

Part I: Multiple Choice. Place the correct answer in the corresponding blank at the end of this section.

1. What are the non-permissible for the rational expression: $\frac{3}{x^2-16x}$?

- (A) $x \neq -4, 4$
- (B) $x \neq -16, 0$
- (C) $x \neq 0, 4$
- (D) $x \neq 0, 16$

$$= \frac{3}{x(x-16)}$$

$$x \neq 0, x \neq 16$$

2. What is the simplified form of $\frac{3x^2}{7x-x^2}$, $x \neq 0, 7$?

- (A) $-\frac{3}{7x}$
- (B) $\frac{3}{7x}$
- (C) $\frac{3}{7x-1}$
- (D) $\frac{3x}{7-x}$

$$\frac{3x^2}{x(7-x)}$$

$$= \frac{3x}{7-x}$$

3. What expression is equivalent to $\frac{x-2}{x+3}$, $x \neq -3$?

- (A) $\frac{5x^2-2}{5x+3}$
- (B) $\frac{2x-4}{2x+6}$
- (C) $\frac{x^2-2x}{x^2+3x}$
- (D) $\frac{5x^2-10}{x+3}$

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

i. ✓
ii. ✓
 $x \neq -3$

4. Simplify: $\frac{3x^2-75}{30-6x}$

- (A) $\frac{-x+5}{2}$, $x \neq 5$
- (B) $\frac{-x-5}{2}$, $x \neq 5$
- (C) $\frac{x+5}{2}$, $x \neq 5$
- (D) $\frac{x-5}{2}$, $x \neq 5$

$$\frac{3(x^2-25)}{6(5-x)}$$

$$= \frac{-3(x+5)(x-5)}{2(5-x)}$$

$$= \frac{-(x+5)}{2}$$

$$= \frac{-x-5}{2}$$

5. What is the simplest form of: $\frac{x}{x+1} \times \frac{x+1}{2x}$?

- (A) $\frac{x^2+x}{2x^2+2x}$, $x \neq -1$, $x \neq 0$ = $\frac{1}{2}$
 (B) $\frac{1}{2}$, $x \neq -1$, $x \neq 0$
 (C) $\frac{x}{2x}$, $x \neq -1$, $x \neq 0$
 (D) 1, $x \neq -1$, $x \neq 0$

6. Simplify: $\frac{4x}{15} \div \frac{8x^3}{25}$

- (A) $\frac{8x^4}{9}$, $x \neq 0$
 (B) $\frac{9}{8x^4}$, $x \neq 0$
 (C) $\frac{5}{6x^2}$, $x \neq 0$
 (D) $\frac{6x^2}{5}$, $x \neq 0$

$$\frac{4x}{15} \cdot \frac{25}{8x^3} = \frac{100}{120x^2} = \frac{5}{6x^2}$$

7. Simplify: $\frac{4}{x} + \frac{x+1}{2x}$ L.C.D.: $2x$

- (A) $\frac{x+5}{3x}$, $x \neq 0$
 (B) $\frac{5}{3x}$, $x \neq 0$
 (C) $\frac{x+9}{2x}$, $x \neq 0$
 (D) $\frac{x+5}{2x^2}$, $x \neq 0$

$$\frac{4}{x} + \frac{x+1}{2x} = \frac{8}{2x} + \frac{x+1}{2x} = \frac{8+x+1}{2x} = \frac{x+9}{2x}$$

8. Simplify: $\frac{x}{x+7} - \frac{2x}{3x+21}$ L.C.D.: $3(x+7)$

- (A) $\frac{-x}{3(x+7)}$, $x \neq -7$
 (B) $\frac{x}{3(x+7)}$, $x \neq -7$
 (C) $\frac{5x}{3(x+7)}$, $x \neq -7$
 (D) $\frac{-x}{4(x+7)}$, $x \neq -7$

$$\frac{x}{x+7} - \frac{2x}{3x+21} = \frac{3x}{3(x+7)} - \frac{2x}{3(x+7)} = \frac{3x-2x}{3(x+7)} = \frac{x}{3(x+7)}$$

9. Solve for x : $\frac{8}{4} = \frac{4}{x+1}$ LCM: $4(x+1)$

(A) $x = 1$
 (B) $x = \frac{15}{7}$
 (C) $x = 3$
 (D) no solution

$$4(x+1) \cdot \frac{8}{4} = 4(x+1) \cdot \frac{4}{(x+1)}$$

$$8x + 8 = 16$$

$$8x = 16 - 8$$

$$\frac{8x}{8} = \frac{8}{8}$$

$$x = 1$$

Answers to multiple choice.

