RATIONAL EXPRESSIONS REVIEW

A. Simplify the following by adding, subtracting, multiplying or dividing.

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

2. $\frac{y}{y^2 - 5y + 4} - \frac{y}{y^2 - 6y + 5}$

3. $\frac{y}{3(y - 5)} - \frac{-6y}{2y - 10}$

4. $\frac{9x^2 - 6x + 1}{3x + 1} \div \frac{3x - 1}{9x^2 - 1}$

5. $\frac{1}{x^2 - 9} \div \frac{x + 3}{x - 3}$

6. $\frac{12}{x + 7} + \frac{8x}{x + 7}$

7. $\frac{6a^2 + 17a - 3}{a^2 - 7a + 6} \div \frac{6a^2 + 5a - 1}{a^2 + 3a - 4}$

8. $\frac{6(2x - 5)}{x + 1} + \frac{3(4x + 3)}{x + 1}$

9. $\frac{x - 1}{5} - \frac{7}{x}$

10. $\frac{7a}{a^2 - 7a - 8} - \frac{4a}{a + 1}$

11. $\frac{4x + 7}{x^2 - 2x + 1} + \frac{3x - 5}{x^2 - 1}$

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

13. $\frac{3}{x^2y} - \frac{7}{xy^2} + \frac{2}{y}$

14. $\frac{x^2}{2} \cdot \frac{8}{x^2}$

15. $\frac{3x}{x + 10} + \frac{2x + 20}{x + 10}$

16. $\frac{6}{x} - 5$

17. $\frac{ax^2}{y^2} \div \frac{a^3x}{y^3} \cdot \frac{a^2y}{x}$

18. $\frac{6x}{3x + 1} + \frac{3x + 1}{6x}$

19. $\frac{2(y - 5)}{3a} + \frac{7(y + 3)}{2a}$

20. $\frac{5}{x} + \frac{-7}{x}$

21. $\frac{4}{x^2 - 7x + 6} - \frac{-3}{x^2 + 3x - 4}$

22. $\frac{2a}{a^2 + ab} \cdot \frac{a^2 - b^2}{3a - 3b}$

23. $\frac{1}{h + 1} + h$

24. $\frac{4}{x(3x + 2)} + \frac{3x + 8}{3x + 2} - \frac{3}{x}$

25. $\frac{x^2 - 2x - 24}{x^2 - 49} \div \frac{x^2 + 6x + 8}{2x - 14}$

26. $\frac{x^2 + 3x + 2}{x^2 - 9} \cdot \frac{x^2 - 4x + 3}{x^2 + x - 2}$

27. $\frac{5w}{w^2 - w - 6} + \frac{4}{3w + 6}$

28. $\frac{7x + 3}{x^2 - 4} + \frac{3x - 4}{x^2 + 5x + 6}$

29. $\frac{1}{a^2 + 4a - 5} - \frac{2}{a^2 + a - 2}$

30. $\frac{x^2 - 9x + 8}{x^2 - 1} \div \frac{x^2 + 4x - 5}{x^2 - 25}$

31. $7 - \frac{1}{x}$

32. $\frac{4a^2 + 17a + 15}{2x^2 - 3x} \cdot \frac{6x^2 + x - 15}{a^2 + 6a + 9}$

3. Perform the operations as indicated.

a) $\frac{8}{x}+\frac{x+2}{3}$

b) $\frac{2x+3}{3x+2}-\frac{4}{3x+2}$

c) $\frac{2x}{8+x}-\frac{5x}{x^2+5x-24}$

4. Two types of courses are offered at a flying school. The first involves a flight simulator and costs $\$(20h+75)$. The second is offered on board a plane and costs $\$(32h+120)$. If h represents the number of hours the course is taken, what rational expression represents the relation between the cost of courses using a flight simulator and the cost of courses on board a plane?

5. A reservoir contains $\left(\frac{x^2+3x+2}{2x-3}\right)$L of water. A water pump with capacity $\left(\frac{x+1}{8x-12}\right)$ L/min is used to empty it out.

Which expression corresponds to the time it takes to empty the reservoir?

