Write with a dominator of

**Solution**

=

Write as ( 5n).

= (5n)

Since we multiplied the denominator by 5n, multiply also the numerator by 5n.

= =

Thus,

=

**EXAMPLE 3**

Writewith a denominator of

**Solution**

Write as (y - 2) (y + 3).

=

Since we multiplied denominator (y - 2) by (y + 3), multiply also the numerator by (y + 3).

=

Thus,

=

**C. Reducing Rational Expression**

In the previous section, we learned how to build up rational expression. The reverse of this process is to reduce rational expressions. *Reducing to lowest term* or *simplifying* is the process of removing all factors common to the numerator and denominator.

**Procedure**

*Steps in Reducing Rational Expressions to Lowest Terms*

1. Write the numerator and denominator of the expression in factored form.
2. Find the factors that are common to the numerator and denominator.
3. Replace the quotient of the common factors by the number 1, since
4. Rewrite the expression in simplest form.

**Standard Form of a Fraction**

is written as is written as .

is written as ­- is written as .

- is written as - is written as .

The forms

and , b = 0

Are the standard form of a fraction, we will use these to write answers involving fractions.

**EXAMPLE 1**

Simplify.

**Solution**

1. Write the numerator and denominator

of the expression in factored form.

1. Find the factors that are common to the

numerator and denominator (Arrange the

factors so that the common factors are

in columns).

1. Replace the quotient of the common

factors by the number 1, since

1. Rewrite the expression in simplest form.

**EXAMPLE 2**

Simplify

**Solution**

1. Write the numerator and denominator =

of the expression in factored form.

1. Find the factors that are common to the

numerator and denominator (Arrange the

factors so that the common factors are

in columns).

1. Replace the quotient of the common
2. factors by the number 1, since
3. Rewrite the expression in simplest form.

**EXAMPLE 3**

Simplify

1. Write the numerator and denominator

of the expression in factored form.

1. Find the factors that are common to the

Numerator and denominator.

3.Replace the quotient of the common 1.(a + b). 2

factors by the number 1, since

4.Rewrite the expression in simplest form. 2 (a + b)

**EXAMPLE 4**

Simplify

**Solution**

write the standard form.

**EXAMPLE 5**

Simplify

**Solution**

=

=

= write in standard form.

Note: the expression can still be simplified. Here is how to do this.

= Note: -(4 -x) = -4 + x = x – 4

=

The expression can be simplified as follows :

= Write y – x as – (x – y).

=

**Quotient of Inverses**

x = y

**EXAMPLE 6**

Simplify

**Solution**

1. Factor the numerator =

and the denominator.

1. Factor the rational expression.
2. Apply quotient of inverses. . – 1

=-

= (a = -2)

**EXAMPLE 3.1**

1. Find the value(s) for which the rational expression is undefined.
2. 6.
3. 7.
4. 8.
5. 9.
6. 10.
7. Write each fraction on the left as a fraction in standard form with the indicate denominator on the right. (Assume that no denominator equals 0.)
8. 6.
9. 7.
10. 8.
11. 9.
12. 10.

Rewrite each rational expression. Find an equivalent rational expression using the specified denominator.

1. with a denominator of 45
2. with a denominator of 28
3. with a denominator of 34
4. with a denominator of
5. with a denominator of
6. with a denominator of
7. with a denominator of
8. with a denominator of
9. with a denominator of
10. with a denominator of

Answer each.

1. Write the procedure to determine the values for which a rational expression is undefined.
2. Write the procedure in reducing a rational expression to lowest terms.
3. If a rational expression is equal to – 1,what is the possible relationship between the numerator and the denominator?
4. Consider the rational expression
5. Is this expression always defined when y is positive? Explain.
6. Is this expression always defined when y is negative? Explain.

**3. 2 MULTIPLICATION AND DIVISION OF RATIONAL EXPRESSION**

**Objectives**

Multiply two rational expressions; and

Divide one rational expression by another.

A

B

1. **Multiplication of Rational Expression**

We have learned how to multiply fractions. We can multiply rational expressions in the same way as we multiply fractions.

**EXAMPLE 1**

Multiply and simplify each.

1. b.

**Solution**

1. Multiply the numerators and multiply the

Denominators

= Factor out the GCF .

= Divide out the GCF (Removing a factor of 1)

1. Multiply the numerators and multiply the

Denominators.

= Factors out the GCF

= Divide out the GCF.

It is best to divide out common factors before we multiply. This is true when the numerator or denominator is not a monomial.

**EXAMPLE 2**

Multiply and simplify each.

1. b. c.

**EXAMPLE 3**

Multiply and simplify.

**Solution**

1. Factor the numerators and the denominators. Then, divide out the common factors.

. . =

**Procedure**

*Multiplying Rational Expressions*

1. Write each numerator and each denominator in prime factored form.
2. Divide out all common factors that the numerator has with the denominator.
3. Multiply the remaining factors in the numerator and multiply the remaining factors in the denominator.

*Note : Only common factors can be divided out (cancelled).* Common terms cannot be cancelled.

Thus, .

But ,

Cannot be reduced further.

If we divide out common factors, we are actually using a shortcut method known as cancellation. *Cancellation* is a method of dividing a factor in the numerator by the same factor always gives 1, then the factors cancel each other.

If we use cancellation, we first factor the terms of the fractions and then think of multiplication as if is one fraction. Hence, this simplifies the fraction. The examples below show how cancellation works.

|  |  |  |
| --- | --- | --- |
| Fractions to be multiplied |  |  |
| Fractions whose terms are factored |  |  |
| Use multiplication as if it is one fraction |  |  |
| Rearrange the factors |  |  |
| Separate fractions that are equal to 1. |  |  |
| Cancellation : Fractions that are equal to 1 are replaced by 1 |  |  |
| Product in lowest terms |  |  |

**B. Division of Rational Expression**

Division rational expression uses the same ruleas in arithmetic.

**Rule***Division of Rational Expressions*

If are rational expressions, then

, = = ,

If, simply invert (interchange the numerator and denominator) and multiply. That is, to divide by , multiply by the reciprocal or multiplicative inverse of .

**EXAMPLE 1**

Divide :

**Solution**

Invert the divisor and multiply

= Factor and simplify.

=

**EXAMPLE 2**