

**MATH 1100-005 EXAM 3 (100 Points)**

**For full credit:  
SHOW all work & LABEL all graphs!  
BOX all answers!**

**Name(1pt):**\_\_\_\_\_

1. (18pts) For the following functions, find both vertical and horizontal asymptotes:

(a)  $f(x) = \frac{-x}{3x-1}$

(b)  $f(x) = e^{-x}$

(c)  $f(x) = \frac{\ln(x-1)}{x}$

2. (20pts) Find the derivative of the following functions.

(a)  $f(x) = 1 - e^{4x-2}$

(b)  $f(x) = x^3 e^{x^2-3x}$

(c)  $f(x) = \ln(x^2 + 3x - 1)$

(d)  $f(x) = \ln\left(\frac{x+2}{\sqrt{x+3}}\right)$

3. (30pts) Evaluate the following integrals.

(a)  $\int 2x^3 + e^x - 3dx$

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

(c)  $\int (x + 1)^2 dx$

(d)  $\int \frac{3x^2}{e^{3x^3}} dx$

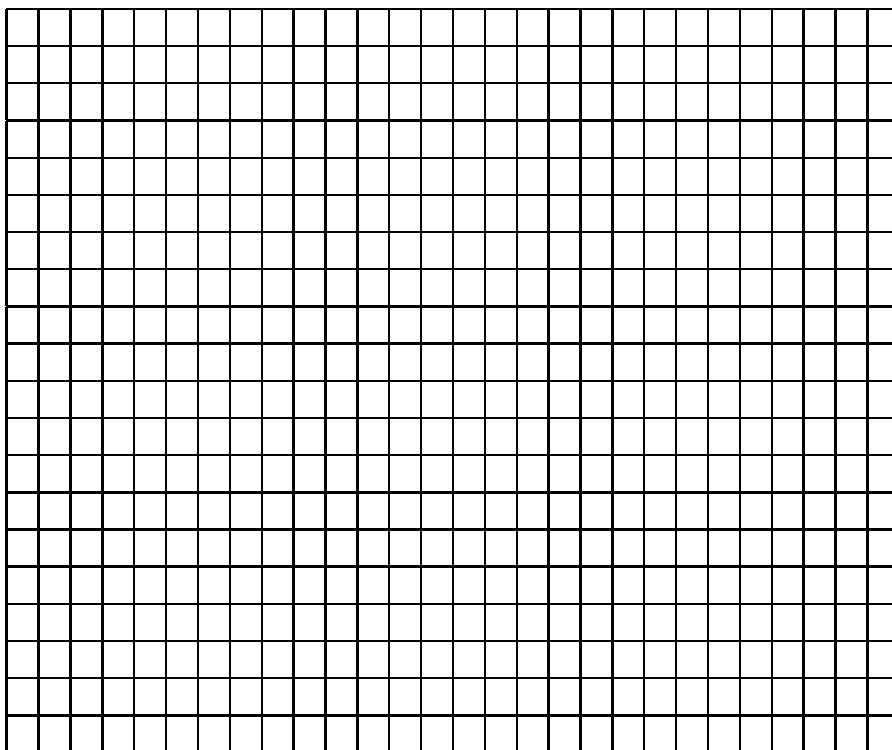
(e)  $\int \frac{x}{\sqrt{1+3x^2}} dx$

(f)  $\int \frac{-2x^3+x-1}{(x^4-x^2+2x-1)^2} dx$

4. (6pts) The weekly revenue for a new product has been increasing. The rate of change of the revenue can be modeled by  $\frac{dR}{dt} = 0.675t^{3/2}$ , where  $t$  is the time in weeks. Find the revenue function if  $R = 100$  when  $t = 10$ .

5. (25pts) Sketch the graph of a function  $f(x)$  that has the following properties (label all local extrema, inflection points, and asymptotes):

- $f'(x) < 0$  on  $(-\infty, -1)$  and  $(2, \infty)$
- $f'(x) > 0$  on  $(-1, 0)$  and  $(0, 2)$
- $f''(x) > 0$  on  $(-2, 0)$  and  $(3, \infty)$
- $f''(x) < 0$  on  $(-\infty, -2)$  and  $(0, 3)$
- $\lim_{x \rightarrow \infty} f(x) = 0$
- $\lim_{x \rightarrow -\infty} f(x) = 3$
- $\lim_{x \rightarrow 0^+} f(x) = -\infty$  and  $\lim_{x \rightarrow 0^-} f(x) = \infty$
- $f(-2) = 2, f(-1) = 0, f(2) = 3, f(3) = 1$



6. (5pts) **EXTRA CREDIT**

From 1995 through 2002, the average salary for superintendents  $S$  (in dollars) in the U.S. changed at the rate of  $\frac{dS}{dt} = 2621.7e^{0.07t}$  ( $t = 5$  corresponds to 1995). In 2001, the average salary for superintendents was \$118,496. Write a model that gives the average salary per year, and find the average salary for superintendents in 1999.

7. (5pts) **EXTRA CREDIT**

For the acceleration function  $a(t) = 2t+6$ , find both the velocity and position functions if given that  $v(1) = 10$  meters/second and  $s(0) = 100$  meters.