Name _____ Date_____

Collecting Rational Number Like Terms

For the problem $\frac{1}{5}g - \frac{1}{10} - g + 1\frac{3}{10}g - \frac{1}{10}$, Tyson created an equivalent expression using the following steps.

$$\frac{1}{5}g + -1g + 1\frac{3}{10}g + -\frac{1}{10} + -\frac{1}{10}$$

$$-\frac{4}{5}g + 1\frac{1}{10}$$

Is his final expression equivalent to the initial expression? Show how you know. If the two expressions are not equivalent, find Tyson's mistake and correct it.

Problem Set

1. Write the indicated expressions.
   a. $\frac{1}{2}m$ inches in feet.
   b. The perimeter of a square with $\frac{2}{3}g$ cm sides.
   c. The number of pounds in 9 oz.
   d. The average speed of a train that travels x miles in $\frac{3}{4}$ hour.
   e. Devin is $1\frac{1}{4}$ years younger than Eli. April is $\frac{1}{5}$ as old as Devin. Jill is 5 years older than April. If Eli is E years old, what is Jill's age in terms of E?

2. Rewrite the expressions by collecting like terms.
   a. $\frac{1}{2}k - \frac{3}{8}k$
   b. $\frac{2r}{5} + \frac{7r}{15}$
   c. $-\frac{1}{3}a - \frac{1}{2}b - \frac{3}{4} + \frac{1}{2}b - \frac{2}{3}b + \frac{5}{6}a$
   d. $-p + \frac{3}{5}q - \frac{1}{10}q + \frac{1}{9} - \frac{1}{9}p + 2\frac{1}{3}p$
   e. $\frac{5}{7}y - \frac{y}{14}$
   f. $\frac{3n}{8} - \frac{n}{4} + 2\frac{n}{2}$

3. Rewrite the expressions by using the distributive property and collecting like terms.
   a. $\frac{4}{5}(15x - 5)$
   b. $\frac{4}{5}\left(\frac{1}{4}c - 5\right)$
   c. $2\frac{4}{5}v - \frac{2}{3}\left(4v + 1\frac{1}{6}\right)$
   d. $8 - 4\left(\frac{1}{8}r - 3\frac{1}{2}\right)$
   e. $\frac{1}{7}(14x + 7) - 5$
   f. $\frac{1}{5}(5x - 15) - 2x$
   g. $\frac{1}{4}(p + 4) + \frac{3}{5}(p - 1)$
   h. $\frac{7}{8}(w + 1) + \frac{5}{6}(w - 3)$
   i. $\frac{4}{5}(c - 1) - \frac{1}{8}(2c + 1)$
   j. $\frac{2}{3}\left(h + \frac{3}{4}\right) - \frac{1}{3}\left(h + \frac{3}{4}\right)$
   k. $\frac{2}{3}\left(h + \frac{3}{4}\right) - \frac{2}{3}\left(h - \frac{3}{4}\right)$
   l. $\frac{2}{3}\left(h + \frac{3}{4}\right) + \frac{2}{3}\left(h - \frac{3}{4}\right)$
   m. $\frac{k}{2} - \frac{4k}{5} - 3$
   n. $\frac{3t + 2}{7} + \frac{t - 4}{14}$
   o. $\frac{9x - 4}{10} + \frac{3x + 2}{5}$
   p. $\frac{3(5g - 1)}{4} - \frac{2g + 7}{6}$
   q. $-\frac{3d + 1}{5} + \frac{d - 5}{2} + \frac{7}{10}$
   r. $\frac{9w}{6} + \frac{2w - 7}{3} - \frac{w - 5}{4}$
   s. $\frac{1 + f}{5} - \frac{1 + f}{3} + \frac{3 - f}{6}$

For the problem $\frac{1}{5}g - \frac{1}{10} - g + 1\frac{3}{10}g - \frac{1}{10}$, Tyson created an equivalent expression using the following steps.

$$\frac{1}{5}g + -1g + 1\frac{3}{10}g + -\frac{1}{10} + -\frac{1}{10}$$

$$-\frac{4}{5}g + 1\frac{1}{10}$$

Is his final expression equivalent to the initial expression? Show how you know. If the two expressions are not equivalent, find Tyson's mistake and correct it.

