3)=P(3)+P(4)=0.40+0.20=0.60$. 0.60

Problem 3: Distribution for three coin flips

- a. HHH, HHT, HTH, THH, HTT, THT, TTH, TTT.
- b. Count heads: $X=0$ once, $X=1$ three times, $X=2$ three times, $X=3$ once. So $P(0)=\frac{1}{8}$, $P(1)=\frac{3}{8}$, $P(2)=\frac{3}{8}$, $P(3)=\frac{1}{8}$ (sum $\frac{8}{8}=1$).
- c. $P(X \geq 2)=\frac{3}{8}+\frac{1}{8}=\frac{4}{8}=\frac{1}{2}$. $\frac{1}{2}$

Problem 4: Spinner prize distribution

- a. Count sections: \$0 appears 2 times, \$1 appears 3 times, \$2 appears 2 times, \$5 appears 1 time. So $P(0)=\frac{2}{8}=0.25$, $P(1)=\frac{3}{8}=0.375$, $P(2)=\frac{2}{8}=0.25$, $P(5)=\frac{1}{8}=0.125$. The total is 1.
- b. $E=0(0.25)+1(0.375)+2(0.25)+5(0.125)=0+0.375+0.5+0.625=1.5$. **The expected prize is \$1.50.**



The distribution found in part (a).

Problem 5: Empirical distribution from a survey

- Divide each count by 40: $P(0) = \frac{8}{40} = 0.20$, $P(1) = \frac{16}{40} = 0.40$, $P(2) = \frac{10}{40} = 0.25$, $P(3) = \frac{6}{40} = 0.15$. They add to 1.
- $P(X \geq 2) = 0.25 + 0.15 = 0.40$. 0.40

Precalculus Expected Value Worksheet Answer Key: problems 6-10

Problem 6: Expected value from a table

$$E(X) = 0(0.20) + 1(0.40) + 2(0.25) + 3(0.15) = 0 + 0.40 + 0.50 + 0.45 = 1.35.$$

$E(X) = 1.35$. In a large group of students chosen this way, the average number of siblings is about 1.35, although no student has exactly 1.35 siblings.

Problem 7: Fair die and unfair die

- $E = \frac{1+2+3+4+5+6}{6} = \frac{21}{6} = 3.5$. 3.5
- The probabilities are $P(1) = \frac{2}{6}$, $P(2) = \frac{1}{6}$, $P(3) = \frac{2}{6}$, $P(6) = \frac{1}{6}$.
 $E = \frac{2(1)+1(2)+2(3)+1(6)}{6} = \frac{16}{6} = \frac{8}{3} \approx 2.67$. $\frac{8}{3}$

Problem 8: Raffle tickets

- Total prizes: $50 + 3(10) = 80$ dollars over 200 tickets. $E = \frac{80}{200} = 0.40$. **\$0.40**
- $0.40 - 1 = -0.60$. **A loss of \$0.60 per ticket.**
- $25(-0.60) = -15$. **A loss of \$15.**

Problem 9: Farmers market stall

- The probabilities add to 1.
 $E = 0(0.10) + 1(0.20) + 2(0.35) + 3(0.25) + 4(0.10) = 0 + 0.20 + 0.70 + 0.75 + 0.40 = 2.05$. **2.05 crates**
- $2.05 \times 12 = 24.60$. **\$24.60 per hour**

Problem 10: Bike insurance

- $E = 0.05(400) + 0.95(0) = 20$. **\$20**
- The insurance costs \$25, which is \$5 more than the expected loss. By expected value, skipping the insurance is better by \$5.
- Losing \$400 at once might be hard to afford, so some people pay a little extra to avoid that risk.

Precalculus Expected Value Worksheet Answer Key: problems 11-15

Problem 11: Is the dice game fair?

- Expected winnings: 3.5. Net: $3.5 - 4 = -0.5$. **A loss of \$0.50 per game.**
- The game is fair when the fee equals the expected winnings. **\$3.50**

Problem 12: Fair price of a game

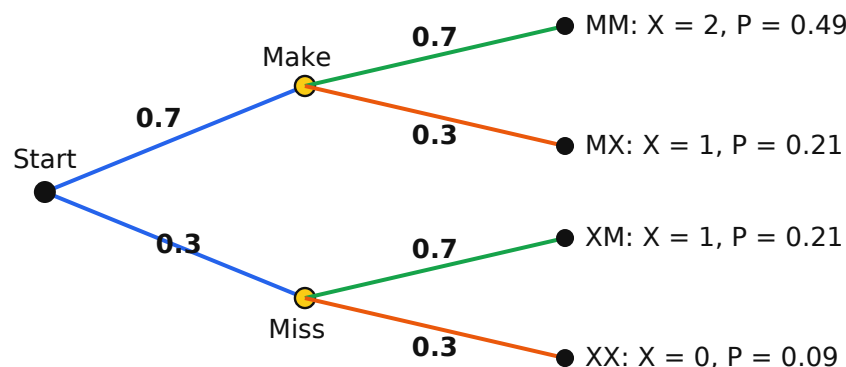
- $1 - 0.1 - 0.4 = 0.5$. 0.5
- $E = 10(0.1) + 2(0.4) + 0(0.5) = 1 + 0.8 = 1.8$. **\$1.80**

Problem 13: Betting on a roulette wheel

- $E = 35\left(\frac{1}{38}\right) + (-1)\left(\frac{37}{38}\right) = \frac{35-37}{38} = -\frac{2}{38} = -\frac{1}{19} \approx -0.053$. **About a \$0.053 loss per bet.**
- $1000 \times \frac{1}{19} \approx 52.63$. **An expected loss of about \$52.63.**

Problem 14: Two free throws

- Multiply along the branches: MM: $0.7 \times 0.7 = 0.49$; Make then Miss: $0.7 \times 0.3 = 0.21$; Miss then Make: $0.3 \times 0.7 = 0.21$; Miss, Miss: $0.3 \times 0.3 = 0.09$.
- $P(0) = 0.09$, $P(1) = 0.21 + 0.21 = 0.42$, $P(2) = 0.49$. The total is 1.
- $E = 0(0.09) + 1(0.42) + 2(0.49) = 0.42 + 0.98 = 1.40$. **1.4 made shots** (which equals 2×0.7).



