

Section 3.3 – Practice Problems

Add or Subtract, Simplify if possible and assume the denominators do not equal zero

1. $\frac{3x}{x+1} + \frac{3}{x+1}$

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

Need a common denominator

2. $\frac{6y}{y-2} - \frac{12}{y-2}$

$$\frac{6y-12}{y-2} = \frac{6(y-2)}{y-2}$$

$$\boxed{6}$$

3. $\frac{14x}{2x+3y} + \frac{21y}{2x+3y}$

$$\frac{14x+21y}{2x+3y} \rightarrow \frac{7(2x+3y)}{2x+3y}$$

$$\boxed{7}$$

4. $\frac{z-2}{5z+3} - \frac{6z-5}{5z+3}$

$$\frac{z-2-(6z-5)}{5z+3}$$

Don't forget the brackets help

$$\frac{z-6z-2+5}{5z+3} \rightarrow \frac{-5z+3}{5z+3}$$

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

$$\frac{9x-1-(3x+9)}{3x-5}$$

$$\frac{6x-10}{3x-5} \rightarrow \frac{2(3x-5)}{3x-5}$$

$$\boxed{2}$$

6. $\frac{-15y}{1-5y} - \frac{3}{5y-1}$

$$\frac{-15y}{(-1)5y-1} - \frac{3}{5y-1}$$

↓

$$\frac{15y}{5y-1} - \frac{3}{5y-1} \rightarrow \frac{15y-3}{5y-1}$$

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

$$7. \frac{2z}{3z-1} + \frac{z}{1-3z}$$

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

$$\frac{2z - z}{3z-1} \rightarrow \boxed{\frac{z}{3z-1}}$$

$$8. \frac{8x}{6x-5} + \frac{10-4x}{5-6x}$$

$$\frac{8x}{6x-5} + \frac{10-4x}{(-1)(6x-5)}$$

$$\frac{8x + (-1)(10-4x)}{6x-5} \rightarrow \frac{8x - 10 + 4x}{6x-5}$$

$$\frac{12x-10}{6x-5} = \frac{2(6x-5)}{6x-5} = \boxed{2}$$

$$9. \frac{3y-2}{y^2-25} - \frac{4y-7}{y^2-25}$$

$$\frac{3y-2 - (4y-7)}{y^2-25}$$

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

$$\boxed{\frac{-1}{y+5}}$$

$$10. \frac{2z-5}{z^2-9} - \frac{3z-8}{z^2-9}$$

$$\frac{2z-5 - (3z-8)}{z^2-9}$$

$$\frac{-z+3}{(z-3)(z+3)} \rightarrow \frac{(-1)z-3}{(z-3)(z+3)}$$

$$\boxed{\frac{-1}{z+3}}$$

$$11. \frac{x}{x} - \frac{y}{x-y}$$

$$\frac{x-y}{x-y} = \boxed{1}$$

$$12. \frac{x^2-8x}{x-5} - \frac{15}{5-x}$$

$$\frac{x(x-8)}{x-5} - \frac{15}{(-1)(x-5)}$$

$$\frac{x(x-8) + 15}{x-5} = \frac{x^2-8x+15}{x-5}$$

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

$$13. \frac{x^2}{x^2 - y^2} - \frac{y^2}{y^2 - x^2} + \frac{2xy}{y^2 - x^2}$$

$$\frac{x^2}{x^2 - y^2} - \left[\frac{y^2}{y^2 - x^2} - \frac{2xy}{y^2 - x^2} \right]$$

$$\frac{x^2}{x^2 - y^2} - \left[\frac{y^2 - 2xy}{y^2 - x^2} \right]$$

$$\frac{x^2}{x^2 - y^2} - (-1) \left[\frac{y^2 - 2xy}{x^2 - y^2} \right]$$

$$\frac{x^2 - 2xy + y^2}{x^2 - y^2} = \frac{(x-y)^2}{(x+y)(x-y)} = \boxed{\frac{x-y}{x+y}}$$

