Math 3201

Chapter 4: Rational Expressions and Equations

Part 1 Multiple Choice

1. Which expression is equivalent to $\frac{x+10}{x+4}$, $x \neq -4$?

    (A) $\frac{x+5}{x+2}$

    (B) $\frac{x^2+10x}{x^2+4x}$

    (C) $\frac{3x+10}{3x+4}$

    (D) $\frac{5x+50}{5x+20}$

2. Determine the non-permissible value(s) for $\frac{9-3x}{12x^2+x}$

    (A) $x \neq 0, x \neq -\frac{1}{12}$

    (B) $x \neq -\frac{1}{12}$

    (C) $x \neq 0$

    (D) $x \neq 0, x \neq \frac{1}{12}$

3. Simplify: $\frac{3+18p}{36p^2}$

    (A) $\frac{1+6p}{12p^2}, p \neq 0$

    (B) $\frac{1+2p}{4p}, p \neq 0$

    (C) $\frac{p+6}{12p^2}, p \neq 0$

    (D) $\frac{3+2p}{6p}, p \neq 0$

4. Perform the indicated operation and simplify: $\frac{4}{x+8} + \frac{1}{x-8}$

    (A) $\frac{5}{x}$

    (B) $\frac{3}{x+8}$

    (C) $\frac{3}{x-8}$

    (D) $\frac{5x-24}{(x-8)(x+8)}$

5. Simplify: $\frac{2x+6}{x^2+7x+12}$

    (A) $\frac{2}{x+4}$

    (B) $\frac{1}{x+2}$

    (C) $\frac{2(x+4)}{(x+4)(x+3)}$

    (D) $\frac{2}{x+3}$

6. Simplify: $\frac{3x^2-3x}{-24x+24}$

    (A) $-\frac{x}{8}$

    (B) $\frac{x-x^2}{8x-8}$

    (C) $\frac{x^2}{16}$

    (D) $\frac{1-x}{16}$

7. Find the product: $\frac{4y^2}{3} \cdot \frac{9}{12y}$

    (A) y

    (B) $\frac{2y}{9}$

    (C) $12y$

    (D) $\frac{1}{4}$

8. Find the quotient: $\dfrac{x+4}{x-4} \div \dfrac{x^2-16}{4-x}$

(A) $\dfrac{x+4}{x-4}$ (B) $-\dfrac{1}{x-4}$ (C) $\dfrac{1}{x-4}$ (D) $\dfrac{1}{2-x}$

9. Simplify: $\dfrac{\frac{2}{x}}{\frac{x+1}{x}}$

(A) $\dfrac{2(x+1)}{x^2}$ (B) $\dfrac{2}{x+1}$ (C) $\dfrac{3}{x}$ (D) $\dfrac{1}{x}$

10. Simplify: $\dfrac{2x+13}{2x+6} - \dfrac{3x-6}{2x+6}$

(A) $\dfrac{-x+19}{2(x+3)}$ (B) $\dfrac{-x+7}{2(x+3)}$ (C) $\dfrac{5x+19}{2(x+3)}$ (D) $\dfrac{5x+7}{4x+12}$

11. Jared incorrectly simplified this rational expression. In which step was his mistake?

$$\frac{9}{x^2-64} + \frac{3}{x+8}$$

$$Step\ One: \quad \frac{9}{(x-8)(x+8)} + \frac{3}{(x+8)}$$

$$Step\ Two: \quad \frac{9(x+8)+3(x+8)(x-8)}{(x+8)(x+8)(x-8)}$$

$$Step\ Three: \frac{9x+72+3x^2-192}{(x+8)(x+8)(x-8)}$$

$$Step\ Four: \quad \frac{3x^2+9x-120}{(x+8)(x+8)(x-8)}$$

(A) Step One   (B) Step Two   (C) Step Three   (D) Step Four

12. Solve for x: $\dfrac{-3}{x} = \dfrac{x-11}{6}$

(A) 2, 9   (B) –2, –9   (C) 0, 11   (D) 0, -11

13. Solve for x: $\dfrac{12}{x} + \dfrac{6}{2x} = \dfrac{5}{x-2}$

(A) 3   (B) 4   (C) 5   (D) 6

14. It takes Dan 5 hours to shovel his driveway. His father takes 3 hours to shovel the same driveway. Which equation below represents the time it takes for them to shovel the driveway if they work together?

