

Check Your Understanding

Practise

1. Add or subtract. Express answers in simplest form. Identify any non-permissible values.

a) $\frac{11x}{6} - \frac{4x}{6}$

b) $\frac{7}{x} + \frac{3}{x}$

c) $\frac{5t+3}{10} + \frac{3t+5}{10}$

d) $\frac{m^2}{m+1} + \frac{m}{m+1}$

e) $\frac{a^2}{a-4} - \frac{a}{a-4} - \frac{12}{a-4}$

2. Show that x and $\frac{3x-7}{9} + \frac{6x+7}{9}$ are equivalent expressions.

3. Simplify. Identify all non-permissible values.

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

b) $\frac{x-5}{x^2+8x-20} + \frac{2x+1}{x^2-4}$

4. Identify two common denominators for each question. What is the LCD in each case?

a) $\frac{x-3}{6} - \frac{x-2}{4}$

b) $\frac{2}{5ay^2} + \frac{3}{10a^2y}$

c) $\frac{4}{9-x^2} - \frac{7}{3+x}$

5. Add or subtract. Give answers in simplest form. Identify all non-permissible values.

a) $\frac{1}{3a} + \frac{2}{5a}$

b) $\frac{3}{2x} + \frac{1}{6}$

c) $4 - \frac{6}{5x}$

d) $\frac{4z}{xy} - \frac{9x}{yz}$

e) $\frac{2s}{5t^2} + \frac{1}{10t} - \frac{6}{15t^3}$

f) $\frac{6xy}{a^2b} - \frac{2x}{ab^2y} + 1$

6. Add or subtract. Give answers in simplest form. Identify all non-permissible values.

a) $\frac{8}{x^2-4} - \frac{5}{x+2}$

b) $\frac{1}{x^2-x-12} + \frac{3}{x+3}$

c) $\frac{3x}{x+2} - \frac{x}{x-2}$

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

e) $\frac{2h}{h^2-9} + \frac{h}{h^2+6h+9} - \frac{3}{h-3}$

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

7. Simplify each rational expression, and then add or subtract. Express answers in simplest form. Identify all non-permissible values.

a) $\frac{3x+15}{x^2-25} + \frac{4x^2-1}{2x^2+9x-5}$

b) $\frac{2x}{x^3+x^2-6x} - \frac{x-8}{x^2-5x-24}$

c) $\frac{n+3}{n^2-5n+6} + \frac{6}{n^2-7n+12}$

d) $\frac{2w}{w^2+5w+6} - \frac{w-6}{w^2+6w+8}$

Apply

8. Linda has made an error in simplifying the following. Identify the error and correct the answer.

$$\begin{aligned} & \frac{6}{x-2} + \frac{4}{x^2-4} - \frac{7}{x+2} \\ &= \frac{6(x+2) + 4 - 7(x-2)}{(x-2)(x+2)} \\ &= \frac{6x+12+4-7x-14}{(x-2)(x+2)} \\ &= \frac{-x+2}{(x-2)(x+2)} \end{aligned}$$

9. Can the rational expression $\frac{-x+5}{(x-5)(x+5)}$ be simplified further? Explain.

- c) The correct answer is the reciprocal of Tessa's answer. Taking reciprocals of either factor produces reciprocal answers.

15. $(x^2 - 9) \div \frac{x^2 - 2x - 3}{x + 1} = x + 3; x \neq 3, x \neq -1$

16. $\left(\frac{1}{2}\right)\left(\frac{x+2}{x-8}\right)\left(\frac{x^2-7x-8}{x^2-4}\right); \frac{x+1}{2(x-2)}, x \neq \pm 2, 8$

17. a) $K = \frac{Pw}{2h}, m \neq 0, w \neq 0, h \neq 0$

b) $y = \frac{2\pi r}{x}, d \neq 0, x \neq 0, r \neq 0$

c) $a = vw, w \neq 0$

18. $2(n - 4), n \neq -4, 1, 4$

19. a) Yes; when the two binomial factors are multiplied, you get the expression $x^2 - 5$.

b) $\frac{x + \sqrt{7}}{x - \sqrt{3}}$

c) $x + \sqrt{7}$; it is the same.

