Punnett Squares

Due Wednesday/Thursday 2.7/2.8. Follow the instructions and use your notes to help you.

**PART ONE**

Look through your notes and define the following key terms:

**Genotype Phenotype**

**Homozygous Heterozygous**

**Recessive Dominant**

**Incomplete Dominance Codominance**

**PART TWO**

**Genotype Phenotype**

**Homozygous Heterozygous**

**Recessive Dominant**

**Incomplete Dominance Codominance**

Follow the instructions to predict the patterns of inheritance for each scenario.

1. **Mr. and Mrs. Hernandez just found out they are going to have a baby! Mr. Hernandez’s genotype is homozygous dominant for unattached earlobes and Mrs. Hernandez’s genotype is heterozygous dominant for unattached earlobes. Is there any chance for their offspring to have attached earlobes?**

1. Determine the genotypes for each parent
2. Write the genotype of each parent on their designated Axis
3. Complete the Punnett square and predict the probable traits of the offspring

MOM

How many homozygous dominant genotypes present?

How many heterozygous dominant genotypes present?

How many homozygous recessive genotypes present?

DAD

What are the possible phenotypes of the offspring?

What is the probability of the offspring inheriting those traits?

PTC is a chemical compound that makes foods or other substances taste bitter. Genetically, the dominant trait is that you are able to taste PTC, and the recessive trait is that you are not able to taste PTC.

1. What is the probability of an offspring inheriting the recessive trait when both of its parents had heterozygous dominant genotypes?

Genotype of Mom: \_\_\_\_\_\_\_\_\_\_

Genotype of Dad:\_\_\_\_\_\_\_\_\_\_\_



1. What is the probability of the offspring inheriting…

* a homozygous dominant genotype? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* a heterozygous dominant genotype? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* a homozygous recessive genotype?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. If an active ingredient in laundry detergent is PTC. If this offspring made a tide-pod smoothie, would he/she/they be able to taste PTC? Why or Why not?
2. Should people eat tide pods?

**PART THREE**

Think about the rules of complete, incomplete, and co dominance when answering the following questions (each offspring will be a heterozygous genotype).

1. If a red (RR) and white flower (rr) were crossbred, resulting in 100% Rr, what phenotype would be seen according to the rules of COMPLETE dominance?
2. If a red (RR) and white flower (rr) were crossbred, resulting in 100% Rr, what phenotype(s) would been seen according to the rules of IN-complete dominance?
3. If a Red (RR) and White flower (WW) were crossbred, resulting in 100% RW, what phenotype(s) would been seen according to the rules of CO-dominance?

# Incomplete dominance practice Problems

1. Snapdragons are incompletely dominant for color; they have phenotypes red, pink, or white. The red flowers are homozygous dominant, the white flowers are homozygous recessive, and the pink flowers are heterozygous. Give the

genotypes for each of the phenotypes, using the letters “R” and “r ” for alleles:

a. Red snapdragon genotype b. Pink snapdragon genotype c. White snapdragon genotype

\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_

**Show genetic crosses between the following snapdragon parents, using the Punnett squares provided, and record the genotypic and phenotypic probabilities below.**

a. pink x pink b. red x white c. pink x white

What are the possible Genotypes of the offspring?

What are the possible phenotypes of the offspring? (include the probability of inheritance)

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What are the possible phenotypes of the offspring? (include the probability of inheritance)

1. In horses, some of the genes for hair color are incompletely dominant. Genotypes are as follows: brown horses are homozygous dominant, white horses are homozygous recessive and the heterozygous genotype creates a yellow-tannish colored horse with a white mane and tail, which is called “palomino”. Use the letter B to guide your answers.

Genotype for brown: Genotype for white: Genotype for “Palomino”

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Cross a Palomino horse with a white horse (A). And a heterozygous brown horse with a white horse (B). Record the Genotypic and Phenotypic probabilities below:

A: B:

What are the possible Genotypes of the offspring?

