Consider a simple gene with completely dominant allele A and recessive allele a. The three possible genotypes are AA (homozygous dominant), Aa (heterozygous), and aa (homozygous recessive). The probability distribution of the genotype of a single offspring for each possible cross are as follows.

	Offspring Genotype		
Parent Genotypes	AA	Aa	aa
$AA \times AA$	1	0	0
$AA \times Aa$	1/2	1/2	0
$AA \times aa$	0	1	0
$Aa \times Aa$	1/4	1/2	1/4
$Aa \times aa$	0	1/2	1/2
$aa \times aa$	0	0	1

In a given population, the proportion of individuals with genotypes AA, Aa, and aa are 0.36, 0.48, and 0.16, respectively. The first parent P_1 is selected from this population at random and crossed with a heterozygous (Aa) individual called P_2. The cross yields seven offspring. Assume that the genotypes of all offspring are independent of one another given the genotypes of both parents.

(a) If P_1 has genotype Aa, what are the mean and standard deviation of $Y =$ "the number of aa offspring"?

(b) If P_1 has genotype aa what is the probability that *two or fewer* of the seven offspring have the aa genotype?

(c) If P_1 has genotype Aa what is the probability that *exactly two* of the seven offspring have the aa genotype?

(d) What is the probability that *exactly two* of the seven offspring have the aa genotype?

(e) Given that *exactly two* of the seven offspring have the aa genotype, what is the probability that the genotype of the P_1 parent is Aa?