Chapter 5B – Factoring



Learning Outcomes:

* Prime Factorization
* Greatest Common Factor
* Lowest Common Multiple
* Factoring using a GCF
* Factoring a trinomial
* Factoring a difference of squares
* Factoring using multiple methods

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**5B.1 Prime Factors**

We will begin by looking at prime factors and then use them to determine the greatest common factor and lowest common multiple.

Factors – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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ex/

Example: State the factors of the following

1. 15
2. 24
3. 3
4. 10
5. 7

Prime and Composite Numbers:

Prime Number - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Composite Number - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\*\*The number 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\*\*The number 0 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

List the first 10 prime numbers: 2, 3, 5, \_\_, \_\_, \_\_, \_\_, \_\_, \_\_, \_\_

Classify the following numbers as prime or composite:

1. 46
2. 37
3. 39
4. 101
5. 103

Prime Factors:

Prime factors of a number are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

For example:

The factors of 6 are:

The prime factors are:

ex/

State the factors of 12: State the prime factors of 12: Express 12 as a product of prime factors:

Prime Factorization:

Every composite number can be expressed as a product of prime factors:

ex/ use a division table and tree diagram to show the prime factorization of 48

Division Table Tree Diagram

Ex/ 2772

**5B.1 Prime Factors Worksheet**

1. State the factors of the following:
	1. 21
	2. 25
	3. 22
	4. 36
2. In each case, determine the number of factors of the given whole number.
	1. 8
	2. 11
	3. 17
	4. 33
	5. 45
3. State the numbers in question #2 which are
	1. Prime
	2. Composite
4. Classify the following numbers as prime or composite.
	1. 30
	2. 41
	3. 43
	4. 57
	5. 59
	6. 121
	7. 133
	8. 169
5. a. State the factors of 20

b. State the prime factors of 20

c. Express 20 as a product of prime factors.

1. Using a division table or tree diagram, state the prime factors of
	1. 15
	2. 24
	3. 45
	4. 66
	5. 140
	6. 330
	7. 390
	8. 289
	9. 1925

**5B.2 Application of Prime Factors**

Greatest Common Factor (GCF):

GCF - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Ex/ State the greatest common factors for:

1. 15, 25, and 35 b. 18 and 20 c. 36 and 45

When finding the GCF is more complicated, we can use prime factorization to determine the GCF.

Ex/ 48 and 72

48: 2 x 2 x 2 x 2 x 3

72:

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

Ex/ Use prime factorization to determine the GCF of the following pairs:

1. 90 and 225 b. 154 and 198

Lowest Common Multiple:

Multiples of 6:

Multiples of 8:

Common multiples of 6 and 8 are:

The **lowest** common multiple is

Ex/ State the LCM of the following:

1. 5 and 7 b. 10, 15, and 20 c. 10, 12, and 14

Prime factors can be used to simplify the solution:

10 =

12 =

14 =

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

Ex/ Use prime factorization to determine the LCM of:

1. 15 and 25
2. 126 and 441
3. 22, 154, and 198

**5B.2 Application of Prime Factors Worksheet**

1. State the greatest common factor of:
	1. 14 and 21
	2. 30 and 40
	3. 12, 30, and 54
2. Use prime factorization to determine the greatest common factor of:
	1. 150 and 420
	2. 126 and 189
	3. 294 and 385
	4. 84 and 231
3. State the lowest common multiple of:
	1. 4 and 6
	2. 3 and 9
	3. 9 and 15
	4. 40, 60 and 100
4. Use prime factorization to determine the lowest common multiple of:
	1. 14 and 30
	2. 28 and 60
	3. 18 and 63
	4. 39 and 52
	5. 6, 10 and 42
	6. 3, 5, 7, and 13

**5B.3 Common Factors**

Factoring Polynomials:

To factor a polynomial means to write it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

In the previous chapter, a product such as 3(2*x* + 1) was expanded as 6*x* + 3 using the distributive law (“rainbowing”). Factoring is the reverse process. The sum 6*x* + 3 can be written as the product 3(2*x* + 1), we just need to find the GCF first.

Examples:

1. Find the GCF of: 2x3 + 4x2 - 6x

2x3 =

4x2 =

-6x =

 GCF =

 Use the GCF to factor:

 Check:

1. 6x – 15
2. a3 – 4a2 + 2a
3. 18n2 – 12n
4. -20x4y + 10x2y
5. -12p2q3 – 20p3q3
6. 3x(x – 2) + 5(x – 2)

**5B.3 Common Factors Worksheet**

1. Find the greatest common factor. *Do not factor.*
2. Factor as products.
3. Factor.
4. Express as products (factor).
5. Factor.

**5B.4 Factoring Trinomials**

Trinomial – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The product of two binomials is often a trinomial (FOIL). Factoring is the reverse process (a trinomial to 2 binomials)

How to factor a trinomial:

Steps: Example: x2 + 7x+ 12

1. Write down two sets of brackets
2. What multiples to equal x2?
3. Look for two numbers that:

Add to the middle term

Multiple to the last term

* Fill these in the ends of the brackets
1. Check by FOIL

Examples:

1. x2 + 14x + 49
2. a2 – 8a + 12
3. b2 – 16b + 64
4. m2 – 5m – 14
5. x2 + 6x – 7
6. x2 + 9x – 36
7. x2 + 7xy – 18y2
8. 3x2 – 3x – 18
9. x2 + 9x + 12

**5B.4 Factoring Trinomials Worksheet**

1. Find a pair of numbers that multiplies and adds to the given values.
2. 
3. 
4. 
5. 
6. 
7. 
8. Factor.
9. Factor completely.
10. Factor *if possible*.

**5B.5 Factoring a Difference of Squares**

Review:

FOIL the following – what patterns do you see?

1. (x – 3)(x + 3) b. (x + 5)(x – 5) c. (x – 6)(x + 6)

So, (a – b)(a + b) =

We can write this rule backwards:

This is known as a difference of squares.

Examples: Factor the following

1. x2 – 16
2. x2 – 49
3. x2 – 64y2
4. 36x2 – 1
5. 4a2 – 25b2
6. 4y2 – 9x2
7. 3b2 – 12
8. 8x2 – 8

**5B. 5 Factoring a Difference of Squares Worksheet**

1. Factor the following.
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. Combinations of Factoring – look for a GCF first!
27. 
28. 
29. 
30. 
31. 
32. 
33. Factor.
34. 
35. 
36. 

**Chapter 5 Factoring Review**

1. Identify the following as prime or composite numbers:
	1. 23
	2. 32
	3. 54
	4. 99
2. Using prime factorization, find the LCM of the following:
	1. 10, 15, and 20
	2. 10, 12, and 14
	3. 15 and 35
	4. 48 and 56
3. Using prime factorization, find the GCF of the following:
	1. 48 and 72
	2. 126 and 441
	3. 22 and 154
	4. 15 and 35
4. Find the greatest common factor.
5. 
6. 
7. 
8. 
9. 
10. 
11. Factor using a GCF.
12. Factor the following trinomials.
13. Factor using a difference of squares.
14. Combinations of Factoring – you may have to factor more than once!
15. Factor the following expressions. You decide which method to use.