編號： 154

國立成功大學104學年度碩士班招生考試試題

系所組別：環境工程學系丙組

考試科目：微積分

考試日期：0211，節次：3

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Please determine the limit for the following functions. (10%)

(1) $\lim_{x\to-\infty}\frac{-3x+1}{\sqrt{x^2+x}}$ (2) $\lim_{x\to\infty}\frac{3-x}{2x+5}$

2. Please find the derivate of the following functions. (24%)

(1) $g(x)=\text{sech}^2 3x$ (2) $g(x)=\ln\frac{e^x}{1+e^x}$ (3) $f(x)=x^{3/2}\log_2\sqrt{x+1}$

(4) $f(t)=\ln(t^2+4)-\frac{1}{2}\arctan(\frac{t}{2})$

3. Please evaluate the integral of the following functions. (36%)

(1) $\int\frac{x}{\sqrt{9+8x^2-x^4}}dx$ (2) $\int t\ln(t+1)dt$ (3) $\int\frac{x^3e^{x^2}}{(x^2+1)^2}dx$

(4) $\int\frac{1}{1-\sin\theta}d\theta$ (5) $\int\frac{1}{(x^2+5)^{3/2}}dx$ (6) $\int_{-1}^{1}\int_{-1}^{1}\int_{-1}^{1}x^2y^2z^2dxdydz$

4. Solving the linear differential equations:

(1) $\frac{dy}{dx}=\frac{1}{(x-1)\sqrt{-4x^2+8x-1}}$ (7%)

(2) $(y-1)\sin x dx-dy=0$ (8%)

5. A model that is often used to describe the bacteria growth with a limited carrying capacity is given by the logistic differential equation:

$$\frac{dy}{dt}=ky(1-\frac{y}{L}),$$

Where y is the bacteria population; t is hold for all time; k is the growth rate constant (positive); and L is the carrying capacity (a positive constant).

(1) Deriving the general solution of logistic differential equation. (10%)

(2) At t=0, a bacteria culture weights 1 gram. Two hours later, the culture weights 4 grams. The maximum weight, i.e., carrying capacity, of the culture is 20 grams. When will the culture's weight reach 15 grams. (You don't have to derive the exact solution, just explain the procedure of calculation) (5%)