

Part I: Multiple Choice. Write the correct answer in the space provided at the end of this section.

1. What expression is equivalent to $\frac{2x-1}{x+5}$, $x \neq -5$?

(A) $\frac{10x^2-5x}{x+15}$

(B) $\frac{4x-2}{2x+10}$ $\frac{2(2x-1)}{2(x+5)}$ $x \neq -5$

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

(D) $\frac{6x-3}{x+5}$

$\frac{x(2x-1)}{x(x+5)}$ $x \neq -5, 0$

2. What are the non-permissible values that apply to the expression $\frac{x^2-9}{x^2+4x+3}$?

(A) $x \neq -3, x \neq -1$

(B) $x \neq -1$

(C) $x \neq 1$

(D) $x \neq 1, x \neq 3$

$(x+1)(x+3)$
 $x \neq -1, x \neq -3$

3. Simplify $\frac{4}{x} + \frac{x+1}{2x}$. $LCM: 2x$

(A) $\frac{x+5}{3x}$

(B) $\frac{5}{3x}$

(C) $\frac{x+9}{2x}$

(D) $\frac{x+5}{2x^2}$

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

4. What is the simplified form of the expression $\frac{x^2+x-12}{x+2} \div \frac{x-3}{x+4}$?

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

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

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

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

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

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

5. What is the simplest form of the expression of $\frac{2x^2+8x}{4x^3+16x^2}$?

(A) $\frac{1}{2}$

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

(C) $\frac{2x}{4x^2}$

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

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

$$= \frac{1}{2x}$$

6. What is the lowest common denominator of the rational equation:

(A) 5 $\frac{3}{x-3} + \frac{x}{x^2-3x} = \frac{3x-1}{5}$

(B) x

(C) $x(x-3)$

(D) $5x(x-3)$

$$\frac{3}{(x-3)} + \frac{x}{x(x-3)} = \frac{3x-1}{5}$$

$$\text{LCD: } 5x(x-3)$$

7. What is the simplified form of $\frac{x-3}{3-x}$? $= -1$

- (A) 0
- (B) 1
- (C) -1
- (D) $\frac{x-3}{3-x}$

$$\begin{aligned}
 &= \frac{x-3}{-x+3} \\
 &= \frac{\cancel{(x-3)}}{-\cancel{(x-3)}} = \frac{1}{-1} = -1
 \end{aligned}$$

8. Fred makes a mistake on his assignment. In which step does the mistake appear?

- (A) Step 1
- (B) Step 2
- (C) Step 3
- (D) Step 4

$$\frac{c^2-36}{2c} \div \frac{c-6}{8c^2}$$

Step 1

$$\frac{c^2-36}{2c} \times \frac{8c^2}{c-6}$$

Step 2

$$\frac{(c-6)(c-6)}{2c} \times \frac{(2c)(4c)}{c-6}$$

Step 3

$$\frac{(c-6)(c-6)}{2c} \times \frac{(2c)(4c)}{c-6}$$

Step 4

$$\frac{4c(c-6)}{1}$$

9. Simplify:

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

$$\begin{aligned}
 &\frac{\left(2 + \frac{1}{x}\right) \times}{\left(4x - \frac{1}{x}\right) \times} = \frac{2x + \frac{1}{x}}{4x^2 - \frac{1}{x}} \\
 &= \frac{2x + 1}{4x^2 - 1} \\
 &= \frac{\cancel{(2x+1)}}{(2x-1)\cancel{(2x+1)}} = \frac{1}{2x-1}
 \end{aligned}$$

10. Bram can clean the shed in 5 hours, but it takes Sam 6 hours to do the same job. How long would it take them to clean the shed if they worked together? Which equation would you use to solve this problem?

(A) $\frac{5}{x} + \frac{6}{x} = 1$

(B) $\frac{x}{5} + \frac{x}{6} = \frac{x}{1}$

(C) $\frac{1}{5+6} = \frac{1}{x}$

(D) $\frac{1}{5} + \frac{1}{6} = \frac{1}{x}$

Name	Time	rate
Bram	5	$\frac{1}{5}$
Sam	6	$\frac{1}{6}$
both	x	$\frac{1}{x}$

$\frac{1}{5} + \frac{1}{6} = \frac{1}{x}$

Answers to multiple choice.

