

Practice 9.4 - 9.6

Rational Expressions

key

Simplify each rational expression. State any restrictions on the variable.

$$1. \frac{x^2+x}{x^2+2x} = \frac{x(x+1)}{x(x+2)} = \frac{x+1}{x+2}$$

$x \neq 0, -2$

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

$x \neq -2$

$$3. \frac{2y}{y^2+6y} = \frac{2y}{y(y+6)} = \frac{2}{y+6}$$

$y \neq 0, -6$

$$4. \frac{x^2-5x}{x^2-25} = \frac{x(x-5)}{(x+5)(x-5)} = \frac{x}{x+5}$$

$x \neq \pm 5$

$$5. \frac{x^2+3x-18}{x^2-36} = \frac{(x+6)(x-3)}{(x+6)(x-6)} = \frac{x-3}{x-6}$$

$x \neq \pm 6$

$$6. \frac{x^2+13x+40}{x^2-2x-35} = \frac{(x+8)(x+5)}{(x-7)(x+5)} = \frac{x+8}{x-7}$$

$x \neq 7, -5$

Multiply or divide. Write the answer in simplest form. State any restrictions on the variables.

$$7. \frac{9-x^2}{5x^3+17x^2+6x} \cdot \frac{5x^2+2x}{x-3}$$

$$= \frac{-(x^2-9)}{x(5x^2+17x+6)} \cdot \frac{x(5x+2)}{x-3}$$

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

$x \neq 0, -\frac{2}{5}, \pm 3$

$$8. \frac{y^2-49}{(y-7)^2} \div \frac{5y+35}{y^2-7y} = \frac{(y+7)(y-7)}{(y-7)(y-7)} \cdot \frac{y(y-7)}{5(y+7)}$$

$y \neq \pm 7, 0$

$$= \frac{y}{5}$$

$$9. \frac{x^2-3x-10}{2x^2-11x+5} \div \frac{x^2-5x+6}{2x^2-7x+3}$$

$$= \frac{x^2-3x-10}{2x^2-11x+5} \times \frac{2x^2-7x+3}{x^2-5x+6}$$

$$= \frac{(x-5)(x+2)}{(2x-1)(x+5)} \times \frac{(2x-1)(x-3)}{(x-3)(x-2)} = \frac{x+2}{x-2}$$

$x \neq \frac{1}{2}, 5, 3, 2$

$$10. \frac{x^2-5x+4}{x^2-1} \cdot \frac{x^2+5x+4}{x^2-9}$$

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

$x \neq \pm 1, \pm 3$

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

Simplify.

$$12. \frac{x^2-2}{12} + \frac{x}{6} \cdot \frac{2}{2}$$

$$\frac{x^2-2}{12} + \frac{2x}{12} = \boxed{\frac{x^2+2x-2}{12}}$$

$$14. \frac{3}{x^2+5} - \frac{1}{x^2+5}$$

$$\frac{3(x^2+5)}{x^2+5} - \frac{1}{x^2+5} = \frac{3x^2+15-1}{x^2+5} = \boxed{\frac{3x^2+14}{x^2+5}}$$

$$17. \frac{1}{6x^2-11x+3} + \frac{1}{8x^2-18}$$

$$\frac{2(2x+3)}{2(2x+3)(3x-1)(2x-3)} + \frac{3x-1}{2(2x+3)(2x-3)(3x-1)} = \boxed{\frac{7x+5}{2(2x+3)(2x-3)(3x-1)}}$$

$$19. \frac{3}{x^2+3x-10} + \frac{1}{x^2+6x+5}$$

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

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

$$13. \frac{2}{n+4} - \frac{n^2}{n^2-16}$$

$$\frac{(n-4)-2}{(n-4)n+4} - \frac{n^2}{(n+4)(n-4)}$$

$$\frac{-2(n-4) - n^2}{(n+4)(n-4)} = \boxed{\frac{-2n+8-n^2}{(n+4)(n-4)}}$$

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

$$15. \frac{3 \cdot 3y}{3y \cdot 7x^2y} + \frac{4 \cdot x}{21xy^2 \cdot x}$$

$$\frac{9y}{21x^2y^2} + \frac{4x}{21x^2y^2} = \boxed{\frac{9y+4x}{21x^2y^2}}$$

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

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

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

$$\boxed{\frac{5a^2+2a}{(a+2)(a-2)}}$$

$$20. \frac{1+\frac{2}{x}}{4-\frac{6}{x}} = \frac{\frac{x+2}{x}}{\frac{4x-6}{x}} = \frac{x+2}{4x-6}$$

$$\frac{x+2}{x} \times \frac{x}{4x-6} = \boxed{\frac{x+2}{4x-6}}$$

$$21. \frac{\frac{3}{x+1}}{\frac{5}{x-1}} = \frac{3}{x+1} \times \frac{x-1}{5}$$

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

$$22. \frac{3}{3-x} = \frac{4}{2-x}$$

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

$$6-3x = 12-4x$$

$$\boxed{x=6}$$

$$23. \frac{1}{4-5x} = \frac{3}{x+9}$$

$$x+9 = 3(4-5x)$$

$$x+9 = 12-15x$$

$$16x = 3$$

$$\boxed{x = \frac{3}{16}}$$

$$24. \left(\frac{x}{1} + \frac{10}{x-2} = \frac{x^2+3x}{x-2} \right) \frac{x-2}{1}$$

$$\frac{x(x-2)}{1} + \frac{10(x-2)}{(x-2)} = \frac{(x^2+3x) \cdot (x-2)}{(x-2)}$$

$$x(x-2) + 10 = x^2 + 3x$$

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

$$-2x + 10 = 3x$$

$$10 = 5x$$

makes den=0 $\rightarrow x=2$ no solution

$$25. \frac{2}{x+3} + \frac{5}{3-x} = \frac{6}{x^2-9}$$

$$(x+3)(x-3) \left[\frac{2}{x+3} + \frac{5}{-(x-3)} \right] = \left[\frac{6}{(x+3)(x-3)} \right] \frac{(x+3)(x-3)}{1}$$

$$\frac{2(x+3)(x-3)}{(x+3)} + \frac{5(x+3)(x-3)}{-1(x-3)} = \frac{6(x+3)(x-3)}{x+3}$$

$$2(x-3) + -5(x+3) = 6$$

$$2x-6-5x-15 = 6$$

$$-3x-21 = 6$$

$$-3x = 27$$

$$\boxed{x = -9}$$

$$26. \frac{2}{6x+2} = \frac{x}{3x^2+11}$$

$$2(3x^2+11) = x(6x+2)$$

$$6x^2+22 = 6x^2+2x$$

$$22 = 2x$$

$$\boxed{11 = x}$$

$$27. \frac{5x}{1} \left[\frac{5+\frac{5}{x}}{5x} \right] = \left[\frac{6}{5x} \right] \frac{5x}{1}$$

$$25x + \frac{25x}{x} = \frac{30x}{5x}$$

$$25x + 25 = 6$$

$$25x = -19$$

$$\boxed{x = \frac{-19}{25}}$$