

**The Scene:** In this activity we build and investigate some discrete probability models.

1. Consider 2 regular dice, a red one and a blue one. Let  $X$  denote the sum of the values if we roll them together.

- (a) Convince yourself that the sample space for this random process is

$$S = \{2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}.$$

Convinced? You may proceed.

- (b) In the grid below, record the sum of the dice for each of the 36 possible outcomes (For instance, if the red die is 3 and the blue die is 5, the sum is 8.) Then, assuming each of these 36 outcomes is equally likely, determine a valid probability model for the sum of two dice in the table at right.

		blue die					
		1	2	3	4	5	6
red die	1						
	2						
	3					8	
	4						
	5						
	6						

$x$	2	3	4	5	6	7	8	9	10	11	12
$P(x)$											

- (c) Based on your probability model, what is the probability that a given roll produces a sum that is greater than 8?
- (d) Which is more likely, that the dice give a sum greater than 8, or a sum less than 5? Explain.
2. A regular deck of cards has 52 cards, 13 of each suit (diamond, heart, spade, club). Suppose we pick a card at random. Let  $A$  be the event that we pick a face card (a J, Q, or K of any suit). Let  $B$  be the event that we pick a red card (diamond or heart). Determine  $P(A)$ ,  $P(\text{not } A)$ ,  $P(B)$ , and  $P(A \text{ or } B)$ .
3. Suppose we flip a coin 3 times and we're interested in  $X =$  the number of heads we flip in 3 tries.
- (a) What is the sample space for  $X$ ?

(b) There are 8 different possible sequences of 3 flips. Here are 2 possibilities: T T T; and T T H. List the other 6.

(c) Treat these 8 different sequences as equally likely and use them to determine a probability model for  $X$ . That is, complete this table.

$x$	0	1	2	3
$P(x)$				

(d) Using the probability model above, what is the probability of flipping at least 2 heads?

4. Suppose we have three strange dice. The numbers on the blue die: 1, 1, 4, 4, 4, 4. The numbers on the red die: 2, 2, 2, 2, 5, 5. The numbers on the purple die: 3, 3, 3, 3, 3, 6.

(a) What is the probability that red beats blue if each is rolled once?

(b) What is the probability that blue beats purple if each is rolled once?

(c) What is the probability that purple beats red if each is rolled once?