1. (9 points) Let the rational function $r(x)$ be defined by

$$r(x) = \frac{2x^2 + 3x + 6}{x^2 - 4x - 5}$$

(a) (3 pts) Find the domain of $r(x)$.
(b) (2 pts) Find the horizontal asymptote of $r(x)$ if it exists. If not, state that it does not exist.
(c) (4 pts) By polynomial long division (or any other method you want), write $r(x)$ in the form

$$A + \frac{Bx + C}{x^2 - 4x - 5}$$

where $A, B,$ and $C$ are real numbers.

2. (6 points) Solve the equation for $x$:

$$\log_4(x + 1) + \log_4(x - 2) = 1$$

(i.e. find all real $x$ that satisfy the equation)

3. (7 points) Suppose $u$ and $v$ are two numbers such that

$$\log_3(u) = 6.3 \quad \text{and} \quad \log_3(v) = 2.5$$

Find:

(a) (2 pts) $\log_3\left(\frac{u^2}{v}\right)$
(b) (3 pts) $\log_9(u^2)$
(c) (2 pts) $\log_3(v\sqrt{u})$

4. (5 points) Suppose a bacteria culture initially has a population of 100 cells and also suppose that it doubles in population every 2 hours. How much time will pass before the population reaches 1400 cells?

(Your answer may or may not be an integer and your answer may include logs or exponents- That is expected because you do not have a calculator)

5. (7 points) Solve the system of equations:

\[
x + 2e^y = 5 \\
2x + e^y = 4
\]

(i.e. find all pairs $(x, y)$ that satisfy both equations).

6. (6 points) Suppose for a snack you have some strawberries and cherries. Each strawberry has 4 Calories and each cherry has 5 Calories. Suppose the snack has a total of 116 Calories and that you have 25 pieces of fruit. How many fruits of each kind do you have?