a) $y = e^{2x}$

$\frac{dy}{dx} = 2e^{2x}$ at $(0,1)$.

eqn tangent

$y - 1 = 2e^{2x}(x)$.

$y = 2xe^{2x} + 1$.

b) i) $x \sin x$

$y' = x.\cos x + \sin x$

$= x\cos x + \sin x$.

ii) $\frac{\ln x}{x^2}$

$y' = \frac{x^2.\frac{1}{x} - \ln x.2x}{x^4}$

$= \frac{x - 2x\ln x}{x^4}$

$= \frac{x(1 - 2\ln x)}{x^{4+3}}$

$= \frac{1 - 2\ln x}{x^3}$

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c) $\frac{\sin 45}{y} = \frac{\sin 60}{x}$

$\frac{\frac{1}{\sqrt{2}}}{y} = \frac{\frac{\sqrt{3}}{2}}{x}$.

$\frac{1}{\sqrt{2}y} = \frac{\sqrt{3}}{2x}$

$\frac{2x}{\sqrt{2}y} = \sqrt{3}$.

$\frac{x}{y} = \sqrt{3} \div \frac{2}{\sqrt{2}}$.

$\frac{x}{y} = \frac{\sqrt{6}}{2}$. $= \frac{\sqrt{3}.\sqrt{2}}{2}$.

$\frac{x}{y} = \sqrt{3} \div \frac{2\sqrt{2}}{2}$. $= \frac{\sqrt{3}}{\sqrt{2}}$.

di) $\int \cos 3x \, dx$.

$= \frac{1}{3}\sin 3x + c$.

ii) $\int_0^1 (e^{5x} - 1)dx$.

$= \left[\frac{1}{5}e^{5x} - x\right]_0^1$

$= \left(\frac{1}{5}e^5 - 1\right) - \left(\frac{1}{5}e^0 - 0\right)$.

$= \frac{1}{5}e^5 - 1 - \frac{1}{5}$

$= \frac{1}{5}e^5 - 1\frac{1}{5}$.