**Lesson 12 Notes: Prime and Composite**

**ANSWER KEY**

**Composite Number:** A positive integer than can be divided by a smaller positive integer other than one and itself (has more than 2 factors)

**Prime Number:** a whole number greater than 1 that cannot be exactly divided by any whole number other than itself and 1 (has 2 factors)

**Is 1 prime or composite?** Neither special case

**Is 0 prime or composite?** Neither special case

**Is 2 prime or composite?** prime

***Prime numbers are often referred to as the building blocks of whole numbers.***

Manipulatives like Base 10 Blocks are useful for teaching subtraction. ([Video](https://www.youtube.com/watch?v=JjpJVvvC-jI)) Matholia YouTube

**Example 1**

List the numbers 13 – 20 and identify if it is **Prime** or **Composite**.

13 Prime 17 Prime

14 Composite 18 Composite

15 Composite 19 Prime

16 Composite 20 Composite

Examples of prime numbers: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

2, 5, 7

**Prime Number Test**

How do you determine if a number is prime?

To determine if a number is prime, you must check only divisibility by prime numbers less than the given number.

One method is to check whether it has any factors other than 1 and itself.

Use Divisibility Tests!

TRICK: Check the numbers up to the square root of the number

**Primes**

**Example 2** Prime or Composite?

1. **43,101** Add up all the digits 4 + 3 + 1 + 0 +1= 9 So, divisible by

3.  Composite

1. **24,638** It’s even. Composite
2. **53**  Check to see if 53 is divisible by all numbers up to 7.

It is not divisible by 2, 3, 4, 5, 6, or 7. Prime

1. **421**  Check to see if 421 is divisible by any number up

to 21. It is not! Prime

**5. 667**  Check to see if 667 is divisible by numbers 2 –

25. It is divisible by 23. Composite

**Sieve of Eratosthenes**

An ancient efficient algorithm to find all prime numbers up to any given limit

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *To find prime numbers, you begin the process by crossing out 1, which is not prime,* | | | | | | | | | | | |
| *and then circling 2 and crossing out all multiples of 2. Then 3 is circled and all multiples of 3 are crossed out. This process is continued. The numbers in the Sieve of Eratosthenes that are not crossed out are prime.* | | | | | | | | | | |  |
|  | | | | | | | | | | |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |  |  |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |  |  |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |  |  |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |  |  |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |  |  |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |  |  |
| 61 | 61 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |  |  |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |  |  |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |  |  |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |  |  |
| 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 |  |  |
| 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |  |  |
| 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 |  |  |
| 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 |  |  |
| 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 |  |  |
| 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 |  |  |
| 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 |  |  |
| 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 |  |  |
| 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 |  |  |
| 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 |  |  |
| 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 |  |  |
| 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 |  |  |
| 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 |  |  |
| 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 |  |  |
| 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 |  |  |
| 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 |  |  |
| 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 |  |  |
| 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 |  |  |
| 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 |  |  |
| 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 |  |  |
| 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 |  |  |
| 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 |  |  |
| 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 | 330 |  |  |
| 331 | 332 | 333 | 334 | 335 | 336 | 337 | 338 | 339 | 340 |  |  |
| 341 | 342 | 343 | 344 | 345 | 346 | 347 | 348 | 349 | 350 |  |  |
| 351 | 352 | 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 |  |  |
| 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 | 369 | 370 |  |  |
| 371 | 372 | 373 | 374 | 375 | 376 | 377 | 378 | 379 | 380 |  |  |
| 381 | 382 | 383 | 384 | 385 | 386 | 387 | 388 | 389 | 390 |  |  |
| 391 | 392 | 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 |  |  |

Composite numbers can always be written as a product of **\_\_\_\_\_\_\_\_\_\_\_\_\_.**

primes

One method to find the prime factorization of a composite number is by using a \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Factor tree

**Fundamental Theorem of Arithmetic**

Every composite whole number can be expressed as the product of primes in exactly one way except for the order of the factors of the product.

**Prime Factorization**

To find the prime factorization of a composite number, rewrite the number as a product of two smaller natural numbers. If these smaller numbers are both prime, you are finished. If either is not prime, then rewrite it as the product of smaller natural numbers. Continue until all the factors are prime.

**Example 3:** Find the prime factorization of each number. Show your work.

12 40

4 3

4 10

2 5

2 2

2 2

23 · 5

22 · 3

**Example 3 (cont’d):** Find the prime factorization of each number. Show your work.

75 88

23 · 11

52 · 3

924 360

22 · 3· 7 · 11

22 · 32· 5

**Factors**

Numbers that can be multiplied together to get another number

**List the factors of 10:** 1, 10, 2, 5

**Number of Divisors**

All factors of a number are its divisors.

If p and q are different primes, m and n are whole number then pnqm has (n + 1)(m + 1) positive divisors.

**Example 4:** Find the number of positive divisors of 1,000,000.

The prime factorization of 1,000,000 is 106 = (2 · 5)6 = 26 · 56

26 · 56 =26 has 6 + 1 = 7 divisors, and 56 has 6 + 1 = 7 divisors

1,000,000 has (7)(7) = 49 divisors