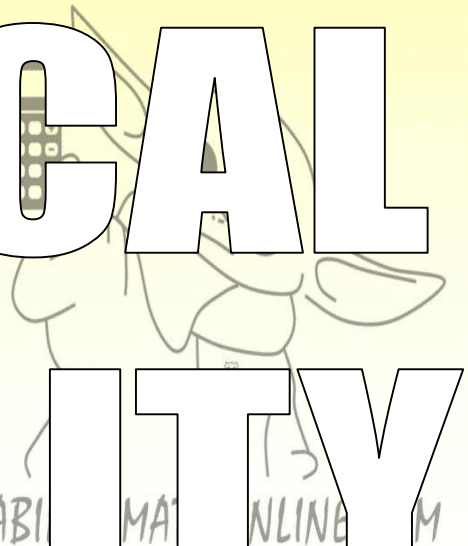
ST. JEAN DE BREBEUF MATHEMATICS

CHAPTER 2.2

THEORETICAL PROBABILITY



CHAPTER 2.2 THEORETICAL PROBABILITY

KEY CONCEPTS

Theoretical probability is another measure of the likelihood of an event.
→It is the ratio of the **number of successful outcomes** and the **total number of possible outcomes**.

$$Theoretical\ probability = \frac{\#of\ successful outcomes}{Total\ possible \#of\ outcomes}$$

where all outcomes are **equally likely**

"Equally likely" means the same chance of occurring because the conditions are fair.

For example, in the toss of a fair coin, the chances of getting heads or tails are equally likely.

The probability of an event is a value between **0 and 1**

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CHAPTER 2.2 THEORETICAL PROBABILITY

EXAMPLE *Deck of Cards*

*There are **13 hearts***

*There are **4 aces** in total*

*There are **52 cards** in total*

If one card is drawn from the deck, find the probability of each event.

(a) a **heart**

$$P(heart) = \frac{\#\,of\ successful outcomes}{Total\ possible \#\,of\ outcomes}$$

$$P(heart) = \frac{13}{52}$$

$$P(heart) = \frac{1}{4}, 0.25 or\ 25\%$$

(b) an **ace**

$$P(ace) = \frac{\#\,of\ successful outcomes}{Total\ possible \#\,of\ outcomes}$$

$$P(ace) = \frac{4}{52}$$

$$P(ace) = \frac{1}{13}, 0.08 or\ 8\%$$

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CHAPTER 2.2 THEORETICAL PROBABILITY

EXAMPLE *Deck of Cards*

If one card is drawn from the deck, find the probability of each event.

(c) a heart, a club, or a jack **(do not count Jack of Hearts or Jack of Clubs** since they are already included)

$$P(heart, club, jack) = \frac{\#\ of\ successful outcomes}{Total\ possible \#\ of\ outcomes}$$

$$P(heart, club, jack) = \frac{13+13+2}{52}$$

$$P(heart, club, jack) = \frac{28}{52}$$

$$P(heart, club, jack) = \frac{7}{13}, 0.538 or 53.8\%$$

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CHAPTER 2.2 THEORETICAL PROBABILITY

EXAMPLE *Deck of Cards*

*There are **52 cards** in total*

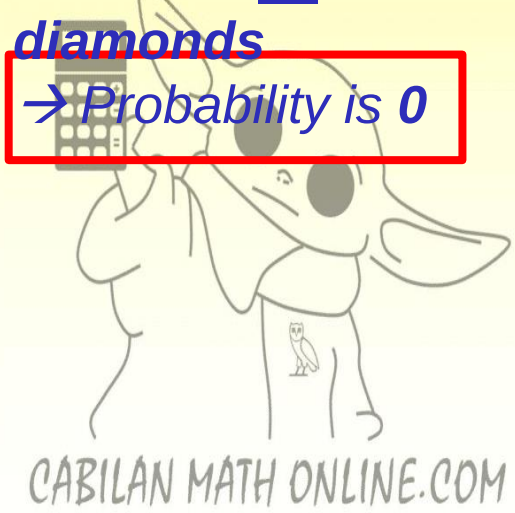
If one card is drawn from the deck, find the probability of each event.

(d) a **black diamond**

$$P(\text{black diamond}) = \frac{\#\text{of successful outcomes}}{\text{Total possible \#of outcomes}}$$

*There are no **black diamonds***

*→ Probability is **0***



CHAPTER 2.2 THEORETICAL PROBABILITY

EXAMPLE *Deck of Cards*

*There are **52 cards** in total*

If one card is drawn from the deck, find the probability of each event.

