NAME: _____   DATE: _____

Hardy-Weinberg Practice Problems

1. At a locus with a dominant and recessive allele in a population that is in Hardy-Weinberg equilibrium, 16% of the individuals are homozygous for the recessive allele.

a) What is the frequency of the dominant allele?
Since q = 0.4 & p+q = 1,   p + 0.4 = 1,   p = 0.6

b) What is the frequency of the recessive allele?
Given: q2 = 0.16, so q = 0.4

c) What proportion of the population will show the dominant phenotype?
1 – 0.16 = 0.84   OR   f(AA) + f(Aa) = $(0.6)^2$ + 2(0.6)(0.4) = 0.36 + 0.48 = 0.84

d) What proportion of the population will show the recessive phenotype?
Since q = 0.4,   f(aa) = q^2 = $(0.4)^2$ = 0.16
Alternatively, the f(recessive phenotype) = f(homozygous recessive genotype) = 0.16 given in the problem.

e) What proportion of the population will have the homozygous dominant genotype?
Since p = 0.6,   f(AA) = p^2 = $(0.6)^2$ = 0.36

f) What proportion of the population will be heterozygous?
Since p = 0.6 & q = 0.4,   f(Aa) = 2pq = 2(0.6)(0.4) =0.48

g) What proportion of the population will have the homozygous recessive genotype?
Given in the problem f(aa) = 0.16
Since q = 0.4,   f(aa) = q^2 = $(0.4)^2$ = 0.16

2. 25% of a population in Hardy-Weinberg equilibrium has a recessive-based disease. To have the disease, an individual must have both copies of the recessive allele.

a) What is the frequency of the recessive allele?
Given in the problem f(aa) = 0.25,   so q2 = 0.25   q = 0.5

b) What is the frequency of the dominant allele?
Since q = 0.5 & p+q = 1,   p + 0.5 = 1,   p = 0.5

c) What proportion of the population will show the dominant phenotype?
f(dominant phenotype) + f(recessive phenotype) = 1
f(dominant phenotype) + 0.25 = 1   f(dominant phenotype) = 0.75

d) What proportion of the population will show the recessive phenotype?
Given in the problem = 0.25

e) What proportion of the population will have the homozygous dominant genotype?
Since p = 0.5,   f(AA) = p^2 = $(0.5)^2$ = 0.25

f) What proportion of the population will be heterozygous?
Since p = 0.5 & q = 0.5,   f(Aa) = 2pq = 2(0.5)(0.5) =0.50

g) What proportion of the population will have the homozygous recessive genotype?
Given in the problem f(aa) = 0.25
Since q = 0.5,   f(aa) = q^2 = $(0.5)^2$ = 0.25

3. 51% of a population in Hardy-Weinberg equilibrium is normal for the recessive-based disease, 3TC.

$f(AA)$ + $f(Aa)$ + $f(aa)$ = 1   &   51% = $f(AA)$ + $f(Aa)$, so $f(aa)$ = 0.49

$f(aa)$ = q^2 = 0.49,   q = f(a) = 0.7

p + q = 1   p + 0.7 = 1   p = 0.3

    a) What percentage of the population is heterozygous for this trait?

        $f(Aa)$ = 2pq = 2(0.3)(0.7) = 0.42

    b) What percentage of the population shows the recessive phenotype?

        Since q = 0.7, $f(aa)$ = q^2 = $(0.7)^2$ = 0.49

        Given in the problem: $f(aa)$ = 1 - 0.51 = 0.49

    c) What is the frequency of the dominant allele?

        p = 0.3 SEE ABOVE.

4. 4% of a population in Hardy-Weinberg equilibrium has phenylketonuria (PKU), a metabolic disorder that results from the homozygosity for a recessive allele.

    a) What is the frequency of the recessive allele?

        $f(aa)$ = q^2 = 0.04,   q = f(a) = 0.2

    b) What is the frequency of the dominant phenotype?

        f(dominant phenotype) + f(recessive phenotype) = 1

        f(dominant phenotype) + 0.04 = 1

        f(dominant phenotype) = 0.96

    c) What is the frequency of homozygote recessive in this population?

        Given in the problem since f(recessive phenotype) = f(homozygous recessive genotype) = 0.04

    d) What is the frequency of homozygote dominant in this population?

        If q = 0.2 & p + q = 1, p = 0.8

        $f(AA)$ = p^2 = $(0.8)^2$ = 0.64

5. 91% of a feline population in Hardy-Weinberg equilibrium display polydactyly. Polydactyly is a dominant disease.

    a) What is the frequency of the recessive allele?

        $f(AA)$ + $f(Aa)$ + $f(aa)$ = 1   & $f(AA)$ + $f(Aa)$ = 0.91

        0.91 + $f(aa)$ = 1 $f(aa)$ = 0.09

        $f(aa)$ = q^2 = 0.09,   q = f(a) = 0.3

    b) What is the frequency of felines with the homozygous recessive genotype?

        $f(aa)$ = q^2 = 0.09   SEE ABOVE FOR FURTHER EXPLANATION

    c) What is the frequency of felines who do not display polydactyly?

        $f(aa)$ = q^2 = 0.09   SEE ABOVE FOR FURTHER EXPLANATION

6. A population in Hardy-Weinberg has an allelic frequency of the recessive allele of 0.20.

    a) What is the frequency of the dominant allele?

        GIVEN: q = 0.20 & p + q = 1,   p + 0.2 = 1   p = 0.8

    b) What is the frequency of the heterozygote genotype in this population?

        p = 0.8 & q = 0.2, $f(Aa)$ = 2(p)(q) = 2(0.8)(0.2) = 0.32

    c) What proportion of the population display the dominant phenotype?

        $f(AA)$ + $f(Aa)$ + $f(aa)$ = 1   &   q = 0.2 q^2 = $f(aa)$ = 0.04

        $f(AA)$ + $f(Aa)$ + 0.04 = 1

        $f(AA)$ + $f(Aa)$ = 0.96