

Calculus I, Section 3.1, #28
Derivatives of Polynomials and Exponential Functions

Differentiate the function.¹

$$F(z) = \frac{A + Bz + Cz^2}{z^2}$$

We will use algebra to rewrite the given function in the form of the power rule for differentiation. Also, the function notation $F(z)$ tells us the input variable is z , so A , B , and C are constants.

$$\begin{aligned} F(z) &= \frac{A + Bz + Cz^2}{z^2} \\ &= \frac{A}{z^2} + \frac{Bz}{z^2} + \frac{Cz^2}{z^2} \\ &= \frac{A}{z^2} + \frac{B}{z} + C \\ &= Az^{-2} + Bz^{-1} + C \end{aligned}$$

and now we differentiate

$$\begin{aligned} \frac{dF}{dz} &= A \cdot -2 \cdot z^{-2-1} + B \cdot -1 \cdot z^{-1-1} + 0 \\ &= -2Az^{-3} - Bz^{-2} \end{aligned}$$

or

$$= -\frac{2A}{z^3} - \frac{B}{z^2}$$

or

$$= -\frac{2A + Bz}{z^3}$$

¹Stewart, *Calculus, Early Transcendentals*, p. 180, #28.