HEREDITY

Vocabulary

* **Phenotype**

  * <u>Observable</u> characteristics or traits

* **Genotype**

  * <u>Gene</u> makeup

  * Capital letters represent dominant genes and lowercase represent recessive genes

Vocabulary

* Pure bred

    * Offspring that are <u>identical</u> to their parents

* Hybrid

    * <u>Mixture</u> of two pure breeds

* P generation

* <u>Parent</u> generation

Vocabulary

* **F1 generation**

  * **Filial generation 1, offspring of the parents (P generation)**

* **F2 generation**

  * **Filial generation 2, offspring of the F1 generation**

Vocabulary

* Dominant

   * Traits that dominate over other traits and are <u>expressed</u>

* Recessive

   * Traits that are not expressed <u>when dominate present</u>

* Allele

   * <u>Alternate</u> form of the same trait

Vocabulary

* Phenotypic Ratio

    * Ratio of <u>phenotypes</u> in an offspring.

    * Ex. 3 tall plants for every 1 dwarf plant has a ratio of 3:1

* Genotypic Ratio

    * Ratio of <u>genotypes</u> in offspring

Sex Determination

* One pair of the 46 chromosomes is the sex chromosomes

* Mom gives X or X, Dad gives X or Y, Male determines sex

* If sperm Y joins with X from egg ->boy

* If sperm X joins with X from egg ->girl

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Genes

* Each chromosome carries many <u>genes</u>

* Some traits have one gene (ie. blood type)

* Some traits are the result of <u>pairs</u> of genes together:

  * Ex. Hair colour, eye colour, height

Genes

* Genes can either be dominant or recessive

  * Dominant: <u>cancels</u> out trait carried by recessive gene

    * Ex. Brown eye colour is dominant over blue

Genes

* Recessive: for trait to appear must get recessive gene from <u>BOTH</u> parents

* Ex. Both parents have blue eyes child will have blue eyes

Punnett Squares

* Used to illustrate the possible outcomes (offspring) of a mating or cross

* Steps to construct a Punnett Square:

* 1)Determine parental genotypes

* 2)Determine the possible genotypes of the gametes of each parent

* 3)Write these genotypes in the exterior of the squares

* 4) Fill in the interior and interpret the genotype and phenotype of the next generation

Example

* Consider the cross between a purebred tall plant (TT) and a purebred dwarf plant (tt)

* 1) Determine parental genotypes

    * TT – tall and tt - dwarf

* 2) Determine the possible genotypes of the gametes of each parent

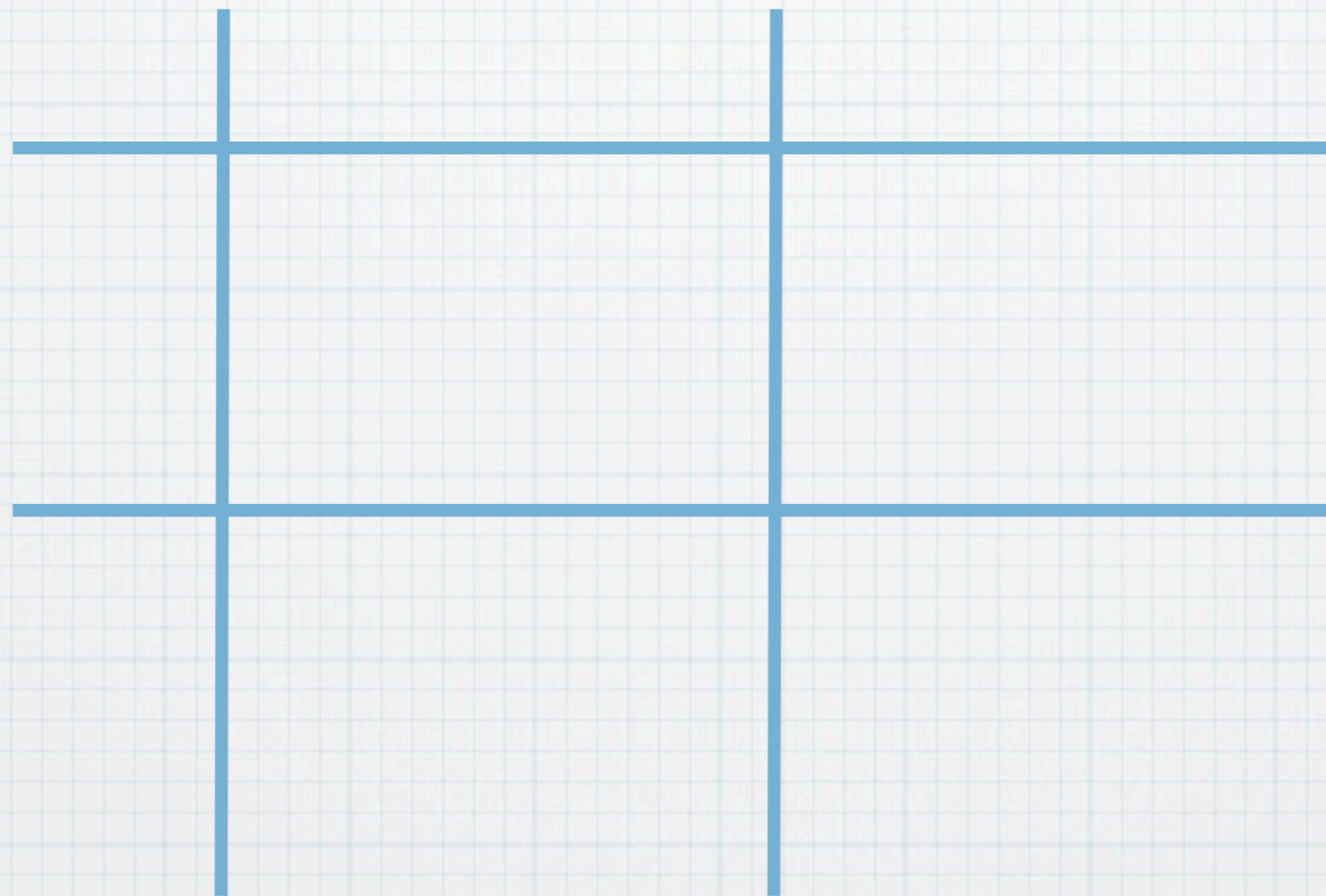   * Tall can only have T gametes, dwarf can only have t gametes