No, he added the first two terms correctly, but he forgot the third term and added to the other like terms.

If $g = 10$,

$$\frac{1}{5}g + -1g + 1\frac{3}{10}g + -\frac{1}{10} + -\frac{1}{10} \qquad -\frac{4}{5}g + 1\frac{1}{10}$$

$$\frac{1}{5}(10) + -1(10) + 1\frac{3}{10}(10) + -\frac{1}{10} + -\frac{1}{10} \qquad -\frac{4}{5}(10) + 1\frac{1}{10}$$

$$2 + (-10) + 13 + \left(-\frac{2}{10}\right) \qquad -8 + 1\frac{1}{10}$$

$$4\frac{4}{5} \qquad -6\frac{9}{10}$$

The expressions are not equal.

He should factor out the g and place parentheses around the values using the distributive property in order to make it obvious which rational numbers need to be combined.

$$\frac{1}{5}g + -1g + 1\frac{3}{10}g + -\frac{1}{10} + -\frac{1}{10}$$

$$\left(\frac{1}{5}g + -1g + 1\frac{3}{10g}\right) + \left(-\frac{1}{10} + -\frac{1}{10}\right)$$

$$\left(\frac{1}{5} + -1 + 1\frac{3}{10}\right)g + \left(-\frac{2}{10}\right)$$

$$\left(\frac{2}{10} + \frac{3}{10}\right)g + \left(-\frac{1}{5}\right)$$

$$\frac{1}{2}g - \frac{1}{5}$$

1. **Write the indicated expressions.**

   a. $\frac{1}{2}m$ **inches in feet**

   $\frac{1}{2}m \times \frac{1}{12} = \frac{1}{24}m$. *It is* $\frac{1}{24}m$ ft.

b. The perimeter of a square with $\frac{2}{3}g$ cm sides

$4 \times \frac{2}{3}g = \frac{8}{3}g$. *The perimeter is* $\frac{8}{3}g$ cm.

c. The number of pounds in 9 oz.

$9 \times \frac{1}{16} = \frac{9}{16}$. *It is* $\frac{9}{16}$ lb.

d. The average speed of a train that travels x miles in $\frac{3}{4}$ hour

$R = \frac{D}{T}; \frac{\frac{x}{3}}{4} = \frac{4}{3}x$. *The average speed of the train is* $\frac{4}{3}x$ *miles per hour.*

e. Devin is $1\frac{1}{4}$ years younger than Eli. April is $\frac{1}{5}$ as old as Devin. Jill is 5 years older than April. If Eli is E years old, what is Jill's age in terms of E?

$D = E - 1\frac{1}{4}$, $A = \frac{D}{5}$, $A + 5 = J$, *so* $J = \left(\frac{D}{5}\right) + 5$. $J = \left(\frac{E}{5} + 4\frac{3}{4}\right)$.

2. Rewrite the expressions by collecting like terms.

a. $\frac{1}{2}k - \frac{3}{8}k$

$\frac{4}{8}k - \frac{3}{8}k$

$\frac{1}{8}k$

b. $\frac{2r}{5} + \frac{7r}{15}$

$\frac{6r}{15} + \frac{7r}{15}$

$\frac{13r}{15}$

c. $-\frac{1}{3}a - \frac{1}{2}b - \frac{3}{4} + \frac{1}{2}b - \frac{2}{3}b + \frac{5}{6}a$

$-\frac{1}{3}a + \frac{5}{6}a - \frac{1}{2}b + \frac{1}{2}b - \frac{2}{3}b - \frac{3}{4}$

