

ANSWER to Question #84596, Math / Statistics and Probability

Let probability of a child having genotype AB = $p = 1/2$

Then probability of a child having genotype BB = $1 - p = 1 - 1/2 = 1/2$

Let random variable X = number of children having genotype AB in 5 children i.e. in 5 trials

$n=5$, probability of success = p , $X \sim B(n, p)$ i.e. $X \sim B(5, 1/2)$

$$P [X = r] = \binom{5}{r} p^r (1-p)^{5-r}$$

$$r = 0, 1, 2, 3, 4, 5$$

We need the probability that 2 children have genotype AB and 3 children have genotype BB i.e. we need $P [X = 2]$.

$$P [X = 2] = \binom{5}{2} p^2 (1-p)^{5-2} = \frac{5!}{2!3!} \cdot \left(\frac{1}{2}\right)^2 \cdot \left(\frac{1}{2}\right)^3 = \frac{5 \times 4 \times 3!}{2 \times 3!} \cdot \frac{1}{2^5} = \frac{5}{16}$$