Simplify each of the following.

1. $\frac{4}{9}+\frac{4}{5}=\frac{4\times5+9\times4}{9\times5}=\frac{20+36}{45}=\frac{56}{45}=1\frac{11}{45}$

2. $\frac{4}{7}-\frac{2}{3}=\frac{4\times3-7\times2}{7\times3}=\frac{12-14}{21}=-\frac{2}{21}$

3. $\frac{4}{3}\div\frac{3}{7}=\frac{4}{3}\times\frac{7}{3}=\frac{28}{9}=3\frac{1}{9}$

4. $\frac{2}{3}\times\frac{7}{8}=\frac{14}{24}=\frac{7}{12}$

5. $2\frac{1}{3}+\left(-7\frac{2}{9}\right)=2\frac{1}{3}-7\frac{2}{9}$

Start by changing both to improper fractions:

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

$7\frac{2}{9}=\frac{(9)(7)+(2)}{9}=\frac{65}{9}$

The problem is now:

$\frac{7}{3}-\frac{65}{9}=\frac{(7)(9)-(3)(65)}{(3)(9)}=\frac{63-195}{27}=\frac{-132}{27}=\frac{-44}{9}$

$$\begin{array}{r} 4 \\ 9\overline{)\,44} \\ -36 \\ \hline 8 \end{array}$$

$\frac{-44}{9}=-4\frac{8}{9}$

6. $1\frac{1}{5}-2\frac{7}{9}\times 3\frac{1}{2}$

Everything to improper fractions first:

$$1\frac{1}{5}=\frac{(5)(1)+(1)}{5}=\frac{6}{5}$$

$$2\frac{7}{9}=\frac{(9)(2)+(7)}{(9)}=\frac{25}{9}$$

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

The problem is now:

$$\frac{6}{5}-\frac{25}{9}\times\frac{7}{2}$$

Work with the $-\frac{25}{9}\times\frac{7}{2}$ first :

$$-\frac{25}{9}\times\frac{7}{2}=-\frac{(25)(7)}{(9)(2)}=-\frac{175}{18}$$

The problem is now: $\frac{6}{5}-\frac{175}{18}$

$$\frac{6}{5}-\frac{175}{18}=\frac{(6)(18)-(5)(175)}{(5)(18)}$$

$$\begin{array}{r} 1\ 8 \\ \times\ \ 6 \\ \hline 1\ 0\ 8 \end{array} \qquad \begin{array}{r} 1\ 7\ 5 \\ \times\ \ 5 \\ \hline 8\ 7\ 5 \end{array} \qquad \begin{array}{r} 1\ 8 \\ \times\ 5 \\ \hline 9\ 0 \end{array}$$

$$\frac{(6)(18)-(5)(175)}{(5)(18)}=\frac{108-875}{90}=-\frac{767}{90}$$

$$\begin{array}{r} 8 \\ 90\overline{)\ 7\,6\,7} \\ -7\,2\,0 \\ \hline 4\,7 \end{array}$$

$$-\frac{767}{90}=-8\frac{47}{90}$$

7. $2\frac{7}{8}\div 2\frac{7}{8}=1$

Anything divided by itself is 1

8. $4\frac{1}{2}-2\frac{1}{4}\div 7\frac{2}{9}$

Everything to improper fractions first:

$$4\frac{1}{2}=\frac{(2)(4)+(1)}{2}=\frac{9}{2}$$

$$2\frac{1}{4}=\frac{(4)(2)+(1)}{(4)}=\frac{9}{4}$$

$$7\frac{2}{9}=\frac{(9)(7)+(2)}{(9)}=\frac{65}{9}$$

The problem is now:

$$\frac{9}{2}-\frac{9}{4}\div\frac{65}{9}$$

Work with the $-\frac{9}{4}\div\frac{65}{9}$ first :

