

## 5.2 Solving Rational Equations

### Homework – Day 2

Name: Key

Date: \_\_\_\_\_ Block: \_\_\_\_\_

Solve each of the following rational equations. State any extraneous solutions.

$$1. \frac{3}{x} = \frac{1}{x-2}$$

$$3x - 6 = x$$

$$-6 = -2x$$

$$\boxed{x=3}$$

$$3. \frac{2n(2)}{3(2)} + \frac{1(3)}{2(3)} = \frac{2n-3}{6}$$

$$\frac{4n+3}{6} + \frac{2n-3}{6}$$

$$4n+3 = 2n-3$$

$$2n = -6$$

$$\boxed{n=-3}$$

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

$$\frac{12x^2 + 8x + 6x^2 + 4x}{(3x+2)(3x-2)} = \frac{2}{1}$$

$$18x^2 + 4x = 18x^2 - 8$$

$$-18x^2 \quad -18x^2$$

$$\frac{4x}{4} = \frac{-8}{4} \quad \boxed{x=-2}$$

$$7. \frac{2a-3}{a-3} - 2 = \frac{12}{a+3}$$

$$\frac{2a-3-2(a-3)}{a-3} = \frac{12}{a+3}$$

$$12a - 36 = 3a + 9$$

$$9a = 45$$

$$\boxed{a=5}$$

$$\frac{2a-3-2a+6}{a-3} = \frac{12}{a+3}$$

$$\frac{3}{a-3} = \frac{12}{a+3}$$

$$9. \frac{m}{m+1} + \frac{5}{m-1} = 1 = \frac{1}{1}$$

$$m^2 - m + 5m + 5 = m^2 - 1$$

$$m^2 + 4m + 5 = m^2 - 1$$

$$-m^2 \quad -m^2$$

$$4m + 5 = -1$$

$$\frac{4m}{4} = \frac{-6}{4} \quad \boxed{m = -\frac{3}{2}}$$

$$2. \frac{x-3}{x} = \frac{x-3}{x-6}$$

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

$$x^2 - 9x + 18 = x^2 - 3x$$

$$18 = 6x \quad \boxed{x=3}$$

$$4. \frac{5}{4} + \frac{3y}{2} = \frac{7y}{6}$$

$$\frac{5+6y}{4} = \frac{7y}{6}$$

$$30 + 36y = 28y$$

$$30 = -8y$$

$$y = \frac{-30}{8}$$

$$\boxed{y = -\frac{15}{4}}$$

$$6. \frac{5}{5-p} - \frac{p^2}{5-p} = \frac{-2}{1}$$

$$p \neq 5$$

$$\frac{5-p^2}{5-p} = \frac{-2}{1}$$

$$(p+5)(p-3) = 0$$

$$5-p^2 = -2(5-p)$$

$$\boxed{p=-5 \quad p=3}$$

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

$$0 = p^2 + 2p - 15$$

$$8. \frac{k}{k(k+2)} + \frac{2}{k(k+2)} = 5$$

$$\frac{5k^2 + 2k + 4}{k(k+2)} = 5$$

$$5k^2 + 2k + 4 = 5k^2 + 10k$$

$$-8k^2 - 2k \quad -5k^2 - 2k$$

$$\frac{4}{8} = \frac{8k}{8} \quad \boxed{k = \frac{1}{2}}$$