* 3) Write these genotypes in the exterior of the squares

TT TALL GAMETES

tt dwarf gametes

* 4) Fill in the interior and interpret the genotype and phenotype of the next
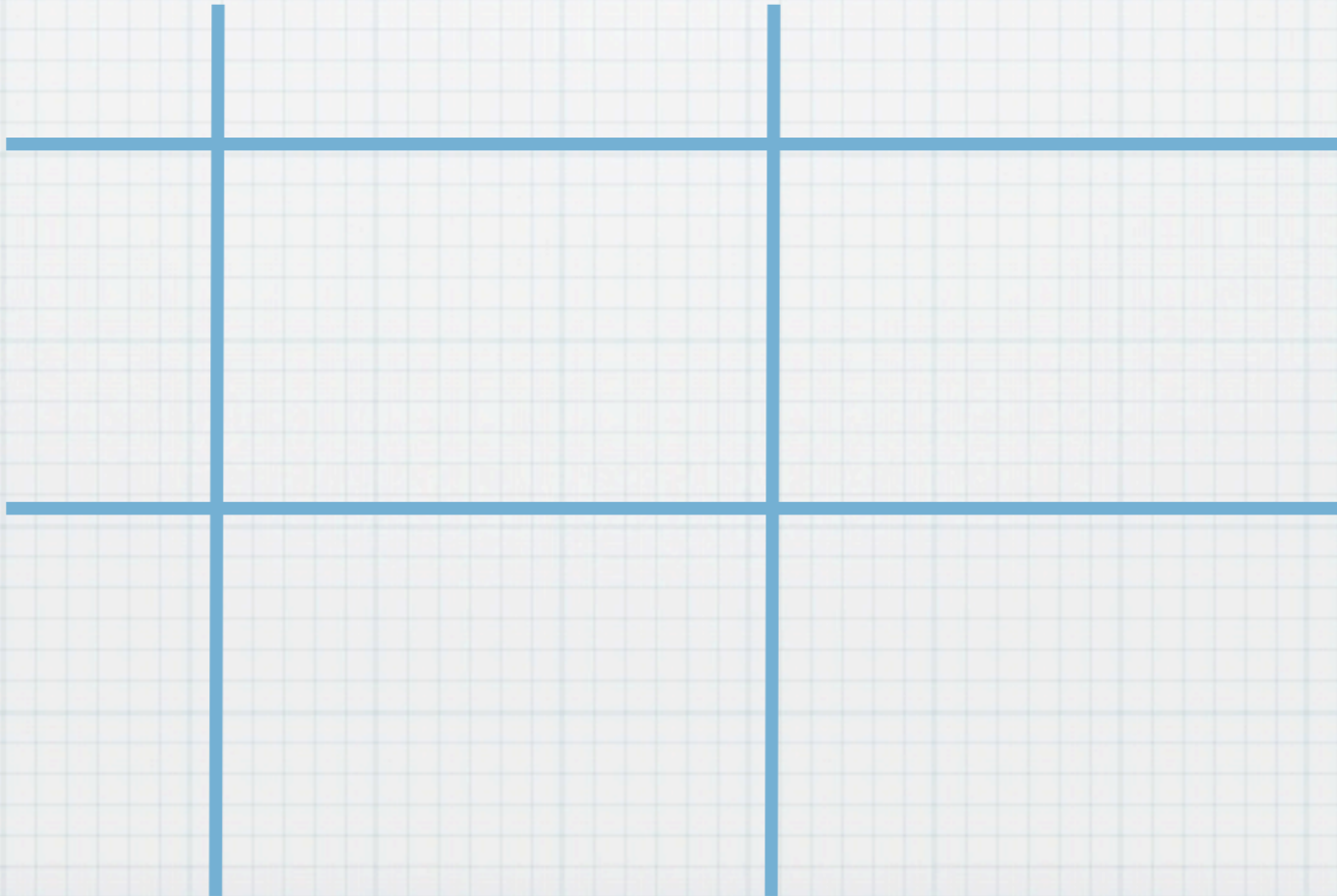
Genotype