(e) a **heart**, a **club**, a **spade**, or a **diamond**

$$P(heart, club, spade, diamond) = \frac{\#\ of\ successful outcomes}{Total\ possible\ \#\ of\ outcomes}$$

$$P(heart, club, spade, diamond) = \frac{13+13+13+13}{52}$$

$$P(heart, club, spade, diamond) = \frac{52}{52}$$

$$P(heart, club, spade, diamond) = 1 or 100\%$$

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CHAPTER 2.2 THEORETICAL PROBABILITY

EXAMPLE 2

Roll the Dice (Revisited)

Kayla rolls a pair of dice. Shown is a table of possible outcomes

(a) How many possible outcomes are there? 36

	1	2	3	4	5	6
1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6
6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

36 possible outcomes

CHAPTER 2.2 THEORETICAL PROBABILITY

EXAMPLE 2

Roll the Dice (Revisited)

Kayla rolls a pair of dice. Shown is a table of possible outcomes

What is the probability of

	1	2	3	4	5	6
1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6
6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

36 possible outcomes

(b) Rolling **doubles**?

→ *Two of the same number*

$$P(doubles) = \frac{\#\ of\ successful outcomes}{Total\ possible\ \#\ of\ outcomes}$$

$$P(doubles) = \frac{6}{36}$$

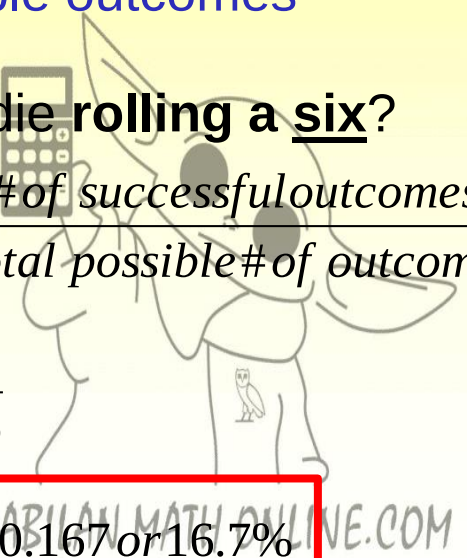
$$P(doubles) = \frac{1}{6}, 0.167\ or\ 16.7\%$$

(c) The *first* die **rolling a six**?

$$P(\ first die is\ 6) = \frac{\#\ of\ successful outcomes}{Total\ possible\ \#\ of\ outcomes}$$

$$P(\ first die is\ 6) = \frac{6}{36}$$

$$P(\ first die is\ 6) = \frac{1}{6}, 0.167\ or\ 16.7\%$$



CHAPTER 2.2 THEORETICAL PROBABILITY

EXAMPLE 2

Roll the Dice (Revisited)

Kayla rolls a pair of dice. Shown is a table of possible outcomes

	1	2	3	4	5	6
1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6
6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

36 possible outcomes

What is the probability of

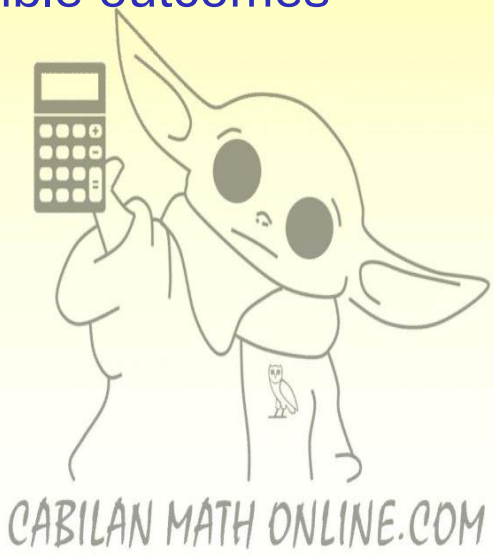
(d) The *second* die **rolling <u>four or less</u>**

→***24*** *outcomes*

$$P(2nd\ die\ is\ 4\ or\ less) = \frac{\#\ of\ successful\ outcomes}{Total\ possible\ \#\ of\ outcomes}$$

$$P(2nd\ die\ is\ 4\ or\ less) = \frac{24}{36}$$

$$P(2nd\ die\ is\ 4\ or\ less) = \frac{2}{3}, 0.667\ or\ 66.7\%$$



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Homework

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