Textbooks, class notes and electronic devices of any kind are NOT permitted. Box your final answers for each question.

Start each numbered problem on a new page. All problems should be clearly numbered and in order.

You may use this exam paper as scratch paper, but only work done in your bluebook will be graded.

Exam total points: 100

For problems #1 - #3, show your work. Fully simplify all solutions. You must show a complete and valid solution method for full credit.

1. [8 points each] Let \( p(x) = x^3 + 4x^2 + x - 6 \).

(a) Write \( p(x) \) in factored form.

(b) Find all the \( x \)-intercepts of \( p(x) \).

(c) Where is \( p(x) > 0 \)? Give your answer in interval notation.

2. [8, 8, 4, 4 points] These questions are not related.

(a) Find the equation of a rational function \( q(x) \) that satisfies all of the following conditions:
   - vertical asymptote: \( x = -4 \)
   - horizontal asymptote: \( y = 2 \)
   - \( x \)-intercept: 8
   - hole at \( x = 0 \)

For part (a) you may leave your function in factored form; that is, you do not need to multiply it out.

(b) State all the asymptotes of \( r(x) = \frac{2x + 2}{(x + 3)(x - 1)(x + 1)} \).

(c) Which of the following figures shows the behavior of the function \( r(x) = \frac{2x + 2}{(x + 3)(x - 1)(x + 1)} \) around the vertical asymptote that is farthest to the left? Give the letter corresponding to the correct figure.

(d) Find the slant asymptote of the function \( s(x) = \frac{1 - 2x^2}{x - 4} \).
3. [8 points each] These questions are not related.

(a) Given \( f(x) = \frac{4x - 2}{x + 3} \), find all the \( x \)-intercepts of \( f^{-1} \).

(b) If \( g(x) = x^2 - 5x + 4 \) and \( h(x) = x^2 \), state \( g \circ h \) and find all the \( x \)-intercepts of \( g \circ h \).

(c) The graph of \( y = \frac{4x^2}{x^2 - x + 2} \) intersects its horizontal asymptote. State the horizontal asymptote and give the \((x, y)\) coordinates of the point(s) of intersection.

4. [28 points total, 4 points each] These questions will be graded on your answers only. You do not need to show work.

(a) State all the asymptotes of \( y = e^{x-2} + 5 \).

(b) Find the domain of \( y = \ln(x + 7) \). Give your answer in interval notation.

(c) Solve for \( x \): \( \log_9 x = -\frac{3}{2} \). Remember to fully simplify your answer.

(d) Evaluate \( \log_2 6 - \log_2 18 + \log_2 96 \)

(e) Given the relation \( \log S = k \log A - n \log B + \log 100 \), which of the following is an equation for \( S \)? State the letter corresponding to the correct answer as well as the correct answer.

\[
\begin{align*}
A. \quad S &= \frac{100A^k}{B^n} \\
B. \quad S &= A^k - B^n + 2 \\
C. \quad S &= \frac{2A^k}{B^n} \\
D. \quad S &= \frac{A^k}{2B^n} \\
E. \quad S &= \frac{A^k}{B^n} + 2
\end{align*}
\]

Use \( \log_b 2 = 0.4 \), \( \log_b 3 = 0.6 \) and \( \log_b 5 = 0.8 \) to evaluate the following:

(f) \( \log_b 40 \)

(g) \( \log_b (5b)^{-3} \)

END OF EXAM