

Name: _____
 PC: Solving Rational Equations

Date: _____
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Do Now: \swarrow expression, no = sign

$$1. \text{ Simplify: } \frac{(x+2)^4}{(x+2)(x-2)} + \frac{x(x-2)}{(x+2)(x-2)} = \frac{4x+8+x^2-2x}{(x-2)(x+2)} = \frac{x^2+2x+8}{(x-2)(x+2)} \quad x \neq \pm 2$$

Examples

\downarrow equations

$$1. \text{ Solve: } \frac{7x}{x} \cdot \frac{4}{7} + \frac{2x}{x} \cdot \frac{8}{7} = \frac{7x}{x} \quad \text{LCD: } 7x$$

$$28 + 2x = 56$$

$$2x = 28$$

$$x = 14$$

2. $\frac{6x+18}{x+3} = 5 \quad \text{LCD: } x+3$

or $\frac{6x+18}{x+3} = \frac{5}{1}$ or $\frac{6x+18}{x+3} = 5$ (could simplify first)

$$6x+18 = 5x+15$$

$$x = 3 \text{ reject}$$

$$\emptyset$$

$\frac{6(x+3)}{x+3} = 5$
 $6 \neq 5$

$$3. \frac{2x}{x+5} + \frac{1}{x-5} = \frac{10}{x^2-25} \quad \text{LCD: } (x-5)(x+5)$$

$$2x^2 - 10x + x + 5 = 10$$

$$2x^2 - 9x + 5 = 10$$

$$2x^2 - 9x - 5 = 0$$

$$\left. \begin{array}{l} 2x^2 - 10x + x - 5 = 0 \\ 2x(x-5) + 1(x-5) = 0 \\ (2x+1)(x-5) = 0 \end{array} \right\} \left\{ -\frac{1}{2} \right\}$$

$$x = -\frac{1}{2} \mid x = 5$$

Steps for solving rational equations:

1. Find LCD
2. multiply through by that LCD
 (your denominators should divide out)
3. solve the resulting equation

* make sure to reject any values that would make any of the denominators 0

Exercises

In 1-4, match the equation with the corresponding transformed equation, and state any necessary restrictions on the variable.

$$1. \frac{1}{z^2} - \frac{1}{3z} = \frac{1}{6}$$

$$3. \frac{1}{z-2} + \frac{1}{z+3} = \frac{1}{z^2+z-6}$$

$$2. \frac{4}{z-1} + \frac{4}{z} = \frac{3}{z-1}$$

$$4. \frac{8}{z^2-4} + \frac{1}{z-2} = \frac{1}{z+2}$$

a. $2z+1=1$ b. $6-2z=z^2$ c. $8z-4=3z$ d. $z+10=z-2$

In 5- 34, solve.

$$5. \frac{8}{14} = \frac{3}{m}$$

$$6. \frac{2}{x} + 1 = \frac{1}{4}$$

$$7. \frac{x-1}{4} = \frac{5}{6}$$

$$8. \frac{x}{4} = \frac{16}{x}$$

$$9. \frac{3}{p+2} = \frac{7}{8}$$

$$10. \frac{2}{q} = \frac{q-1}{3}$$

$$11. \frac{4}{m} - \frac{1}{m} = 3$$

$$12. \frac{1}{b} - \frac{1}{2} = 1$$

$$13. \frac{2}{p} + 1 = \frac{1}{4}$$

$$14. \frac{2}{v} - \frac{2}{3} = \frac{1}{3v}$$

$$15. \frac{1}{3} - \frac{2}{z} = \frac{1}{12}$$

$$16. \frac{3}{2} + \frac{1}{y} = \frac{1}{4}$$

$$17. \frac{1}{x^2} + \frac{2}{x} = \frac{9}{16}$$

$$18. \frac{4}{u^2} - 10 = \frac{3}{u}$$

$$19. \frac{1}{t} - \frac{2}{t-1} = \frac{2}{t}$$

$$20. \frac{1}{w+2} + \frac{1}{w} = \frac{3}{w}$$

$$21. \frac{z}{z-2} + \frac{z}{z+1} = 2$$

$$22. \frac{2m}{m-2} - \frac{m}{m-1} = 1$$

$$23. \frac{x}{2} - \frac{5}{2} = 2 - \frac{4}{x}$$

$$24. \frac{r}{6} + \frac{1}{2} = \frac{1}{r} + \frac{1}{3}$$

$$25. \frac{a}{4} + \frac{5a-20}{4a} = \frac{1}{a}$$

$$26. \frac{3y^2}{y-1} + \frac{3}{2} = \frac{2y-1}{y-1}$$

$$27. \frac{3d^2}{2d-1} + \frac{3d-4}{2d-1} = -2$$

$$28. \frac{2n}{n+6} = \frac{3}{n-3}$$

$$29. \frac{3x}{x-2} - \frac{2x}{x-3} = \frac{x+27}{x^2-5x+6}$$

$$30. \frac{m-1}{2m+4} = \frac{m}{3m+15} - \frac{1}{m^2+7m+10}$$

$$10. \frac{2}{q} = \frac{q-1}{3} \quad \text{LCD: } 3q$$

or you

would have cross multiplied

Since it was a proportion

$$6 = q^2 - q$$

$$0 = q^2 - q - 6$$

$$0 = (q-3)(q+2)$$

$$q = 3, -2$$

$$27. \frac{3d^2}{2d-1} + \frac{3d-4}{2d-1} = -2 \quad \text{LCD: } 2d-1$$

$$3d^2 + 3d - 4 = -4d + 2$$

$$3d^2 + 7d - 6 = 0$$

$$3d^2 + 9d - 2d - 6 = 0$$

$$3d(d+3) - 2(d+3) = 0$$

$$(3d-2)(d+3) = 0$$

$$d = \frac{2}{3}, -3$$

$$32. \frac{b+3}{3-b} + \frac{3b+1}{b^2-9} = \frac{1-5b}{b+3} \quad \text{LCD: } (b+3)(b-3)$$

$$-(b+3)(b+3) + 3b+1 = (b-3)(1-5b)$$

$$-(b^2+6b+9) + 3b+1 = b-5b^2-3+15b$$

$$-b^2-6b-9+3b+1 = -5b^2+16b-3$$

$$-b^2-3b-8 = -5b^2+16b-3$$

$$4b^2-19b-5=0$$

$$4b^2-20b+b-5=0$$

$$4b(b-5)+1(b-5)=0$$

$$(4b+1)(b-5)=0$$

$$b = -\frac{1}{4}, b = 5$$

LCM: $(m-2)(m-1)$

22. $\frac{2m}{m-2} + \frac{-m}{m-1} = 1$

(m-2)(m-1) change subtraction into addition and
(m-2)(m-1) negated the second numerator

$$2m^2 - 2m - m^2 + 2m = (m-2)(m-1)$$

$$m^2 = m^2 - 3m + 2$$

$$0 = -3m + 2$$

$$3m = 2$$

$$m = \frac{2}{3}$$