Exercise 27

Differentiate the function.

$$G(q) = (1 + q^{-1})^2$$

Solution

Rewrite the given function.

$$G(q) = 1 + 2q^{-1} + q^{-2}$$

Take the derivative of the given function.

$$G'(q) = \frac{d}{dq}(1 + 2q^{-1} + q^{-2})$$

Use the sum rule.

$$G'(q) = \underbrace{\frac{d}{dq}(1)}_{=0} + \frac{d}{dq}(2q^{-1}) + \frac{d}{dq}(q^{-2})$$

The derivative of a constant is zero.

$$G'(q) = \frac{d}{dq}(2q^{-1}) + \frac{d}{dq}(q^{-2})$$

Use the constant multiple rule.

$$G'(q) = 2\frac{d}{dq}(q^{-1}) + \frac{d}{dq}(q^{-2})$$

Use the power rule.

$$G'(q) = 2(-q^{-2}) + (-2q^{-3})$$

Therefore,

$$G'(q) = -2q^{-2} - 2q^{-3}.$$