Key

Rational Expressions Review

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

-4
$-2 \quad -2$

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

$4x^2-4x-1$ if $x \neq -4, 4$

2. $\frac{y}{y^2-5y+4} - \frac{y}{y^2-6y+5}$

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

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

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

$\frac{-y}{(y-4)(y-1)(y-5)}$ if $y \neq 4, 1, 5$

3. $\frac{y}{3(y-5)} - \frac{-6y}{2y-10}$

$\frac{y}{3(y-5)} + \frac{2 \cdot 3y^{\times 3}}{2(y-5)^{\times 3}}$

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

$\frac{10y}{3(y-5)}$ $y \neq 5$

4. $\frac{(3x-1)^2}{3x+1} \div \frac{(3x-1)}{(3x-1)(3x-1)}$

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

$3x+1 \neq 0$ $\quad 3x-1 \neq 0$

$\frac{3x}{3} \neq \frac{-1}{3}$ $\quad \frac{3x}{3} \neq \frac{1}{3}$

$x \neq -\frac{1}{3}$ $\quad x \neq \frac{1}{3}$

$(3x-1)^2$ if $x \neq -\frac{1}{3}, \frac{1}{3}$

5. $\frac{1}{x^2-9} \div \frac{x+3}{x-3}$

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

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

6. $\frac{12+8x}{x+7}$ $\quad x \neq -7$

$= \frac{4(2x+3)}{x+7}$ $\quad x \neq -7$

7. $6a^2 + 18a - a - 3$

$6a(a+3) - 1(a+3)$

$(6a-1)(a+3)$

$\div$

$6a^2 + 6a - a - 1$

$6a(a+1) - 1(a+1)$

$(6a-1)(a+1)$

$a^2 - 7a + 6$

$(a-6)(a-1)$

$a^2 + 3a - 4$

$(a+4)(a-1)$

$\frac{(6a-1)(a+3)}{(a-6)(a-1)} \times \frac{(a+4)(a-1)}{(6a-1)(a+1)}$

$6a-1 \neq 0$

$6a \neq 1$

$a \neq \frac{1}{6}$

$\frac{(a+3)(a+4)}{(a-6)(a+1)}$ $\quad a \neq 6, 1, -1, \frac{1}{6},$

18. $\frac{6x}{3x+1} \cdot \frac{6x}{6x} + \frac{3x+1}{6x} \cdot \frac{(3x+1)}{(3x+1)}$

$\frac{36x^2 + 9x^2 + 6x + 1}{(3x+1)(6x)}$

$\frac{45x^2 + 6x + 1}{(3x+1)(6x)}$ $\quad x \neq 0, -\frac{1}{3}$

$3x+1 \neq 0$

$\frac{3x}{3} \neq \frac{-1}{3}$

$x \neq -\frac{1}{3}$

19. $\frac{25y+43}{6a}$ $\quad a \neq 0$

20. $\frac{-2}{x}$ $\quad x \neq 0$

21. $\frac{7x-2}{(x-1)(x+4)(x-6)}$ $\quad x \neq 1, -4, 6$

22. $\frac{2}{3}$ $\quad a \neq 0$ $\quad a \neq b$ $\quad a \neq -b$ $\quad \frac{2a}{a(a+b)} \cdot \frac{(a+b)(a-b)}{3(a-b)}$

23. $\frac{h^2+h+1}{h+1}$ $\quad h \neq -1$

24. $\frac{x-1}{x}$ $\quad x \neq 0, -\frac{2}{3}$ $\quad 3x+2 \neq 0$

$\frac{3x}{3} \neq \frac{-2}{3}$

25. $\frac{2(x-6)}{(x+7)(x+2)}$ $\quad x \neq 7, -7, -2, -4$ $\quad x \neq -\frac{2}{3}$

26. $\frac{x+1}{x+3}$ $\quad x \neq 3, -3, -2, 1$ $\quad \frac{(x+2)(x+1)}{(x+3)(x-3)} \cdot \frac{(x-3)(x-1)}{(x+2)(x-1)}$

