**Lesson Title 7.1 Rational Functions DAY ONE NOTES** **B2A2** **Date** ____________________

*A rational number is a number that can be written as a quotient of two integers (positive & negative whole numbers.) A rational expression is also a quotient (fraction) of two polynomials.*

- ***Remember your denominator can never equal zero.***
- $\frac{0}{K}$ ***VS*** $\frac{N}{0}$***: 0 on top is OK, 0 on bottom is a NO go, not ok.***
- $f(x) = \frac{x^2+2}{x-3}$ ***is a rational function, has f(x)***
- $\frac{x^2+2}{x-3}$ ***is a rational expression, no =***

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## OBJECTIVE 1: Finding the Domain of a Rational Function

- Just like ANY fraction, if a rational expression has a zero in the denominator it is considered undefined.
- Whenever there is a variable in the denominator we are required to restrict the domain.
- To restrict the domain, you set the denominator with a variable = 0 and solve for the variable.
- The solution is what the variable CANNOT = or the answer would be undefined.

$$\boxed{\frac{0}{K}\checkmark \qquad \frac{N}{0}\times}$$

TASK 1: Restrict the domain. Write your answer in interval notation.

a) $f(x) = \frac{x^2+2}{x-3}$

$x - \cancel{3} \neq 0$
$\quad + \cancel{3} \quad +3$
$x \neq 3$

$\boxed{D: (-\infty, 3) \cup (3, \infty)}$

b) $f(x) = \frac{4x^5-3x^2+2}{-6}$

no variable in denominator so $\mathbb{R}$

$\boxed{D: (-\infty, \infty)}$

c) $g(x) = \frac{6x^2+1}{x+3}$

$x + \cancel{3} \neq 0$
$\quad - \cancel{3} \quad -3$
$x \neq -3$

$\boxed{D: (-\infty, -3) \cup (-3, \infty)}$

## OBJECTIVE 2: Simplifying Rational Expressions

STEPS:

1. Factor the top and bottom.
2. Cancel any factors that are on both top and bottom, one for one.

$$\frac{x^2-9}{x^2+x-6} = \frac{(x-3)(x+3)}{(x-2)(x+3)}$$ Factor the numerator and the denominator.

$$= \frac{(x-3)\cdot\cancel{(x+3)}}{(x-2)\cdot\cancel{(x+3)}}$$ Look for common factors.

$$= \frac{x-3}{x-2}\cdot\frac{x+3}{x+3}$$

$$= \frac{x-3}{x-2}\cdot 1$$ Write $\frac{x+3}{x+3}$ as 1.

$$= \frac{x-3}{x-2}$$ Multiply to remove a factor of 1.

TASK 2: Simplify each rational expression.

a) $\frac{2x^2}{10x^3-2x^2} = \frac{\cancel{2x^2}}{\cancel{2x^2}(5x-1)}$ $\boxed{\frac{1}{5x-1}}$

$2x^2 \neq 0$
$x \neq 0$
$5x-1 \neq 0$
$5x \neq 1$
$x \neq \frac{1}{5}$

$D: (-\infty,0)\cup(0,\frac{1}{5})\cup(\frac{1}{5},\infty)$

b) $\frac{x^2+x}{x+1} = \frac{x\cancel{(x+1)}}{\cancel{x+1}}$ $\boxed{x}$

$x+1 \neq 0$
$-1 \quad -1$
$x \neq -1$

$D: (-\infty,-1)\cup(-1,\infty)$

c) $\frac{5z^4}{10z^5-5z^4} = \frac{\cancel{5z^4}}{\cancel{5z^4}(2z-1)}$ $\boxed{\frac{1}{2z-1}}$

$5z^4 \neq 0$
$z \neq 0$
$2z-1 \neq 0$
$2z \neq 1$
$z \neq \frac{1}{2}$

$D: (-\infty,0)\cup(0,\frac{1}{2})\cup(\frac{1}{2},\infty)$

TASK 3: Simplify each rational expression.

a) $\frac{(2+x)}{(x+2)} = \frac{\cancel{x+2}}{\cancel{x+2}} = \boxed{1}$

$D: (-\infty,-2)\cup(-2,\infty)$

b) $\frac{2-x}{x-2} = \frac{-x+2}{x-2} = \frac{-1\cancel{(x-2)}}{\cancel{x-2}}$ $\boxed{-1}$

$D: (-\infty,2)\cup(2,\infty)$

c) $\frac{x+3}{3+x} = \frac{\cancel{x+3}}{\cancel{x+3}} = \boxed{1}$

$D: (-\infty,-3)\cup(-3,\infty)$

d) $\frac{3-x}{x-3} = \frac{-x+3}{x-3} = \frac{-1\cancel{(x-3)}}{\cancel{x-3}} = \boxed{-1}$

$D: (-\infty,3)\cup(3,\infty)$

Common Mistakes:

All or nothing

$\frac{x+2}{x}$ $\boxed{\text{Done}}$

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

Multiplication not + or −

**Still need help with:**