The same tree with the end probabilities filled in.

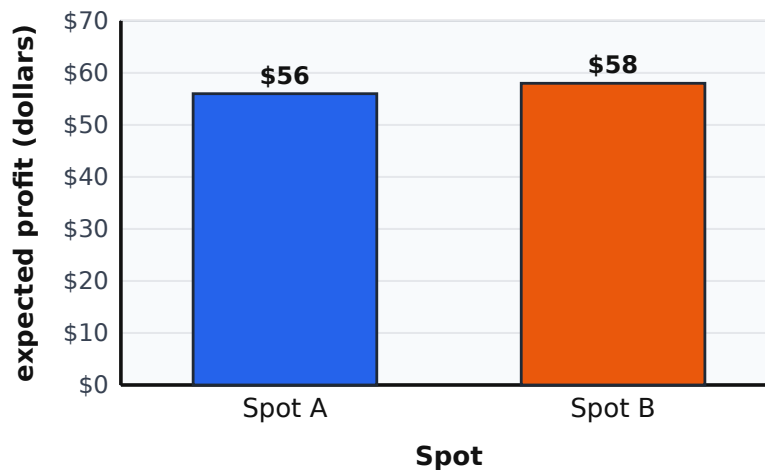
Problem 15: Guessing on a quiz

- a. $E = \frac{1}{4}(4) + \frac{3}{4}(-1) = 1 - 0.75 = 0.25$. **0.25 points**
- b. Let the penalty be p . $\frac{1}{4}(4) - \frac{3}{4}p = 0$, so $1 = \frac{3}{4}p$ and $p = \frac{4}{3}$. **A penalty of $\frac{4}{3}$ points.**

Precalculus Expected Value Worksheet Answer Key: problems 16-20

Problem 16: Choosing a lemonade stand spot

- a. Spot A: $0.6(80) + 0.4(20) = 48 + 8 = 56$. Spot B: $0.6(70) + 0.4(40) = 42 + 16 = 58$.
- b. **Spot B**, because \$58 is greater than \$56. Spot B also has the smaller gap between its best and worst day (\$30 versus \$60).



Expected profit at each spot.

Problem 17: Tablet warranty

- a. $0.12(250) = 30$. **\$30**
- b. No. The warranty costs \$50, which is \$20 more than the expected repair cost.
- c. Solve $p(250) = 50$: $p = \frac{50}{250} = 0.20$. **20%**

Problem 18: Laptop warranty break-even

- a. $0.18(600) = 108$. The warranty costs \$12 more than the expected repair cost.
- b. $p(600) = 120$ gives $p = \frac{120}{600} = 0.20$. **20%**
- c. $0.18(900) = 162$, which is more than \$120. **Yes**, the expected loss is \$42 greater than the warranty price.

Problem 19: Insurance company profit

- a. $0.01(25000) = 250$. **\$250**
- b. $450 - 250 = 200$. **\$200**
- c. $10000 \times 200 = 2000000$. **\$2,000,000**

Problem 20: School fundraiser lottery

- a. Total prizes: $400+4(50)+10(10)=700$. $E = \frac{700}{300} \approx 2.33$. **\$2.33**
- b. $2.33-5 \approx -2.67$. **About a \$2.67 loss per ticket.**
- c. Ticket sales: $300 \times 5 = 1500$. $1500-700=800$. **\$800**

Precalculus Expected Value Worksheet Answer Key: problems 21-24

Problem 21: Empirical versus theoretical

- a. $E = \frac{1+2+3+4}{4} = 2.5$. **2.5**
- b. $\frac{11(1)+14(2)+12(3)+13(4)}{50} = \frac{11+28+36+52}{50} = \frac{127}{50} = 2.54$. **2.54**
- c. The empirical result comes from only 50 spins and varies by chance. With many more spins, the mean should settle near 2.5.

Problem 22: Drawing two marbles

- a. There are 10 equally likely pairs. Both blue: 1 pair, so $P(0) = \frac{1}{10}$. One of each: $3 \times 2 = 6$ pairs, so $P(1) = \frac{6}{10}$. Both red: 3 pairs, so $P(2) = \frac{3}{10}$. The total is 1.
- b. $E = 0\left(\frac{1}{10}\right) + 1\left(\frac{6}{10}\right) + 2\left(\frac{3}{10}\right) = \frac{12}{10} = 1.2$. **1.2 red marbles**

Problem 23: A risky investment

- a. $E = 0.30(40000) + 0.50(5000) + 0.20(-10000) = 12000 + 2500 - 2000 = 12500$. **\$12,500**
- b. $12500 - 3000 = 9500$. The project has an expected gain \$9,500 greater than the savings plan.
- c. There is a 20% chance of losing \$10,000, while the savings plan has no chance of a loss.

Problem 24: Food truck decision

- a. Net results: $900-200=700$, $500-200=300$, $200-200=0$.
 $E = 0.4(700) + 0.4(300) + 0.2(0) = 280 + 120 + 0 = 400$. **\$400**
- b. The regular spot nets \$350, so the festival is better by $400-350=50$ dollars on average.
- c. 0.2, the chance of the \$200 revenue.



Expected net result of each option.

How to use this precalculus expected value worksheet answer key

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