Example

* Consider the cross of 2 F1 plants from the last cross

* Parental genotypes:

    * Tt and Tt

* Gametes:

    * T (tall) or t (dwarf) for both parents

* Write these genotypes in the exterior of the squares
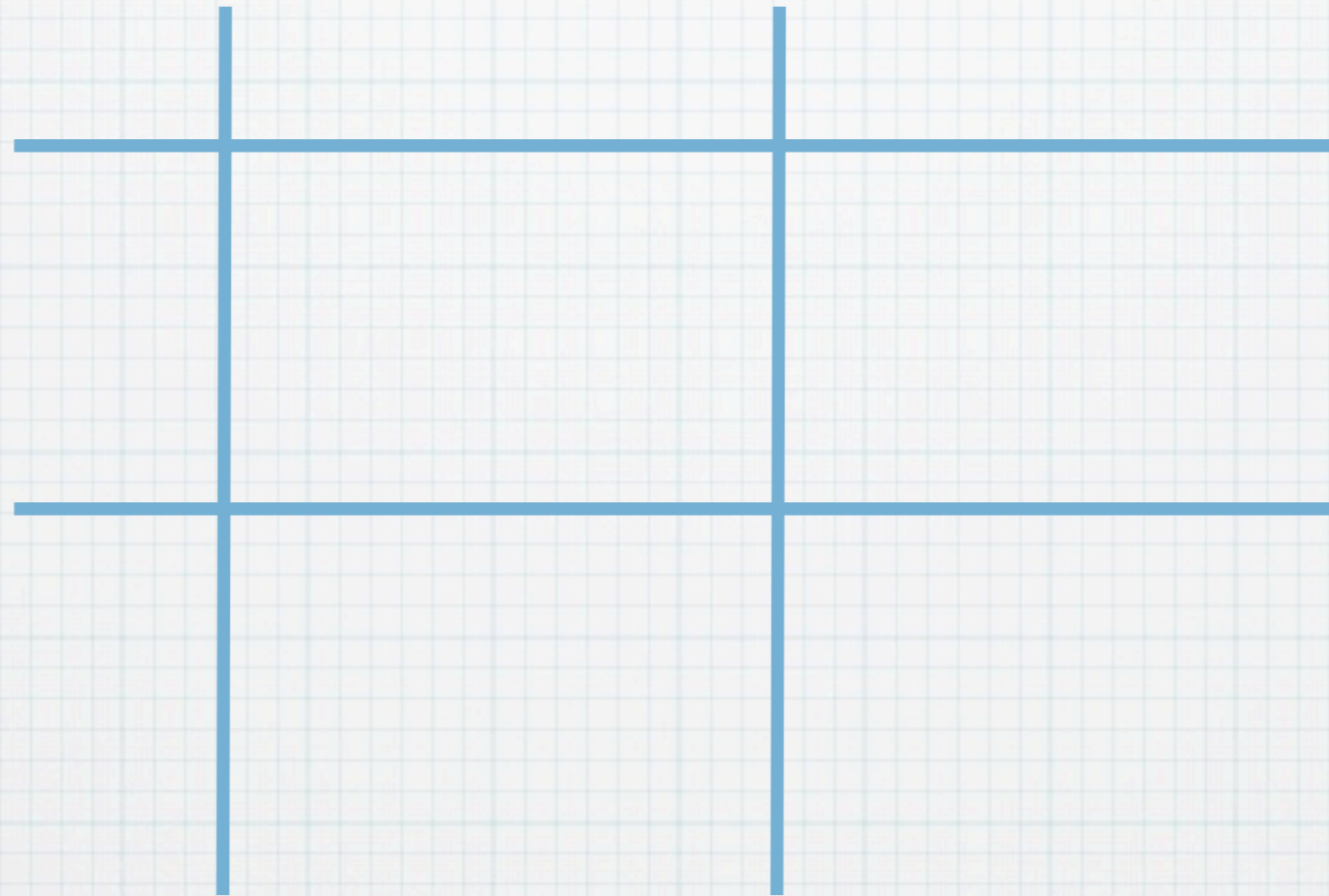
Tt Tall gametes

Tt Tall gametes

* Fill in the interior and interpret the genotype and phenotype of the next

Genotypic Ratio

Phenotypic Ratio

Harry Potter Genetics!

Harry's Hair Colour

* Harry has dark brown hair like his dad James, but his mother Lily has red hair. Brown hair is dominant and red is recessive. Using the genotypes of rr, Rr, and RR, what possible genotypes does each of the Potters have?

