1): $y = \sin(3/x^2)$

$y + \Delta y = \sin(3/x^2 + \Delta x^2)$

$\Delta y = \sin(3/x^2 + \Delta x^2) - y$

$\Delta y = \sin(3/x^2 + \Delta x^2) - \sin(3/x^2)$

from the factor formulae.

$\Delta y = \sin(3/x^2 + \Delta x^2) - \sin(3/x^2)$

$= \Delta y = 2\cos\left(\frac{3}{x^2} + \frac{\Delta x^2}{2}\right) \sin \frac{\Delta x^2}{3}$

Divide by Δx^2

$$\frac{\frac{\Delta y}{\Delta x} = 2\cos\left(\frac{3}{x^2} + \frac{\Delta x^2}{2}\right) \sin \frac{\Delta x^2}{2}}{\Delta x^2}$$

Multiply denominator by $4z$

$$\frac{\Delta y}{\Delta x} = 2\cos\left(\frac{3}{2}+\frac{\Delta x^2}{2}\right)\frac{\sin\left[\frac{\Delta x^2}{2}\right]}{\Delta x^2 \times 1/2} \times \frac{1}{2}$$

$$\lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} = \cos\left(\frac{3}{x^2}+0\right) = 1$$

Since $\lim_{\Delta x \to 0} \frac{\sin(\Delta x^2/2)}{\Delta x^2/2} = 1$

Hence $\frac{dy}{dx} = \cos 3/x^2$.

2a) $dx / (x^2 + 36)$

$$\int \frac{dx}{(x^2+36)}$$

$$\int \frac{dx}{x^2+36} = \int \frac{dx}{x^2+6^2}$$

$x = 6 \tan\theta$

$\frac{dx}{d\theta} = 6\sec^2\theta$

$dx = 5\sec^2\theta \, d\theta$

$x^2 + 6^2 = 6\tan\theta + 6^2 = 8^2(\tan^2\theta + 1)$

$= 36 \sec^2\theta$

$$\int \frac{5\sec^2\theta \, d\theta}{36\sec^2\theta} = \int \frac{d\theta}{6} = \frac{1}{6}\int d\theta$$

$\frac{1}{6}[\theta] + C$

$\frac{1}{6} \tan^{-1} x/5 + C$ //

26) $\int dx/x^2+13 = \int \frac{dx}{x^2+4+9}$

$\int \frac{dx}{(x+2)^2+3^2}$

$(x+2) = 3\tan\theta$

$x = 3\tan\theta - 2$

$dx/d\theta = 3\sec^2\theta \Rightarrow dx = 3\sec^2\theta d\theta$

$(x+2)^2+3^2 = 3^2\tan^2\theta + 3^2 =$

$= 3^2\sec^2\theta d\theta$

$\int \frac{3\sec^2\theta d\theta}{3^2\sec^2\theta} = 1/3 \int d\theta$

$= 1/3[\theta] + C.$

$= 1/3\tan^{-1}\left(\frac{x+2}{3}\right) + C$

) $y = 4/x^3$

$y = 4x^{-3}$ and in the

$(4)(-3)x^{-3-1}$

$= -12x^4 = \frac{-12}{x^4}$