Math 20-1 KEY

LO2 – 6.1 Rational Expressions

Part 1 – Non-Permissible Values

Key Ideas:

- The denominator of a fraction ***cannot*** be equal to zero.
- The variable cannot be a value that will result in the denominator being zero.

Q1: Determine the Non-Permissible Values (NPV) for each of the following expressions.

$\frac{5}{x}$ $x \neq 0$

$\frac{x+3}{x}$ $x \neq 0$

$\frac{5}{x-3}$ $x-3 \neq 0$, $x \neq 3$

$\frac{x+6}{x-4}$ $x-4 \neq 0$, $x \neq 4$

Q2: Determine the Non-Permissible Values (NPV) for each of the following expressions.

$\frac{4}{(x-3)(x+2)}$ $x-3 \neq 0$, $x \neq 3$; $x+2 \neq 0$, $x \neq -2$

$\frac{10}{(x+5)(2x-1)}$ $x+5 \neq 0$, $x \neq -5$; $2x-1 \neq 0$, $2x \neq 1$, $x \neq 1/2$

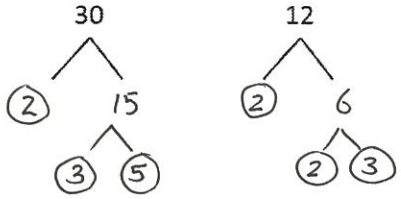
$\frac{(x+5)}{(3x+4)(2x-5)}$ $3x+4 \neq 0$, $3x \neq -4$, $x \neq -4/3$; $2x-5 \neq 0$, $2x \neq 5$, $x \neq 5/2$

KEY

Part 2 – Simplifying Rational Expressions, stating Non-Permissible Values

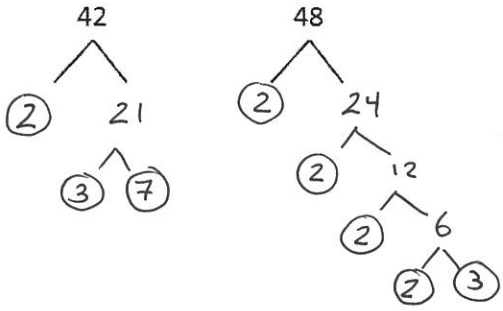
Q3: Simplify the following fraction using factor trees.

$$\frac{30}{12} = \frac{2 \cdot 3 \cdot 5}{2 \cdot 2 \cdot 3} = \frac{5}{2}$$



Q4: Simplify the following fraction using factor trees.

$$\frac{42}{48} = \frac{2 \cdot 3 \cdot 7}{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3} = \frac{7}{2 \cdot 2 \cdot 2} = \frac{7}{8}$$



Q5: Simplify the following fraction using factoring, and state Non-Permissible Values.

$$\frac{x^2-x-12}{x^2+8x+15}$$

$x^2 - x - 12$

+3 -4

□ + □ = -1

□ x □ = -12

1, 12
2, 6
3, 4

$x^2 + 8x + 15$

+3 +5

□ + □ = 8

□ x □ = 15

1, 15
3, 5

$$\frac{(x+3)(x-4)}{(x+3)(x+5)} \Rightarrow \frac{x-4}{x+5}, \text{ where } x \neq -3, -5$$

Keep restrictions of original, unsimplified expression.

$x+3 \neq 0$ $\quad$ $x+5 \neq 0$

$x \neq -3$ $\quad$ $x \neq -5$

Math 20-1 KEY

Q6: Simplify the following fraction using factoring, and state Non-Permissible Values.

$$\frac{x^2-5x+6}{x^2+2x-8}$$

$x^2 - 5x + 6$

-2 -3

□ + □ = -5

□ x □ = +6

1,6

2,3

$x^2 + 2x - 8$

-2 +4

□ + □ = 2

□ x □ = -8

1,8

2,4

$$\frac{(x-2)(x-3)}{(x-2)(x+4)}$$

$x-2 \neq 0$, $x \neq 2$

$x+4 \neq 0$, $x \neq -4$

$$\frac{x-3}{x+4}, \text{ where } x \neq -4, 2$$

Q7: Simplify the following fraction using factoring, and state Non-Permissible Values.

$$\frac{x^2+3x+2}{2x^2+14x+20}$$

$x^2 + 3x + 2$

+1 +2

□ + □ = 3

□ x □ = 2

1,2

$2x^2 + 14x + 20$

$2(x^2 + 7x + 10)$

+2 +5

□ + □ = 7

□ x □ = 10

1,10

2,5

$$\frac{(x+1)(x+2)}{2(x+2)(x+5)}$$

$x+2 \neq 0$, $x \neq -2$

$x+5 \neq 0$, $x \neq -5$

$$\frac{x+1}{2(x+5)}, \text{ where } x \neq -5, -2$$

Math 20-1

KEY

Q8: Simplify the following fraction using factoring, and state Non-Permissible Values.

