



MATHS

BOOKS - CENGAGE

RATIONAL EXPRESSIONS

Examples

1. Reduce the following the the lowest term :

$$\frac{15x^3y^2}{35xy^5}, \text{ for all } x \neq 0 \text{ and } y \neq 0$$



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2. Reduce the following the the lowest term :

$$\frac{x^2 - x - 6}{x^2 - 5x + 6}, \text{ for all } x \neq 2 \text{ and } x \neq 3$$



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3. Simplify the following rational expression indicating the values of the variable which are not admissible :

$$\frac{2x^2 - 3x - 44}{x^2 16}$$



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4. Simplify the following rational expression indicating the values of the variable which are not admissible :

$$\frac{x^4 + 4y^4}{x^2 + 2y^2 - 2xy}$$

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5. Simplify $\frac{11 + x}{x} + \frac{x - 10}{x}$

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6. Simplify $\frac{x + 10}{y - 2} - \frac{8}{y - 2} + \frac{x - 2}{y - 2}$

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7. Simplify $\frac{2p + 1}{p^2 - 5} + \frac{p + 11}{p^2 - 5} - \frac{p + 1}{p^2 - 5}$

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8. Simplify $\frac{5}{(x+1)(x+2)} + \frac{11}{x+1}$



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9. Simplify $\frac{6}{(x+2)} + \frac{4}{x(x+2)} - \frac{4}{x}$



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10. Simplify $\frac{x+4}{x^2-1} + \frac{x-1}{x^2-3x-4} \frac{x+1}{x^2-5x+4}$



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11. Multiply $\frac{2x^2y}{5x} by \frac{15x^3}{6y}$ if $x \neq 0$ and $y \neq 0$



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12. Multiply $\frac{11x}{5x - 10}$ by $\frac{(x - 2)^3}{5(2 - x)}$ for all $x \neq 2$

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13. Assuming that no denominator has zero polynomial, simplify the following expression :

$$\frac{x^2 + x - 6}{x^2 - 5x + 6} \times \frac{x^3 - 27}{x^2 - 2xy + 2y^2} \times \frac{x^4 + 4y^4}{x^2 - 9}$$

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14. Divide $\frac{x^2 - 5x}{x^2 - 25}$ by $\frac{x^2 - 8x + 15}{x - 5}$ specifying the restrictions on the values of x

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15. Simplify the following :

$$\frac{x^4 - 8x}{2x^2 + 5x - 3} \times \frac{2x - 1}{x^2 + 2x + 4} + \frac{x^2 - 2x}{x + 3}$$

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Test Yourself Level 1

1. Reduce the following expressions to the lowest common denominator :

$$\frac{x}{yz}, \frac{y}{zx}, \frac{z}{xy}$$



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2. Reduce the following expressions to the lowest common denominator :

$$\frac{x+y}{x-y}, \frac{x^2+xy+y^2}{x+y}, \frac{x^2+y^2}{x^2-y^2}$$



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3. Reduce the following expressions to the lowest common denominator :

$$\frac{x + 4}{x^2 - 3x - 4}, \frac{x}{x^3 + 1}, \frac{x - 4}{x^3 - x^2 + x}$$

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4. Reduce the following to their lowest terms indicating the restriction :

$$\frac{2x + 10}{5x + 25}$$

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5. Reduce the following to their lowest terms indicating the restriction :

$$\frac{15x^2y^3z^5}{3xy^4z^2}$$



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6. Reduce the following to their lowest terms indicating the restriction :

$$\frac{x^4 - x^2y^2}{x^2 + 3xy + y^2}$$



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7. Reduce the following to their lowest terms indicating the restriction :

$$\frac{x^2 - 3x - 10}{x^2 - 11x + 30}$$



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8. Simplify the following

$$\frac{1}{x} + \frac{2}{3x^2} + \frac{x-4}{4x^3}$$



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9. Simplify the following

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



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10. Simplify the following

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



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11. Simplify the following

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

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Test Yourself Level 2

1. Simplify the following assuming that no denominator has zero value :

$$\frac{x + 3}{x^2 - 3x + 2} + \frac{x + 2}{x^2 - 4x + 3} + \frac{x + 1}{x^2 - 5x + 6}$$

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2. Simplify the following assuming that no denominator has zero value :

$$\frac{a + x}{a^2 + ax + x^2} + \frac{a - x}{a^2 - ax + x^2} + \frac{2x^3}{a^4 + a^2x^2 + x^4}$$

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3. Simplify the following assuming that no denominator has zero value :

$$\frac{x^2 - 2x - 15}{x^2 + 7x + 12} + \frac{x^2 + 3x - 10}{x^2 + 9x - 20} - \frac{x^2 - 4x - 77}{x^2 + 11x + 28}$$

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4. Multiply the following :

$$\frac{x^2}{y^2} \times \frac{y}{x^3} \times \frac{1}{x^2y^2}$$

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5. Multiply the following :

$$\frac{x^2 + 3x + 2}{x^2 + 5x + 4} \times \frac{x + 4}{x - 1}$$

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6. Multiply the following :

$$\frac{x^4 - 8x}{2x^2 + 5x - 3} \times \frac{x - 1}{x^2 + 2x + 4} \times \frac{x + 3}{x^3 - 2x}$$

