LESSON 10 **Excluded Values** and the Zero Product Property

LEARNING OBJECTIVES

- Today I am: watching a YouTube video about why you can't divide by zero.
- So that I can: understand why this is so important in mathematics.
- I'll know I have it when I can: write an equation with 14, 2 and 0 as excluded values.

Opening Exercise

Watch the YouTube video of the TED-Ed cartoon *Why* can't you divide by zero? at https://www.youtube.com/ watch?v=NKmGVE85GUU.



Complete each statement.

- 1. Normally, dividing by smaller numbers
 - A. Gives you smaller numbers as answers
 - B. Makes you need to use decimal points
 - C. Gives you larger numbers as answers
 - D. Results in a negative number as an answer

- 2. Dividing by a number is essentially the
 - A. Reverse of subtracting by it.
 - B. Same as multiplying by it.
 - C. Reverse of multiplying by it
 - D. Same as infinity

3. The product of any number and its	4. It is impossible to find the multiplicative
multiplicative inverse is always	inverse of zero because
A. The number itself	A. Anything multiplied by zero is zero
B. I	B. Anything multiplied by zero is one
C. 0	C. Anything multiplied by zero is infinity
D. ½	D. Anything multiplied by zero is undefined

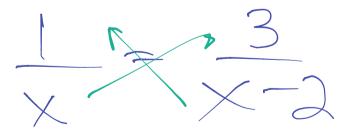
5. Discussion Why might it be beneficial to break mathematical

rules? _ J-[] - hon Euclidean Geomet (sphere) 6. Consider the equation $\frac{1}{x} = \frac{3}{x-2}$. A. What values of x would lead to division by 0? Why is division by 0 a problem? O and 2 Excluded Value $X \neq 0, 2$

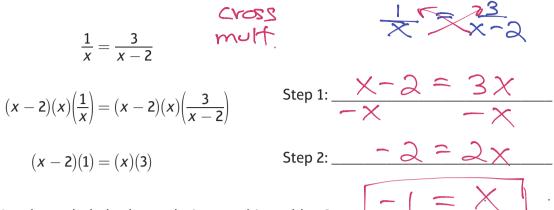


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B. Thinking back on the work you've done in this module. What could you do to isolate the variable?



C. Explain what Avery did in his first two steps and then finish finding the solution.



D. Are the excluded values solutions to this problem?

No
$$x \neq 0, 2$$

- 7. Consider the equation $\frac{3}{x-2} = \frac{5}{x-2}$.
 - A. What values of *x* would lead to division by 0?
 - B. Clear the fraction to find the value of *x*. You can complete the problem in the box on the right.
 - C. How could you tell by looking at the original equation that the solution was going to be different?

$$\frac{3}{x-2} \times \frac{5}{x-2} \times \neq 2$$

$$3(x-2) = 5(x-2)$$

$$3x-6 = 5x - 10$$

$$-3x - 6 = 2x - 10$$

$$-6 = 2x - 10$$

$$+(0)$$

$$4 = 2x$$

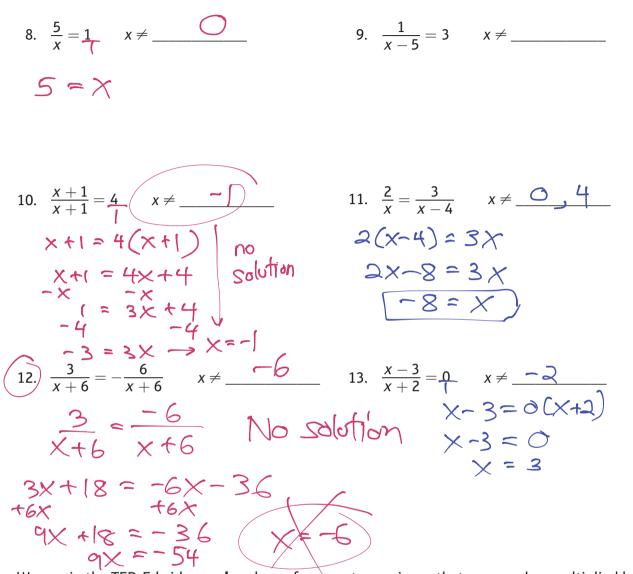
$$2 = x$$
But $x \neq 2$ and solution



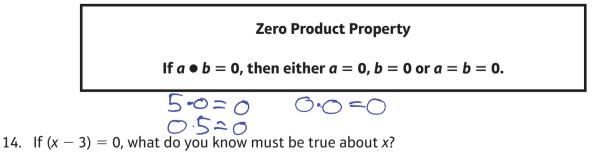
When solving equations that have a variable in the denominator, it is critical that you **exclude** values that would make the denominator equal to zero.

no-nol value(s)

Determine the excluding the value(s) of *x* that lead to a denominator of zero for each equation; then, solve the equation for *x*.



