

Assignment: Probability :

Odds Vs Probability & Expected Value

Name: _____ **SOLUTION** _____ Section: MCU504-_____

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Short answers: Each sub-questions for each question is worth zero or 2 marks

1. One jar contains 5 red marbles and 3 blue marbles. A second jar contains 2 red and 4 blue marbles. You randomly pick one marble from each jar.

a) What is the probability of picking 2 red marbles? $\frac{5}{8} \times \frac{2}{6}$ answer $\rightarrow \frac{10}{48}$ Or $\frac{5}{24}$

b) What is the probability of picking 2 blue marbles? $\frac{3}{8} \times \frac{4}{6}$ answer $\rightarrow \frac{12}{48}$ Or $\frac{1}{4}$

c) What are the odds against picking 2 red marbles? answer $\rightarrow 38:10$ or $19:5$

d) What are the odds against picking 2 blue marbles? answer $\rightarrow 36:12$ or $3:1$

e) What are the odds of getting a blue then a red marbles? $\frac{3}{8} \times \frac{2}{6}$ answer $\rightarrow 6:42$ or $2:1$ or $1:7$

Probability (blue and red) = $\frac{3}{8} \times \frac{2}{6} = \frac{6}{48}$ or $\frac{2}{16}$

2. There are 21 students in Mr. Roberts's class. 8 are girls and the rest are boys. The Principal removed two students randomly out of the class to help out for the school concert.

a) What is the probability of picking two girls? $\frac{8}{21} \times \frac{7}{20}$ answer $\rightarrow \frac{56}{420}$ Or $\frac{14}{105}$ Or $\frac{2}{15}$

b) What are the odds for picking two boys? $\frac{13}{21} \times \frac{12}{20}$ answer $\rightarrow 156:264$ or $39:66$ or $13:22$

$$\text{Probability (boy and boy)} = \frac{13}{21} \times \frac{12}{20} = \frac{156}{420} \text{ Or } \frac{39}{105}$$

c) What are the odds of picking "a boy then a girl"? answer $\rightarrow 104:316$ or $26:79$
(use results from e))

d) What are the odds for picking two girls? answer $\rightarrow 56:364$ or $14:91$ or $2:13$

e) What is the probability of picking "a boy then a girl"? $\frac{13}{21} \times \frac{8}{20}$ answer $\rightarrow \frac{104}{420}$ Or $\frac{26}{105}$

Long answers: Each question is worth 10 marks. Show detailed and clear answer

3. A game involves drawing cubes of the same size but different colors from a box. There are 6 red cubes, 3 yellow cubes and 1 blue cube. If you draw a:

- RED cube you lose \$5
- YELLOW cube, you win nothing
- BLUE cube you win \$15

Mélanie claims that this game is in the player's advantage. Is Mélanie's statement correct? Explain. (10 marks)

Solution:

$$E.V. = \frac{6}{10}(-5) + \frac{3}{10}(0) + \frac{1}{10}(15)$$

$$E.V. = \frac{-30}{10} + 0 + \frac{15}{10}$$

$$E.V. = \frac{-15}{10}$$

$$E.V. = -1.5$$

The Expected Value (E.V.) is negative. Therefore, Mélanie's claim is not correct. A negative expected value is not in the player's advantage.

4. A wheel is divided into four sections. Players bet \$3 and spin the wheel. The bet is not returned.

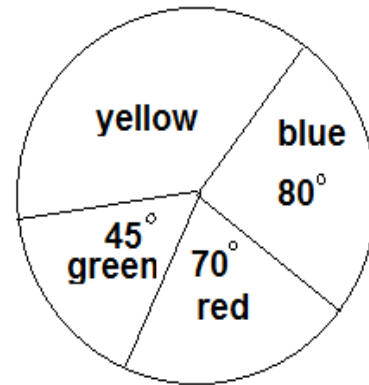
If the wheel lands on yellow, you win nothing.

If the wheel lands on red, you win \$5.

If the wheel lands on blue, you win \$3.

If the wheel lands on green, you win a certain amount of money.

If the game is fair, how much should you win if the wheel lands on green? (10 marks)



Solution:

The angle of the yellow region is $360 - (45 + 70 + 80) = 165^\circ$

The game is fair \rightarrow Expected Value = 0

$$E.V. = \frac{165}{360}(0-3) + \frac{70}{360}(5-3) + \frac{80}{360}(3-3) + \frac{45}{360}(x-3) = 0$$

$$E.V. = \frac{-495}{360} + \frac{140}{360} + \frac{0}{360} + \frac{45x-135}{360} = 0$$

Multiply by 360 on both sides to remove the denominators

$$\rightarrow E.V. = -495 + 140 + 45x - 135 = 360(0) = 0$$

$$\rightarrow -490 + 45x = 0 \rightarrow 45x = 490$$

$$\rightarrow x = \frac{490}{45} \text{ or } x = 10.89$$

Conclusion:

You win \$10.89 if the wheel lands on green. You receive

(\$10.89 - \$3) or \$7.89 in profit.

5. A game consists of rolling two six-sided dice. A bet of \$2 must be paid before playing.
If you roll and obtain two identical odd numbers you win \$10.
If you roll and obtain two identical even numbers you win a certain amount
If you roll any other pairs of numbers, you win nothing.
The game is fair.

Tim decided to play and rolls a pair (4, 4). How much will Tim win? (10 marks)

Solution:

$$E.V. = \frac{3}{36}(10-2) + \frac{3}{36}(x - 2) + \frac{30}{36}(0-2) = 0$$

$$E.V. = \frac{24}{36} + \frac{3x-6}{36} + \frac{-60}{36} = 0$$

By multiplying by 36 on every term we can write:

$$\rightarrow 24 + 3x - 6 - 60 = 0$$

$$\rightarrow -42 + 3x = 0$$

$$\rightarrow 3x = 42$$

$$\rightarrow x = 14$$

Conclusion:

Tim wins \$14 rolling (4, 4). He receives \$14 -\$2 Or \$12.