# Monday 5/18 Notes: Properties of Logs

| **Property Name** | **Condensed Form** | **Expanded Form** |
|---|---|---|
| Product Property | $\log_b(mn)$ | $\log_b(m)+\log_b(n)$ |
| Division Property | $\log_b\left(\frac{m}{n}\right)$ | $\log_b(m)-\log_b(n)$ |
| Power Property | $\log_b\left(m^a\right)$ | $a\log_b(m)$ |

**Change of Base Formula**: $\log_b(a)=\frac{\log(a)}{\log(b)}$

**Inverse Properties**: $\log_b\left(b^x\right)=x$

$b^{\log_b x}=x$

**<u>Expanding & Condensing Examples</u>**

Ex. 1: Expand the following log completely: $\log_5\left(a^2b^7\right)$

Ex. 2: Expand the following log completely: $\ln\left(\frac{25}{3}\right)$

Ex. 3: Write the following as a single logarithm: $4\log_4 m+3\log_4 n-\log_4 p$

Ex. 4: Write the following as a single logarithm: $3\ln 2-2\ln 5$

# Wednesday 5/20 Notes: Solving with Logs

**<u>Solving Techniques:</u>**

- Changing to log form
- Changing to exponential form
- Change of base
- Cancel the logs on each side
- Use log properties
- Exponential common bases
- Take the log of both sides – please see the optional challenge video

*You need to make sure you are checking your answers! You cannot take the log of a negative number.*

**Change to Log Form**

*This is a good technique for when you have a number with an exponent = #, you need to get the base & exponent alone 1$^{st}$.*

1. $10^{x-1} - 4 = -2$

**Change to Exponent Form**

*This is a good technique when you have log = #, you need to get the log alone 1$^{st}$.*

2. $3\log_2(x-5) = 9$

**Change of Base**

This technique is best for solving when you have exponentials that do not have the same base or logs that you cannot plug into your calculator right away.

3. $7^{3x} = 5$

**Cancelling Logs on Both Sides**

This technique only works when you have log = log, one log per side with no extra pieces

4. $\ln\left(x^2 - 20\right) = \ln(-x)$

**Using Log Properties**

Sometimes you might need to condense one or both sides to then use another property listed above.

5. $\log_6(x+4)+\log_6(2)=3$

6. $\log_5(3)-\log_5(x)=\log_5(14)$

**Using Exponential Common Bases**

This technique only works when both bases can be written using the same base, always use the smallest base.

7. $2^{x+1}=8^{2x}$

8. $\left(\frac{1}{25}\right)^x=625^{x-4}$