$$\frac{3x^2+7x+2}{3x+1}$$

$3x^2 + 7x + 2$ (+6)

+1 +6
□ + □ = 7
□ x □ = 6

1, 6
2, 3

$3x^2+7x+2$
$3x^2+1x+6x+2$
$(3x^2+1x)+(6x+2)$
$x(3x+1)+2(3x+1)$
$(3x+1)(x+2)$

$$\frac{(3x+1)(x+2)}{(3x+1)} \Rightarrow x+2, \text{ where } x \neq -1/3$$

$3x+1 \neq 0$
$3x \neq -1$
$x \neq -1/3$

Q9: Simplify the following fraction using factoring, and state Non-Permissible Values.

$$\frac{2x^2+10x+12}{2x^2+3x-2}$$

$2x^2 + 10x + 12$
$2(x^2+5x+6)$
+2 +3
□ + □ = 5
□ x □ = 6

1, 6
2, 3

$2x^2 + 3x - 2$ (-4)

-1 +4
□ + □ = 3
□ x □ = -4

1, 4
2, 2

$2x^2-1x+4x-2$
$(2x^2-1x)+(4x-2)$
$x(2x-1)+2(2x-1)$
$(2x-1)(x+2)$

$$\frac{2(x+2)(x+3)}{(2x-1)(x+2)} \Rightarrow \frac{2(x+3)}{2x-1}, \text{ where } x \neq -2, 1/2$$

$2x-1 \neq 0$
$2x \neq 1$
$x \neq 1/2$

$x+2 \neq 0$
$x \neq -2$

KEY

Q10: Simplify the following fraction using factoring, and state Non-Permissible Values.

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

$s \neq 0$ $\quad r^2 \neq 0$, $r \neq 0$

$$\frac{1-t}{t^2-1} = \frac{(1-t)}{(t+1)(t-1)} = \frac{-1(-1+t)}{(t+1)(t-1)}$$

$$= \frac{-1(t+1)}{(t+1)(t-1)}$$

$t+1 \neq 0$, $t \neq -1$ $\quad$ $t-1 \neq 0$, $t \neq 1$

Part 3 – Simplifying Rational Expressions with Pairs of Non-Permissible Values

Q11: Simplify the following fraction using factoring, and state Non-Permissible Values.

$$\frac{16x^2-9y^2}{8x-6y}$$

$$\frac{(4x+3y)(4x-3y)}{2(4x-3y)}$$

$4x-3y \neq 0$

$4x \neq 3y$

$x \neq \frac{3y}{4}$

$$\frac{4x+3y}{2}, \text{ where } x \neq \frac{3y}{4}$$

$$\frac{x^2+5xy+6y^2}{x^2-4y^2}$$

$x^2+5x+6 = (x+2)(x+3)$

$x^2-4 = (x+2)(x-2)$

$$\frac{(x+2y)(x+3y)}{(x+2y)(x-2y)}$$

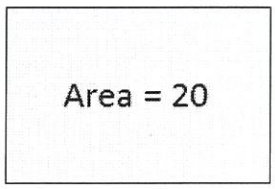
$x+2y \neq 0$, $x \neq -2y$ $\quad$ $x-2y \neq 0$, $x \neq 2y$

$$\frac{x+3y}{x-2y}, \text{ where } x \neq -2y, 2y$$

KEY

Part 4 – Areas

Q12: Determine the missing of the rectangles.



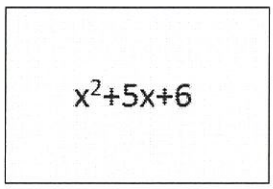
5

AREA = LENGTH × WIDTH

$\text{WIDTH} = \frac{\text{AREA}}{\text{LENGTH}}$

$\text{WIDTH} = \frac{20}{5}$

$= 4$

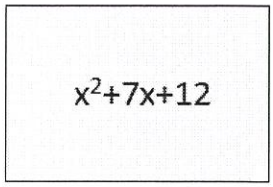


x+3

$\text{WIDTH} = \frac{x^2+5x+6}{x+3}$

$= \frac{(x+2)(x+3)}{(x+3)}$

$= x+2$, where $x \neq -3$



x^2+2x-3

$\text{WIDTH} = \frac{x^2+7x+12}{x^2+2x-3}$

$= \frac{(x+3)(x+4)}{(x+3)(x-1)}$

$x+3 \neq 0$

$x \neq -3$

$x-1 \neq 0$

$x \neq 1$

$= \frac{x+4}{x-1}$, where $x \neq -3, 1$