Extra practice solutions

Problems 1-4 goal: correctly simplify to get rid of fractions

Strategy 1: distribute first	**Strategy 2: distribute second**
1. $\dfrac{2}{3}x+\dfrac{1}{5}(x+2)=4$ $\dfrac{2}{3}x+\dfrac{1}{5}x+\dfrac{2}{5}=4$ $\dfrac{5\cdot3}{1}\cdot\left(\dfrac{2}{3}x+\dfrac{1}{5}x+\dfrac{2}{5}\right)=5\cdot3\cdot4$ $\dfrac{5\cdot\cancel{3}}{1}\cdot\dfrac{2}{\cancel{3}}x+\dfrac{\cancel{5}\cdot3}{1}\cdot\dfrac{1}{\cancel{5}}x+\dfrac{\cancel{5}\cdot3}{1}\cdot\dfrac{2}{\cancel{5}}=15\cdot4$ $10x+3x+6=60$ $13x=54$ $x=54/13$	1. $\dfrac{2}{3}x+\dfrac{1}{5}(x+2)=4$ $\dfrac{5\cdot3}{1}\cdot\left(\dfrac{2}{3}x+\dfrac{1}{5}(x+2)\right)=5\cdot3\cdot4$ $\dfrac{5\cdot\cancel{3}}{1}\cdot\dfrac{2}{\cancel{3}}x+\dfrac{\cancel{5}\cdot3}{1}\cdot\dfrac{1}{\cancel{5}}(x+2)=5\cdot3\cdot4$ $10x+3(x+2)=60$ $10x+3x+6=60$ $13x=54$ $x=54/13$
2. $\dfrac{2}{3}(x+3)+x=\dfrac{2}{9}$ $\dfrac{2}{3}x+\dfrac{2}{\cancel{3}}\cdot\cancel{3}+x=\dfrac{2}{9}$ $\dfrac{3\cdot3}{1}\cdot\left(\dfrac{2}{3}x+2+x\right)=\dfrac{3\cdot3}{1}\cdot\dfrac{2}{9}$ $\dfrac{3\cdot\cancel{3}}{1}\cdot\dfrac{2}{\cancel{3}}x+\dfrac{3\cdot3}{1}\cdot2+\dfrac{3\cdot3}{1}\cdot x=\dfrac{\cancel{3}\cdot3}{1}\cdot\dfrac{2}{\cancel{9}}$ $2x+18+9x=2$ $11x=-16$ $x=-16/11$	$\dfrac{2}{3}(x+3)+x=\dfrac{2}{9}$ $\dfrac{3\cdot3}{1}\cdot\left(\dfrac{2}{3}(x+3)+x\right)=\dfrac{3\cdot3}{1}\cdot\dfrac{2}{9}$ $\dfrac{3\cdot\cancel{3}}{1}\cdot\dfrac{2}{\cancel{3}}(x+3)+\dfrac{3\cdot3}{1}\cdot x=\dfrac{\cancel{3}\cdot3}{1}\cdot\dfrac{2}{\cancel{9}}$ $6(x+3)+9x=2$ $2x+18+9x=2$ $11x=-16$ $x=-16/11$

3.

Left column:

$$\frac{3}{7} - 2\left(\frac{1}{3} - x\right) = \frac{1}{7}$$

$$\frac{3}{7} - 2 \cdot \frac{1}{3} - 2x = \frac{1}{7}$$

$$\frac{3 \cdot 7}{1} \cdot \left(\frac{3}{7} - \frac{2}{3} - 2x\right) = \frac{3 \cdot 7}{1} \cdot \frac{1}{7}$$

$$\frac{3 \cdot \cancel{7}}{1} \cdot \frac{3}{\cancel{7}} - \frac{\cancel{3} \cdot 7}{1} \cdot \frac{2}{\cancel{3}} - \frac{3 \cdot 7}{1} \cdot 2x = \frac{3 \cdot \cancel{7}}{1} \cdot \frac{1}{\cancel{7}}$$

$$9 - 14 - 42x = 3$$

$$-42x = 8$$

$$x = -8/42$$

$$x = -4/21$$

Right column:

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

$$\frac{3 \cdot 7}{1} \cdot \left(\frac{3}{7} - 2\left(\frac{1}{3} + x\right)\right) = \frac{3 \cdot 7}{1} \cdot \frac{1}{7}$$

$$\frac{3 \cdot \cancel{7}}{1} \cdot \frac{3}{\cancel{7}} - \frac{3 \cdot 7}{1} 2\left(\frac{1}{3} + x\right) = \frac{3 \cdot \cancel{7}}{1} \cdot \frac{1}{\cancel{7}}$$

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

$$9 - \frac{\cancel{3} \cdot 7 \cdot 2}{1} \cdot \frac{1}{\cancel{3}} - \frac{3 \cdot 7 \cdot 2}{1} \cdot x = 3$$

$$9 - 14 - 42x = 3$$

$$-42x = 8$$

$$x = -8/42$$

$$x = -4/21$$

4.

