

1) Answer: C

Explanation: When you roll two fair six-sided dice, the sample space of the event will have 36 elements since both dice have six possible outcomes ($6 \times 6 = 36$).

The elements of the sample space where the numbers are equal are as follows:

- (1, 1) - this means that the first die results in 1 dot and the second die results in 1 dot.
- (2, 2) - this means that the first die results in 2 dots and the second die results in 2 dots.
- (3, 3) - this means that the first die results in 3 dots and the second die results in 3 dots.
- (4, 4) - this means that the first die results in 4 dots and the second die results in 4 dots.
- (5, 5) - this means that the first die results in 5 dots and the second die results in 5 dots.
- (6, 6) - this means that the first die results in 6 dots and the second die results in 6 dots.

There are 6 total outcomes where the resulting numbers of the dice are equal.

Using the formula for theoretical probability:

$$\text{Probability} = \frac{\text{number of favorable outcomes}}{\text{total number of outcomes}} = \frac{6}{36} = \frac{1}{6}$$

Thus, the answer is $\frac{1}{6}$.

2) Answer: B

Explanation: Obtaining a queen and a spade in a standard deck of cards is a non-mutually exclusive event since it is possible to obtain a card that is both a queen and a spade at the same time (i.e., queen of spades).

We are tasked to find the probability of picking a card that is either a queen or a spade. Take note of the word “**or**.” This means we are looking for the probability of the event that we pick a queen or a spade from the deck of cards.

The formula for the probability that either one of two non-mutually exclusive events to happen is:

$$P(\text{queen or spade}) = P(\text{queen}) + P(\text{spade}) - P(\text{intersection of queen and spade})$$

There are four queen cards in the deck: queen of hearts, queen of spades, queen of clovers, and queen of diamonds. So, the probability of picking a queen card from the deck is $\frac{4}{52}$ (the deck has 52 cards).

Meanwhile, there are 13 spade cards from the deck (i.e., ace, king, queen, etc.). So, the probability of picking a spade card from the deck is $\frac{13}{52}$.

Lastly, the intersection of the events of getting a queen and a spade card is the event of getting the queen of spades. There is only one queen of spades in the deck, so we have $\frac{1}{52}$ as the probability of getting the intersection.

Using the formula we have stated above:

$$\begin{aligned} P(\text{queen or spade}) &= P(\text{queen}) + P(\text{spade}) - P(\text{intersection of queen and spade}) \\ P(\text{queen or spade}) &= \frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{16}{52} \end{aligned}$$

The probability we have computed is $\frac{16}{52}$. When reduced to the lowest terms, this is equal to $\frac{4}{13}$.

3) Answer: A

Explanation: The sample space of rolling a fair six-sided die is $\{1, 2, 3, 4, 5, 6\}$. Among these numbers, the composite numbers are 4 and 6 only ([composite numbers are those that have factors aside from themselves and 1 or the opposite of prime numbers](#)). Therefore, the probability of getting a composite number is $\frac{2}{6}$ or $\frac{1}{3}$.

4) Answer: B

Explanation: When you roll two fair six-sided dice, the highest possible sum of resulting numbers is 12. This occurs when both of the dice give 6 as the result. Hence, all sums of the combination of the resulting numbers of the dice will be less than 15. In other words, it is certain that as we roll two dice, the resulting numbers will always have a sum of less than 15. The probability of a certain event is always 1 or 100%.

5) Answer: D

Explanation: 1456X will be divisible by 4 if and only if the last two digits of it are divisible by 4. Hence, we can consider 6X only for this problem. If the value of X already made 6X divisible by 4, then the number 1456X is divisible by 4.

We are going to randomly pick a number value for X in 6X from 0 to 9. Among the numbers from 0 to 9, only $X = 0$, $X = 4$, and $X = 8$ will make 6X divisible by 4 (64 and 68 are divisible by 4). Thus, the number of favorable outcomes for this event is 3.

Since there are a total of 10 possible outcomes (there are 10 numbers from 0 to 9), then the probability that the value of X will make 6X divisible by 4 is equal to $3/10$.

Therefore, the final answer is $3/10$.