(A) $\dfrac{5}{t}+\dfrac{3}{t}=t$ (B) $\dfrac{5}{t}+\dfrac{3}{t}=\dfrac{1}{t}$ (C) $\dfrac{1}{5}+\dfrac{1}{3}=\dfrac{1}{t}$ (D) $\dfrac{1}{5}+\dfrac{1}{3}=t$

15. Express each product or quotient in simplest form.

(A) $\dfrac{4x}{3x-12}\cdot\dfrac{5x-20}{16x^2}$ (B) $\dfrac{2x-x^2}{x^2-100}\cdot\dfrac{70+7x}{7x^2-14x}$ (C) $\dfrac{10x^2+5x}{x-3}\div\dfrac{2x^3+x^2}{x^2-3x}$

16. Express each sum or difference in simplest form. Identify the non-permissible values.

(A) $\dfrac{3}{n+1}+\dfrac{3}{n^2+n}$ (B) $\dfrac{3x-5}{x^2-25}-\dfrac{2}{x+5}$ (C) $\dfrac{2x}{2x+6}-\dfrac{x^2+9}{x^2-9}$

17. Arnold simplified an expression as follows:

$$\dfrac{2x}{x^2-4}+\dfrac{7}{2x-4}$$

$$=\dfrac{2x}{(x+2)(x-2)}+\dfrac{7}{2(x-2)} \qquad \text{Step 1}$$

$$=\dfrac{\cancel{2}x}{(x+2)(x-2)}+\dfrac{7}{\cancel{2}(x-2)} \qquad \text{Step 2}$$

$$=\dfrac{x}{(x+2)(x-2)}+\dfrac{7(x+2)}{(x-2)(x+2)} \qquad \text{Step 3}$$

$$=\dfrac{x+7x+14}{(x+2)(x-2)} \qquad \text{Step 4}$$

$$=\dfrac{8x+14}{(x+2)(x-2)} \qquad \text{Step 5}$$

(i) Identify the step in which the error occurred and explain the mistake.

(ii) Correct the errors and simplify.

18. Solve for x and state the non-permissible values: $\dfrac{6}{x+4}-1=\dfrac{-1}{x}$

19. A school volleyball team and its chaperones are going to a tournament out of the province that has a total cost of $7200. The cost of the trip is to be divided amongst everyone going. At the last minute, two people get sick and cannot attend, increasing the cost per person by $40. If x represents the number of people travelling and the situation is modelled by $\dfrac{7200}{x-2}-\dfrac{7200}{x}=40$, algebraically determine the number of people who originally planned to attend the tournament.

20. Two hoses together can fill a pool in 2 hours. If only hose A is used, the pool fills in 3 hours. How long would it take to fill the pool if only hose B is used?

21. When they work together, Mandy and Sandy can clean their room in 2 minutes. When Mandy cleans the room by herself, it will take 3 minutes less than when Sandy cleans the room by herself. The function:

$$1 + \frac{t}{t-3} = \frac{t}{2}$$

models this situation for both Mandy and Sandy where t represents the time in minutes for Sandy to clean the room by herself. Use the function to algebraically determine the time for Mandy to clean the room by herself.

Answers: 1D 2A 3A 4D 5A 6A 7A 8B 9B 10A 11B 12A 13A 14C

15A) $\frac{5}{12x}$ B) $\frac{-1}{x-10}$ C) 5 16A) $\frac{3}{n}, n \neq 0, -1$ B) $\frac{1}{x-5}, x \neq \pm 5$ (C) $\frac{-3}{x-3}, x \neq \pm 3$

17. see solution below   18. NPV's: $x \neq 0$, $x \neq -4$ solution: $x = 4$ and $x = -1$

19. 20 people originally plan to attend the trip.

20. 6 hours if only hose B is used.   21. It takes Mandy 3 min to clean the room by herself.

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17. Solution
    (i) The error occurs in step 2 when the 2 in the numerator and denominator are cancelled across the addition operation. Step 2 should establish the LCD.

    (ii)

$$\frac{2x}{x^2 - 4} + \frac{7}{2x - 4}$$

$$= \frac{2x}{(x+2)(x-2)} + \frac{7}{2(x-2)} \qquad \text{Step 1}$$

$$= \frac{(2)2x}{2(x+2)(x-2)} + \frac{7(x+2)}{2(x-2)(x+2)} \qquad \text{Step 2}$$

$$= \frac{4x+7x+14}{2(x+2)(x-2)} \qquad \text{Step 3}$$

$$= \frac{11x+14}{2(x+2)(x-2)} \qquad \text{Step 4}$$