October 02, 2012

Math 30-2: U3L2 Teacher Notes

Probability and Odds

Key Math Learnings:

By the end of this lesson, you will learn the following concepts:

- Interpret and assess the validity of odds and probability statements

What are Odds?

Odds is the ratio that compares the number of favorable outcomes of an event to the number of unfavorable outcomes.

Odds in favor can be describe as a ratio in two different ways:

- **the probability that an event will occur ： the probability that the event will not occur**
  - **the number of favorable outcomes： the number of unfavorable outcomes**

It can also be written in fraction form and set notation form.

$$P(A):P(A') \text{ or } \frac{P(A)}{P(A')}$$

Odds Against

The odds against an event A occuring are given by

the probability that an event will not occur ： the probability that the event will occur

the number of unfavorable outcomes： the number of favorable outcomes

It can also be written in fraction form and set notation form.

$$P(A'): P(A) \ \ or \ \ \frac{P(A')}{P(A)}$$

Click here to watch a video on Calculating Odds and Probability

Click here to watch a video on Calculating Odds of an Event

What is the Difference Between Odds and Probability

The difference between odds and probability is this:

- Probability is based on favourable outcomes in relation to the total number of possible outcomes.
- Odds are based on the favourable outcomes forîin relation to unfavourable outcomes against.

Click here to watch a video on The Difference Between Odds and Probability

For Example:

If the probability of winning is 7/15, then the odds of winning is _____?

Solution:

The numerator is the same which is 7.

The denominator is: 15 - 7 = 8.

The answer is $^{7}/_{8}$.

For Example:

If the odds of winning is 6/7 then the probability of winning is _____?

Solution:

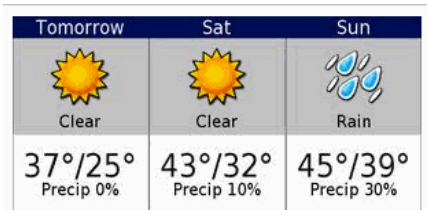
The numerator is the same which is 6.

The denominator is: 6 + 7 = 13.

The answer is $^{6}/_{13}$.

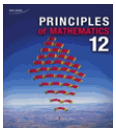
Where do we Find Odds and Why are they Important?

Many probabilities and odds are based on actual data and not just some number pulled out of thin air. Weather forecasts and cancer survival rates are some examples where the probabilities and the odds are calculated based on real information. These odds and probabilities are assessed and then used to make decisions for upcoming events.



Probability and odds can be used to make decisions that may have a significant impact on an event. For example, imagine that game 7 of the Stanley Cup final will be decided by a shootout after a five-minute overtime period. Imagine the pressure on the coach to make the right decision about which players to choose for the shootout.

Read Example 4 on pages 145 and 146 of your textbook. This is a good example of making a decision based on odds and probability to try to win a hockey game but not game 7 of the Stanley Cup! The information that the coach has to work with is based on real data and, therefore, the calculation of the odds and probability would be valid.



Practice Problem:

Complete “Check your Understanding” question 5 on page 148 of your textbook.

Solution:

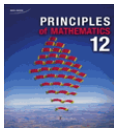
5. Let S represent two students in Mario's class sharing a birthday.

$$P(S) = \frac{7}{7+3}$$

$$P(S) = \frac{7}{10}$$

$$P(S) = 0.7$$

The probability two students share a birthday is 0.7.



Practice Problem:

Complete "Check your Understanding" question 6 on page 148 of your textbook.

Solution:

6. Let C represent Jamia climbing to the top.

a) $P(C) = \frac{12}{24}$

$P(C) = \frac{1}{2}$

The probability Jamia will make it to the top is $\frac{1}{2}$, or 0.5.

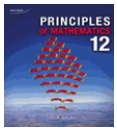
b) $P(C') = \frac{24 - 12}{24}$

$P(C') = \frac{12}{24}$

$P(C') = \frac{1}{2}$

The odds against Jamia making it to the top are 12 : 12, or 1 : 1.

c) e.g., The odds against and the odds in favour are both 1 : 1.

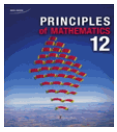


Practice Problem:

Complete “Check your Understanding” question 8 on page 148 of your textbook.