$$-\frac{9}{4}\div\frac{65}{9}=-\frac{9}{4}\times\frac{9}{65}=-\frac{81}{260}$$

The problem is now: $\frac{9}{2}-\frac{81}{260}$

$$\frac{9}{2}-\frac{81}{260}=\frac{(9)(260)-(2)(81)}{(2)(260)}$$

$$\begin{array}{r} 2\ 6\ 0 \\ \times\ \ 9 \\ \hline 2\ 3\ 4\ 0 \end{array} \qquad \begin{array}{r} 8\ 1 \\ \times\ 2 \\ \hline 1\ 6\ 2 \end{array} \qquad \begin{array}{r} 2\ 6\ 0 \\ \times\ 2 \\ \hline 5\ 2\ 0 \end{array}$$

$$\frac{(9)(260)-(2)(81)}{(2)(260)}=\frac{2340-162}{520}=\frac{2178}{520}$$

$$\begin{array}{r} 4 \\ 520\overline{)\ 2\,1\,7\,8} \\ -2\,0\,8\,0 \\ \hline 9\,8 \end{array}$$

$$4\frac{98}{520}=4\frac{49}{260}$$

Simplify each of the following improper fractions.

9. $\frac{45}{6} = \frac{15}{2}$

$$2\overline{)15}\quad 7,\ -14,\ 1$$

$\frac{15}{2} = 7\frac{1}{2}$

10. $\frac{17}{3}$

$$3\overline{)17}\quad 5,\ -15,\ 2$$

$\frac{17}{3} = 5\frac{2}{3}$

11. $\frac{16}{12} = \frac{4}{3}$

$$3\overline{)4}\quad 1,\ -1,\ 1$$

$\frac{16}{12} = 1\frac{1}{3}$

12. $\frac{132}{5}$

$$5\overline{)132}\quad 26,\ -10,\ 32,\ -30,\ 2$$

$\frac{132}{5} = 26\frac{2}{5}$

13. $\frac{82}{3}$

$$3\overline{)82}\quad 27,\ -6,\ 22,\ -21,\ 1$$

$\frac{82}{3} = 27\frac{1}{3}$

14. $\frac{78}{5}$

$$5\overline{)78}\quad 15,\ -5,\ 28,\ -25,\ 3$$

$\frac{78}{5} = 15\frac{3}{5}$

15. $\frac{79}{7}$

$$7\overline{)79}\quad 11,\ -7,\ 09,\ -7,\ 2$$

$\frac{79}{7} = 11\frac{2}{7}$

16. $\frac{50}{6} = \frac{25}{3}$

$$3\overline{)25}\quad 8,\ -24,\ 1$$

$\frac{50}{6} = 8\frac{1}{3}$

List two fractions that are equivalent to the following fractions.

17. $\frac{3}{4} = \frac{6}{8} = \frac{9}{12} = \frac{12}{16} = \frac{15}{20} = \frac{18}{24} = \frac{21}{28} = \ldots$

18. $\frac{5}{9} = \frac{10}{18} = \frac{15}{27} = \frac{20}{36} = \frac{25}{45} = \frac{30}{54} = \frac{35}{63} = \ldots$

19. $\frac{6}{9} = \frac{2}{3} = \frac{4}{6} = \frac{8}{12} = \frac{10}{15} = \frac{12}{18} = \frac{14}{21} = \ldots$

20. $\frac{1}{7} = \frac{2}{14} = \frac{3}{21} = \frac{4}{28} = \frac{5}{35} = \frac{6}{42} = \frac{7}{49} = \ldots$

21. $\frac{2}{8} = \frac{1}{4} = \frac{3}{12} = \frac{4}{16} = \frac{5}{20} = \frac{6}{24} = \frac{7}{28} = \ldots$

22. $\frac{3}{5} = \frac{6}{10} = \frac{9}{15} = \frac{12}{20} = \frac{15}{25} = \frac{18}{30} = \frac{21}{35} = \ldots$

Determine if the two fractions given are equivalent.

23. $\frac{4}{7} \stackrel{?}{=} \frac{8}{14}$

Yes, since:

$4 \times 14 = 7 \times 8$

$56 = 56$

24. $\frac{6}{8} \stackrel{?}{=} \frac{40}{30}$

No, since:

$6 \times 30 \neq 8 \times 40$

$180 \neq 320$

25. $\frac{9}{4} \stackrel{?}{=} \frac{45}{25}$

No, since:

$9 \times 25 \neq 4 \times 45$

$225 \neq 180$