8 $\frac{3(8x-7)}{x+1}$ $x \neq -1$

9 $\frac{x^2-x-35}{5x}$ $x \neq 0$

10 $\frac{7a}{a^2-7a-8} - \frac{4a}{a+1}$

$\frac{7a}{(a-8)(a+1)} - \frac{4a(a-8)}{(a+1)(a-8)}$

$\frac{7a - 4a^2 + 32a}{(a-8)(a+1)}$

$\frac{-4a^2+39a}{(a+1)(a-8)}$ $a \neq -1, 8$

11 $\frac{7x^2+3x+12}{(x-1)^2(x+1)}$ $x \neq 1, -1$

12 $\frac{2}{x+1}$ $x \neq -1, +1$

13 $\frac{3y-7x+2x^2y}{x^2y^2}$ $x \neq 0$ $y \neq 0$

14 4 $x \neq 0$

15. $\frac{5(x+4)}{x+10}$ $x \neq -10$

16. $\frac{6-5x}{x}$ $x \neq 0$

17. y^2 $y \neq 0$ $x \neq 0$

27. $\frac{5w}{w^2-w-6} + \frac{4}{3w+6}$

$\frac{5w^{\times 3}}{(w-3)(w+2)^{\times 3}} + \frac{4^{\times (w-3)}}{3(w+2)^{\times (w-3)}}$

$\frac{15w + 4w - 12}{3(w-3)(w+2)}$

$\frac{19w - 12}{3(w+2)(w-3)}$ $\quad w \neq -2, 3$

28. $\frac{10x^2 + 14x + 17}{(x+2)(x-2)(x+3)}$ $\quad x \neq 2, -2, -3$

29. $\frac{1^{\times (a+2)}}{(a+5)(a-1)^{(a+2)}} - \frac{2^{(a+5)}}{(a+2)(a-1)^{(a+5)}}$

$\frac{a+2 - 2a - 10}{(a+5)(a-1)(a+2)}$

$\frac{-a-8}{(a+5)(a-1)(a+2)}$ $\quad a \neq -5, 1, -2$

30. $\frac{(x-8)(x-5)}{(x+1)(x-1)}$ $\quad x \neq +1, -1, +5, -5$ $\quad (x+5)(x-1)$

31. $\frac{7x-1}{x}$ $\quad x \neq 0$

32. $\frac{(4a+5)(3x+5)}{x(a+3)}$ $\quad x \neq 0, 3/2$ $\quad a \neq -3$

60
15 4
10 6
30 2
5 12

90
-9 10

32. $\frac{4a^2+17a+15}{2x^2-3x} \cdot \frac{6x^2+x-15}{a^2+6a+9}$

$\frac{(4a^2+5a)+(12a+15)}{x(2x-3)} \cdot \frac{(6x^2-9x)+(10x-15)}{(a+3)(a+3)}$

$\frac{a(4a+5)+3(4a+5)}{x(2x-3)} \cdot \frac{3x(2x-3)+5(2x-3)}{(a+3)(a+3)}$

$\frac{(a+3)(4a+5) \cdot (3x+5)(2x-3)}{x(2x-3)(a+3)(a+3)}$

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

$a \neq -3$

$x \neq 0, 3/2$

$2x-3 \neq 0$

$\frac{2x}{2} \neq \frac{3}{2}$

$x \neq 3/2$

3. a) $\frac{8^{x3}}{x^{x3}} + \frac{(x+2)^{x}}{3^{x}}$

$\frac{24}{3x} + \frac{x^2+2x}{3x}$

$\frac{x^2+2x+24}{3x}$ $\quad x \neq 0$

b) $\frac{2x+3}{3x+2} - \frac{4}{3x+2}$ $\quad 3x+2 \neq 0$

$\frac{3x}{3} \neq \frac{-2}{3}$

$\frac{2x+3-4}{3x+2}$

$\frac{2x-1}{3x+2}$ $\quad x \neq -\frac{2}{3}$ $\quad x \neq -2/3$

c) $\frac{(2x)^{(x-3)}}{(8+x)^{(x-3)}} - \frac{5x}{(x+8)(x-3)}$

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

$\frac{2x^2-11x}{(x+8)(x-3)}$

4. 1st $\quad 20h + 75$

Ratio

2nd $\quad 32h + 120$

$\frac{20h+75}{32h+120}$

$\frac{5(4h+15)}{8(4h+15)}$

$\frac{5}{8}$

5.

$$\left(\frac{x^2+3x+2}{2x-3}\right) \div \left(\frac{x+1}{8x-12}\right)$$

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

$4(x+2)$ min

$8x-12 \neq 0$

$\frac{8x}{8} \neq \frac{12}{8}$ $\quad x \neq 1.5$

$2x-3 \neq 0$

$\frac{2x}{2} \neq \frac{3}{2}$

$x \neq 3/2$

$x \neq -1, 3/2$