$$10. \frac{4}{k^2-8k+12} = \frac{k}{k-2} + \frac{1}{k-6}$$

$$4 = k^2 - 6k + k - 2$$

$$4 = k^2 - 5k - 2 \quad k \neq 6, 2$$

$$0 = k^2 - 5k - 6$$

$$0 = (k-6)(k+1)$$

$$\boxed{k=-1}$$

$$11. \frac{(a-1)a-1}{(a-1)a+1} - \frac{2a(a+1)}{a-1(a+1)} = -1$$

$$\frac{a^2-2a+1}{(a-1)(a+1)} - \frac{2a^2+2a}{(a-1)(a+1)} = \frac{-1}{1}$$

$$\frac{-a^2-4a+1}{(a-1)(a+1)} = \frac{-1}{1}$$

$$-a^2-4a+1 = -a^2+1$$

$$-4a+1 = 1 \quad \boxed{a=0}$$

$$13. \frac{2(7)}{2(k-3)} - \frac{1(k-3)}{2(k-3)} = \frac{3}{k-4}$$

$$\frac{14}{2k-6} - \frac{k-3}{2k-6} = \frac{3}{k-4}$$

$$\frac{-k+17}{2k-6} = \frac{3}{k-4}$$

$$-1(k^2-15k+50) = 0$$

$$-1(k-10)(k-5) = 0$$

$$6k-18 = -k^2+21k-68$$

$$-k^2+15k-50 = 0$$

$$\boxed{k=10, k=5}$$

$$15. \frac{(b+2)(2b-5)}{(b+2)b-2} - 2 = \frac{(b+2)(b-2)}{3(b-2)}$$

$$\frac{2b^2-b-10}{(b+2)(b-2)} + \frac{-2b^2+8}{(b+2)(b-2)} = \frac{3b-6}{(b+2)(b-2)}$$

$$\frac{-b-2}{(b+2)(b-2)} = \frac{3b-6}{(b+2)(b-2)}$$

$$-b-2 = 3b-6$$

$$4 = 4b$$

$$\boxed{b=1}$$

$$12. \frac{5 \cdot a}{3a+6} - \frac{a \cdot 3}{5a+10} = \frac{2}{5}$$

$$5 \cdot \frac{a}{3(a+2)} - \frac{3a}{5(a+2)} = \frac{2}{5}$$

$$\frac{5a}{15(a+2)} - \frac{3a}{15(a+2)} = \frac{2}{5}$$

$$\frac{2a}{15(a+2)} = \frac{2}{5}$$

$$10a = 30(a+2)$$

$$10a = 30a + 60$$

$$-20a = 60$$

$$\boxed{a=-3}$$

$$14. \frac{3z}{z^2-5z+4} = \frac{2(z-1)}{(z-4)} + \frac{3(z-4)}{(z-1)(z-4)}$$

$$\frac{3z}{(z-4)(z-1)} = \frac{2z-2}{(z-4)(z-1)} + \frac{3z-12}{(z-4)(z-1)}$$

$$\frac{3z}{(z-4)(z-1)} = \frac{2z-2}{(z-4)(z-1)} + \frac{3z-12}{(z-4)(z-1)}$$

$$3z = 5z - 14$$

$$-2z = -14$$

$$\boxed{z=7}$$

$$16. \frac{(n+1)2n}{n-1} + \frac{n-5}{n^2-1} = 1$$

$$\frac{(n+1)2n}{(n+1)(n-1)} + \frac{n-5}{(n+1)(n-1)} = 1$$

$$\frac{2n^2+2n}{(n+1)(n-1)} + \frac{n-5}{(n+1)(n-1)} = 1$$

$$\frac{2n^2+3n-5}{(n+1)(n-1)} = 1$$

$$2n^2+3n-5 = n^2-1$$

$$n^2+3n-4 = 0$$

$$(n+4)(n-1) = 0$$

$$\boxed{n=4} \quad n \neq -1$$

Add or subtract each rational expression.

