# RATIONAL EXPONENTS & SOLVING EXPONENTIAL EQUATIONS, INCLUDING LOGS

## Rational Exponents

| Topics | Type | Things to Remember | Example |
|---|---|---|---|
| **Rational Exponents** | Converting<br>Rational ↔ Radical | Remember: *exponent* *over* *index* OR *power* *over* *root*. Each in alphabetical order. | $a^{\frac{e}{i}} = \sqrt[i]{a^e}$<br>e = exponent  i = index<br>*or*<br>p = power  r = root<br>Example → $x^{\frac{5}{3}} = \sqrt[3]{x^5}$ |
| | Negative exponents | Take the reciprocal to make a positive exponent in the denominator | $b^{-n} = \frac{1}{b^n}$ |

## Exponential Equations

| Topics | Type | Things to Remember | Equation |
|---|---|---|---|
| **Exponential Equations** | Growth or Decay | Discern if the problem is growth or decay by identifying key words<br>growth, increase, incline, deposit / decay, decrease, decline, withdrawal<br>$y$ = total end amount<br>$a$ = initial amount<br>$r$ = rate *(converted to a decimal)*<br>$x$ = time | $y = a(1 \pm r)^x$<br>Growth → $1 + r$<br>Decay → $1 - r$ |

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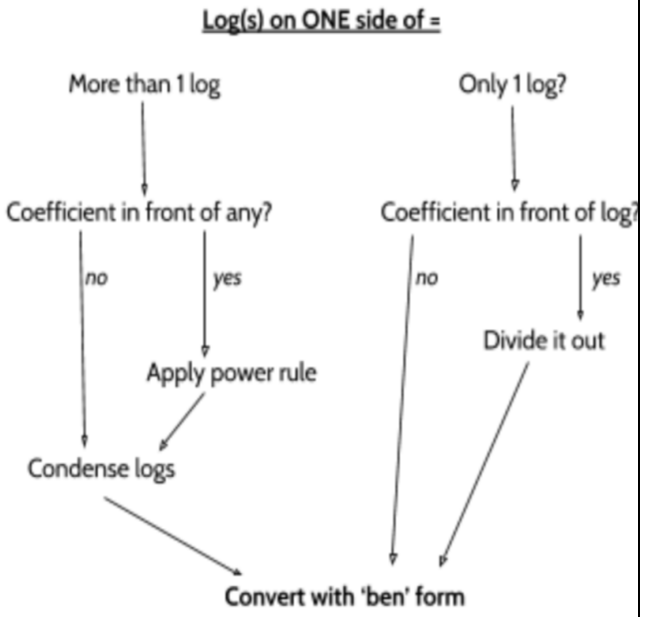
| | Compounding ***n times*** | Problem will say the word "***compounding***" (or "*compounded*") followed by a period of time. Such as: *daily, weekly, monthly, quarterly, annually, etc.* [This is your $n$ value]<br><br>i.e.) daily → $n = 365$, monthly → $n = 12$, etc.<br><br>$A$ = total end amount<br>$P$ = Principle or initial amount<br>$r$ = rate *(converted to a decimal)*<br>***n*** = measure of time<br>$t$ = time | $A = P(1 + \frac{r}{n})^{nt}$ |
| | Compounding ***continuously*** | Will say ***continuously*** in the problem.<br><br>$A$ = total end amount<br>$P$ = Principle or initial amount<br>$r$ = rate *(converted to a decimal)*<br>$t$ = time | $A = P e^{rt}$ |
| | **Half-life** | Will say the term **half-life** in the problem.<br><br>*must say the full term; "half" does *not* always mean half-life<br><br>$A$ = total end amount<br>$a_0$ = initial amount<br>$t$ = time<br>***h*** = half-life | $A = a_0(\frac{1}{2})^{\frac{t}{h}}$ |

| Working with Logarithms | | | |
|---|---|---|---|
| **Topic** | **Type** | **Rule /Goals** | **Example** |
| **Applying Properties of Logs** | Converting Exponential ↔ Log | $b^e = n \leftrightarrow log_b n = e$ | $log_2 8=3 \leftrightarrow 2^3=8$ |
| | Product Rule | $log_b(m \cdot n) = log_b m + log_b n$ | $log_6 24 + log_6 9 = log_6 216$ |
| | Quotient Rule | $log_b(\frac{m}{n}) = log_b m - log_b n$ | $log_2 55 - log_2 11 = log_2 5$ |
| | Power Rule | $log_b(m^r) = r\ log_b m$ | $log_5 x^3 = 3\ log_5 x$ |
| **Solving Equations with Logs**<br><br>*cont'd on next page* ↓ | Equations with Logs on ONE side of equal sign | **Goal** → *Convert* with 'ben' form, then solve |  <br>Solve for unknown variable |

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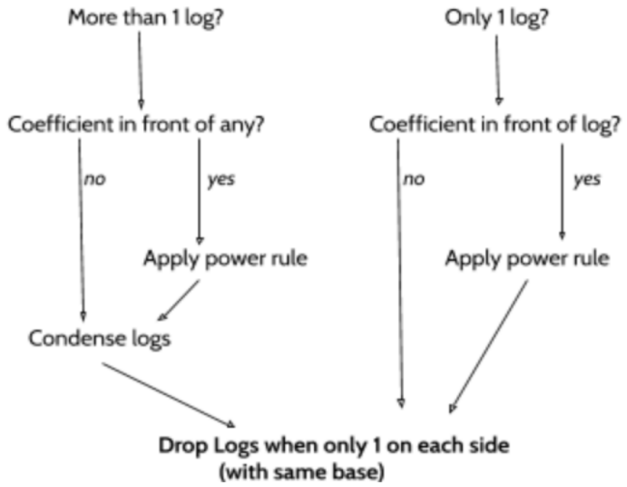
|---|---|---|---|
| | Equations with Logs on BOTH sides of equal sign | **Goal** → *Drop Logs* once only 1 on each side of equal sign, then solve | **Logs on BOTH sides**<br><br>Ask yourself the same questions for *only* ***ONE side of equation at a time***<br><br>  <br>Solve for unknown variable |