$$15. \frac{x+a}{x(a+b)+y(a+b)} - \frac{x-b}{x(a+b)+y(a+b)}$$

$$\frac{x+a}{(x+y)(a+b)} - \frac{(x-b)}{(x+y)(a+b)}$$

$$\frac{x+a-x+b}{(x+y)(a+b)}$$

$$\frac{a+b}{(x+y)(a+b)} = \boxed{\frac{1}{x+y}}$$

$$14. \frac{x^2}{x^2 - y^2} + \frac{y^2}{x^2 - y^2} + \frac{2xy}{y^2 - x^2} \rightarrow \frac{-2xy}{x^2 - y^2}$$

$$\frac{x^2 + y^2 - 2xy}{x^2 - y^2}$$

$$\frac{x^2 - 2xy + y^2}{(x+y)(x-y)} = \frac{(x-y)(x-y)}{(x+y)(x-y)}$$

$$\boxed{\frac{x-y}{x+y}}$$

$$16. \frac{2x^2 + 1}{2x^2 - 5x - 12} - \frac{4 - x}{2x^2 - 5x - 12}$$

$$\frac{2x^2 + 1 - (4 - x)}{2x^2 - 5x - 12}$$

$$\frac{2x^2 + 1 - 4 + x}{2x^2 - 5x - 12} = \frac{2x^2 + x - 3}{2x^2 - 5x - 12}$$

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

$$\boxed{\frac{(x-1)}{(x-4)}}$$

Add or Subtract. Simplify if possible, and assume non-zero denominators

$$17. \frac{5}{6x^2} + \frac{4}{3x} \cdot \frac{2x}{2x}$$

$$\frac{5}{6x^2} + \frac{8x}{6x^2}$$

$$\boxed{\frac{8x+5}{6x^2}}$$

$$18. \frac{5}{3x^2y^3} - \frac{1}{6xy^4}$$

$$\frac{5}{3x^2y^3} \cdot \frac{2y}{2y} - \frac{1}{6xy^4} \cdot \frac{x}{x}$$

$$\frac{10y}{6x^2y^4} - \frac{x}{6x^2y^4}$$

$$\boxed{\frac{10y-x}{6x^2y^4}}$$

$$19. \frac{4z}{z^2-36} - \frac{2}{z-6}$$

$$\frac{4z}{(z+6)(z-6)} - \frac{2}{z-6}$$

$$\frac{4z}{(z+6)(z-6)} - \frac{2(z+6)}{(z-6)(z+6)}$$

$$\frac{4z - 2(z+6)}{(z+6)(z-6)}$$

$$\frac{2z-12}{(z+6)(z-6)} \rightarrow \frac{2(z-6)}{(z+6)(z-6)} = \boxed{\frac{2}{z+6}}$$