Left column:

$$\frac{3}{5}x - \left(\frac{1}{3}x + 4\right) = 9$$

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

$$\frac{3 \cdot 5}{1} \cdot \left(\frac{3}{5}x - \frac{1}{3}x - 4\right) = \frac{3 \cdot 5}{1} \cdot 9$$

$$\frac{3 \cdot \cancel{5}}{1} \cdot \frac{3}{\cancel{5}}x - \frac{\cancel{3} \cdot 5}{1} \cdot \frac{1}{\cancel{3}}x - \frac{3 \cdot 5}{1} \cdot 4 = \frac{3 \cdot 5}{1} \cdot 9$$

$$9x + 5x - 60 = 135$$

$$14x = 195$$

$$x = 195/14$$

Right column:

$$\frac{3}{5}x - \left(\frac{1}{3}x + 4\right) = 9$$

$$\frac{3 \cdot 5}{1} \cdot \left(\frac{3}{5}x - \left(\frac{1}{3}x + 4\right)\right) = \frac{3 \cdot 5}{1} \cdot 9$$

$$\frac{3 \cdot 5}{1} \cdot \frac{3}{5}x - \frac{3 \cdot 5}{1} \cdot \left(\frac{1}{3}x + 4\right) = \frac{3 \cdot 5}{1} \cdot 9$$

$$\frac{3 \cdot \cancel{5}}{1} \cdot \frac{3}{\cancel{5}}x - \frac{\cancel{3} \cdot 5}{1} \cdot \frac{1}{\cancel{3}}x - \frac{3 \cdot 5}{1} \cdot 4 = \frac{3 \cdot 5}{1} \cdot 9$$

$$9x + 5x - 60 = 135$$

$$14x = 195$$

$$x = 195/14$$

5-8 steps:
- factor all of the denominators
- multiply all terms by the product of the factors in the denominators
- simplify each term
- multiply out products
- combine like terms

5.

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

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

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

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

$$(x-4)\cdot x=(x+4)\cdot3+x(x-4)\cdot5$$

$$x^2-4x=3x+12+(x^2-4x)\cdot5$$
$$x^2-4x\ \ =3x+12+5x^2-20x$$
$$\underline{-x^2+4x\qquad\qquad -x^2+4x}$$
$$0=4x^2-13x+12$$

6.

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

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

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

$$(x+1)x-(2x+1)\cdot3=(x+2)(x-4)$$

$$x^2+x-6x-3=x^2-4x+2x-8$$
$$x^2-5x-3\ \ =x^2-2x-8$$
$$\underline{-x^2+5x+3\ \ \ -x^2+5x+3}$$
$$0=3x-5$$

7.

$$\frac{x+1}{x^2-25} - \frac{x+3}{x^2-5x} = \frac{x-1}{x^2+5x}$$

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

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

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

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

$$x^2 + x - (x^2 + 3x + 5x + 15) = x^2 - x - 5x + 5$$

$$x^2 + x - x^2 - 8x - 15 = x^2 - 6x + 5$$

$$-7x - 15 = x^2 - 6x + 5$$

$$\underline{+7x \quad +15 \qquad \quad +7x+15}$$

$$0 = x^2 + x + 20$$

8.

$$\frac{x-4}{x^2+5x+6} = \frac{x-2}{x^2+4x+3} - \frac{5}{x^2+3x+2}$$

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

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

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

$$(x+1)(x-4) = (x-2)(x+3) - (x+3)\cdot 5$$

$$x^2 - 4x + x - 4 = x^2 + 3x - 2x - 6 - (5x+15)$$

$$x^2 - 3x - 4 = x^2 + x - 6 - 5x - 15$$

$$x^2 - 3x - 4 = x^2 - 4x - 9$$

$$\underline{-x^2 + 4x + 9 \quad -x^2 + 4x + 9}$$

$$x + 5 = 0$$