***Section* 3.4 – Properties of Logarithms**

***Product* Rule**

**** ***For M >* 0 *and N >* 0**

 ⇒ MN = *bx by* = *bx+y*

Convert back to logarithmic form: 



***Example***

Use the product rule to expand the logarithmic expression



***Power* Rule**



***Example***

Use the power rule to expand each logarithmic expression



***Quotient* Rule**

****

***Example***

Use the quotient rule to expand the logarithmic expression





***Example***

Express each of the following in terms of sums and differences of logarithm: 

***Solution***

 *Product Rule*

***Example***

Express each of the following in terms of sums and differences of logarithm: 

***Solution***

 *Quotient Rule*

***Example***

Express each of the following in terms of sums and differences of logarithm: 

***Solution***



 *Power Rule*



***Example***

Express each of the following in terms of sums and differences of logarithm: 

***Solution***

 *Product Rule*

=  *Power Rule*



***Example***

Express each of the following in terms of sums and differences of logarithm: 

***Solution***

 *Quotient Rule*

 *Product Rule*



 *Power Rule*

***Example***

Express each of the following in terms of sums and differences of logarithm: 

***Solution***

 *Quotient Rule*

 *Product Rule*

=  



***Example***

Write as a single logarithmic 

***Solution***

 *Quotient Rule*

***Example***

Write as a single logarithmic 

***Solution***

 *Product Rule*

 *Quotient Rule*

***Example***

Write as a single logarithmic 

***Solution***

 *Power Rule*

 *Product Rule*



***Example***

Write as a single logarithmic 

***Solution***

 *Power Rule*

 *Quotient Rule*

***Exercises Section* 3.4 – Properties of Logarithms**

(**1** − **31**) Express the following in terms of sums and differences of logarithms

|  |  |  |
| --- | --- | --- |
|  |  |  |

(**32** − **55**) Write the expression as a single logarithm and simplify if necessary

|  |  |
| --- | --- |
|  |  |
|  |  |

1. Assume that. Find each logarithm , 
2. Given that: ,, and  find each of the following:

|  |  |  |
| --- | --- | --- |
|  |  |  |