Lesson 2 p1

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Number Lesson #2:
Applications of Prime Factors

Review

Express the numbers 48 and 72 as products of prime factors. (Lesson 1)

$48 = 2\times2\times2\times2\times3$

$72 = 2\times2\times2\times3\times3$

Greatest Common Factor

The greatest common factor (GCF) of a set of whole numbers is the largest whole number which divides exactly into each of the members of the set.

For example, the GCF of 8, 16, and 20 is 4.

Factor → ÷ GCF
Multiple → × LCM

$\frac{16}{20}\ \overset{\div 4}{=}\ \frac{4}{5}$

Class Ex. #1

State the greatest common factor of

a) 15, 25, and 35 — 5 b) 18 and 20 — 2 c) 36 and 54 — 9

In the example above, parts a) and b) were fairly simple to do, but part c) was more complicated because each number had a large number of factors.

In cases like this we can use prime factorization to determine the GCF.

From the warm-up $48 = 2\times2\times2\times2\times3$ and $72 = 2\times2\times2\times3\times3$.

To determine the greatest common factor of 48 and 72 we find the product of each prime factor (including repeats) which is common to each prime factorization.

GCF of 48 and 72 is $2\times2\times2\times3 = 24$.

$\frac{48}{72}\ \overset{\div 24}{=}\ \frac{24}{36} = \frac{12}{18} = \frac{6}{9} = \frac{2}{3}$

Class Ex. #2

Use prime factorization to determine the greatest common factor of the given whole numbers.

a) 90 and 225

b) 154 and 198

GCF = 2×11 = 22

GCF = 3×3×5 = 45

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Use prime factorization to determine the greatest common factor of the given whole numbers.

a) 245, 315, and 770 b) 171, 285, 399, and 1 140

GCF=57

GCF=5×7=35

Lowest Common Multiple

Factoring → ÷
Multiple → ×

Multiples of 6 are 6, 12, 18, 24, 30, 36, 42, 48, ...

Multiples of 8 are 8, 16, 24, 32, 40, 48, 5, ...

Common multiples of 6 and 8 are 24, 48, ...

The lowest common multiple (LCM) of 6 and 8 is 24.

$\frac{1^{\times 3}}{2^{\times 3}} + \frac{1^{\times 2}}{3^{\times 2}} = \frac{3}{6} + \frac{2}{6} = \frac{5}{6}$

State the lowest common multiple of the following:

a) 5 and 7 35 b) 10, 15, and 20 60 c) 10, 12, and 14 420

$\frac{1}{10} + \frac{1}{12} + \frac{1}{14}$

In the example above, parts a) and b) were fairly simple to do, but part c) was more complicated. Prime factors can be used to simplify the solution.

$10 = 2 \times 5$
$12 = 2 \times 2 \times 3$
$14 = 2 \times 7$

To determine the LCM, take all the prime factors of one of the numbers and multiply by any additional factors in the other numbers.

Take 2 and 5 from 10, another 2 and 3 from 12, and 7 from 14.

$2 \times 5 \times 2 \times 3 \times 7 = 420$, the LCM of 10, 12, and 14.

2×2×3

10 12 14

2×5×3×2×7

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Use prime factorization to determine the lowest common multiple of

a) 15 and 35 b) 126 and 441 c) 22, 154, and 198

5 3 7

2 63 3 147

7 9 3 49

3 3 7

LCM: 5×3×7 = 105

LCM: 2×3×3×7×7

= 882

LCM:
1) Prime Factors
2) Take all the PF of one number
3) Cross off PF that are already in LCM
4) Add the remaining PF to LCM

22 → 2 11

154 → 7 22 → 2 11

198 → 2 99 → 9 11 → 3 3

LCM = 2×11×7×3×3

= 1386

Complete Assignment Questions #1 - #7

HW (1,2)c, 3ace, 4b, 5cd, 6aceh, 7bd

Prime Factorization of a Perfect Square

Perfect squares of whole numbers include 1, 4, 9, 16, 25, 36, 49, etc.

Every perfect square has two **square roots:** one positive and one negative. The square root which is positive is called the **principal square root**.

The principal square root of each number above is 1, 2, 3, 4, 5, 6, 7, etc.

In this lesson, where we are dealing only with whole numbers, we will use the term square root to mean the principal square root.

Complete the prime factorization of the following perfect squares: 9, 36, 49, and 64.

9 → 3

36 → 4

49

64

9 = 3 × 3	The square root of 9 is
36 = 2 × 2 × ×	The square root of 36 is 2 × 3 =
49 =	The square root of 49 is
64 =	The square root of 64 is 2 × × =

The prime factorization of a perfect square will involve factors which occur in pairs.

If the prime factorization of a number does not result in pairs of factors, then we can say that the number is not a perfect square.