$$20. \frac{3x}{x^2-49} - \frac{3}{2x-14}$$

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

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

$$\frac{6x - 3x - 21}{2(x+7)(x-7)}$$

$$\frac{3x-21}{2(x+7)(x-7)} \rightarrow \frac{3(x-7)}{2(x+7)(x-7)}$$

$$\boxed{\frac{3}{2(x+7)}}$$

$$21. \frac{y}{y^2-9} + \frac{3}{3-y}$$

$$\frac{y}{(y-3)(y+3)} + \frac{3}{(-1)(y-3)}$$

$$\frac{y}{(y-3)(y+3)} - \frac{3(y+3)}{(y-3)(y+3)}$$

$$\frac{y-3y-9}{(y-3)(y+3)} \rightarrow \boxed{\frac{-2y-9}{(y-3)(y+3)}}$$

$$22. \frac{4z}{z-1} - 4$$

$$\frac{4z}{z-1} - \frac{4(z-1)}{z-1}$$

$$\frac{4z-4z+4}{z-1}$$

$$\boxed{\frac{4}{z-1}}$$

$$23. \frac{x+1}{x^2-x-6} - \frac{2}{x-3}$$

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

$$\frac{x+1-[2x+4]}{(x-3)(x+2)}$$

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

$$24. \frac{4y}{y^2-5y} - \frac{3}{2y-10}$$

$$\frac{4y}{y(y-5)} - \frac{3}{2(y-5)}$$

$$\frac{4y(2)}{2y(y-5)} - \frac{3y}{2y(y-5)}$$

$$\frac{8y-3y}{2y(y-5)} \rightarrow \frac{5y}{2y(y-5)}$$

$$\boxed{\frac{5}{2(y-5)}}$$

$$25. \frac{1}{z-5} - \frac{z}{z^2-z-20}$$

$$\frac{1}{z-5} - \frac{z}{(z-5)(z+4)}$$

$$\frac{z+4}{(z-5)(z+4)} - \frac{z}{(z-5)(z+4)}$$

$$\boxed{\frac{4}{(z-5)(z+4)}}$$

$$27. \frac{2}{y+5} + \frac{5y}{y^2-25} + \frac{4}{5-y}$$

$$\frac{2}{y+5} + \frac{5y}{(y-5)(y+5)} + \frac{4}{(-1)(y-5)}$$

$$\frac{2(y-5) + 5y - 4(y+5)}{(y-5)(y+5)}$$

$$\frac{2y - 10 + 5y - 4y - 20}{(y-5)(y+5)}$$

$$\frac{3y - 30}{(y-5)(y+5)} = \boxed{\frac{3(y-10)}{(y-5)(y+5)}}$$

$$26. \frac{4}{x^2-4} + \frac{1}{2-x} - \frac{1}{x+2}$$

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

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

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

$$\frac{4 - 2x}{(x+2)(x-2)} \rightarrow \frac{-2(x-2)}{(x-2)(x+2)}$$

$$\boxed{\frac{-2}{x+2}}$$

$$28. \frac{z+2}{z^2+z-2} + \frac{3}{z^2-1}$$

$$\frac{\cancel{z+2}}{(\cancel{z+2})(z-1)} + \frac{3}{(z-1)(z+1)}$$

$$\frac{1}{z-1} + \frac{3}{(z-1)(z+1)}$$

$$\frac{z+1 + 3}{(z-1)(z+1)} \rightarrow \boxed{\frac{z+4}{(z-1)(z+1)}}$$

29. $\frac{3x+3}{x^2+5x+4} - \frac{x-3}{x^2+x-12}$

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

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

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

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

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

$$\frac{x^2-2x+1 - [x^2+2x+1]}{(2x+1)(x-1)(x+1)}$$

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

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

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

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

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

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

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

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

32. $\frac{5}{2x^3} - \frac{3x-9}{x^2-6x+9} + \frac{12x}{4x^2-12x}$

$$\frac{5}{2x^3} - \frac{3(\cancel{x-3})}{(x-3)(\cancel{x-3})} + \frac{\cancel{12x^3}}{4x(x-3)}$$

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

cancel out

$$\boxed{\frac{5}{2x^3}}$$

33. $\frac{y-5}{(x^2+5x)+(xy+5y)} + \frac{1}{x+y} - \frac{2}{x+5}$

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

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

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

$$\frac{-x-y}{(x+y)(x+5)} \rightarrow \frac{-1(x+y)}{(x+y)(x+5)}$$

$$\boxed{\frac{-1}{x+5}}$$

35. The length of a rectangle is $\frac{2}{(x-4)}$ and the width is $\frac{3}{x}$. Find the perimeter of the rectangle.

$$2l + 2w = P$$

$$2\left(\frac{2}{x-4}\right) + 2\left(\frac{3}{x}\right) \Rightarrow \frac{4}{x-4} + \frac{6}{x}$$

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

$$\frac{10x - 24}{x^2 - 4x} = \boxed{\frac{2(5x-12)}{x(x-4)}}$$

$$\boxed{\frac{-3}{z+3}}$$

34. $\frac{2z+11}{z^2+z-6} - \frac{2}{z+3} + \frac{3}{2-z}$

$$\frac{2z+11}{(z+3)(z-2)} - \frac{2(z-2)}{(z+3)(z-2)} + \frac{3(z+3)}{(-1)(z-2)(z+3)}$$

$$\frac{2z+11 - [2z-4] - [3z+9]}{(z+3)(z-2)}$$

$$\frac{2z+11 - 2z+4 - 3z-9}{(z+3)(z-2)}$$

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

36. The sum of a rational expression and $\frac{1}{(x+3)}$ is $\frac{3x}{2x^2+5x-3}$. Determine the rational expression.

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

$$\Rightarrow \frac{3x}{2x^2+5x-3} - \frac{1}{x+3} = ?$$

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