No calculators are allowed.

1. (14 points) Solve for $x$ in the following equations.

(a) $10e^{3x} - 6 = 44$

(b) $3\ln(x) - \ln(4) = \ln(2)$
2. (8 points) If $y^3 + x^2y + 1 = x^3$, then find $\frac{dy}{dx}$. Your final answer may include both variables $(x$ and $y)$. 

3. (8 points) When a circular plate of metal is heated in an oven, its radius increases at the rate of 0.03 centimeters per minute. At what rate is the plate's area increasing when the radius is 100 centimeters?
4. (8 points) Circle each function which has an inverse on its natural domain.

- $f(x) = -3x$

- $f(x) = x^3 - 2x + 4$

- $f(x) = x^3 + 2x - 4$

- $f(x) = \sin(x) - 25x + 40$
5. (8 points) Find a formula for $f^{-1}(x)$ given that $f(x) = \sqrt[3]{x^5 - 1}$. 

6. (10 points) Determine the exact value of each of the following quantities.

   (a) $\sin^{-1}\left(-\frac{\sqrt{2}}{2}\right)$.

   (b) $\cos^{-1}\left(\cos\left(\frac{7\pi}{6}\right)\right)$.
7. (16 points) Complete each boxed equation with the exact value of limit. You must simplify your answer.

(a) \[ \lim_{x \to 1} \frac{x^2 + 3x - 4}{\sin(x - 1)} = \]

(b) \[ \lim_{x \to \infty} \left(1 + \frac{2}{x}\right)^{2x-1} = \]
8. (28 points) Complete each boxed equation with the appropriate formula for the derivative. You do not need to simplify your answers.

(a) If \( y = \ln(x^2 + x + 5), \) then

\[
\frac{dy}{dx} =
\]

(b) If \( f(x) = x^2e^{-x}, \) then

\[
f'(x) =
\]
(c) If \( g(x) = \sin^{-1}(x) \), then

\[
g'(x) =
\]

(d) If \( F(x) = \tan^{-1}(3x) \), then

\[
F'(x) =
\]