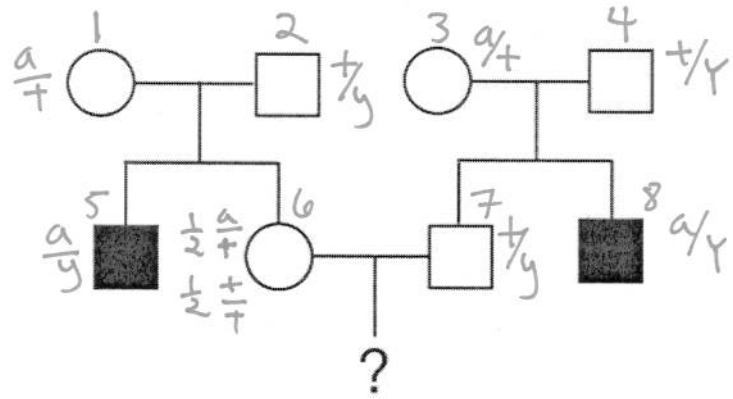
**Name:** KEY

**3.** Consider the following pedigree showing inheritance of an X-linked recessive trait. (Assume the trait is completely penetrant and no new mutations arise in the individuals shown).




**(a** 8 pts.**)** What is the probability that a child indicated by **?** will be affected by the trait?

$p(? = \frac{a}{Y}) = p(\text{male}) \cdot p(6 = \frac{a}{+}) \cdot p(\text{getting } a)$

$p(? = \frac{a}{Y}) = \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \boxed{\frac{1}{8}}$

**(b** 12 pts.**)** Say that the child indicated by **?** turns out to be a son who **does not have** the trait. Use Bayes Theorem to calculate the probability that a second child (either son or daughter) by the same couple would have the trait.

① find $p(6 = \frac{a}{+} \mid ? = \frac{+}{Y})$ by Bayes

$$p(6 = \tfrac{a}{+} \mid ? = \tfrac{+}{Y}) = \frac{p(? = \frac{+}{Y} \mid 6 = \frac{a}{+})\, p(6 = \frac{a}{+})}{p(? = \frac{+}{Y} \mid 6 = \frac{a}{+})\, p(6 = \frac{a}{+}) + p(? = \frac{+}{Y} \mid 6 = \frac{+}{+})\, p(6 = \frac{+}{+})}$$

$p(6 = \frac{a}{+}) = 1/2$

$p(? = \frac{+}{Y} \mid 6 = \frac{a}{+}) = \frac{1}{2}$

$p(6 = \frac{+}{+}) = \frac{1}{2}$

$p(? = \frac{+}{Y} \mid 6 = \frac{+}{+}) = 1$

$$\cancel{p(6 = \tfrac{a}{+} \mid ? = \tfrac{+}{Y})} = \frac{\frac{1}{2} \cdot \frac{1}{2}}{\frac{1}{2} \cdot \frac{1}{2} + 1 \cdot \frac{1}{2}} = \boxed{\frac{1}{3}}$$

$p(\text{2nd child} = \frac{a}{Y}) = p(\text{male}) \cdot p(6 = \frac{a}{+}) \cdot p(\text{getting } a) = \frac{1}{2} \cdot \frac{1}{3} \cdot \frac{1}{2}$

$\boxed{= \frac{1}{12}}$