1. Combine into a single logarithm: $\ln(x + 1) + 3\ln(x) - 2\ln(x - 2)$

(A) $\frac{\ln(3x^2 + 3x)}{\ln(2x - 4)}$  
(B) $\ln\left(\frac{x^4 + x^3}{(x - 2)^2}\right)$  
(C) $\ln\left(\frac{x^4 + x^3}{(2x - 4)^2}\right)$

(D) $\ln(2x + 5)$  
(E) $\frac{3\ln(x^2 + x)}{2\ln(x - 2)}$

2. Which of the following equations represents a parabola with vertex at the point (2, 5) which passes through the point (0, 8)?

(A) $f(x) = x^2 - 2x + 8$  
(B) $f(x) = x^2 - 4x + 8$  
(C) $f(x) = \frac{3}{4}(x - 2)^2 + 5$

(D) $f(x) = (x - 2)^2 + 5$  
(E) $f(x) = (x + 2)^2 + 5$

3. Consider the function defined by

$$h(x) = \frac{(x^2 + 5x - 6)(x^3 - 8)(x^2 - 2x + 4)}{(x^3 + 8)(3x - 6)(x - 6)(x + 2)^2}.$$ 

Circle all the equations of vertical asymptotes

(A) $x = -6$  
(B) $x = -2$  
(C) $x = 0$  
(D) $x = 2$  
(E) $x = 6$

4. For the same function $h$ as in problem 3., circle all the equations of horizontal asymptotes.

(A) $y = 0$  
(B) $y = 1/3$  
(C) $y = 1/2$  
(D) $y = 2/3$  
(E) $y = 1$
5. Solve: $10 = e^{5x}$

(A) $x = \ln(2)$  
(B) $x = \frac{\ln(10)}{5}$  
(C) $x = \frac{\ln(10)}{\ln(5)}$

(D) $x = \ln(5)$  
(E) $x = \frac{\ln(10)}{e^5}$

6. Solve: $\log(3x + 2) = 2\log(6)$

(A) $x = \frac{38}{3}$  
(B) $x = \frac{34}{3}$  
(C) $x = \frac{14}{3}$  
(D) $x = \frac{10}{3}$  
(E) $x = \frac{4}{3}$

7. If $3,000 is invested in an account which pays 7.5% compounded continuously, what will the balance be at the end of 10 years?

(A) $5250.00$  
(B) $5254.12$  
(C) $6,183.09$

(D) $6,351.00$  
(E) $22,500.00$
Free response section. Show your work. No partial credit will be given without clear evidence of a correct method.

8. (20 points) Consider the polynomial function \( p(x) = x^3 - 5x^2 + \frac{3}{4}x + 7 \).

(a) Compute the values \( p(0), p(1), p(2), p(3), \) and \( p(4) \).

(b) One of the values above is 0. Therefore you can use the factor theorem to write \( p(x) \) in the form \( (x - r)(ax^2 + bx + c) \), where \( r \) is the number in part a for which \( p(r) = 0 \). Use long division (or synthetic division) to find the values of \( a, b \) and \( c \).

(c) Find the other two zeros of \( p \) using the quadratic formula.

(d) Sketch the graph of \( p \) on the grid provided.
9. (10 points) Find the inverse of the function defined by \( f(x) = \frac{2x+3}{4} \). Then prove that your answer \( g(x) \) is correct by computing both composite functions \( f \circ g(x) \) and \( g \circ f(x) \).

10. (12 points) Suppose that $800 is deposited into an account with an annual percentage rate of 6%.

(a) What is the balance in the account after 3 years, assuming that compounding takes place quarterly? Round your answer to the nearest penny.

(b) How many years (to the nearest hundredth of a year) does it take the account to double, again compounding quarterly?
(c) How many years (to the nearest hundredth of a year) does it take the account to double, this time compounding continuously?

11. (20 points) Asymptotes and graphs. The graph of a function with zeros at $x = -2$ and $x = 2$ and vertical asymptotes $x = -1$ and $x = 1$ and a horizontal asymptote $y = 1/4$ is shown below. Find a symbolic representation of such a function.
12. (20 points) Explain how you can describe the graph of the quadratic equation

\[ y = ax^2 + bx + c \]

based on the coefficients \( a, b, \) and \( c \). Hint: it may be useful to define the discriminant \( D \) to be \( b^2 - 4ac \). In particular, address the questions (a) does the curve open upwards or downwards, and (b) does it have \( x \)-intercepts?