## PRACTICE MATH 150 ADVANCEMENT EXAM

Directions for actual test: You may use a scientific calculator for arithmetic operations. Write neatly, show your work and steps. Label your work so it's easy to follow. Answers without appropriate work will receive NO credit. Be sure to simplify all radicals and fractions. Attach your neat and organized solutions behind this cover sheet.

Evaluate each limit

- 1.  $\lim_{x \to 4} \frac{x 4}{x^2 3x 4}$
- $2. \quad \lim_{x \to 0} \frac{1 \sec x}{x}$
- 3.  $\lim_{x \to \infty} \frac{3x^4 2x^3 + 7}{2x^4 + 4x^2}$

Find 
$$\frac{dy}{dx}$$
 for each of the following.  
4.  $y = \frac{3x^2 - 4x}{2x^3 + x}$   
5.  $y = \ln\left(\frac{1}{\sqrt{6x^2 - 4x + 1}}\right)$   
6.  $3x^2y^3 + e^y = xy$   
7.  $y = \ln(\tan^3 x)$   
8.  $y = \frac{x^2}{\sec x}$   
9.  $y = \tan^{-1}(x^4)$   
10. Find the extrema of  $y = \frac{x^3}{e^x}$ 

11. Find the intervals of concavity and inflection points for  $f(x) = x^4 - 8x^3 + 18x^2 - 14$ 

12. A 1000-room hotel currently operates with 800 rooms rented at any given time, with each room renting for \$220 per night. Management has determined that for each increase (or decrease) of \$5 per room, the number of rented rooms will decrease (or increase) by 10. What is the price that the hotel should charge per room and how many rooms will the hotel rent if it wants to maximize the revenue?

Evaluate each integral. If necessary, show the substitution.

13. 
$$\int_{0}^{\pi} \sec(\frac{1}{4}x) dx$$
  
14. 
$$\int \frac{1 - \cos x}{\sin^{2}x} dx$$
  
15. 
$$\int \frac{6x - 6}{(4x^{2} - 8x + 1)^{3}} dx$$
  
16. 
$$\int 6x^{2} \sec^{2}(x^{3}) dx$$
  
17. 
$$\int_{0}^{\pi/4} \frac{e^{\sin x}}{\sec x} dx$$
  
18. 
$$\int_{0}^{2} \frac{2x^{3}}{8 + x^{4}} dx$$

- 19. Find the area bounded by the curves  $y = x^2$  and  $x = y^2$
- 20. The first quadrant region bounded by  $y = x^2$ , y = 9 and x = 0 is rotated about the x-axis. Find the volume of the resulting solid.

ANSWERS:

1.  $\frac{1}{5}$  2. 0 3.  $\frac{3}{2}$  4.  $-\frac{6x^2 - 16x - 3}{(2x^2 + 1)^2}$  5.  $-\frac{2(3x - 1)}{6x^2 - 4x + 1}$ 6.  $\frac{y - 6xy^3}{9x^2y^2 + e^{y} - x}$  7.  $\frac{3sec^2x}{\tan x}$  8.  $-x^2\sin(x) + 2x\cos x$  9.  $\frac{4x^3}{1 + x^8}$ 10. relative maximum at (3, 1.34) 11. Points of inflection (1, -3), (3, 13) Concave up on (- $\infty$ , 1) U (3,  $\infty$ ) concave down on (1, 3) 12. Price = \$310, number of rooms is 620 13.  $4\ln(1 + \sqrt{2})$  14.  $-\cot x + s\csc x + C$  15.  $\frac{-3}{8}(4x^2 - 8x + 1)^{-2} + C$ 16.  $2\tan(x^3) + C$  17.  $e^{\sqrt{2}/2} - 1 \approx 1.028$  18.  $\frac{1}{2}\ln 3$ 19.  $\frac{1}{3}$  sq units 20.  $\frac{972\pi}{5}$  cubic units