Math 1620 Calculus II   Your Name:_____
Corning Community College
Instructor: J.Hurlburt   **Exam 2 (Sections 5.7- 6.2)**
Directions: Please show all your work neatly and clearly. You will not receive full credit unless you show all work. Unless otherwise indicated, each problem is worth 6 points.

1. Determine the following. If the integral is definite, please leave your answer in simplified exact form.

    a. $\displaystyle\int_{0}^{\pi/2} \frac{\cos x}{4 + \sin^2 x}\,dx$

    b. $\displaystyle\int \frac{2x - 3}{\sqrt{1 - x^2}}\,dx$

    c. $\displaystyle\int \frac{1}{(x - 2)\sqrt{x^2 - 4x}}\,dx$

d. $\displaystyle \int \frac{\sec h(1/x)\tanh(1/x)}{x^2}\,dx$

e. $\displaystyle \int_0^4 \frac{1}{25-x^2}\,dx$

f. $\displaystyle \int \frac{dx}{x^2-4x+7}$

g. $\displaystyle \int \frac{x}{\sqrt{x^4-1}}\,dx$

2. Determine the derivative:

   a. $f(x) = \tanh(2x^3 + 1)$

   b. $g(t) = \arctan(\sinh t)$

   c. $y = \cosh^{-1}(3x)$

3. Determine whether the function $y = x^3$ is a solution of the differential equation $x^2 y' + 3y = 6x^3$

4. Find the principal P that must be invested at the rate of 7%, compounded continuously, so that $500{,}000 is available after 20 years (for Jay to retire).

5. **(10 pts)** In some chemical reactions, the rate at which the amount of a substance changes with time is proportional to the amount present. For the change of δ-gluconolactone into gluconic acid, for example,

$$\frac{dy}{dt} = -0.6y$$

when t is measured in hours.

a. Solve the differential equation to determine y as a function of t.

b. If there are 100 grams of δ-gluconolactone present when $t = 0$, how many grams will be left after the first hour?

6. **(9 points)** Find the particular solution of the differential equation:

$y\frac{dy}{dx} = e^x$ with initial conditions: $y(0) = 4$

7. (9 points) Solve the differential equation $y' = x(1 + y)$