1. ___ 2. ___ 3. ___ 4. ___ 5. ___

6. ___ 7. ___ 8. ___ 9. ___ 10. ___

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

11. Simplify and state all non-permissible values:

$$\frac{x^2-4}{2x^2+11x+5} \div \frac{x^2-x-6}{x^2+2x-15}$$

$$\frac{\cancel{(x+2)}(x-2)}{\cancel{(x+5)}(2x+1)} \times \frac{\cancel{(x-3)}\cancel{(x+5)}}{\cancel{(x+2)}\cancel{(x-3)}}$$

$$\frac{x-2}{2x+1}, x \neq -5, -\frac{1}{2}, 3, 2$$

$$\begin{array}{r} \overbrace{2x^2+11x+5}^{(2x+5)(x+2)} \quad \overbrace{x^2-x-6}^{(x-3)(x+2)} \\ 2x^2+10x+x+5 \quad 1, 10 \\ 2x(x+5) + (x+5) \\ (x+5)(2x+1) \end{array}$$

12. Simplify and state all non-permissible values: $\frac{4x+9}{4x^2+13x+3} - \frac{3}{4x+1}$

$$= \frac{(4x+9)}{(x+3)(4x+1)} - \frac{3}{(4x+1)}$$

LCM: $(x+3)(4x+1)$

$$\begin{aligned} & \frac{4x^2+13x+3}{4x^2+12x+x+3} = \frac{12}{1 \cdot 12} \\ & \frac{4x^2+12x+x+3}{4x(x+3)+x+3} \\ & \frac{4x(x+3)+x+3}{(x+3)(4x+1)} \end{aligned}$$

$$= \frac{4x+9}{(x+3)(4x+1)} - \frac{3}{(x+3)} \cdot \frac{4x+1}{4x+1}$$

$$= \frac{4x+9}{(x+3)(4x+1)} - \frac{(3x+9)}{(x+3)(4x+1)}$$

$$= \frac{4x+9-3x-9}{(x+3)(4x+1)}$$

$$= \frac{x}{(x+3)(4x+1)}, x \neq -3, -\frac{1}{4}$$

13. Solve. Be sure to check for extraneous roots.

$$\frac{9}{y-3} - \frac{4}{y-6} = \frac{18}{y^2 - 9y + 18}$$

$$\frac{9}{(y-3)(y-6)} - \frac{4}{(y-3)(y-6)} = \frac{18}{(y-3)(y-6)} \quad \text{LCD: } (y-3)(y-6)$$

$$\cancel{(y-3)}\cancel{(y-6)} \cdot \frac{9}{\cancel{(y-3)}\cancel{(y-6)}} - \cancel{(y-3)}\cancel{(y-6)} \cdot \frac{4}{\cancel{(y-3)}\cancel{(y-6)}} = \cancel{(y-3)}\cancel{(y-6)} \cdot \frac{18}{\cancel{(y-3)}\cancel{(y-6)}}$$

$$(y-6) \cdot 9 - (y-3) \cdot 4 = 18$$

$$9y - 54 - (4y - 12) = 18$$

$$9y - 54 - 4y + 12 = 18$$

$$5y = 18 - 12 + 54$$

$$5y = 60$$

$$\frac{5y}{5} = \frac{60}{5}$$

$$y = 12$$

$$\frac{9}{12-3} - \frac{4}{12-6} = \frac{18}{12^2 - 9(12) + 18}$$

$$6 \cdot \frac{9}{9} - \frac{4 \cdot 9}{6 \cdot 9} = \frac{18}{54}$$

$$\frac{54}{54} - \frac{36}{54} = \frac{18}{54}$$

$$\frac{18}{54} = \frac{18}{54} \checkmark$$

14. The rectangle has a perimeter of 4 units. What is the value of x ?

$$\frac{2}{1} \left(\frac{4}{x-2} \right) + \frac{2}{1} \left(\frac{6}{x-2} \right) = 4$$

$$\frac{8}{x-2} + \frac{12}{x-2} = 4$$

$$\frac{20}{x-2} = 4$$

$$4x - 8 = 20$$

$$4x = 28$$

$$x = 7$$

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



$$\frac{6}{x-2}$$

15. It takes Bill 8 hours longer to construct a patio than it takes Fred. If they work together, they can construct the patio in 20 hours. How long would it take Bill to construct the patio alone?

Name	time	rate
Bill	$x+8$	$\frac{1}{x+8}$
Fred	x	$\frac{1}{x}$
both	20	$\frac{1}{20}$

$$\frac{1}{x+8} + \frac{1}{x} = \frac{1}{20} \quad \text{LCD: } 20x(x+8)$$

$$20x(x+8) \cdot \frac{1}{x+8} + 20x(x+8) \cdot \frac{1}{x} = 20x(x+8) \cdot \frac{1}{20}$$

$$20x + 20x + 160 = x^2 + 8x$$

$$x^2 + 8x - 40x - 160 = 0$$

$$x^2 - 32x - 160 = 0$$

$$x = \frac{-(-32) \pm \sqrt{(-32)^2 - 4(1)(-160)}}{2(1)}$$

$$x = \frac{32 \pm \sqrt{664}}{2}$$

$$x = \frac{32 \pm 40.8}{2}$$

$$x = \frac{32 - 40.8}{2}, \quad x = \frac{32 + 40.8}{2}$$

$$x = -4.4, \quad x = 36.4$$

Bill takes $36.4 + 8 = 44.4$ h to construct the patio.