Topic: The addition rule, and union vs. intersection

Question: Which events are mutually exclusive?

Answer choices:

A   The probability of rolling a sum that's divisible by 5 and 2 when two dice are thrown.

B   The probability of drawing a blue gum ball or a pink gum ball from a jar.

C   The probability of drawing a black card or an ace from a deck of cards.

D   The probability of rolling a 10 or a double when a pair of dice is rolled.

Solution: B

The events in answer choice A are not mutually exclusive, because if you roll a 10, it's divisible by both 5 and 2, so both events could occur at the same time.

The events in answer choice B are mutually exclusive, because you can only draw one gum ball at a time, so you can't draw a blue gum ball and a pink gum ball at the same time.

The events in answer choice C are not mutually exclusive, because if you draw a black ace, you're drawing a black card and an ace, so both events could occur at the same time.

The events in answer choice D are not mutually exclusive, because if you could roll two 5s, your roll is a double and sums to 10, so both events could occur at the same time.

Topic: The addition rule, and union vs. intersection

Question: Which events are not mutually exclusive?

Answer choices:

A   The probability of drawing an ace and the probability of drawing a king from a deck of cards.

B   The probability of rolling a sum that is either 8 or 10 when two dice are thrown.

C   The probability of rolling three 5s in a row when you roll a six-sided die and the probability you roll three 1s in a row when you roll a six-sided die.

D   The probability of selecting a small dog from an animal shelter and the probability of selecting a brown dog from an animal shelter.

Solution: D

The events in answer choices A, B, and C are mutually exclusive because they can't happen at the same time.

But the events in answer choice D are not mutually exclusive, because you could choose a small, brown dog, which means you can choose a small dog and a brown dog at the same time. The events can occur at the same time, so they are not mutually exclusive.

Topic: The addition rule, and union vs. intersection

Question: If we roll one standard 6-sided die, what's the probability that the outcome is both odd and divisible by 3?

Answer choices:

A $\dfrac{1}{3}$

B $\dfrac{1}{2}$

C $\dfrac{1}{6}$

D   Can't be determined

Solution: C

Let A be the event of rolling an odd number. Then

$$A = \{1,3,5\}$$

Then let B be the event of rolling a number that's divisible by 3. Then

$$B = \{3,6\}$$

The probability that the outcome is both odd and divisible by 3 is the intersection of A and B, which means we need to find any common outcomes in both event spaces. The only overlap is 3, so the intersection is

$$A \cap B = \{3\}$$

Then the probability of rolling a 3 is

$$P(A \cap B) = \frac{1}{6}$$