Differentiate the following functions:

(a) \( f(x) = \frac{2x}{\sqrt{x+1}} \)

\[
\left( \frac{2x}{\sqrt{x+1}} \right)' = \frac{(2x)'\sqrt{x+1} - 2x(\sqrt{x+1})'}{(x+1)^{3/2}} = \frac{2\sqrt{x+1} - 2x \cdot \frac{1}{2\sqrt{x+1}}}{x+1} = \frac{2(x+1) - x}{(x+1)^{3/2}}
\]

using the chain rule to differentiate \( \sqrt{x+1} \): \( u = x+1 \) and \((x+1)' = 1\),

\( (\sqrt{u})' = \frac{1}{2\sqrt{u}} \).

(b) \( g(t) = \cos(\ln(t+1)) \)

\[
(\cos(\ln(t+1)))' = -\sin(\ln(t+1)) \cdot \frac{1}{t+1} = -\frac{\sin(\ln(t+1))}{t+1}
\]

using the chain rule with \( u = \ln(t+1) \):

\( (\ln(t+1))' = \frac{1}{t+1} \) (this uses another chain rule with \( u = t+1 \) and \( (\ln u)' = \frac{1}{u} \)) and \( (\cos u)' = -\sin u \).

(c) \( w(z) = z^3 e^z \)

\[
(z^3 e^z)' = (z^3)'e^z + z^3(e^z)' = 3z^2 e^z + z^3 e^z = (3z^2 + z^3)e^z
\]