Direction: Do as indicated. Show complete and clear solution to get full points. Box your final answers.

1. Evaluate the following integrals. (**7 points each**)

   i. $\displaystyle\int_0^{\pi/6} x\tan^2 3x\, dx$

   ii. $\displaystyle\int \frac{2x^2 - 2x - 1}{x^3 - x^2}\, dx$

   iii. $\displaystyle\int \frac{1}{x^2\sqrt{9 - 4x^2}}\, dx$

   iv. $\displaystyle\int_0^{\infty} \frac{e^{-\sqrt{x}}}{\sqrt{x}}\, dx$

2. Find the orthogonal trajectories for the family of curves, $\sin^2 y = k\ln x$. (**6 points**)

3. Solve the differential equation. (**6 points**)
$$\frac{y'\cos y}{\sin x} = \frac{x^2}{\sin^2 y}$$

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