  * The phenotypes of the Potters are:

    * James Potter (dad)—dark/brown hair

    * Lily Potter (mom)—red hair

    * Harry Potter—dark/brown hair
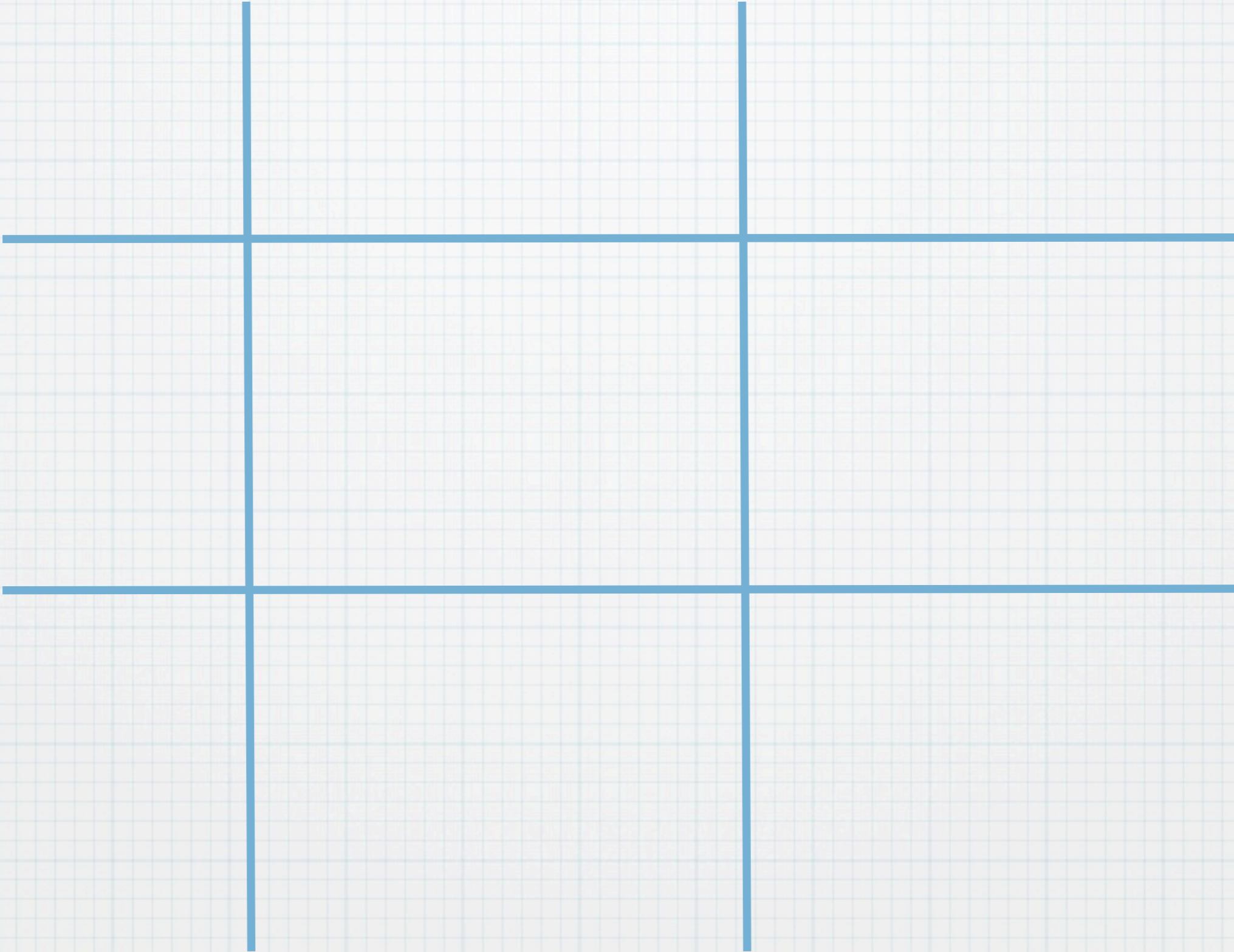
Solution

* Possible genotypes for James:

* Possible genotypes for Lily:

Lily

James

Harry's Genotype

The Weasley's

* All of the Weasley's have red hair. Is it possible for Arthur and Molly Weasley to have children who have brown hair? Remember brown hair is dominant and red is recessive. Use the letters R and r to show Arthur and Molly's genotypes:

