independent practice

NAME ______________________________

Module 15 Simplifying Rational Expressions
Lesson 1 Finding Restricted Values of Rational Expressions

State the restricted values of the following rational expressions.

1. $\frac{2 + x}{5}$ **no restricted values**

2. $\frac{3}{x}$ **0**

3. $\frac{6x}{x + 1}$ **–1**

4. $\frac{c + 1}{c - 5}$ **5**

5. $\frac{4y - 3}{4y + 3}$ $-\frac{3}{4}$

6. $\frac{4z - 6}{7}$ **no restricted values**

7. $\frac{2x + 3}{5x + 15}$ **–3**

8. $\frac{r + 2}{r^2 + 4r}$ **–4, 0**

9. $\frac{2}{x^2 - 16}$ **–4, 4**

10. $\frac{4m - 1}{2m^2 - 12m}$ **0, 6**

11. $\frac{c - 4}{c^2 - 64}$ **–8, 8**

12. $\frac{x + 3}{x^2 + 9x + 18}$ **–6, –3**

13. $\frac{2q + 1}{8q^2 - 72}$ **–3, 3**

14. $\frac{x - 7}{x^2 + 8x + 16}$ **–4**

15. $\frac{x + 5}{x^2 + 7x + 10}$ **–5, –2**

16. $\frac{t + 2}{t^3 + 5t^2 + 6t}$ **–3, –2, 0**

17. $\frac{h - 4}{4h^2 - 24h + 36}$ **3**

18. $\frac{g^2 + 4g - 5}{4g^4 - 16g^2}$ **–2, 0, 2**

19. $\frac{2x - 3}{2x^2 - x - 15}$ $-\frac{5}{2}$, **3**

20. $\frac{h - 4}{h^2 - 2h}$ **0, 2**

Journal

1. Martha does not understand why the denominator of a rational expression cannot have a value of zero. Explain to her why the expression $\frac{2}{0}$ is undefined.
2. Explain why –3 is excluded from the domain of the expression $\frac{2x}{x + 3}$.
3. Explain how one would find the restricted values of $\frac{3x + 1}{x^2 - 8x + 12}$.
4. Jolie says that –2 and 4 are the restricted values for a certain rational expression. Find an expression that has these restricted values.
5. Find the value of the expression $\frac{6x}{x - 2}$ when x is equal to zero. Is zero a restricted value? Explain.

Cumulative Review

Factor completely.

1. $5x + 10y + 25z$ **$5(x + 2y + 5z)$**

2. $4m^2z + 12mz^2 - 18m^2$ **$2m(2mz + 6z^2 - 9m)$**

3. $r^2 - 5r - 36$ **$(r - 9)(r + 4)$**

4. $t^2 - 100$ **$(t - 10)(t + 10)$**

5. $4u^2 - 25$ **$(2u - 5)(2u + 5)$**

6. $z^2 + 8z - 48$ **$(z + 12)(z - 4)$**

7. $4x^2 + 28x + 48$ **$4(x + 3)(x + 4)$**

8. $3x^3 + 6x^2 - 105x$ **$3x(x + 7)(x - 5)$**

9. $8s^2 + 2s - 3$ **$(4s + 3)(2s - 1)$**

10. $5b^2 - 17b - 12$ **$(b - 4)(5b + 3)$**

Possible Journal Answers

1. Division problems can be changed into multiplication problems. For example, $\frac{6}{2} = 3$ can be written as $6 = 2 \cdot 3$. Now, let $\frac{2}{0} = n$. As a multiplication problem, this would be $2 = n \cdot 0$, but any number times zero is equal to zero, and therefore, there is no value of n that makes this true. This expression, $\frac{2}{0}$, is undefined.
2. The denominator of a rational expression cannot have a value of zero. When negative three is substituted for the x in $x + 3$, it becomes $-3 + 3 = 0$. Therefore, negative three is excluded from the domain of $\frac{2x}{x + 3}$.
3. Find the restricted values of $\frac{3x + 1}{x^2 - 8x + 12}$ by setting the denominator equal to zero; $x^2 - 8x + 12 = 0$. First, factor $x^2 - 8x + 12$ to be $(x - 6)(x - 2)$. Then, solve the equation $(x - 6)(x - 2) = 0$ by setting each factor equal to zero and solving for x: $x - 6 = 0$ and $x - 2 = 0$. The restricted values are six and two.
4. The value of the expression $(x - a)(x - b)$ is zero when x equals either a or b. Let $a = -2$ and $b = 4$. This gives $(x - (-2))(x - 4)$ or $(x + 2)(x - 4)$. The expression $\frac{x^3 - 5x}{(x + 2)(x - 4)}$ has the restricted values negative two and four.
5. Substitute zero for x to get $\frac{6(0)}{0 - 2} = \frac{0}{-2} = 0$. Zero is not a restricted value. Only the number two would make the value of the denominator zero. So, two is the only restricted value in this expression. When the numerator of a rational expression has a value of zero, the value of the expression is zero except when the denominator is zero; in which case, the expression is undefined.