

Work carefully and neatly. You must show all relevant work! You may receive no credit if there is insufficient work. Graphing calculators are not allowed!

[5] 1. Evaluate $\int_0^2 \frac{x}{\sqrt{4+x^2}} dx$.

$$x = 2 \tan \theta$$

$$dx = 2 \sec^2 \theta d\theta$$

$$= \int_{x=0}^2 \frac{2 \tan \theta (2 \sec^2 \theta d\theta)}{2 \sec \theta} = 2 \int \tan \theta \sec \theta d\theta$$

$$= 2 \sec \theta \Big|_{x=0}^{x=2}$$

$$x=0 = 2 \tan \theta$$

$$\theta = 0$$

$$x=2 = 2 \tan \theta$$

$$1 = \tan \theta$$

$$\frac{\pi}{4} = \theta$$

$$= 2 \sec \theta \Big|_0^{\pi/4}$$

$$= 2 \sec \pi/4 - 2 \sec 0$$

$$= \boxed{2(\sqrt{2}) - 2(1) = 2(\sqrt{2}-1)}$$

[5] 2. Evaluate $\int \frac{x^2+3x-1}{(x-1)(x+2)} dx$

$$x^2+x-2$$

$$\begin{array}{r} x^2+x-2 \overline{) x^2+3x-1} \\ \underline{x^2+x-2} \\ 2x+1 \end{array}$$

$$= \int 1 + \int \frac{2x+1}{(x-1)(x+2)} = \frac{A}{x-1} + \frac{B}{x+2}$$

$$A(x+2) + B(x-1) = 2x+1$$

$$Ax+2A+Bx-B = 2x+1$$

$$A+B=2$$

$$2A-B=1$$

$$3A=3$$

$$So A=1$$

$$+ B=1$$

$$= \int 1 dx + \int \frac{1}{x-1} + \int \frac{1}{x+2}$$

$$= \boxed{x + \ln|x-1| + \ln|x+2| + C}$$