MATH 122 **Exam #3** **Name:______________________**
Fall, 2001

There are 100 points. For full credit you must show your work.

1. (28 points) Compute the derivative. Your answers should have the form "derivative (in suitable notation) equals formula answer".

   a. $y = \frac{3}{5}x^{10} - 4\sqrt{x} + \dfrac{2}{x^7}$

   b. $z = t^5 \ln(\dfrac{1}{t^2+1})$

   c. $P(r) = (e^{4r} + 1)^8$

   d. $w = \frac{1}{\sqrt{2\pi}} e^{-x^2}$

2. (18 points) Compute the **general** antiderivative.

a. $\int (\frac{2}{3}x^5 - 6)\, dx$

b. $\int (\frac{6}{x^2} - \frac{1}{x})\, dx$

c. $\int e^{-2t}\, dt$

3. (8 points) Verify (check) the formula $\int xe^{-x}\, dx = xe^{-x} + e^{-x} + C$.

4. (18 points) Use the graphs shown below to answer the questions. Where you are asked to find an interval ______ $< x <$ ______ , give the most comprehensive interval possible (for example, it is not good enough to say that f is increasing for $-3 < x < -2$). Your answers should be correct to one decimal place; the marks on the x-axis are in intervals of 0.2.

a. Clearly indicate which is the graph of f' and which is the graph of f''.

b. f has one or more local minima at $x =$ ______ ______ .

c. f is concave down for ______ $< x <$ ______ .

d. Considering just negative values of x, f is increasing at an increasing rate for ______ $< x <$ ______ .

e. Considering just negative values of x, f has its steepest positive slope at $x =$ ______ . At this x-value f'' changes from (circle one) *increasing to decreasing* / *positive to negative*.

f. Considering just values of $x > -3$, $f'(x)$ has its minimum (lowest) value at $x =$ ______ . At this x-value f' changes from (circle one) $\left\{\begin{array}{l}\text{negative to positive}\\ \text{decreasing to increasing}\end{array}\right.$ and f'' changes from (circle one) $\left\{\begin{array}{l}\text{negative to positive}\\ \text{decreasing to increasing}\end{array}\right.$.

5. (12 points) The function $f(x)$ has one or more critical point(s) at $x =$ ______ ______ . There is a local minimum at $x =$ ______ , which is / is not (circle one) also a global minimum. There is a local maximum at $x =$ ______ , which is / is not also a global maximum. The concavity appears to change (there are point(s) of inflection) at $x =$ ______ ______ . If $f(x) = G'(x)$ is the derivative of $G(x)$, then of the listed x-coordinates, $G(x)$ is greatest at $x =$ ______ .

6. (16 points) The graph of $h'(t)$, NOT $h(t)$, is shown below. We also know that $h(-2) = 8$.

a. On which interval(s) is h decreasing?

b. At which t-coordinate(s) does h have a local minimum? ______

c. On which interval(s) is h concave up?

d. Compute the values $h(0) =$ ______ , $h(2) =$ ______ , and $h(3) =$ ______ .