  * Arthur Weasley

  * Molly Weasley

Molly
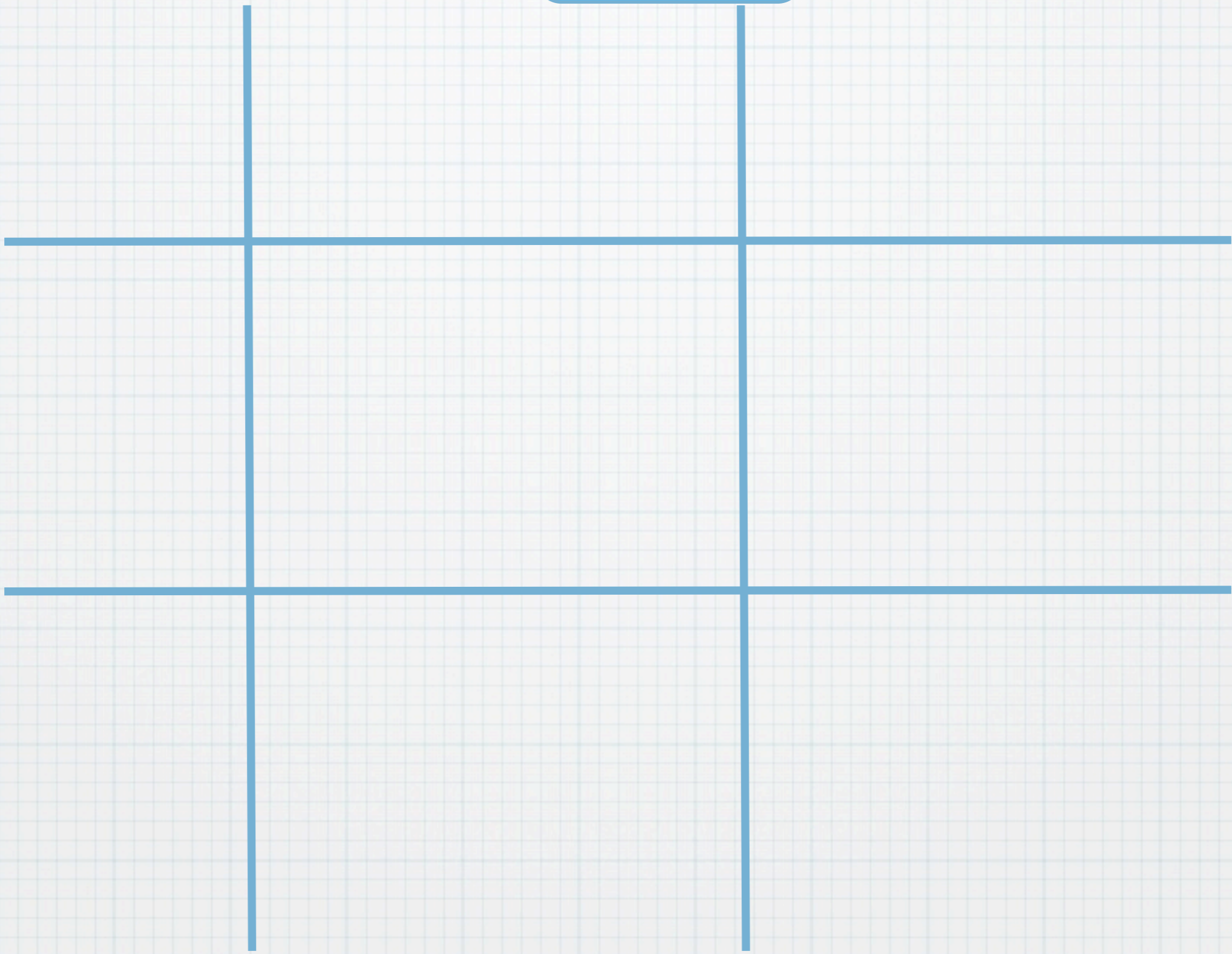
Arthur

Weasley children genotypic ratio

Harry's Children

* Harry marries Ginny who has red hair. What are possible genotypes of their children's hair colours?

* First, what are the genotypes for Harry and Ginny's hair colors?