1. ___ 2. ___ 3. ___ 4. ___ 5. ___
 6. ___ 7. ___ 8. ___ 9. ___

Part II: Constructed Response. Answer each question in the space provided. Show all workings.

11. Simplify and list the non-permissible values:

$$\frac{(11x^2 - 22x)}{(x+3)} \div \frac{(10x^2 - 40)}{(10x+30)}$$

$$= \frac{(11x^2 - 22x)}{(x+3)} \cdot \frac{(10x+30)}{(10x^2 - 40)}$$

$$= \frac{11x(x-2)}{(x+3)} \cdot \frac{10(x+3)}{10(x^2 - 4)}$$

$$= \frac{11x \cancel{(x-2)}}{\cancel{(x+3)}} \cdot \frac{10 \cancel{(x+3)}}{10(x+2)\cancel{(x-2)}}$$

$$= \frac{11x}{(x+2)}, x \neq -3, -2, 2$$

12. Simplify: ** Rational expression: use the LCD (no = sign) to find a common denominator for all expressions*

$$\frac{2}{x+5} - \frac{(10x+3)}{x^2-25}, x \neq \pm 5$$

$$= \frac{2}{x+5} - \frac{(10x+3)}{(x+5)(x-5)} \quad \text{LCD: } (x+5)(x-5)$$

$$= \frac{(x-5) \cdot 2}{(x-5)(x+5)} - \frac{(10x+3)}{(x+5)(x-5)}$$

$$= \frac{(2x-10)}{(x+5)(x-5)} - \frac{(10x+3)}{(x+5)(x-5)}$$

$$\rightarrow = \frac{(2x-10) - (10x+3)}{(x+5)(x-5)}$$

$$= \frac{2x-10-10x-3}{(x+5)(x-5)}$$

$$= \frac{-8x-13}{(x+5)(x-5)}, x \neq \pm 5$$

13. Solve for x; check to see if your answer is admissible. *rational equation: use the LCD (= sign) to eliminate all denominators.*

$$\frac{7}{x-2} = \frac{3}{2x} + \frac{4}{x-2}$$

LCM: 2x(x-2)

$$2x(x-2) \cdot \frac{7}{\cancel{x-2}} = 2x(x-2) \cdot \frac{3}{\cancel{2x}} + 2x(x-2) \cdot \frac{4}{\cancel{x-2}}$$

$$14x = 3x - 6 + 8x$$

$$14x - 3x - 8x = -6$$

$$\frac{3x}{3} = \frac{-6}{3}$$

$$x = -2, x \neq 0, 2$$

14. It takes Karen and Jessica 6 minutes to collect their school's recyclables when they work together. If Karen works by herself it will take her 5 minutes less than Jessica, if Jessica collects the recyclables by herself. Algebraically determine how long it would take both Karen and Jessica to collect the recyclables if they worked alone.

Name	time	rate
Karen	$x-5$	$\frac{1}{x-5}$
Jessica	x	$\frac{1}{x}$
both	6	$\frac{1}{6}$

$$\frac{1}{(x-5)} + \frac{1}{x} = \frac{1}{6} \quad \text{LCD: } 6x(x-5)$$

$$6x \cancel{(x-5)} \cdot \frac{1}{\cancel{(x-5)}} + 6x \cancel{(x-5)} \cdot \frac{1}{x} = \cancel{6x(x-5)} \cdot \frac{1}{6}$$

$$6x + 6x - 30 = x^2 - 5x$$

$$0 = x^2 - 5x - 12x + 30$$

$$0 = x^2 - 17x + 30$$

$$0 = (x-2)(x-15)$$

$$\cancel{x=2} \quad \boxed{x=15}$$

Jessica: 15 minutes, Karen: $15-5=10$ minutes