20. a) approximately 290 m

b) $\frac{(x+3)^2}{4g(x-5)^2}$ metres

21. Agree. Example: $\left(\frac{2}{3}\right)\left(\frac{1}{5}\right) = \frac{(2)(1)}{(3)(5)} = \frac{2}{15}$,

and $\frac{2}{3} \div \frac{1}{5} = \left(\frac{2}{3}\right)\left(\frac{5}{1}\right) = \frac{10}{3}$

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

$$= \frac{x^2 + 3x + 2}{x^2 + 6x + 9}, x \neq -3$$

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

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

22. a) $\frac{p+2}{4-p}$

b) $\frac{p-4}{p+2}$

23. a) $\tan B = \frac{b}{a}$

b) $\frac{\frac{b}{c}}{\frac{a}{c}} = \frac{b}{a}$

c) They are the same; $\tan B = \frac{\sin B}{\cos B}$.

6.3 Adding and Subtracting Rational Expressions, pages 336 to 340

1. a) $\frac{7x}{6}$

b) $\frac{10}{x}, x \neq 0$

c) $\frac{4t+4}{5}$ or $\frac{4(t+1)}{5}$

d) $m, m \neq -1$

e) $a + 3, a \neq 4$

2. $\frac{3x-7}{9} + \frac{6x+7}{9} = \frac{3x-7+6x+7}{9}$

$$= \frac{9x}{9}$$

$$= x$$

3. a) $\frac{-4x+13}{(x-3)(x+1)}, x \neq -1, 3$

b) $\frac{3x(x+6)}{(x-2)(x+10)(x+2)}, x \neq -10, \pm 2$

4. a) 24, 12; LCD = 12

b) $50a^3y^3, 10a^2y^2$; LCD = $10a^2y^2$

c) $(9 - x^2)(3 + x), 9 - x^2$;
LCD = $9 - x^2$ or $(3 - x)(3 + x)$

5. a) $\frac{11}{15a}, a \neq 0$

b) $\frac{x+9}{6x}, x \neq 0$

c) $\frac{2(10x-3)}{5x}, x \neq 0$

d) $\frac{(2z-3x)(2z+3x)}{xyz}, x \neq 0, y \neq 0, z \neq 0$

e) $\frac{4st+t^2-4}{10t^3}, t \neq 0$

f) $\frac{6bxy^2-2ax+a^2b^2y}{a^2b^2y}, a \neq 0, b \neq 0, y \neq 0$

6. a) $\frac{-5x+18}{(x+2)(x-2)}, x \neq \pm 2$

b) $\frac{3x-11}{(x-4)(x+3)}, x \neq -3, 4$

c) $\frac{2x(x-4)}{(x-2)(x+2)}, x \neq \pm 2$

d) $\frac{3}{y}, y \neq -1, 0$

e) $\frac{-3(5h+9)}{(h+3)(h+3)(h-3)}, h \neq \pm 3$

f) $\frac{(2x-3)(x+2)}{x(x-2)(x-1)(x+3)}, x \neq -3, 0, 1, 2$

7. a) $\frac{2(x^2-3x+5)}{(x-5)(x+5)}, x \neq \pm 5, \frac{1}{2}$

b) $\frac{-x+4}{(x-2)(x+3)}, x \neq -3, 0, 2, 8$

c) $\frac{n+8}{(n-4)(n-2)}, n \neq 2, 3, 4$

d) $\frac{w+9}{(w+3)(w+4)}, w \neq -2, -3, -4$

8. In the third line, multiplying by -7 should give $-7x + 14$. Also, she has forgotten to list the non-permissible values.

$$= \frac{6x+12+4-7x+14}{(x-2)(x+2)}$$

$$= \frac{-x+30}{(x-2)(x+2)}, x \neq \pm 2$$

9. Yes. Factor -1 from the numerator to create $-1(x - 5)$. Then, the expression simplifies to $\frac{-1}{x+5}$.

10. a) $\frac{2x}{x+3}, x \neq 0, \pm 3$

b) $\frac{3(t+6)}{2(t-3)}, t \neq -6, -2, 0, 3$

c) $\frac{3m}{m+3}, m \neq 0, -\frac{3}{2}, -3$

d) $\frac{x}{x-2}, x \neq \pm 4, 2$