(a) Use the technique of integration by parts to find the following indefinite integral
\[ \int \sqrt{x} \ln x \, dx. \]

Let \( u = \ln x \) and \( dv = \sqrt{x} \, dx \). It follows that \( du = \frac{dx}{x} \) and \( v = \frac{x^{3/2}}{3/2} \). Using integration by parts, we have
\[
\int \sqrt{x} \ln x \, dx \text{ IBP} = (\ln x) \left( \frac{x^{3/2}}{3/2} \right) - \int \frac{x^{3/2}}{3/2} \frac{dx}{x}
\]
\[
= \frac{2}{3} x^{3/2} \ln x - \frac{2}{3} \int x^{1/2} \, dx
\]
\[
= \frac{2}{3} x^{3/2} \ln x - \frac{4}{9} x^{3/2} + C
\]

(b) Use the technique of partial fractions to find the following indefinite integral.
\[ \int \frac{3x^2 + 4x + 4}{(4x + 1)(x^2 + 1)} \, dx. \]

First, write
\[
\frac{3x^2 + 4x + 4}{(4x + 1)(x^2 + 1)} = \frac{A}{(4x + 1)} + \frac{Bx + C}{(x^2 + 1)}.
\]
Thus, \( 3x^2 + 4x + 4 = A(x^2 + 1) + (Bx + C)(4x + 1) \). At \( x = -\frac{1}{4} \), we have \( 3 \left( -\frac{1}{4} \right)^2 + 4 \left( -\frac{1}{4} \right) + 4 = A \left( -\frac{1}{4} \right)^2 + 1 \).
It follows that \( A = 3 \). Now when \( x = 0 \), we have \( 0 + 0 + 4 = 3(0 + 1) + (0 + C)(0 + 1) \) so that \( C = 1 \).
Finally, when \( x = 1 \), we have \( 3 + 4 + 4 = 3(1 + 1) + (B + 1)(4 + 1) \) which implies that \( B = 0 \). Thus,
\[
\int \frac{3x^2 + 4x + 4}{(4x + 1)(x^2 + 1)} \, dx = \int \frac{3 \, dx}{4x + 1} + \int \frac{dx}{x^2 + 1}
\]
\[
= \frac{3}{4} \ln |4x + 1| + \arctan x + C.
\]