Products and quotients (fractions) are very common in mathematics. Section 2-3 taught how to differentiate addition and subtraction expressions, but what about products and quotients? How can they be differentiated? This section explains how, divided into rules for each case.

# Product Rule

Multiplication is different from addition, so it has different rules for differentiation. For example, for about any two functions, the product of the derivatives of the functions does not equal the derivative of the product of the functions. That is, . There is a different rule for differentiating two functions that are multiplied by each other. In Leibniz and prime notation, the product rule says:

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# Quotient Rule

Division breaks one number according to how many times the bottom number says it should be broken. This makes the derivative of a quotient tricky, because there is also an option to divide the fraction and then differentiation the results instead of applying the quotient rule. In Leibniz and prime notation, the quotient rule states:

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# Trigonometric Function Derivative Rules

All trigonometric functions can be defined in terms of addition, subtraction, multiplication, and division of a constant and the sine of an angle. This means that the product and quotient rules can differentiate them, using the circle of sine and cosine derivatives from section 2-3. A table below illustrates the differentiation of these functions, in prime notation.

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| --- | --- | --- |
| Function () | 🡺 🡺 | Derivative () |
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# What Did You Learn?

* How do you find the derivative of a product?
* How do you find the derivative of a quotient?
* Why does this relate to trigonometry?