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|  | **COUNTING NUMBERS** *1, 2, 3, … n* | **WHOLE NUMBERS**counting numbers***n***and ***0*** *0, 1, 2, 3 … m* | **FRACTIONS**whole numbers***m****,* ***n*** (***n*** *≠ 0*) and their divisions  $\frac{0}{n}$ *,* $\frac{1}{n}$ *,* $\frac{2}{n}$ *,*$ \frac{3}{n}$ *, …* $ \frac{m}{n}$ | **RATIONAL NUMBERS**(positive) fractions$ \frac{m}{n}$, their reflections$ \frac{-m}{n}$ across *0* (negative fractions)$ \frac{-m}{n}$ *…* $\frac{-3}{n}$*,* $\frac{-2}{n}$ *,*$ \frac{-1}{n}$ *,* $\frac{0}{n}$ *,* $\frac{1}{n}$ *,* $\frac{2}{n}$ *,*$ \frac{3}{n}$ *, …* $ \frac{m}{n}$ |
| **ADDITION*a + b = c******b*** added onto***a*** gives you ***c******a***and***b***can be **any two numbers** | ***c > a***[sums will***always***be greater] | if***b = 0****,* then***c = a****0 is the identity element.* if ***b ≠ 0****,* then ***c > a****,* [sums will be greater] | if***b = 0****,* then***c = a****0 is the identity element.* if ***b ≠ 0****,* then ***c > a****,* [sums will be greater] | if***b = 0****,* then***c = a****0 is the identity element.*if***b ≠ 0****,* if***b > 0****,* then***c > a*** [sums will be greater]if***b < 0****,* then***c < a*** [sums will be less]if***b = –a****,* then***c = 0***sums will be *0*. [*additive inverse*] |
| **MULTIPLICATION*a ∙ b = d******a***copies of***b***gives you***d******a***and***b***can be **any two numbers** | if***a > 1****,* then ***d > b***if ***a = 1****,* then ***d = b****1 is the identity element.* | if ***a = 0****,* then ***d = 0***if***a > 1****,* then ***d > b***if***a = 1****,* then ***d = b*** *1 is the identity element*  | if ***a = 0****,* then ***d = 0***if ***a > 1****,* then ***d > b***if ***a < 1****,* then ***d < b***if ***a = 1****,* then ***d = b*** *1 is the identity element.*if ***a =*** $\frac{1}{b}$then***d = 1***[*multiplicative inverse*] | if ***a = 0****,* then ***d = 0******sign*** *[positive or negative]:*if ***a > 0****,* then ***d*** and ***b***have the same sign if ***a < 0****,* then ***d*** and ***b***have opposite signs***absolute value*** *[distance from 0]:*if **|*a| > 1****,* ***|d| > |b|*** products will be *farther from* *0*if **|*a| < 1****,* ***|d| < |b|***products will be *closer to* *0*if **|*a| = 1****,* then ***|d| = |b|****1 is the identity element.*if **|*a| =***$ \frac{1}{|b|}$then***|d| = 1***[*multiplicative inverse*] |
| **SUBTRACTION**(from addition)***c* – *a = b*** means ***b*** is the number so that ***a* + *b = c*** | *Make sure* ***c > a****,*then ***b***will be the number added onto***a*** that gives you***c*** | *For* ***any numbers****,* ***a****,* ***b****, and* ***c****,****b***will be the number added onto***a***that gives you***c*** |
| **DIVISION**(from multiplication) $\frac{d}{a}$ **= *b*** means ***b*** is the number so that ***a ∙ b = d*** | *Make sure* ***d*** *is a multiple of* ***a****.*Then ***b*** will be the number such that ***a*** copies of ***b*** gives you ***d****.* | *Make sure* ***d*** *is a multiple of* ***a******AND*** *that* ***a ≠ 0****.*Then ***b*** will be the number such that ***a*** copies of ***b*** gives you ***d****.* | *Make sure* ***a ≠ 0****. Then* ***d****,* ***a****, and* ***b*** *can be* ***any numbers—including fractions****.* (It is not necessary that ***d*** be an integer multiple of ***a***.)***b*** will still be the number such that ***a*** copies of ***b*** gives you ***d****.* *(Since* ***a****,* ***b****, and* ***d*** *can all be fractions, “****a*** *copies of* ***b*** *gives you* ***d****” has to be appropriately interpreted for fractions.)* |