5. Find the Taylor polynomial \( p_k(x) \) of \( f(x) = \sqrt{x} \), \( k = 3 \) at point \( x = 9 \).

\[
\begin{align*}
  f'(x) &= \frac{1}{2\sqrt{x}}, \\
  f'(a) &= \frac{1}{2\sqrt{a}}, \\
  f''(x) &= -\frac{1}{4x^{3/2}}, \\
  f''(a) &= -\frac{1}{4a^{3/2}}, \\
  p_k(x) &= 3 + \frac{1}{2}(x-9) - \frac{1}{16}(x-9)^2 + \frac{1}{3888}(x-9)^3.
\end{align*}
\]

11. Find the 1st and 2nd order Taylor polynomials for \( f(x, y) = e^{2x}\cos 3y + \alpha = (0, 0) \).

\[
\begin{align*}
  f_x &= 2e^{2x}\cos 3y, \\
  f_y &= -3e^{2x}\sin 3y, \\
  f_{xx} &= 4e^{2x}\cos 3y, \\
  f_{yy} &= -9e^{2x}\sin 3y, \\
  f_{xy}(0, 0) &= -2, \\
  f_y(a) &= 0, \\
  f_{xx}(a) &= -4, \\
  f_{yy}(a) &= 0, \\
  f_x(0, 0) &= 0, \\
  f_y(0, 0) &= 0.
\end{align*}
\]

14. Calculate the Hessian matrix \( H_f(a) \) for \( f(x, y) = \frac{x + y}{x + y + 1} \) at \( a = (0, 0) \).

\[
H_f(0, 0) = \begin{bmatrix}
-2 & 0 \\
0 & 2
\end{bmatrix} = H_f(0, 0).
\]

21. Find the 3rd order polynomial of \( f(x, y, z) = x^3 + y^3 + z^3 + 3xy + 3yz + 3zx + x + y + z + 2 \) at \((0, 0, 0)\).

\[
\begin{align*}
  f_x &= 3x^2 + 3y^2 + z^2, \\
  f_y &= 3x^2 + 3y^2 + z^2, \\
  f_z &= 3x^2 + 3y^2 + z^2, \\
  f_{xx} &= 3x^2 + 3y^2 + z^2, \\
  f_{yy} &= 3x^2 + 3y^2 + z^2, \\
  f_{zz} &= 3x^2 + 3y^2 + z^2, \\
  f_{xy} &= 3x^2 + 3y^2 + z^2, \\
  f_{xz} &= 3x^2 + 3y^2 + z^2, \\
  f_{yz} &= 3x^2 + 3y^2 + z^2.
\end{align*}
\]

\[
p_3(x, y, z) = f(x, y, z) + f_y(x, y, z) + \frac{1}{2}f_{xx}(x, y, z) + f_{xy}(x, y, z) + f_{yy}(x, y, z) + \frac{1}{2}f_{xy}(x, y, z) + f_{yy}(x, y, z) + \frac{1}{2}f_{xz}(x, y, z) + f_{yz}(x, y, z) + \frac{1}{2}f_{yz}(x, y, z) + f_{yz}(x, y, z) + \frac{1}{2}f_{xz}(x, y, z) + f_{xz}(x, y, z) + f_{yz}(x, y, z) + \frac{1}{2}f_{xy}(x, y, z) + f_{xy}(x, y, z) + f_{yy}(x, y, z) + \frac{1}{2}f_{yy}(x, y, z) + f_{yy}(x, y, z) + f_{yy}(x, y, z) + \frac{1}{2}f_{yy}(x, y, z) + f_{yy}(x, y, z) + f_{yy}(x, y, z) + \frac{1}{2}f_{yy}(x, y, z) + f_{yy}(x, y, z) + f_{yy}(x, y, z).
\]

\[
p_3(0, 0, 0) = 2 + 12 + 18 + 6 + 2 + 12 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 = 0
\]

\[
p_3(0, 0, 0) = 2 - z + 3x + 2y^3 + x^2 - z^2
\]