Evaluate each integral. Show your work on separate paper.

1) $\displaystyle\int \frac{3x}{\sqrt{4-9x^2}}\,dx$

2) $\displaystyle\int x^3 e^{2x}\,dx$

3) $\displaystyle\int \sec^3 x \tan^3 x\,dx$

4) $\displaystyle\int \ln 5x\,dx$

5) $\displaystyle\int \sin^5 x \cos^4 x\,dx$

6) $\displaystyle\int \frac{\sec x}{\tan^2 x}\,dx$

7) $\displaystyle\int \sin^2 x\,dx$

8) $\displaystyle\int \frac{\sec^2 x}{\sqrt{\tan x}}\,dx$

9) $\displaystyle\int \frac{5}{x^3 - x}\,dx$

10) $\displaystyle\int e^{2x}\sin x\,dx$

11) Solve the differential equation:

$$\frac{dy}{dt} = 0.3y(4-t), \quad y(0) = 1$$

Evaluate the improper integrals. Show your work!

12) $\displaystyle\int_0^\infty e^{3x}\,dx$

13) $\displaystyle\int_{-1}^2 \frac{dx}{x^3}$

(Calculator Active)

14) Twenty-eight lowland gorillas were known to be in a wild animal preserve in 1970. The rate of growth of this population is $\dfrac{dP}{dt} = P(0.1 - 0.0004P)$, where time t is in years.

    a) What is $\displaystyle\lim_{t\to\infty} P(t)$? Interpret this limit in the context of the problem.

    b) What is the rate of change of the population of gorillas when it is growing fastest? Indicate units of measure.

    c) Solve the differential equation, given that $P(0) = 28$. Write your answer so that P is a function of t.