6.1 Rational Expressions

Concept #23 – Simplify Rational Expressions and Determine the Non – Permissible Values

Rational expression – an algebraic expression with a numerator and a denominator that are polynomials.

Example:

Non-permissible values – a value for a variable that makes the expression undefined. In rational numbers, the denominator ≠ 0.

Example: What are the non-permissible values for x in the following?

1. $\frac{6-x}{2x}$

2. $\frac{3}{x-7}$

3. $\frac{4x-1}{x^2+4x+3}$

4. $\frac{5t}{4sr^2}$

Simplifying Rational Expressions

- divide out common factors in the numerator and denominator.

Example: Simplify and state non-permissible values.

1. $\frac{9}{12}$

2. $\frac{12m^2t^5}{3mt}$

3. $\frac{3x-6}{x-2}$

4. $\frac{x^2+2x-15}{x-3}$

5. $\frac{2y^2+y-10}{y^2+3y-10}$

6. $\frac{x^2-10x+24}{x^2-6x}$

7. $\frac{1-t}{t^2-1}$

8. $\frac{25-x^2}{x^2-3x-10}$

<u>6.1 Assignment</u>: Page 317 #3 ace, 4 acef, 6, 8,11,13

6.2 Multiplying and Dividing Rational Expressions

Concept #24 - To multiply and divide rational expressions

Multiplying Rational Expressions

- Factor numerators and denominators
- Divide out common terms (Reduce all fractions)

Examples: State non-permissible values then multiply.

1. $\frac{5}{8} \cdot \frac{2}{12}$

2. $\left(\frac{4x^2}{3xy}\right)\left(\frac{y^5}{8}\right)$

3. $\left(\frac{a^2-a-12}{a^2-9}\right)\left(\frac{a^2-4a+3}{a^2-4a}\right)$

4. $\frac{x^2-25}{x^2-49} \cdot \frac{x^2-6x-7}{x^2+6x+5}$

Dividing Rational Expressions

- Multiply by the reciprocal of the rational following the division sign
- Divide out common terms only when multiplying
- Restrictions(Non – Permissible Values) apply to anything in the denominator at any time

Reciprocals- Interchange the numerator and denominator

- Examples: $\frac{1}{2} \rightarrow$, $\frac{x^2}{y} \rightarrow$, $\frac{a+5}{a} \rightarrow$

Examples: Divide and simplify. State non-permissible values.

1. $\frac{6}{5} \div \frac{3}{2}$

2. $\frac{3x^2}{y^2} \div \frac{x}{y}$

3. $\frac{x^2-4}{x^2-4x} \div \frac{x^2+x-6}{x^2+x-20}$

4. $\frac{3x+12}{3x^2-5x-12} \div \frac{12}{3x+4} \times \frac{2x-6}{x+4}$

6.2 Assignment: Page 327 #1,2 3, 8, 14,15,18,19

6.3 Adding/Subtracting Rational Expressions

Concept #25 – Add and Subtract Rational Expressions

Review Adding and Subtracting Fractions

a. $\frac{5}{7}-\frac{3}{7}$

b. $\frac{3}{5}+\frac{1}{10}$

Steps for Add/Subt. Rational Expressions

- Must have a common denominator (add numerators, leave denominators)
- Answer in simplest form (Reduce)
- State any non – permissible values (NPV)

Examples: Simplify the following rational expressions, leave answers in simplest form and state non-permissible values

1. $\frac{2a}{b}-\frac{a-1}{b}$

2. $\frac{x^2}{x-2}+\frac{3x}{x-2}-\frac{10}{x-2}$

3. $\frac{2x}{xy}+\frac{4}{x^2}$

4. $\frac{y^2-20}{y^2-4}+\frac{y-2}{y+2}$

5. $\dfrac{x-1}{x^2+x-6}-\dfrac{x-2}{x^2+4x+3}$

6. $\dfrac{1+\dfrac{1}{x}}{x-\dfrac{1}{x}}$

7. $\dfrac{x^2-49}{x^2-8x+7}+\dfrac{2-2x}{x^2-1}$

8. $\dfrac{x+1}{x+6}-\dfrac{x^2-4}{x^2+2x}\div\dfrac{2x^2+7x+3}{2x^2+x}$

<u>6.3 Assignment</u>: Page 336 #1e, 5bf, 6ade, 7ad, 8, 9, 10cd, 12, 15ac

6.4 Rational Equations (Day 1)

Concept #26- To solve Rational Equations and check for extraneous roots

- An equation containing at least one rational (fractional) expression
- TO solve , find the LCD and multiply each term by the LCD to eliminate the fractions.
- Check. There may be extraneous roots

Review

$\frac{1}{2}x-\frac{2}{3}=\frac{1}{2}$

Example #1 Solve the following rational equations. Check for extraneous roots.

a) $\frac{x}{4}-\frac{7}{x}=3$

b) $\frac{2x}{x-4}=\frac{10}{x-4}$

c) $\frac{x}{x-2}+\frac{2}{x+2}=1$

d) $\frac{9}{y-3}-\frac{4}{y-6}=\frac{18}{y^2-9y+18}$

e) $\frac{3x}{x+2} - \frac{5}{x-3} = \frac{-25}{x^2 - x - 6}$

6.4 Assign. Pg 348 #1,2,3,6,8,11

6.4 Rational Equations Word Problems (Day 2)

Concept #27 – To solve situational problems involving rational expressions

Example #1 Two friends share a paper route. Sheena can deliver the papers in 40min. Jeff can cover the same route in 50min. How long, to the nearest minute, does the paper route take if they work together?

Make a table to organize the information

Sheena			
Jeff			
Together			

Example #2 A train has a scheduled run of 160km between two cities in Saskatchewan. If the average speed is decreased by 16km/h, the run will take ½ hour longer. What is the average speed of the train?

Example #3/ Jerry jogged 9 km in an hour. He covered the last 4 km at a speed that was 2 km/h slower than his speed over the first 5 km. What was his speed over the first 5 km?

6.4 Day 2 Assignment Pg 349#12,13,14, 15,16 and 17

The time for the first 5 km is calculated using the equation $t = \frac{d}{s} = \frac{5}{s}$. The time for the last 4 km is $t = \frac{4}{s-2}$, because he jogged at 2 km/h less than the first 5 km.
The total time is 1 h, which is the sum of the time for the 5-km segment and the time for the 4-km segment:

$$1 = \frac{5}{s} + \frac{4}{s-2}$$

Add the rational expressions and solve for *s*:

$$1 = \frac{5}{s} + \frac{4}{s-2}$$

$$1 = \frac{5(s-2)}{s(s-2)} + \frac{4s}{s(s-2)}$$

$$s(s-2) = 5(s-2) + 4s$$

$$s^2 - 2s = 5s - 10 + 4s$$

$$s^2 - 11s + 10 = 0$$

$$(s-1)(s-10) = 0$$

$$s = 1 \text{ or } s = 10$$

Since a speed of 1 km/h would result in a negative speed for the 4-km segment, this answer is rejected. Jerry jogged at a speed of 10 km/h for the first 5 km.