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Test Yourself Level 3

1. Prove that

$$\frac{1}{1-x} - \frac{1}{1+x} - \frac{2x}{1+x^2} - \frac{4x^3}{1+x^4} = \frac{8x^7}{1-x^8}$$

Simplify the following

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2.
$$\frac{a^4 + 4b^4}{a^2 + 2ab + 2b^2}$$

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$$3. \frac{2x^3 - 4x^2 - 6x}{3x^5 - 6x^4 - 6x^3 - 9x^2}$$

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$$4. \frac{x^6 + y^6}{x^4 + 4y^4} \times \frac{x^2 + 2xy + y^2}{x^2 + y^2} \times \frac{x^2 + 2xy + 2y^2}{x^2 - x^2y^2 + y^4}$$

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$$5. \frac{1}{(a-b)(a-c)} + \frac{b}{(b-c)(c-a)} + \frac{c}{(c-a)(c-b)}$$

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$$6. \frac{a+b-c}{(b-c)(a-c)} + \frac{b+c-a}{(a-b)(c-a)} + \frac{+a-b}{(b-a)(b-c)}$$



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$$7. \frac{1}{(x-1)} - \frac{1}{x+1} - \frac{2}{x^2+1} - \frac{4}{x^4+1}$$



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$$8. \frac{1}{(x+a)} + \frac{2x}{x^2+a^2} + \frac{4x^3}{x^4+a^4} - \frac{8x^7}{x^8-a^8}$$



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$$9. \frac{1}{a^2 - (b-c)^2} + \frac{1}{b^2 - (c-a)^2} + \frac{1}{c^2 - (a-b)^2}$$



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1. The value of x for which the given expression is not

defined $\frac{x^2 - 5x + 4}{(x - 4)(x - 1)^2}$ is

A. 4,1

B. only 1

C. 0

D. none of these

Answer: A



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2. Which of the following is an improper rational expression ?

A. $\frac{x^2 + 3x + 2}{x^2 + 2}$

B. $\frac{(x + 5)}{(x + 7)}$

C. $\frac{x^2 + 3x + 2}{(x + 5)}$

D. none of these

Answer: C



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3. The value of expression $\frac{y + 10}{x - 2} - \frac{8 + y}{x - 2} - \frac{2}{x - 2}$

A. is 0

B. depends on x

C. depends on y

D. is 1

Answer: A



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4. The expression $\frac{2x + 1}{x^2 - 5} + \frac{x + 11}{x^2 - 5} - \frac{x + 1}{x^2 - 5}$ is equivalent to

A. $\frac{2x + 1}{x^2 - 5}$

B. $\frac{3x + 14}{x^2 - 5}$

C. $\frac{2x}{x^2 - 5}$

D. $\frac{2x + 11}{x^2 - 5}$

Answer: D



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5. Simplified form of the expression

$$\frac{10}{(x + 1)(x + 2)} + \frac{11}{x + 1} - \frac{8}{x + 2} \text{ is}$$

A. $\frac{(x + 8)}{(x + 1)(x + 2)}$

B. $\frac{3(x + 8)}{(x + 1)(x + 2)}$

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

D. $\frac{(x + 8)}{(x + 1)}$

Answer: B



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6. Simplified form of the rational expression

$$\frac{y + 4}{y^2 - 1} + \frac{y - 1}{y^2 - 3y - 4} - \frac{y + 1}{y^2 - 5y + 4} \text{ is}$$

A. $\frac{y^2 + 4y - 16}{(y - 4)(y^2 - 1)}$

B. $\frac{y^2 - 4y - 16}{(y - 4)(y^2 - 1)}$

C. $\frac{y^2 - 4y + 16}{(y - 4)(y^2 - 1)}$

D. none of these

Answer: B



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7. Divide $\frac{x^2 - 5x}{x^2 - 25}$ by $\frac{x^2 - 8x + 15}{x - 15}$ and indicate the values of the variable which are not admissible

A. $\frac{x}{(x + 5)(x - 3)}, x \neq -5, 5, 3$

B. $\frac{3x}{(x + 5)(x + 3)}, x \neq -5, -3$

C. $\frac{2x + 5}{(x + 5)(x + 3)}, x \neq -5, -3$

D. none of these

Answer: A



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8. The simplified form of the expression

$$\frac{x^2 + x - 6}{x^2 - 5x + 6} \times \frac{x^3 - 27}{x^2 - 2xy + 2y^2} \times \frac{x^4 + 4y^4}{x^2 - 9} \text{ is}$$

