12. \( \omega = \ln (1 + rs) \).

\[
d\omega = \frac{\partial \omega}{\partial r} \, dr + \frac{\partial \omega}{\partial s} \, ds
\]

\[
= \frac{S}{1 + rs} \, dr + \frac{r}{1 + rs} \, ds
\]

15. \( \omega = \sqrt{x^4 + y^2 + z^2} \)

\[
d\omega = \frac{\partial \omega}{\partial x} \, dx + \frac{\partial \omega}{\partial y} \, dy + \frac{\partial \omega}{\partial z} \, dz
\]

\[
= \frac{1}{\sqrt{x^4 + y^2 + z^2}} \left( x \, dx + y \, dy + z \, dz \right)
\]

31. 32.

Use approximation formulas.

\[ f(x + \Delta x, y + \Delta y) \approx f(x, y) + f_x(x, y) \Delta x + f_y(x, y) \Delta y. \]

In these two problems, both \( f(x + \Delta x, y + \Delta y) = f(x, y) = 0 \).

In 31, \( y = 2.08 \)
In 32, \( x = 1.95 \).