1. (10 pts.) Solve: \[
\frac{3}{x - 1} + \frac{x}{x + 1} < 1
\]

2. (8 pts.) Find the domain of the function given by \( f(x) = e^{x^2 - 1} + \ln(4x - x^3) + \cos x \)

3. (10 pts.) Let \( f(x) = x^2 - 4x + 5 \) and \( g(x) = 6 - x^2 \). Find and simplify completely
   
   (a) \( (g \circ f)(x) \)
   
   (b) \( \frac{f(x + h) - f(x)}{h} \)

4. (6 pts.) Let \( f(x) = \frac{8x - 4}{2x + 6} \). Find \( f^{-1}(x) \), where \( f^{-1} \) is the inverse function of \( f \).

5. (10 pts.) A painter has 200 feet of very thin tape (shown here as solid black lines). He is going to use it to enclose a large rectangle on a basketball court. He is also going to use a piece of tape to partition the rectangle in half (see figure). Express the area \( A \) of the large rectangle as a function of \( x \).

6. (10 pts.) A manufacturer of radios has daily production costs of \( C = 800 - 10x + 0.25x^2 \) where \( C \) is the total cost (in dollars) and \( x \) is the number of radios produced. How many radios should be produced each day to yield a minimum cost?

7. (10 pts.) Let \( P(x) = x^4 - 3x^3 + 6x^2 + 2x - 60 \). Given that \( x = 1 + 3i \) is a solution to the equation \( P(x) = 0 \), find the complete solution set for this equation.
8. (8 pts.) Find the average rate of change of the function from
   a) \( x_1 = -2 \) to \( x_2 = 4 \)
   b) \( x_1 = -1 \) to \( x_2 = 3 \)

9. (14 pts.) Graph \( f(x) = \frac{5x^2 - 10x}{x^2 - 16} \), finding and labeling all intercepts and asymptotes.

10. (10 pts.) Graph \( f(x) = 4 - 2\ln(2x - 1) \), finding and labeling all intercepts and asymptotes.

11. (12 pts.) (a) Given that \( \ln 2 = 0.69 \) and \( \ln 8 = 2.07 \), find the exact value of: \( \ln(2e^8) \)
    (b) Solve: \( 6(2^{3x-1}) - 7 = 9 \).

12. (10 pts.) Solve the equation \( \log_{10}(5x) + 2\log_{10}(\sqrt{x-1}) = 2 \) and simplify your result.
13. (10 pts.) A Lightpost design (see figure). Find the angle $\theta$.

14. (10 pts.) Find the exact value, if it is defined: (a) $\csc \left( -\frac{10\pi}{3} \right)$ (b) $\sec \left( \frac{19\pi}{6} \right)$

15. (12 pts.) Given that $\tan \theta = -\frac{4}{3}$ and $\sec \theta < 0$, find the exact value of $\sin \left( \theta + \frac{\pi}{6} \right)$

16. (12 pts.) Let $f(x) = 4\sin(3x + \frac{\pi}{2})$. Graph $f$ over one complete cycle, labeling the $x$-intercepts and the highest and lowest points.

17. (12 pts.) Find all solutions ($0 \leq x < 2\pi$) of the equation $2\sec^2 x + \tan^2 x - 3 = 0$

18. (10 pts.) Find the exact value, if it is defined

   (a) $\cot \left[ \cos^{-1} \left( -\frac{2}{5} \right) \right]$ 
   (b) $\sin^{-1} \left[ \sin \frac{10\pi}{3} \right]$

19. (10 pts.) Prove the identity: $\sec^2 x \cot x - \cot x = \tan x$

20. (6 pts.) Given the point $(\sqrt{3}, -3)$ in rectangular coordinates, convert it to polar coordinates $(r, \theta)$ where $r \geq 0$ and $0 \leq \theta < 2\pi$. 