1. (8 points) Match the graphs shown to four of the following functions.
No explanation is necessary.

(a) $y = -e^x$
(b) $y = e^{-x}$
(c) $y = \ln x$
(d) $y = \log_4 x$
(e) $y = \sin^{-1} x$
(f) $y = \tan^{-1} x$

2. (32 points) Evaluate the following.

(a) Find $f'(\sqrt{3}/2)$ if $f(u) = \ln \left(\sqrt[3]{\cos^{-1} u}\right)$. Simplify your answer.
(b) If $g(x) = Ca^x$, $g(1) = 3$, and $g(3) = \frac{4}{9}$, find the positive constants $C$ and $a$.
(c) Find $dy/dx$ given $x^{2y} = (\sqrt[3]{y})^x$, $x > 0$, $y > 0$. Leave your answer unsimplified.
(d) Find the local maximum and minimum values of $h(t) = \left(\ln(t + 5)\right)^2$, if any.

3. (20 points)

(a) $\int_{e^6}^{\infty} \frac{dx}{x \log_6 x}$
(b) $\int \frac{\sec^2(e^{-3x})}{e^{3x}} dx$
(c) $\int \frac{\tan^{-1}(2t)}{1 + 4t^2} dt$

4. (20 points) Let $f(x) = \frac{\ln x}{2 + 3 \ln x}$.

(a) Find the domain of $f$.
(b) Evaluate $\lim_{x \to 0^+} f(x)$.
(c) Find an equation for the line tangent to $y = f(x)$ at $x = \frac{1}{e}$.
(d) Show that $f$ is one-to-one.
(e) Find the inverse function $f^{-1}$.

5. (20 points) Use these approximations to calculate your answers to the following problems:
$\ln 2 \approx 0.7$, $\ln 3 \approx 1.1$, $\ln 5 \approx 1.6$, $\ln 11 \approx 2.4$.

(a) How long will it take an investment of $D$ dollars to quadruple in value if the interest rate is 5% per year compounded continuously?
(b) Superman is locked in a room with a kryptonite-like substance, which renders him powerless. His strength will be restored once the radioactive substance has disintegrated by two-thirds. This will take 22 hours. What is the half-life of the substance?