We saw in the TED-Ed video **and** we know from past experience that any number multiplied by zero is zero. This leads us to the Zero Product Property.



$$\chi = 3$$

 \frown

(*+4)(

15. If x(x - 3) = 0, what do you know must be true about x?

$$\chi = 0, 3$$

16. If (x + 4)(x - 3) = 0, what do you know must be true about x?

Practice Exercises

X = -4 or 3 (x+4)=0actice Exercises (x-3)=0

For each equation below, determine the solution.

17.
$$(y-2)(y-3) = 0$$

 $y = 2 \text{ or } 3$
 $x = -5 \text{ or } -3$
 $b=0$
 b

$$23. \ a(2a-1)(3a+8) = 0 \qquad 24. \ \left(\frac{1}{2}x+2\right)\left(\frac{2}{3}x-6\right) = 0 \qquad 25. \ (8b+1)(b+8) = 0$$

$$2a=(3a+8) = 0 \qquad 24. \ \left(\frac{1}{2}x+2\right)\left(\frac{2}{3}x-6\right) = 0 \qquad 25. \ (8b+1)(b+8) = 0$$

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Lesson Summary

Applying the distributive, commutative, and associative properties and the properties of equality to equations will not change the solution set.

When solving equations, be careful to exclude any solutions that would make the denominator equal to 0.

The equation $\frac{2x}{x-2} = 4$ has an excluded value of 2.

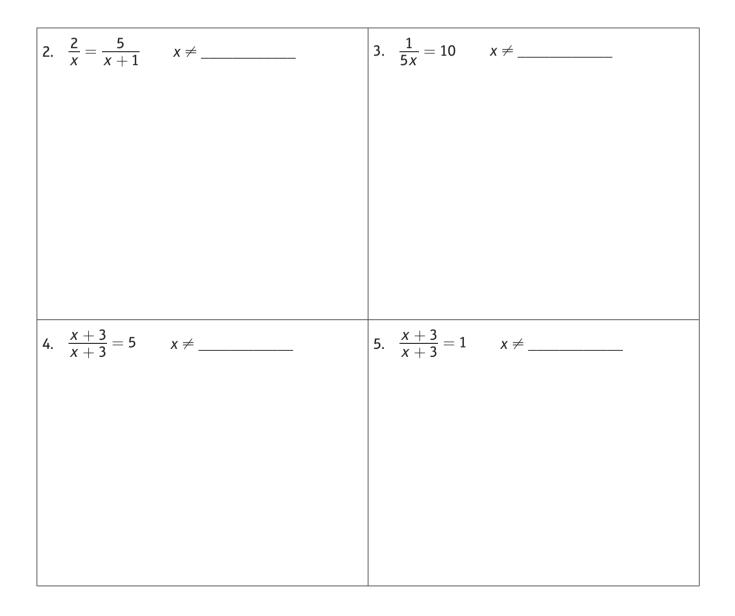
The Zero Product Property states that if $a \cdot b = 0$, then either a = 0, b = 0 or a = b = 0.

NAME: ______ PERIOD: _____ DATE: _____

Homework Problem Set

1. Consider the equation $\frac{10(x^2 - 49)}{3x(x - 4)(x + 1)} = 0$. Is x = 7 permissible? Which values of x are excluded? (You do not need to solve this equation.)

Determine the excluding the value(s) of x that lead to a denominator of zero for each equation; then, solve the equation for x.



For each equation, determine the solution(s) using the Zero Product Property.

6.
$$(b-4)(3b-1) = 0$$

7. $(n+3)(6n+1) = 0$
8. $(r+5)(r-3) = 0$

9.
$$(v + 8)(2v - 5) = 0$$
 10. $(3p - 5)(p - 2) = 0$ 11. $(2x + 1)(7x + 5) = 0$

12.
$$(3x-5)(3x+1) = 0$$
 13. $(x-2)(x+3)(x-4) = 0$ 14. $(\frac{2}{5}x+4)(\frac{1}{3}x-5) = 0$

Determine the excluded value for each equation. You do NOT need to solve the equation.

15.
$$\frac{3}{x-7} = 5$$
 16. $-4 = \frac{3}{x+4}$

17.
$$\frac{(x-2)(x+1)}{(x-1)(x+1)} = 7$$
 18. $\frac{(x-3)}{(x-3)(x+4)} = \frac{(x+4)}{(x+4)}$

19.
$$10 = \frac{(x+3)(x+5)}{(x+5)(x+6)}$$
 20. $-2 = \frac{4-x}{6}$

- 346 Module 2 Solving Equations and Systems of Equations
- 21. **Challenge** Write an equation with the restrictions $x \neq 14$, $x \neq 2$, and $x \neq 0$.

22. **Challenge** Use any of the digits 1-9 to create an equation with the smallest solution possible.

