10.) $f(x) = x^2 \ln x \quad (e, e^2)$

$f'(x) = x^2 \cdot \frac{1}{x} + \ln x \cdot 2x$

$f'(x) = x + 2x \ln x$

$f'(e) = e + 2e \cdot \underset{(1)}{\cancel{\ln e}}$

$= 3e$

43.) $\frac{dy}{dx} = \frac{3}{2-x}$ $(1,0)$

$\frac{-3}{x-2}$

$\int dy = \int \frac{3}{2-x} dx$

$y = 3\int \frac{1}{2-x} dx$

$y = -3\ln|2-x|$ or $y = -3\ln|x-2|$

$u = 2-x$

$du = -1\,dx$

$y = -3\int \frac{1}{u} du = -3\ln|2-x| + c$

$c = 0$

15.) $\int \frac{x^2-3x+2}{x+1}\,dx = \int \left(x-4+\frac{6}{x+1}\right)dx$

$\frac{1}{2}x^2-4x+6\int \frac{1}{x+1}\,dx$

$u=x+1$

$du=1\,dx$

$6\int \frac{1}{u}\,du$

$\frac{1}{2}x^2-4x+6\ln|x+1|+C$

$-1 \mid 1 \quad -3 \quad 2$

$\qquad\quad -1 \quad 4$

$1 \quad -4 \quad 6$

$x-4+\frac{6}{x+1}$

$$\ln x - \ln y = \ln \frac{x}{y}$$

$$\ln 2 - \ln 7 = \ln \frac{2}{7}$$

11.) $\int \frac{x^2 - 4}{x} dx = \int \left(x - \frac{4}{x}\right) dx$

$\int x dx - \int \frac{4}{x} dx$

59.) $\int_1^2 \frac{1-\cos\theta}{\theta-\sin\theta}\,d\theta = \int \frac{1}{u}\,du$

$u = \theta - \sin\theta$

$du = 1-\cos\theta\,d\theta$

$= \ln|u|$

$= \ln|\theta-\sin\theta|\Big]_1^2$

$\ln|2-\sin 2| - \ln|1-\sin 1|$

$\ln\left|\frac{2-\sin 2}{1-\sin 1}\right|$ if $\approx 51^\circ$

35.) $\int(\cos 3\theta - 1)\,d\theta$

$\int \cos 3\theta\,d\theta - \int 1\,d\theta$

$u = 3\theta$

$du = 3\,d\theta$

$\int 1\,dx$

$x + C$

$\frac{1}{3}\int \cos u\,du$

$\frac{1}{3}\sin 3\theta - \theta + C$

$$\int \tan x \, dx = -\ln|\cos x| + C$$

$$\int \cot x \, dx = \ln|\sin x| + C$$

$$\int \sec x \, dx = \ln|\sec x + \tan x| + C$$

$$\int \csc x \, dx = -\ln|\csc x + \cot x| + C$$

$$y = \ln\sqrt{3x-1}$$

$$y = \frac{1}{2}\ln(3x-1)$$

$$y' = \frac{1}{2} \cdot \frac{3}{3x-1}$$

$$y' = \frac{3}{2(3x-1)}$$

$$y = \ln x^2(1-2x)^5$$

$$y = 2\ln x + 5\ln(1-2x)$$

$$y' = 2 \cdot \frac{1}{x} + 5 \cdot \frac{-2}{1-2x}$$

$$y' = \frac{2}{x} + \frac{-10}{1-2x}$$