

Quiz #2
Probability and Population Genetics

1. $(a+b)^5 = a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$

If 5 cows are bred, what is the probability of getting 5 bull calves?

a = bull; 5 replications; $\rightarrow a^5 = (1/2)^5 = 1/32$

If 5 cows bred, what is the probability of getting 3 bulls and 2 heifers?

a = bull; b = heifer; 5 reps $\rightarrow 10a^3b^2 = 10(1/2)^3(1/2)^2 = 10(1/8)(1/4) = 10/32$

Why is the probability of getting 3 bull calves and 2 heifer calves greater than getting 5 bull calves?

2. If we breed a bull of unknown genotype to 198 cows and produce 1 dwarf calf, what is the genotype of the bull? WHY?

3. If we breed a homozygous black bull to 1,000 black cows of unknown genotype, what is the probability of producing 89 red calves? WHY?

4. If we have a herd of horned Hereford cattle, what is the gene frequency of the polled gene (P)? If we replace all of the horned cows with polled cows, how does this affect the gene frequency of P and p?

We continue to randomly mate with the population of horned/polled for five generations. What is the gene frequency of P and p in the fifth generation? WHY? WHY?

5. Discuss the four factors that can modify gene frequency in a specific population.

BONUS: Two black parents produce a red offspring. What is the probability that their next offspring will be black? (Black is dominant) WHY?