

Show all your work. Late Homework will not be accepted without prior approval.

1. Using the digits 1 – 9, how many five digit numbers are there
 - (a) in total?
 - (b) which begin and end with an odd digit?
 - (c) which use only odd digits?
 - (d) which use three odd and two even digits in the order odd-even-odd-even-odd?
 - (e) which use three odd and two even digits in any order?
 - (f) which use three odd and two even digits in any order with no repetitions allowed?
 - (g) if the digits must all be different?
 - (h) if the digits must be different and in increasing order?

Bonus. What if the digits must be in increasing order but repetitions are allowed?

2. Throw two dice and let X be the difference in the numbers showing.
 - (a) What are the possible values of X ?
 - (b) Find and sketch the graph of the probability density function f_X .
 - (c) Carefully sketch the graph of the cumulative distribution function F_X .

3. Let X be the number showing when a die is thrown. Find the density function for $Y = (X - 3)^2$.

Bonus. Assume everyone in a population of size n buys one lottery ticket each week. Use these hints to find the probability someone will win twice before you win once.

- (a) Let X be the event that you win in week X and nobody has won twice. Find $P(X = k)$, $k = 1, 2, 3, \dots, n$.
- (b) Show the probability you win once before someone else wins twice is $\frac{1}{n+1} \left(1 + \frac{1}{n}\right)^n$.
- (c) What happens to $\left(1 + \frac{1}{n}\right)^n$ as $n \rightarrow \infty$? What can you conclude about the lottery?