    * Harry's genotype =

    * Ginny's genotype =
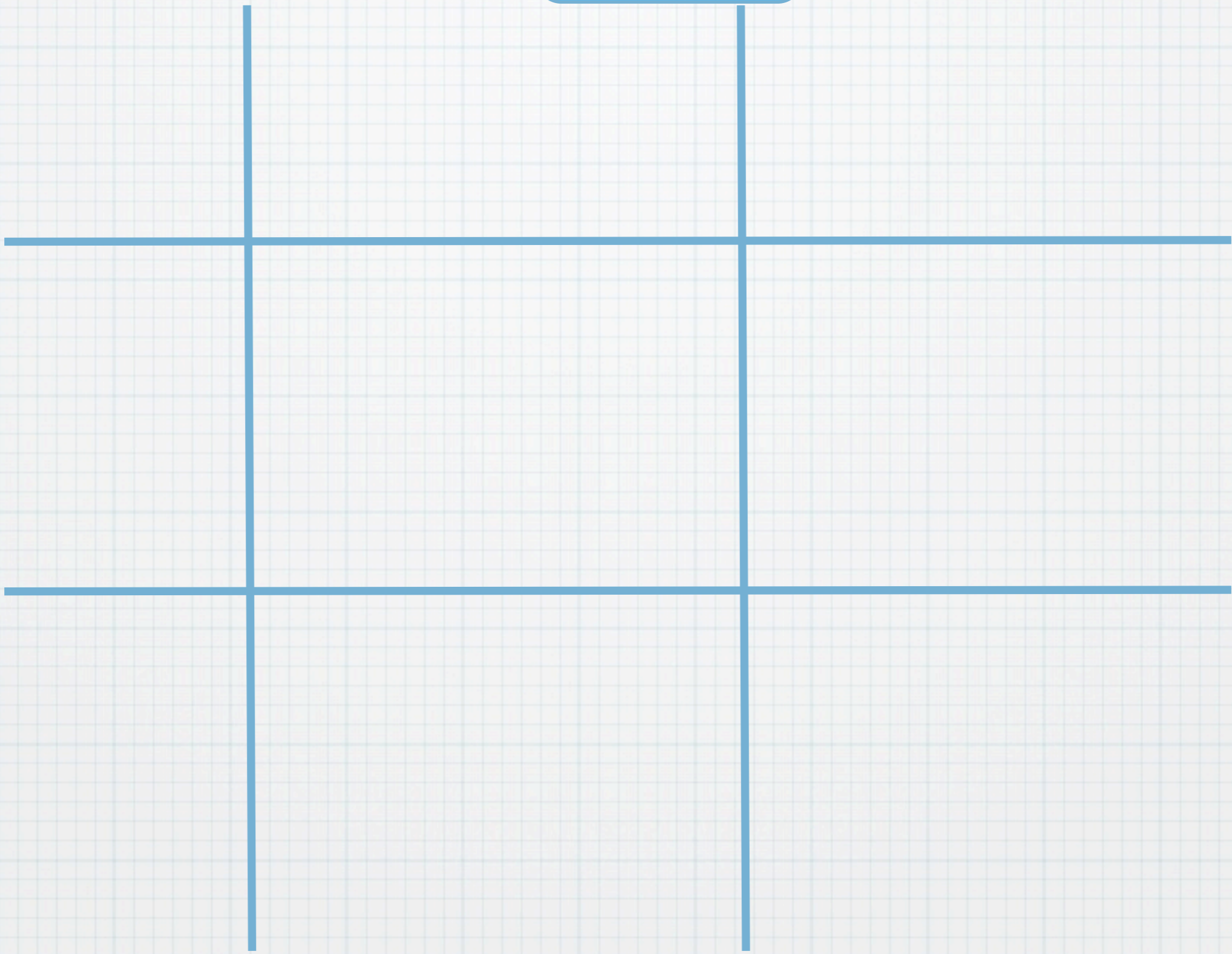
Ginny

Harry

Children's Genotypic Ratio

Ginny

Harry

Children's Genotypic Ratio

Heredity Considering Two Traits

The Inheritance of Magic

Heredity of Magic

* In the Harry Potter series, characters are born with or without magical ability.

* Those with magical ability also show very strong, normal or weak ability.

