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

<table>
<thead>
<tr>
<th>Trait 1</th>
<th>Trait 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTC-taster- TT, Tt</td>
<td>Attached earlobes- EE, Ee</td>
</tr>
<tr>
<td>Non-PTC taster – tt</td>
<td>Free earlobes – ee</td>
</tr>
<tr>
<td>Hitchhikers thumb- HH, Hh</td>
<td>Straight pinky- PP, Pp</td>
</tr>
<tr>
<td>Straight thumb – hh</td>
<td>Bent pinky- pp</td>
</tr>
<tr>
<td>Hair on mid-digit – MM, Mm</td>
<td>Widow’s peak- WW, Ww</td>
</tr>
<tr>
<td>No hair on mid-digit- mm</td>
<td>No widow’s peak- ww</td>
</tr>
<tr>
<td>Can roll tongue- RR, Rr</td>
<td></td>
</tr>
<tr>
<td>Can’t roll tongue - rr</td>
<td></td>
</tr>
</tbody>
</table>

**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).

   Parents’ genotypes: \(ttHh \times Tthh\)

   a. How many PTC taster, Hitchhikers thumb are there? 4
   b. How many PTC taster, straight thumb are there? 4
   c. How many Non-PTC taster, Hitchhikers thumb are there? 4
   d. How many Non-PTC taster, straight thumb are there? 4
   e. What is the phenotypic ratio? 4:4:4:4

2. 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).

   Parents’ genotypes: \(mmEE \times MmEe\)

   a. How many hair, attached earlobes are there? 8
   b. How many hair, not attached earlobes are there? 0
   c. How many hairless, attached earlobes are there? 8
   d. How many hairless, not attached earlobes are there? 0
   e. What is the phenotypic ratio? 8:8

3. John Doe and Jane Doe want to have children and are thinking about how their children's 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).

   Parents’ genotypes: \(PhTh \times PhTh\)

   a. Straight pinky, hitchhikers thumb are there? 9
   b. Straight pinky, Straight thumbs are there? 3
   c. bent pinky, hitchhikers thumb are there? 3
   d. bent pinky, Straight thumbs are there? 1
   e. What is the phenotypic ratio? 9:3:3:1
4. Dohn Joe and Dane Joe want to have children and are thinking about how their children’s 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 \[ WwRr \text{ X } WwRr \]

a. Widow’s Peak, Tongue Roller

b. Widow’s Peak, non tongue roller

c. Straight hair line, Tongue Roller

d. Straight hair line, non tongue roller

e. What is the phenotypic ratio?

f. What are the chances of their child being able to join the circus?

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

Background information:

1. You are a pigeon breeder. In order to make the most money as a pigeon breeder, you must sell mainly checkered winged, red feather pigeons. Lucky for you checkered wings and red feathers are dominant in pigeons (plain wings and brown feathers are recessive). To breed as many checkered winged, red feather pigeons as possible, you need to breed homozygous checkered winged, red feather pigeons with each other (because all of the offspring would be checkered winged, red feather pigeons). You know you have a female homozygous checkered winged, red feathered pigeon (you bred her yourself!) She is so beautiful that she has won prizes in several pigeon beauty contests.

   a. The Problem: You recently purchased a male pigeon that has checkered wings and red feathers from a shady pigeon dealer, who claimed it was homozygous. Before you breed this male with your prize winning female, you want to be sure that it is homozygous for both traits. Describe how you will be able to tell what the genotype for both traits of your pigeon in 1 generation. (test cross here) 5 points

   \[ \begin{array}{ccc}
   C & c \\
   R & r \\
   \end{array} \]

   b. Illustrate the probable outcomes if your pigeon IS homozygous for both traits. (using a Punnett Square) 5 points.

   All offspring show dominant phenotype.