Solution:

8. If Allan has an 8% chance of having red-green colourblindness, then he has a 92% chance of not having red-green colourblindness. Therefore, the odds in favour of Allan having red-green colourblindness are 8 : 92, or 2 : 23

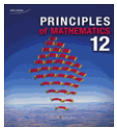


Practice Problem:

Complete “Check your Understanding” question 9 on page 149 of your textbook.

Solution:

9. If Katherine had scored 4 times out of 20, then she had not scored 16 times out of 20. Therefore, the odds in favour are 4:16, or 1:4. This can be written as 1 to 4. The probability of her scoring is 4 in 20, or 1 : 5. Therefore, Katherine is not correct.



Practice Problem:

Complete “Check your Understanding” question 11 on page 149 of your textbook.

Solution:

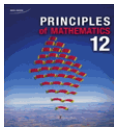
11. Let S represent a person between the ages of 18 and 35 who uses social networking.

$$P(S) = \frac{31}{(31+19)}$$

$$P(S) = \frac{31}{50}$$

$$P(S) = 0.62$$

The probability that a person between the ages of 18 and 35 uses a social networking site is 0.62.



Practice Problem:

Complete “Check your Understanding” question 12 on page 149 of your textbook.

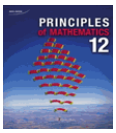
Solution:

12. Let W represent a win, let L represent a loss, and let T represent a tie.

$$P(W)=\frac{3}{3+2} \qquad P(L)=\frac{1}{1+4} \qquad P(T)=\frac{1}{1+4}$$

$$P(W)=\frac{3}{5} \qquad P(L)=\frac{1}{5} \qquad P(T)=\frac{1}{5}$$

The probability of a win is 3 in 5 (60%), the probability of a loss is 1 in 5 (20%), and the probability of a tie is 1 in 5 (20%). The probabilities add up to 100%.



Practice Problem:

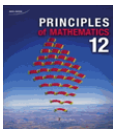
Complete “Check your Understanding” question 15 on page 149 of your textbook.

Solution:

a. odds in favour of scoring a touchdown = 5 : 7

odds in favour of scoring a field goal = 5 : 1

b. The coach should choose the field-goal option. The odds in favour of scoring a field goal are higher than the odds in favour of scoring a touchdown.



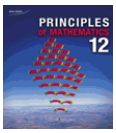
Practice Problem:

Complete “Check your Understanding” question 16 on page 149 of your textbook.

Solution:

16. a) The odds in favour of Eduard winning are 45 : (100 – 45).This is equal to 45 : 55, or 9 : 11. The odds in favour of Julie winning are 35 : (100 – 35). This is equal to 35 : 65, or 7 : 13. The odds in favour of Bill winning are 20 : (100 – 20). This is equal to 20 : 80, or 1 : 4.

b) If Bill’s 20% support goes to Julie, then her support will now be 55%, and the odds in favour of Julie winning will be the same as the odds against Edie winning. So, the odds in favour of Julie winning are 11 : 9.



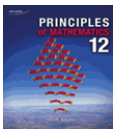
Practice Problem:

Complete “Check your Understanding” question 17 on page 150 of your textbook.

Solution:

a. He should buy the practice exams, because they will help to better prepare him and lower the probability of failing the test, which is 45%.

b. If the odds in favour of passing are 17 : 4, then the probability of failing the test is only about 19%, which means he likely does not need the practice exams. However, if the odds in favour of passing are 3 : 7, the probability of failing the test is 70%, so he should buy the practice exams.



Practice Problem:

Complete "Check your Understanding" question 18 on page 150 of your textbook.

Solution:

18. a) e.g., If the odds for an event are $m : n$, then

$P(A) = \frac{m}{m+n}$ and $P(A') = \frac{n}{m+n}$, so

$P(A') : P(A) = \frac{n}{m+n} : \frac{m}{m+n}$. This ratio is equal to $n : m$.

b) e.g., The probability of the event happening is $\frac{a}{a+b}$.

If the odds in favour of rain tomorrow are 2 : 3, then the probability is $\frac{2}{2+3} = \frac{2}{5}$, or 40%.

c) e.g., The odds against the event happening are $c - a : a$. If the probability of winning the lottery is $\frac{1}{1\,000\,000}$, the odds against are 999 999 : 1.