Name: ___________________________________ Date: _________________

BINOMIAL PROBABILITY – DAY #2
ALGEBRA 2 WITH TRIGONOMETRY

More interesting binomial probability problems occur when we consider *at least* or *at most* r-successes in n-trials. The keys to doing these problems is the fundamental probability concept below:

THE PROBABILITY OF THE UNION OF MUTUALLY EXCLUSIVE EVENTS

If events $E_1, E_2, E_3, \ldots, E_n$ are **mutually exclusive events** then:

$$P\left(E_1 \text{ or } E_2 \text{ or } \ldots E_n\right) = P\left(E_1\right) + P\left(E_2\right) + \cdots + P\left(E_n\right)$$

We can use this concept to combine multiple binomial probabilities to solve more complex problems.

***Exercise* #1:** Jenna is taking a five question multiple choice quiz where each question has four choices on it. If she randomly guesses at each question, determine the probability she correctly answers *at least* four out of five of the questions.

***Exercise* #2:** On a tropical island it consistently rains 40% of the days. Over the next seven days, find the probability that it rains *at most* two times.

To find the probability of an event, E, it is sometimes easier to first find the probability of its **complement**, E_c, and then use the important relationship shown below.

THE PROBABILITY OF AN EVENT AND ITS COMPLEMENT

$P(E)+P(E_c)=1$ or more useful as $P(E)=1-P(E_c)$

***Exercise* #4:** A fair coin is flipped 10 times and the outcome is recorded each time. Let E be the event of getting at least two heads on the ten flips.

(a) What is the complement of this event, E_c?

(b) Find the probability of the complement, E_c.

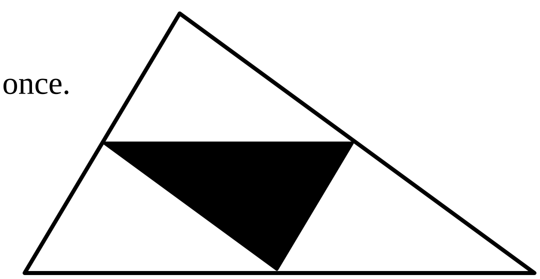
(c) Use your answer from (b) to determine the probability of E.

(d) To the nearest *tenth* of a percent, what is the probability of getting at least one head on 4 flips of a fair coin.

***Exercise* #5:** A carnival game is created where contestants throw bags at the board shown below, which consists of four congruent triangles, one of which is painted black. A contestant pays $3 for two bags and will win if *at least* one bag lands in the shaded area. Assume that the bag always falls in the overall area.

(a) What is the probability that a bag will land in the shaded area?

(b) Determine the probability that Joshua wins the game if he plays it once.



(c) If Joshua plays the game three times, what is the probability he will win at least once time. Round your answer to the nearest percent.

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BINOMIAL PROBABILITY – DAY #2
ALGEBRA 2 WITH TRIGONOMETRY - HOMEWORK

SKILLS

1. If a binomial experiment has 6 trials, with a probability of success of $\frac{2}{3}$, then find the following probabilities in simplified fraction form.

(a) at least 4 successes

(b) at most 2 successes

2. In a binomial experiment with 5 trials, the probability of success is $\frac{1}{5}$. Which of the following gives the probability of getting at least one success?

(1) $\frac{1}{3125}$

(2) $\frac{2101}{3125}$

(3) $\frac{1024}{3125}$

(4) $\frac{623}{3125}$

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APPLICATIONS

3. On a tropical island, it consistently rains 60% of all days. Which of the following is closest to the probability that in a given week it rains at least six of the seven days?

(1) 16%

(2) 42%

(3) 27%

(4) 74%

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4. A family has three children. Assuming that the probability of having a boy and a girl are equal, which of the following is the probability that there are at most two girls in the family?

(1) $\frac{1}{8}$

(2) $\frac{1}{4}$

(3) $\frac{3}{8}$

(4) $\frac{7}{8}$

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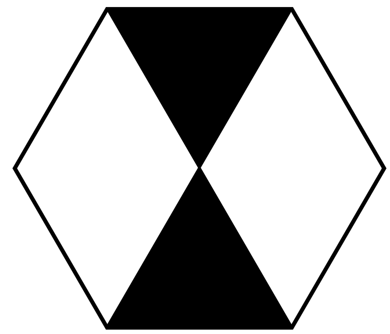
5. Another fair game is created by using the hexagonal board shown below, where one third of the area is shaded. To play, a person pays her money and then receives three darts to throw at the board. She wins if *at least* two out of the three darts hit the shaded area. Assume any dart that is thrown hits the hexagon.

(a) Find the probability that if Hannah plays the game once she will win. Express your answer to the nearest tenth of a percent.



(b) Using your answer from part (a), determine the probability that if Hannah plays the game four times she will win at least one. Express your answer to the nearest percent.

6. Jonah makes 75% of all of the free-throws he takes when playing a basketball game. If Jonah shoots seven free throws in a given game, find the probability that he makes at least five of them. Round your answer to the nearest percent.

7. Darlene rolls a standard die five times. Is it more likely that she will get at most one six or at least one six? Use probability calculations to justify your answer.