Heredity of Magic

* This suggests that two genes are responsible for magical inheritance

  * One that decides if you express magic or not

  * One that decides how strong your magical ability is

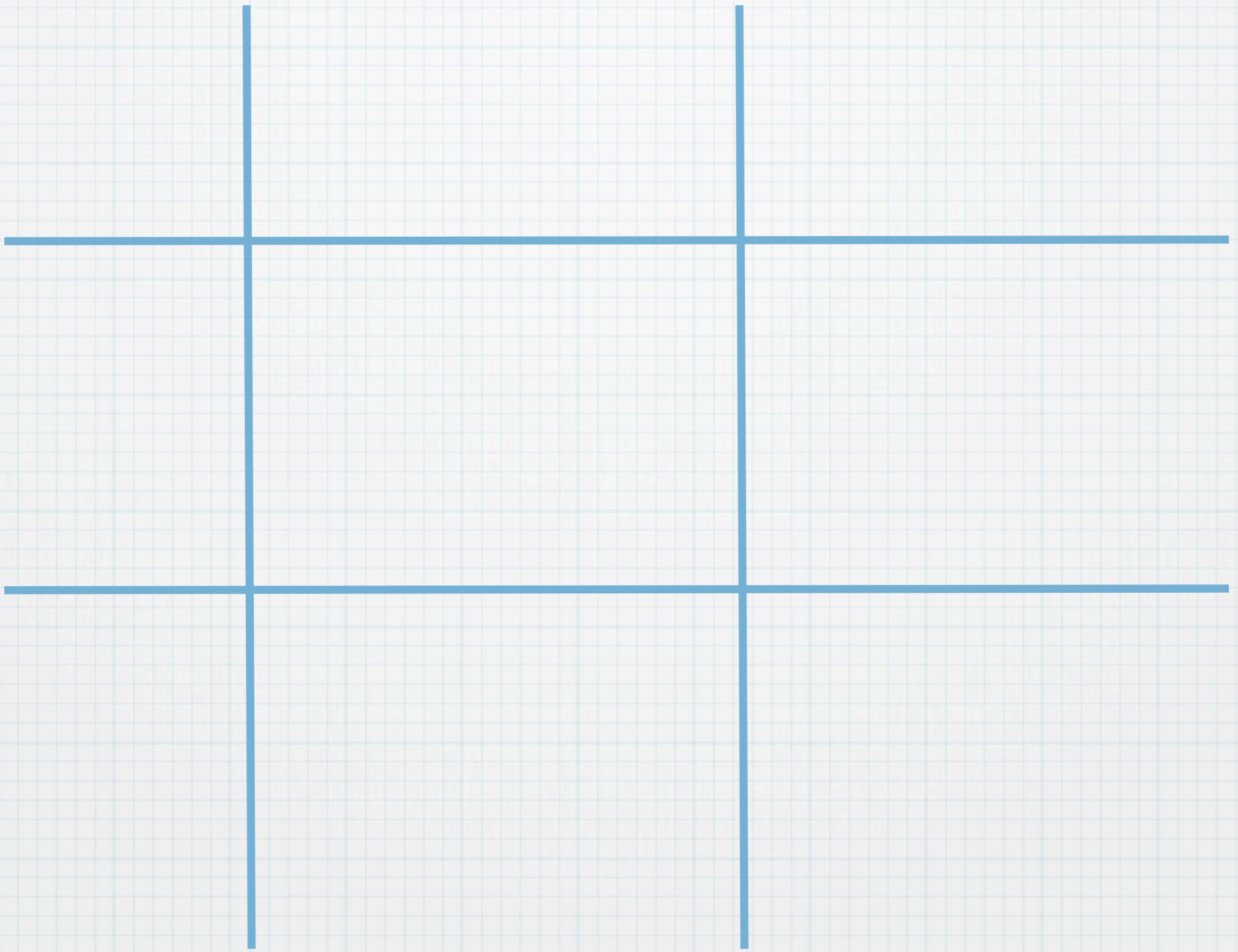# Dominant or Recessive

* Since two non-magic parents (the Grangers) can have a child that inherits magic (Hermione) this would suggest that magic would be recessive(m) and non-magic would be dominant (M).

Mr Granger Mm

Mrs Granger Mm

Hermione's genotype:

Strength of Magic

* The strength of an individuals magic can be describe as S. There are three phenotypes described for the strength of magical ability:

  * strong (Dumbledore)

  * average (Ron)

  * weak (Filch or other Squibs)

Strength of Magic

* The presence of three phenotypes suggests incomplete dominance (blending of parental traits).

* Since weak + strong = average, we can assume that average is the blended phenotype.

  * Strong Strength SS

  * Average Strength SS' or S'S

  * Weak Strength S'S'

Summary

* Presence of magic is determined by the gene M where

  * MM or Mm is a Muggle, mm is a witch/wizard

* Strength or magic is determined by the gene S where

  * SS is strong ability, SS' is average ability and S'S' is weak ability

Examples

* Determine the possible genotypes for the following phenotypes

  * Harry: Strong wizard

  * Ron: Average wizard

  * Filch: Weak wizard

  * Mrs. Granger: no magical ability

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Examples

* **Determine the possible genotypes for the following phenotypes**

  * **Harry: Strong wizard mmSS**

  * **Ron: Average wizard mmSS'**

  * **Filch: Weak wizard mmS'S'**

  * **Mrs. Granger: no magical ability: Any combination of Mm and MM with either SS, SS', or S'S'**
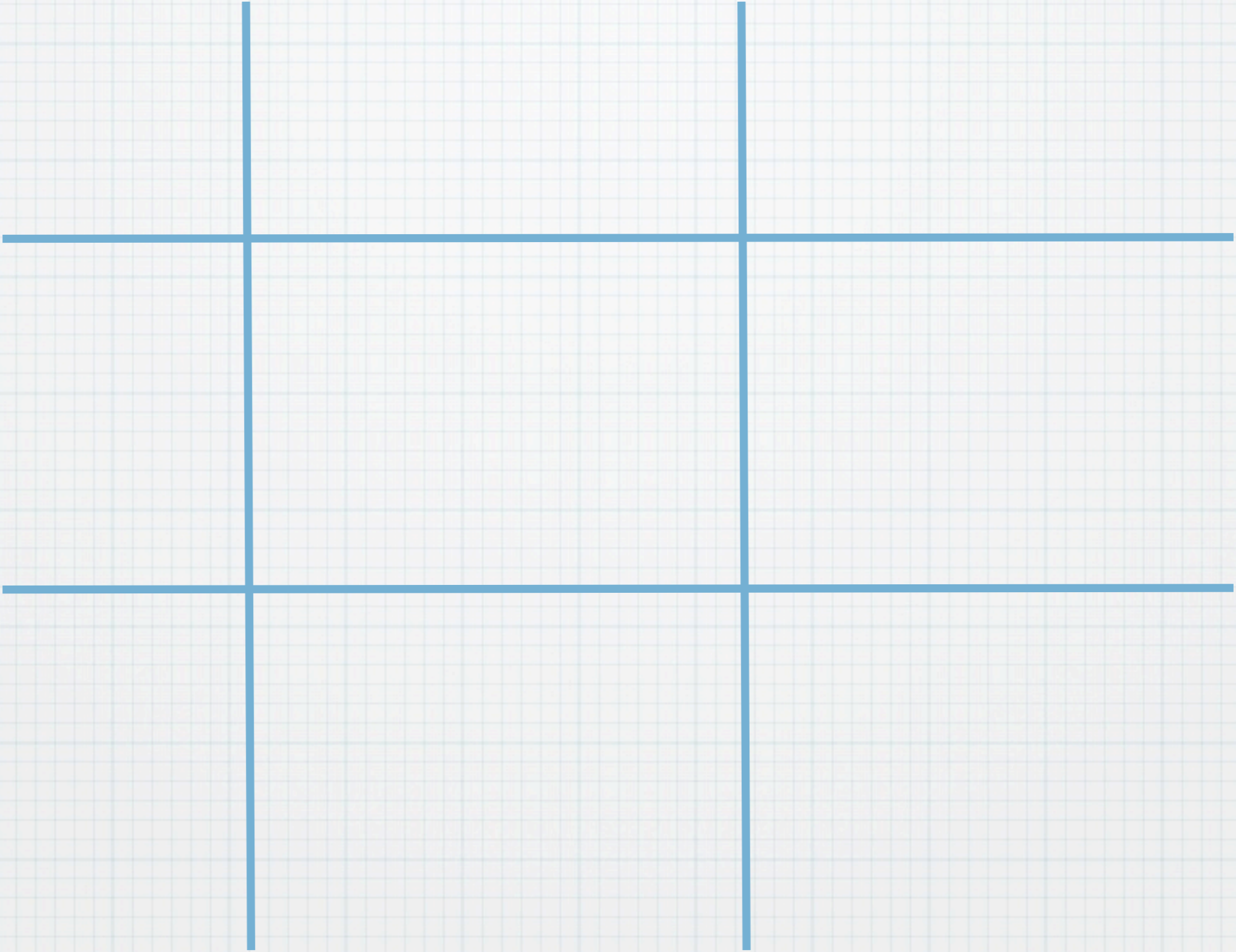
Example

