Problem Set # 1 – Math review -- Due September 13th

Instructions:

This is the first of **six** problem sets that will count towards your final grade. The problem set is due **at the start of lecture** on Monday, September 16th. You may work in groups of up to three people. Please hand in one sheet per group with **up to three names** listed. Late assignments will not be accepted. **Please show your work!** Incorrect answers with correct work will receive part marks; correct answers with no work shown will not receive full marks.

1) Expand $(p + q)^2$ (1 mark)

$p^2 + 2pq + q^2$

2) Expand $(p + q + r)^2$ (1 mark)

$p^2 + q^2 + r^2 + 2pq + 2\,pr + 2\,qr$

3) Solve $x^t = y$ for t. (1 mark)

$t\log(x) = \log(y)$

$t = \dfrac{\log(y)}{\log(x)}$

4) Simplify $x^8y^2x^{-5}y^2x^{-3}$ (1 mark)

$x^0y^4 = y^4$

5) Factor $\dfrac{3x-12}{5x+1} + 14$ (1 marks)

$\dfrac{3x-12+70x+14}{5x+1} = \dfrac{73x+2}{5x+1}$

6) What is the probability that two heterozygote parents (Aa) will produce an offspring that possesses the "a" allele, and is male? (2 marks)

P(A) AND P(male) = P(A)*P(male) = ¾ * ½ = 3/8 = 0.375

7) A male with the genotype aaBb mates with a female with the genotype Aabb. What is the probability that their offspring will have the "A" allele or the "B" allele or both? (2 marks)

=P(A) + P(B) – P(AB) = 0.5 + 0.5 – 0.25 = 0.75 = ¾

8) The following are counts of certain genotypes at one locus in a population:

Genotype	Count
HH	312
HL	221
LL	179
Total	712

a) Calculate the three genotypic frequencies (3 marks).

HH = 312/ 712 = 0.44, HL = 221/ 712 = 0.31, LL = 1-P(HH) – P(HL) = 0.25

b) Calculate the H allelic frequency (2 marks).

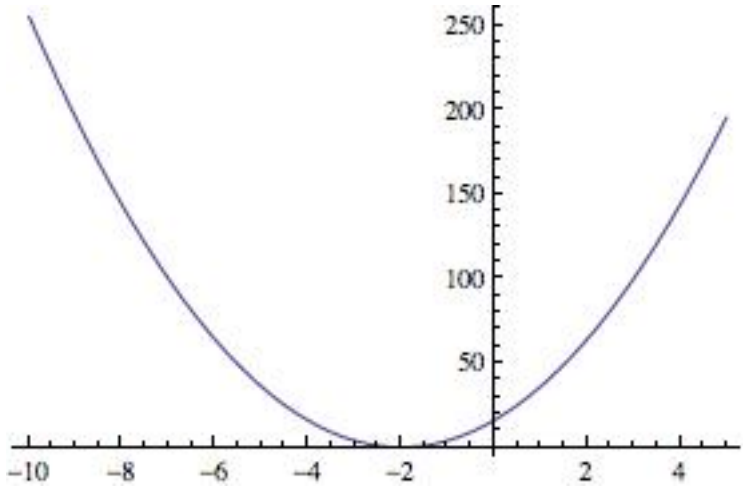
H = (312 + ½ (221)) / 712 = 0.59

c) If you were to randomly choose an individual from the population, what is the probability that this individual carries the H allele (1 mark)?

=P(HH) + P(HL) = 0.44 + 0.31 = 0.75

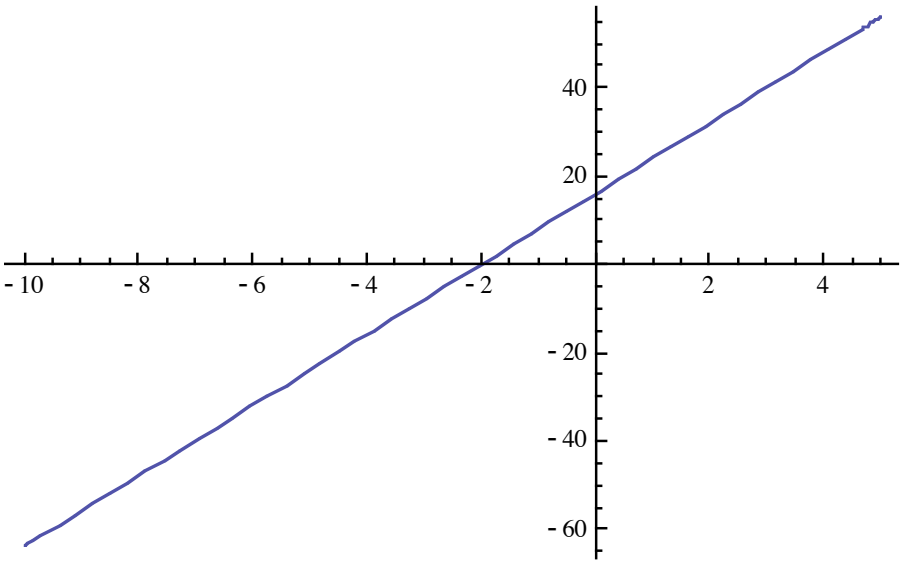
9) Mathematical modeling and graphical analysis.

a) Plot the function $f(x) = (2x + 4)^2$ for values of x ranging from -10 to +5 (you may use a spreadsheet package such as *Excel* or a math package such as *Mathematica* or *Matlab* for this part of the exercise). (2 marks)



b) Determine the first order derivative of this equation. Plot the first order derivative for the same values of x as before. (2 marks)

$$\frac{df}{dx} = 8x + 16$$



c) Solve the derivative to determine the equilibrium value of x. (1 mark)

$8x+16=0$
$x=-2$