$$17. \frac{2x-5}{(x+4)} - \frac{x-8}{x+4} \quad x \neq -4$$

$$\frac{2x^2+3x-20}{x+4} + \frac{-x+8}{x+4}$$

$$\frac{2x^2+2x-12}{x+4} = \frac{2(x^2+x-6)}{x+4} = \frac{2(x+3)(x-2)}{x+4}$$

$$19. \frac{(y-1)y-5}{(y-1)(y-5)(y+2)} + \frac{y(y-5)}{(y+2)(y-1)(y-5)}$$

$$\frac{y^2-6y+5+y^2-5y}{(y-1)(y-5)(y+2)} = \frac{2y^2-11y+5}{(y-1)(y-5)(y+2)}$$

$$\frac{(2y-1)(y-5)}{(y-1)(y-5)(y+2)} = \frac{2y-1}{(y-1)(y+2)}$$

$$18. \frac{2a(a+3)}{a-3} - \frac{2a(a-3)}{a+3} + \frac{36}{(a-3)(a+3)}$$

$$\frac{2a^2+6a-2a^2+6a+36}{(a+3)(a-3)} = \frac{12a+36}{(a+3)(a-3)}$$

$$\frac{12(a+3)}{(a+3)(a-3)} = \frac{12}{a-3}$$

$$20. \frac{(p+3)2p-3}{(p-2)(p-3)} - \frac{5(p-2)}{(p+3)(p-3)}$$

$$\frac{2p^2+3p-9}{(p+3)(p-2)(p+3)} + \frac{-5p+10}{(p+3)(p-2)(p+3)}$$

$$\frac{2p^2-2p+1}{(p+3)(p-3)(p-2)}$$

$$21. \frac{(2x+1)}{4} - \frac{5x(2x-1)}{20x^2-5(2x-1)}$$

$$\frac{(2x+1)(2x-1)(2x-1)}{(2x-1)(2x-1)} \cdot \frac{1}{5(2x-1)(2x+1)}$$

$$\frac{8x+4-2x^2+x}{(2x-1)^2(2x+1)} = \boxed{\frac{-2x^2+9x+4}{(2x-1)^2(2x+1)}}$$

$$23. \frac{(u+4)2u}{(u+4)(u-1)} - \frac{u-1}{(u+4)^2}$$

$$\frac{2u^2+8u-u^2+2u-1}{(u+4)^2(u-1)}$$

$$\boxed{\frac{u^2+10u-1}{(u+4)^2(u-1)}}$$

$$25. \frac{3a}{2a} - \frac{a+1}{2a}$$

$$\frac{6a^2-a-1}{2a}$$

$$\boxed{\frac{6a^2-a-1}{2a}}$$

$$22. \frac{3x+5}{x+5} + \frac{x+1}{x-2} - \frac{4x^2-3x-1}{(x+5)(x-2)}$$

$$\frac{3x^2-x-10+x^2+6x+5-4x^2+3x+1}{(x+5)(x-2)}$$

$$= \frac{8x-4}{(x+5)(x-2)} = \boxed{\frac{4(2x-1)}{(x+5)(x-2)}}$$

$$24. \frac{(x+2)3x}{(x+2)(x-2)} + \frac{4}{(x+2)^2} - \frac{1}{x-2}$$

$$\frac{3x^2+6x+4x-8-x^2-4x-4}{(x+2)^2(x-2)}$$

$$= \frac{2x^2+6x-12}{(x+2)^2(x-2)} = \boxed{\frac{2(x^2+3x-6)}{(x+2)^2(x-2)}}$$

$$26. \frac{(p-4)}{(p+4)} + \frac{p+1}{p-4}$$

$$\frac{(p-4)}{(p-4)} \cdot \frac{p^2-16}{p-4} + \frac{p+1}{p-4} = \boxed{\frac{p^2+p-15}{p-4}}$$

Simplify each expression.

$$27. \frac{y^2-1}{y^2+3y-4} \cdot \frac{1}{y+1}$$

$$\frac{(y+1)(y-1)}{(y+4)(y-1)} \cdot \frac{1}{(y+1)}$$

$$\boxed{\frac{1}{y+4}}$$

$$28. \frac{a^2-2a-3}{a^2-1} \cdot \frac{1}{a-3}$$

$$\frac{(a-3)(a+1)}{(a+1)(a-1)} \cdot \frac{1}{a-3}$$

$$\boxed{\frac{1}{a-1}}$$

$$29. \frac{x^2+4x-21}{x^2-9x+18} \cdot \frac{x^2-3x-28}{x^2-10x+24}$$

$$\frac{(x+7)(x-3)}{(x-6)(x-3)} \cdot \frac{(x-6)(x-4)}{(x+7)(x-4)}$$

$$\boxed{1}$$

$$30. \frac{x-15}{x-20} \cdot \frac{x-2}{x-1}$$

$$\frac{x^2-2x-15}{x-2} = \frac{x^2-2x-15}{x-2}$$

$$\frac{x^2-x-20}{x-1} = \frac{x^2-x-20}{x-1}$$

$$\frac{(x-5)(x+3)}{(x-2)} \cdot \frac{(x-1)}{(x-5)(x+4)} = \boxed{\frac{(x+3)(x-1)}{(x-2)(x+4)}}$$