* Let's take a closer look at Mrs. Granger

  * Mr and Mrs. Granger produced a daughter with strong magical ability

  * What must their genotype for magic be - MM or Mm?

Mr Granger Mm

Mrs Granger Mm

Hermione's genotype:

Example
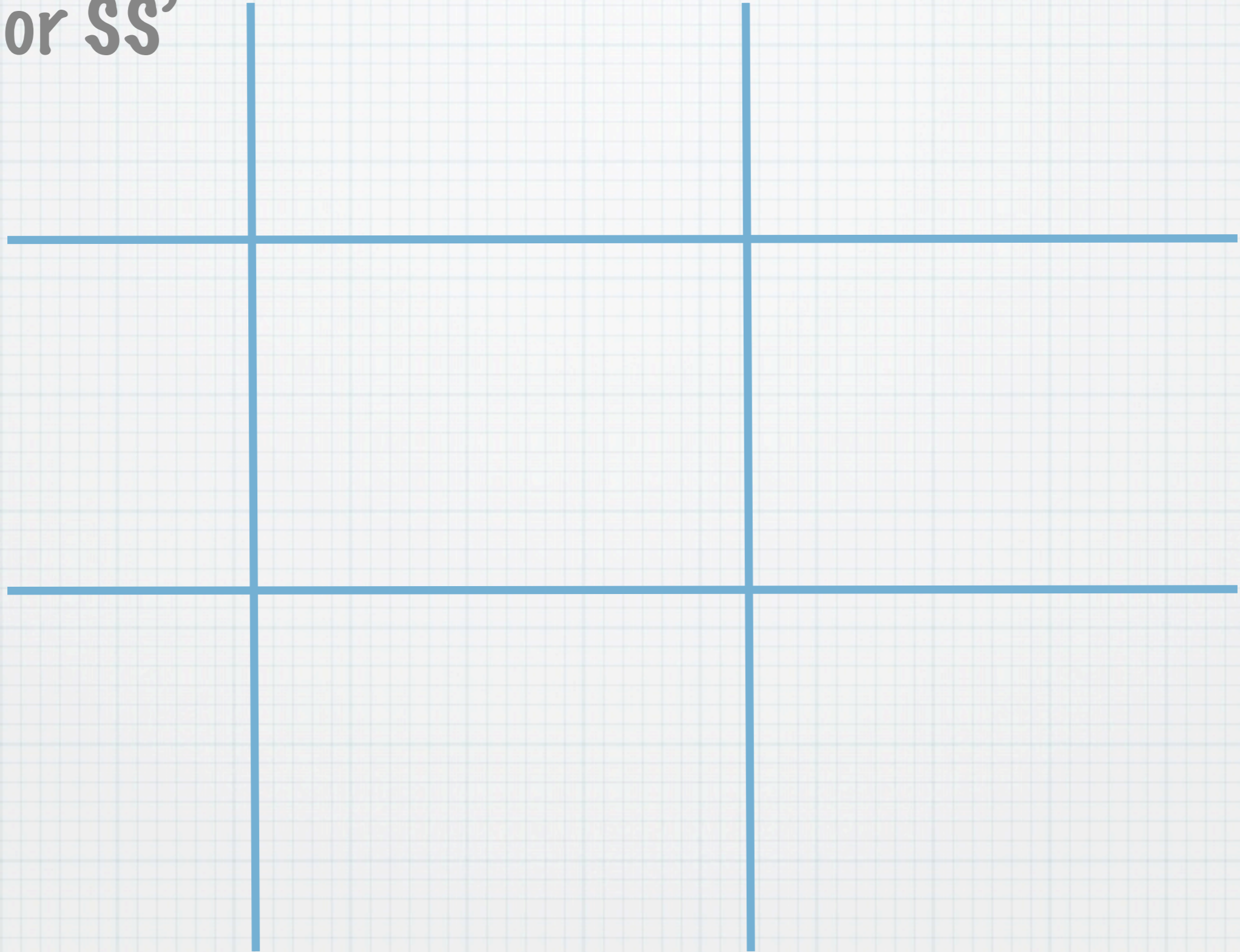
* Hermione is considered a witch with strong abilities. Therefore what must their genotypes be for ability:

  * SS, SS', or S'S'?

* **Answer: Either SS or SS'**

Mr Granger

Mrs Granger

Hermione's genotype: