

**Exercise 28**

Differentiate the function.

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

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**Solution**

Rewrite the given function.

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

Take the derivative of this function.

$$F'(z) = \frac{d}{dz}(Az^{-2} + Bz^{-1} + C)$$

Use the sum rule.

$$F'(z) = \frac{d}{dz}(Az^{-2}) + \frac{d}{dz}(Bz^{-1}) + \underbrace{\frac{d}{dz}(C)}_{=0}$$

The derivative of a constant is zero.

$$F'(z) = \frac{d}{dz}(Az^{-2}) + \frac{d}{dz}(Bz^{-1})$$

Use the constant multiple rule.

$$F'(z) = A \frac{d}{dz}(z^{-2}) + B \frac{d}{dz}(z^{-1})$$

Use the power rule.

$$F'(z) = A(-2z^{-3}) + B(-z^{-2})$$

Therefore,

$$F'(z) = -2Az^{-3} - Bz^{-2}.$$