Given the values of the following, construct the 6th degree Taylor Polynomial centered at \( x = 0 \)

\[
P(x) = a + bx + cx^2 + dx^3 + ex^4 + fx^5 + gx^6
\]

\[
P'(x) = b + 2cx + 3dx^2 + 4ex^3 + 5fx^4 + 6gx^5
\]

\[
P''(x) = 2c + 6dx + 12ex^2 + 20fx^3 + 30gx^4
\]

\[
P'''(x) = 6d + 24ex + 60fx^2 + 120gx^3
\]

\[
P^4(x) = 24e + 120fx + 360gx^2
\]

\[
P^5(x) = 120f + 720gx
\]

\[
P^6(x) = 720g
\]

\[
P_6(x) = 7 + 3x + \frac{9x^2}{2} + \frac{15x^3}{3!} + \frac{6x^4}{4!} + \frac{4x^5}{5!} + \frac{12x^6}{6!}
\]

What would be the next 2 terms if \( P^7(0) = 22 \) and \( P^8(0) = 50 \)?

\[
\frac{22x^7}{7!} + \frac{50x^8}{8!}
\]
Given the values of the following, construct the 4th degree Taylor Polynomial centered at \( x = 0 \):

1. \( P(0) = 2 \) \( P'(0) = 5 \) \( P''(0) = 8 \) \( P'''(0) = 11 \) \( P^4(0) = 14 \)

\[
P_4(x) = \frac{2x^0}{0!} + \frac{5x^1}{1!} + \frac{8x^2}{2!} + \frac{11x^3}{3!} + \frac{14x^4}{4!}
\]

\[
P_4(-2) = 2 + 5(-2) + \frac{8(-2)^2}{2!} + \frac{11(-2)^3}{3!} + \frac{14(-2)^4}{4!}
\]

2. \( P(0) = 5 \) \( P'(0) = -2 \) \( P''(0) = 7 \) \( P'''(0) = -4 \) \( P^4(0) = 10 \)

\[
P_5(x) = \frac{5x^0}{0!} - \frac{2x^1}{1!} + \frac{7x^2}{2!} - \frac{4x^3}{3!} + \frac{10x^4}{4!}
\]

Given the values of the following, construct the 4th degree Taylor Polynomial centered at \( x = 2 \):

3. \( P(2) = 2 \) \( P'(2) = 5 \) \( P''(2) = 8 \) \( P'''(2) = 11 \) \( P^4(2) = 14 \)

\[
P_4(x-2) = \frac{2(x-2)^0}{0!} + \frac{5(x-2)^1}{1!} + \frac{8(x-2)^2}{2!} + \frac{11(x-2)^3}{3!} + \frac{14(x-2)^4}{4!}
\]

\[
P_4(x-2) = 2 + 5(x-2) + 4(x-2)^2 + \frac{1}{2}(x-2)^3 + \frac{7}{12}(x-2)^4
\]

Given the values of the following, construct the 4th degree Taylor Polynomial centered at \( x = -2 \):

4. \( P(-2) = 5 \) \( P'(-2) = -2 \) \( P''(-2) = 7 \) \( P'''(-2) = -4 \) \( P^4(-2) = 10 \)

\[
P_4(x+2) = 5 - 2(x+2) + \frac{7(x+2)^2}{2} - \frac{4(x+2)^3}{3!} + \frac{10(x+2)^4}{4!}
\]
3rd order = 3rd degree (Take 3 derivatives) centered at x = 0

Create the Maclaurin Series for \( f(x) = e^x \) by using the Taylor Polynomial process:

\[
\begin{align*}
 f(x) &= e^x \\
 f'(x) &= e^x \\
 f''(x) &= e^x \\
 f'''(x) &= e^x
\end{align*}
\]

\[
P_3(x) = \frac{1}{0!} + \frac{1}{1!} x + \frac{1}{2!} x^2 + \frac{1}{3!} x^3
\]

\[
\boxed{P_3(x) = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!}}
\]

Create the Maclaurin Series for \( f(x) = \sin x \) by using the Taylor Polynomial process.