What are the possible phenotypes of the offspring? (include the probability of inheritance)

What are the possible Genotypes of the offspring?

What are the possible phenotypes of the offspring? (include the probability of inheritance)

10. Can palominos be considered a purebred line of horses? Why or why not?

11. Which two colors of horse would you want to breed if you wanted to produce the maximum numbers of palominos in the shortest amount of time?

**Codominance (Blood types)**

Human blood types are determined by genes that follow the **CODOMINANCE** pattern of inheritance.

There are two dominant alleles (A & B) and one recessive allele (O).

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| Blood Type (Phenotype) | Genotype | Can donate blood to: | Can receive blood from: |
| O | ii (OO) | A,B,AB and O  (universal donor) | O |
| AB | IAIB | AB | A,B,AB and O  (universal receiver) |
| A | IAIA or IAi (IAO) | AB, A | O,A |
| B | IBIB or IBi (IBO) | AB,B | O,B |

1. Write the genotype for each person based on the description:
   1. Homozygous for the “B” allele \_\_\_\_\_\_\_\_\_
   2. **Heterozygous** for the “A” allele \_\_\_\_\_\_\_\_
   3. Type O \_\_\_\_\_\_\_\_\_
   4. Type “A” and had a type “O” parent \_\_\_\_\_\_\_\_\_
   5. Type “AB” \_\_\_\_\_\_\_\_\_
   6. Blood can be donated to anybody \_\_\_\_\_\_\_\_\_
   7. Can only get blood from a type “O” donor \_\_\_\_\_\_\_\_\_
2. Complete the punnett square showing all the possible blood types for the offspring produced

by a type “O” mother and a Type “AB” father. **What are percentages for each offspring?**

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* Offspring 1: \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Offspring 2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Offspring 3: \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Offspring 4: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Mrs. Johnson is type “A” and Mr. Johnson is type “O.” They have three children named Matthew,

Mark, and Luke. Mark is type “O,” Matthew is type “A,” and Luke is type “AB.” Based on this

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information:

* 1. Mr. Essy must have the genotype \_\_\_\_\_\_
  2. Mrs. Essy must have the genotype \_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_ has blood type \_\_\_\_\_\_
  3. Luke cannot be the child of these parents because neither parent has the allele \_\_\_\_\_.

1. Two parents think their baby was switched at the hospital. Amy the mother has blood type “A,” Lin the father has blood type “B,” and Priscilla the baby has blood type “AB.”

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* 1. Mother’s genotype: \_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_
  2. Father’s genotype: \_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_
  3. Baby’s genotype: \_\_\_\_\_\_
  4. Punnett square that shows the baby’s genotype as a possibility
  5. Could the baby actually be theirs? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Based on the information in this table, which men **could not** be the father of the baby?

*(hint… look at the baby’s blood type only…)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**You can use the Punnett square if you need help figuring it out.**

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| --- | --- | --- | --- | --- | --- |
| **Name** | **Blood Type**   |  |  | | --- | --- | |  |  | |  |  | |
| Mother | Type A |
| Baby | Type B |
| The mailman | Type O |
| The butcher | Type AB |
| The waiter | Type A |
| The cable guy | Type B |

**PART FOUR**

**Dihybrid Cross Problems: How to set them up**

1. Figure out the genotypes of both traits for both parents.
2. Write out the parents’ genotypes together ex. AABB X aabb (make sure you keep similar traits together here)
3. Use the FOIL method to set up the test cross

e

1. Draw the arrows for each parent for the FOIL method. An example is given below.

DAD

MOM

A A B B a a b b

1. Set up the

cross for both sides.

ab

AB

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|  |  |  |  |
|  | FOUR DIGIT GENOTYPES GO IN THESE BOXES |  |  |
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1. Practice filling in the probable offspring below.

