Rational Equations

- **Step 1:** Make sure equation is set up as a proportion
- **Step 2:** Cross-Multiply!
- **Step 3:** For linear equations, just solve for the variable.

  For quadratic equations, set equal to 0, then factor to solve!

1. $\frac{18}{(x-1)}=\frac{6}{(x+3)}$ $18x+54=6x-6$ $12x+54=-6$ $12x=-60$ $\boxed{x=-5}$	**2.** $\frac{(x-1)}{(x+7)}=\frac{3}{5}$ $5x-5=3x+21$ $2x-5=21$ $2x=26$ $\boxed{x=13}$
3. $\frac{x}{6}=\frac{(x-3)}{4}$ $6x-18=4x$ $2x-18=0$ $2x=18$ $\boxed{x=9}$	**4.** $\frac{5}{2}=\frac{(x-8)}{(x-2)}$ $5x-10=2x-16$ $3x-10=-16$ $3x=-6$ $\boxed{x=-2}$
5. $\frac{x}{(x+3)}=\frac{5}{(x+7)}$ $x^2+7x=5x+15$ $x^2+2x-15=0$ $(x+5)(x-3)=0$ $\boxed{x=\{-5,3\}}$	**6.** $\frac{4}{x}=\frac{(x-8)}{5}$ $x^2-8x=20$ $x^2-8x-20=0$ $(x-10)(x+2)=0$ $\boxed{x=\{10,-2\}}$
7. $\frac{(x+1)}{x}=\frac{-7}{(x-12)}$ $x^2-12x+x-12=-7x$ $x^2-11x-12=-7x$ $x^2-4x-12=0$ $(x-6)(x+2)=0$ $\boxed{x=\{6,-2\}}$	**8.** $\frac{(x+2)}{6}=\frac{3}{(x-1)}$ $x^2-x+2x-2=18$ $x^2+x-20=0$ $(x+5)(x-4)=0$ $\boxed{x=\{-5,4\}}$
9. $\frac{15}{(x^2-1)}=\frac{5}{(2x-2)}$ $5x^2-5=30x-30$ $5x^2-30x+25=0$ $5(x^2-6x+5)=0$ $5(x-5)(x-1)=0$ $\boxed{x=\{5,1\}}$	**10.** $\frac{(x-3)}{2}=\frac{(2x+5)}{3x}$ $3x^2-9x=4x+10$ $3x^2-13x-10=0$ $x^2-13x-30=0$ $\frac{(x-15)}{3}\frac{(x+2)}{3}=0$ $(x-5)(3x+2)=0$ $\boxed{x=\{5,-\frac{2}{3}\}}$

11. $\frac{(3x-4)}{(x-5)}=\frac{(x-2)}{(x+2)}$

$3x^2+6x-4x-8=x^2-2x-5x+10$

$3x^2+2x-8=x^2-7x+10$

$2x^2+9x-18=0$

$(2x-3)(x+6)=0$ $\boxed{x=\{\frac{3}{2},-6\}}$

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

$8x^2-6x=5$

$8x^2-6x-5=0$

$(4x-5)(2x+1)=0$ $\boxed{x=\{\frac{5}{4},-\frac{1}{2}\}}$

For the following problems you will need to <u>combine one side of the equation</u> in order to create a proportion!!!

13. $\frac{7x}{9}+\frac{1}{3}=\frac{x-1}{2}$

$\downarrow$

$\frac{7x}{9}+\frac{3}{9}$

$\frac{(7x+3)}{9}=\frac{(x-1)}{2}$

$14x+21=9x-9$

$5x+21=-9$

$5x=-30$

$\boxed{x=-6}$

14. $\frac{x-3}{3}+\frac{x}{2}=\frac{x+4}{2}$

$\downarrow$

$\frac{2x-6}{6}+\frac{3x}{6}$

$\frac{(5x-6)}{6}=\frac{(x+4)}{2}$

$6x+24=10x-12$

$-4x=-36$

$\boxed{x=9}$

15. $\frac{2x-1}{6}-\frac{x}{3}=\frac{x+4}{18}$

$\frac{2x-1}{6}-\frac{2x}{6}$

$\frac{-1}{6}=\frac{(x+4)}{18}$

$6x+24=-18$

$6x=-42$

$\boxed{x=-7}$

16. $\frac{3x}{2}-\frac{1}{4}=\frac{10x}{8}$

$\downarrow$

$\frac{12x}{8}-\frac{2}{8}$

$\frac{12x-2}{8}=\frac{10x}{8}$

$96x-16=80x$

$16x=16$

$\boxed{x=1}$

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

$\frac{x-2}{x+2}=\frac{5}{x+4}$

$(x-2)(x+4)=5x+10$

$x^2+2x-8=5x+10$

$x^2-3x-18=0$

$(x-6)(x+3)=0$

$\boxed{x=\{6,-3\}}$

18. $\frac{x}{2}-\frac{x}{8}=\frac{2}{3x}$

$\downarrow$

$\frac{4x}{8}-\frac{x}{8}$

$\frac{3x}{8}=\frac{2}{3x}$

$9x^2=16$

$x^2=\frac{16}{9}$

$\boxed{x=\{-\frac{4}{3},\frac{4}{3}\}}$

19. $\frac{1}{4}+\frac{1}{4x}=\frac{3}{2x}$

$\downarrow$

$\frac{x}{4x}+\frac{1}{4x}$

$\frac{(x+1)}{4x}=\frac{3}{2x}$

$2x^2+2x=12x$

$2x^2-10x=0$

$2x(x-5)=0$

$\boxed{x=\{0,5\}}$

20. $\frac{11}{4x-4}-\frac{2}{x-1}=\frac{x}{8}$

$\downarrow$

$\frac{11}{4x-4}-\frac{8}{4x-4}$

$\frac{3}{(4x-4)}=\frac{x}{8}$

$4x^2-4x=24$

$4x^2-4x-24=0$

$4(x^2-x-6)=0$

$4(x-3)(x+2)=0$

$\boxed{x=\{3,-2\}}$