Question 1. After learning about geometric growth, the company Zom-B-Gone decides to manufacture zombie repellent, and they hire two independent firms to analyze their potential sales. Firm A predicts that if Zom-B-Gone makes $x$ cans, their profit is given by $\log_2(4x)$. Firm B predicts that if Zom-B-Gone makes $x$ cans, their profit is given by $\log_2(2x) + 1$. For which values of $x$ are the predictions the same?

Question 2. The height of one spooky shadow at time $x$ is given by $8^x$, while the height of another spooky shadow at time $x$ is given by $e^{2x+1}$. At what time are the two shadows at the same height?

Question 3. Boxes are packed with giant mealworms. During shipping, the mealworms reproduce. If the box arrives with $x$ mealworms, the number shipped is given by the equation:

$$\ln(2x) + \ln(5x).$$

If a box is shipped with 7 mealworms, how many are there upon arrival?
Question 4. Solve for $x$.

$$\ln(1 - x) + \ln(1 + x) = 3$$

Question 5. Solve for $x$.

$$2^{2^x} = 5$$

Question 6. Here’s a warm-up before we make you graph some rational functions.

$$f(x) = \frac{5x(x - 2)(x - 4)^2(x - 6)}{x}$$

On the number line below, indicate where $f(x)$ is positive and where it is negative.
Question 7. Match the graphs to their equations.

(I) \( \frac{(x - 1)^2(x + 3)}{(x + 1)(x - 2)} \)  
(II) \( \frac{(x - 1)(x + 3)^2}{(x + 1)(x - 2)} \)  
(III) \( \frac{(x - 1)(x + 3)}{(x + 1)^2(x - 2)} \)  
(IV) \( \frac{(x - 1)(x + 3)}{(x + 1)(x - 2)^2} \)
Question 8.

\[ f(x) = \frac{(x - 1)(x + 2)}{(x - 3)(x + 4)} \]

(a) What are the asymptotes of \( f(x) \)?

(b) What are the intercepts of \( f(x) \)?

(c) Plot the asymptotes and intercepts on a number line. For which values of \( x \) is \( f(x) \) negative? For which is it positive?

(d) Sketch a graph of \( f(x) \).

Question 9. Using \( f(x) \) from Question 8, evaluate the following.

(a) \( \lim_{x \to \infty} f(x) \) 
(b) \( \lim_{x \to -\infty} f(x) \) 
(c) \( \lim_{x \to -4} f(x) \) 
(d) \( \lim_{x \to -4^+} f(x) \)

(e) \( \lim_{x \to 0^-} f(x) \) 
(f) \( \lim_{x \to 0^+} f(x) \) 
(g) \( \lim_{x \to 1^-} f(x) \) 
(h) \( \lim_{x \to 1^+} f(x) \)

(i) \( \lim_{x \to -2^-} f(x) \) 
(j) \( \lim_{x \to -2^+} f(x) \) 
(k) \( \lim_{x \to -3^-} f(x) \) 
(l) \( \lim_{x \to -3^+} f(x) \)

For which values \( a \in \mathbb{R} \) does \( \lim_{x \to a} f(x) \) not exist?
Question 10. Graph \( a(x) = \frac{(x - 3)^5}{(x - 1)^2(x - 4)}. \)

Question 11. Graph \( b(x) = \frac{(x - 2)^5}{(x - 1)(x - 4)^2}. \)

Question 12. It would be difficult solve \( a(x) = b(x) \) (using the functions from Questions 10 and 11). Using your graphs, give an interval in which they intersect.
Question 13. Graph \( f(x) = \frac{(x - 3)(x + 3)}{x^2} \). Use your graph to evaluate \( \lim_{x \to 0^-} f(x) \) and \( \lim_{x \to 0^+} f(x) \).

Question 14. Graph \( f(x) = \frac{2(x - 3)(x + 3)}{(x - 1)(x + 1)} \). Use your graph to evaluate \( \lim_{x \to 1^-} f(x) \) and \( \lim_{x \to 1^+} f(x) \).