1 Hardy Weinberg Tips

Mark L. Mayo
Cypress College

2 The First Hardy-Weinberg Formula

$p + q = 1$

- p = the dominant trait (a decimal)
- q = the recessive trait (a decimal)

- Both decimals add up to 1

3 The Second Hardy-Weinberg Formula

$p^2 + 2pq + q^2 = 1$

- $p^2$ - represents the homozygous dominant genotype
- 2pq – represents the heterozygotes
- $q^2$ - represents the homozygous recessive genotype

- each term is a decimal and all three added together = 1

4 The Hardy-Weinberg Formulas

- There will be one question covered in the last two slides about the Hardy-Weinberg formulas
- Know what each term represents:
  - p
  - q
  - $p^2$
  - 2pq
  - $q^2$

5 Hardy-Weinberg BIG Hint

- ***Do not round*** until the very last step
- Yes, I know you want to, but don't
- On the very last step when you are back to animals or plants or people – then you get to round off

6 Type 1 problems

- Read the problem carefully
- ***ONE OF THESE WILL BE ON THE TEST***
- The problem will tell you the total population (200)
- The problem will also tell you the number of homozygous recessive plants (18)
- You can use that number to find $q^2$
- For example:

  In a population of 200 plants, you count 18 white-fruited plants and 182 blue fruited plants.

- $q^2$ = 18/200 or 0.9 **(homo. recessives/total pop.)**
- q = the square root of 0.9 or 0.3

7 Type 1 problems

- Use the first Hardy-Weinberg formula to find p
- p + q = 1

- We know q from the last slide
- Use algebra to find p
  - p = 1 – q {-- (*memorize this please!*)
  - p = 1-0.3
  - p = 0.7

8 ▨ Type 1 problems

- You now know both p and q
- Use the second Hardy-Weinberg formula to find
  - Homozygous dominant = $p^2$

    $(0.7)^2 = 0.49$

  - Heterozygotes = 2pq

    $2\ (0.7)(0.3) = 0.42$

9 ▨ Type 1 problems

- To find how many blue-flowered plants are homozygous dominant multiply $p^2$ x the total population

  0.49 x 200 = 98

- To find out how many blue-flowered plants are heterozygous multiply 2pq x the total population

  0.42 x 200 = 84

10 ▨ Type 1 problems

- Check your work *before you check my answer* in the following way
- Add up the numbers for homozygous dominant (AA), heterozygous (Aa) and homozygous recessive (aa) and see if they equal 200

  (this is the total population from the question)

- 98 + 84 + 18 = 200
- If they do not add up exactly to one or very close **you rounded** or made an error

11 ▨ Type II Problems

- The key is to very, very carefully do each step in the example
- Again, do not round
- These take a lot of time, but can be done if approached slowly
- ***None of these will be on the test***, but they are worth 6 points on the homework!

12 ▨ Type III Problems

- These are probably the easiest
- ***ONE OF THESE WILL BE ON THE TEST***
- All problems will start out by telling you the recessive gene frequency
- Each problem will have some lower case letter like a, d, or whatever, but think of these lower case letters as q from the first Hardy-Weinberg formula

  In a population of 119 dogfish, the frequency of a recessive gene (a) is 0.25 in a particular population. Please compute the frequency of heterozygotes in the population.

- q = a = 0.25

13 ▨ Type III Problems

- Do not do more work than the question asks you to do
- Read this example to see what you need to do

In a population of 119 dogfish, the frequency of a recessive gene (a) is 0.25 in a particular population. **Please compute the frequency of heterozygotes** in the population.

- Only find the heterozygotes or 2pq
- To find 2pq you have to use q to find p

14 ▨ Type III Problems

- Use this formula first: p + q = 1
- Since we know q from the question algebra gives us p
- p = 1.0-q
- Write in the number for q you got from the question (0.25)
- p = 1.0 – 0.25
- P = 0.75

15 ▨ Type III Problems

- We now know
  - p = 0.75
  - q = 0.25
- The problem asked for heterozygotes (aka = 2pq)
- Do the math for heterozygotes
  - 2pq = 2 (0.75)(0.25) = 0.375

16 ▨ Type III Problems

- If it asked for the homozygous dominant or $p^2$ you would do this math
  - $P^2 = (0.75)^2 =$ 0.5625