1. If

$$\frac{d}{dx}\left(f(x)\right) = 2x + \frac{3}{x} \tag{1}$$

and $f(1) = 1$,then $f(x)$is

(a) $x^2 + 3\log|x| + 1$
(b) $x^2 + 3\log|x|$
(c) $2 - \frac{3}{x^2}$
(d) $x^2 + 3\log|x| - 4$

2. The integral factor of the differential equation

$$\left(1 - y^2\right)\frac{dx}{dy} + yx = ay, (-1 < y < 1) \tag{2}$$

is

(a) $\frac{1}{y^2-1}$
(b) $\frac{1}{\sqrt{y^2-1}}$
(c) $\frac{1}{1-y^2}$
(d) $\frac{1}{\sqrt{1-y^2}}$

3. Anti derivative of $\frac{\tan(x)-1}{\tan(x)+1}$ with respect to x is:

(a) $\sec^2(\frac{\pi}{4} - x) + c$
(b) $-\sec^2(\frac{\pi}{4} - x) + c$
(c) $\log|\sec(\frac{\pi}{4} - x)| + c$
(d) $-\log|\sec(\frac{\pi}{4} - x)| + c$

4. Evaluate $\int_{\log\sqrt{2}}^{\log\sqrt{3}} \left(\frac{1}{(e^x+e^{-x})(e^x-e^{-x})}\right) dx$

5. (a) Find the general solution of the differential equation:

$$\left(xy - x^2\right)dy = y^2 dx \tag{3}$$

(b) Find the general solution of the differential equation:

$$\left(x^2 + 1\right)\frac{dy}{dx} + 2xy = \sqrt{x^2 + 4} \tag{4}$$

6. (a) Evaluate $\int_{-1}^{1} |x^4 - x| dx$

(b) Find $\int e^x \left(\frac{\sin^{-1} x}{(1-x^2)^{\frac{3}{2}}}\right) dx$

7. Find $\int e^x \left(\frac{1-\sin x}{1-\cos x}\right) dx$