$-\frac{2}{6}a + \frac{5}{6}a - \frac{2}{3}b - \frac{3}{4}$

$\frac{1}{2}a - \frac{2}{3}b - \frac{3}{4}$

d. $-p + \frac{3}{5}q - \frac{1}{10}q + \frac{1}{9} - \frac{1}{9}p + 2\frac{1}{3}p$

$-p - \frac{1}{9}p + 2\frac{1}{3}p + \frac{3}{5}q - \frac{1}{10}q + \frac{1}{9}$

$-\frac{9}{9}p - \frac{1}{9}p + 2\frac{3}{9}p + \frac{6}{10}q - \frac{1}{10}q + \frac{1}{9}$

$\frac{11}{9}p + \frac{5}{10}q + \frac{1}{9}$

$1\frac{2}{9}p + \frac{1}{2}q + \frac{1}{9}$

e. $\frac{5}{7}y - \frac{y}{14}$

$\frac{10}{14}y - \frac{1}{14}y$

$\frac{9}{14}y$

f. $\frac{3n}{8} - \frac{n}{4} + 2\frac{n}{2}$

$\frac{3n}{8} - \frac{2n}{8} + 2\frac{4n}{8}$

$2\frac{5n}{8}$

3. Rewrite the expressions by using the distributive property and collecting like terms.

a. $\frac{4}{5}(15x-5)$

$12x-4$

b. $\frac{4}{5}\left(\frac{1}{4}c-5\right)$

$\frac{1}{5}c-4$

c. $2\frac{4}{5}v-\frac{2}{3}\left(4v+1\frac{1}{6}\right)$

$\frac{2}{15}v-\frac{7}{9}$

d. $8-4\left(\frac{1}{8}r-3\frac{1}{2}\right)$

$-\frac{1}{2}r+22$

e. $\frac{1}{7}(14x+7)-5$

$2x-4$

f. $\frac{1}{5}(5x-15)-2x$

$-x-3$

g. $\frac{1}{4}(p+4)+\frac{3}{5}(p-1)$

$\frac{17}{20}p+\frac{2}{5}$

h. $\frac{7}{8}(w+1)+\frac{5}{6}(w-3)$

$\frac{41}{24}w-\frac{39}{24}$ *or* $\frac{41}{24}w-\frac{13}{8}$

i. $\frac{4}{5}(c-1)-\frac{1}{8}(2c+1)$

$\frac{11}{20}c-\frac{37}{40}$

j. $\frac{2}{3}\left(h+\frac{3}{4}\right)-\frac{1}{3}\left(h+\frac{3}{4}\right)$

$\frac{1}{3}h+\frac{1}{4}$

k. $\frac{2}{3}\left(h+\frac{3}{4}\right)-\frac{2}{3}\left(h-\frac{3}{4}\right)$

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l. $\frac{2}{3}\left(h+\frac{3}{4}\right)+\frac{2}{3}\left(h-\frac{3}{4}\right)$

$\frac{4}{3}h$

m. $\frac{k}{2}-\frac{4k}{5}-3$

$-\frac{3k}{10}-3$

n. $\frac{3t+2}{7}+\frac{t-4}{14}$

$\frac{1}{2}t$

o. $\frac{9x-4}{10}+\frac{3x+2}{5}$

$\frac{3x}{2}$ *or* $1\frac{1}{2}x$

p. $\frac{3(5g-1)}{4}-\frac{2g+7}{6}$

$3\frac{5}{12}g-1\frac{11}{12}$

q. $-\frac{3d+1}{5}+\frac{d-5}{2}+\frac{7}{10}$

$\frac{-d}{10}-2$

r. $\frac{9w}{6}+\frac{2w-7}{3}-\frac{w-5}{4}$

$\frac{23w-13}{12}=\frac{23}{12}w-\frac{13}{12}$

s. $\frac{1+f}{5}-\frac{1+f}{3}+\frac{3-f}{6}$

$\frac{11}{30}-\frac{3}{10}f$