AB AB AB AB

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| ab  AaBb |  |  |  |
| ab |  |  |  |
| ab |  |  |  |
| ab |  |  |  |

1. To figure the phenotypic ratio, count the number of individuals with either the dominant or recesssive phenotype for both traits! Then that ratio would be something like 4:4:4:4 or 9:3:3:1

PTC-taster- TT, Tt Un-Attached earlobes- EE, Ee Can roll tongue- RR, Rr

Non-PTC taster – tt Attached earlobes – ee Can’t roll tongue - rr

Hitchhikers thumb- HH, Hh Straight pinky- PP, Pp

Straight thumb – hh Bent pinky- pp

Hair on mid-digit – MM, Mm Straight Hairline- WW, Ww

No hair on mid-digit- mm widow’s peak- ww

**Dihybrid Crosses. Set up the crosses using the rules and the letters from the other page.**

1. If a woman who is a non-PTC taster (recessive) with heterozygous hitchhikers thumb has children with a man who is a heterozygous PTC taster with straight thumbs (recessive), what is the probability of them having each of the following types of children? (Fill in the Punnett Square and the blanks).

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Parents’ genotypes \_\_\_\_\_\_\_\_\_\_\_\_ X \_\_\_\_\_\_\_\_\_\_\_\_

* 1. How many PTC taster, Hitchhikers thumb
  2. How many PTC taster, straight thumb
  3. How many Non-PTC taster, Hitchhikers thumb
  4. How many Non- PTC taster, straight thumb
  5. What is the phenotypic ratio?

1. If a woman who has no hair on her mid-digit (recessive)and is homozygous attached earlobes (dominant) has children with a man who has hair on his mid-digit and has attached earlobes (heterozygous for both traits), what is the probability of them having each of the following types of children? (Fill in the Punnett Square and the blanks).

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Parents’ genotypes \_\_\_\_\_\_\_\_\_\_\_\_ X \_\_\_\_\_\_\_\_\_\_\_\_

* 1. How many hair, attached earlobes
  2. How many hair, not attached earlobes
  3. How many hairless, attached earlobes
  4. How many hairless, not attached earlobes
  5. What is the phenotypic ratio?

1. John Doe and Jane Doe want to have children and are thinking about how their childrens’ hands might look. What would their children look like if they are both heterozygous for straight pinky and hitchhikers thumb? (Fill in the Punnett Square and the blanks).

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Parents’ genotypes \_\_\_\_\_\_\_\_\_\_\_\_ X \_\_\_\_\_\_\_\_\_\_\_\_

* 1. Straight pinky, hitchhikers thumb
  2. Straight pinky, Straight thumbs
  3. bent pinky, hitchhikers thumb
  4. bent pinky, Straight thumbs
  5. What is the phenotypic ratio?

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1. Dohn Joe and Dane Joe want to have children and are thinking about how their childrens’ hair line and tongues will turn out. They are both circus performers and want their children to follow in their footsteps. Their circus only accepts people with a Widow’s Peak and who can roll their tongues. What would their children look like if Dohn is heterozygous for both Widow’s peak and tongue rolling, and Dane is homozygous dominant for Widow’s peak and heterozygous for tongue rolling? (Fill in the Punnett Square and the blanks).

Parents’ genotypes \_\_\_\_\_\_\_\_\_\_\_\_ X \_\_\_\_\_\_\_\_\_\_\_\_

* 1. Widow’s Peak, Tongue Roller
  2. Widow’s Peak, non tongue roller
  3. Straight hair line, Tongue Roller
  4. Straight hair line, non tongue roller
  5. What is the phenotypic ratio?
  6. What are the chances of their child being able to join the circus?

**Part four:**

**This problem will involve both a test cross and a Dihybrid Punnett Square**

Kylie Jenner just had a baby. Rumors have been circulating for months about who the lucky father is! Kylie’s baby has attached earlobes and a widow’s peak hairline. Perform a couple of tests to determine who is the MOST likely to be the father based on the information below.

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**Kylie:** Ee Ww

**Travis scott:** ee Ww

**Tyga:** EE Ww

**2chainz:** Ee Ww

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The person who is most likely to be the father of Kylies baby is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because…(provide three reasons below)

1.

2. 3.