A. $\frac{(x^2 + 3x + 9)(x^2 + 2xy + 2y^2)}{x - 3}$

B. $\frac{(x^2 - 3x + 9)(x^2 - 2xy + 2y^2)}{x + 3}$

C. $\frac{(x^2 + 3x + 9)(x^2 - 2xy + 2y^2)}{x + 3}$

D. none of these

Answer: A



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9. Find the value of x for the following expression

$$\frac{2}{(x+1)(x-3)} - \frac{8(x+4)}{(x+1)(x+2)} + \frac{4x}{(x-3)(x+2)} = 0$$

A. $\frac{-1 \pm \sqrt{201}}{2}$

B. $\frac{-1 \pm \sqrt{401}}{4}$

C. $\frac{1 \pm \sqrt{401}}{4}$

D. $\frac{1 \pm \sqrt{201}}{2}$

Answer: B



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10. Find the value of x for the following expression

$$\frac{x+3}{x^2-3x+2} + \frac{x+2}{x^2-4x+3} + \frac{x+1}{x^2-5x+6} = 0$$

A. $\pm (1)(\sqrt{3})$

B. $\pm \frac{14}{\sqrt{(3)}}$

C. $\pm \left(\frac{14}{3}\right)$

D. none of these

Answer: C



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11. Find the value of x for the following expression

$$\frac{1}{x} + \frac{2}{3x^2} + \frac{x-4}{4x^3} = 0$$

A. $\frac{11 \pm \sqrt{697}}{12}$

B. $\frac{11 \pm \sqrt{697}}{24}$

C. $\frac{-11 \pm \sqrt{697}}{24}$

D. none of these

Answer: C

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12. Find the value of x for the following expression

$$\frac{x + 1}{2x^2 + x - 1} - \frac{x + 1}{2x^2 - 3x + 1} + \frac{4}{2(x^2 - 1)} = 0$$

A. $x = 4, 0$

B. no value of x

C. $x = 2, 3$

D. $x = 1/2, 1$

Answer: B



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13. Find the value of x or which the given equation is satisfied :

$$\frac{x + 5}{(x - 2)(x + 3)} + \frac{x + 8}{(x + 3)(x - 7)} = 0$$

A. $1 \pm \frac{\sqrt{106}}{2}$

B. $\frac{2 \pm \sqrt{106}}{2}$

C. $\frac{1 \pm \sqrt{106}}{2}$

D. $-1 \pm \frac{\sqrt{106}}{2}$

Answer: D

14.
$$\frac{a}{(a-b)(a-c)} + \frac{b}{(b-c)(c-a)} + \frac{c}{(c-a)}$$

equivalent to

A.
$$\frac{a}{(b-c)(c-a)}$$

B.
$$\frac{-b}{(a-b)(a-c)}$$

C.
$$\frac{b}{(a-b)(a-c)}$$

D. none of these

Answer: C

15. $\frac{x^2 - 2x - 15}{x^2 + 7x + 12} + \frac{x^2 + 3x - 10}{x^2 + 9x + 20} - \frac{x^2 - 4x - 77}{x^2 + 11x + 28}$

is equivalent to

A. 0

B. 1

C. 2

D. 3

Answer: B



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16. $\frac{1}{a^2 - (b - c)^2} + \frac{1}{b^2 - (c - a)^2} + \frac{1}{c^2 - (a - b)^2}$ is

equivalent to

$$\text{A. } \frac{1}{(a + b - c)(a - b + c)(-a + b + c)}$$

$$\text{B. } \frac{-1 - b - c}{(a + b - c)(a - b + c)(-a + b + c)}$$

$$\text{C. } (a + b + c)$$

$$\text{D. } \frac{a + b + c}{(a + b - c)(a - b + c)(-a + b + c)}$$

Answer: D



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$$17. \frac{2x^4 - 4x^3 - 6x^2}{3x^4 - 6x^3 - 6x^2 + 12x} \text{ is equivalent to}$$

$$\text{A. } \frac{2x(x - 3)(x + 1)}{3(x - 2)(x^2 - 2)}$$

$$\text{B. } \frac{2x(x - 3)(x + 1)}{(x - 2)(x^2 - 2)}$$

$$\text{C. } \frac{(x + 3)(x - 1)}{(x - 2)(x^2 - 2)}$$

D. none of these

Answer: A



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18. If $\frac{4-x}{x} + \frac{3}{2} = -\frac{4}{x}$ then $x =$

A. -6

B. 16

C. -16

D. 0

Answer: C



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19. If $\frac{x}{x+3} + \frac{5}{x-7} = \frac{30}{x^2 - 4x - 21}$, then $x =$

A. 3, - 5

B. 5

C. 3, - 5

D. 5, - 5

Answer: B

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20. If $\frac{2}{x-1} + \frac{3}{4} = \frac{5}{x-1}$ then $x =$

A. 5

B. -5

C. 0

D. 2

Answer: A



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21. If $\frac{2}{a+1} + \frac{5}{a-1} = \frac{10}{a^2-1}$ then a =

A. 1

B. -1

C. 2

D. no value of a

Answer: D



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22. If $\frac{x}{x-2} - \frac{4}{x+2} = \frac{8}{x^2-4}$ then x =

A. 0,2

B. 2

C. 0

D. 0,-2

Answer: C



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23. If $\frac{-3x}{x+1} + \frac{4x+1}{x} = \frac{-5}{x^2+x}$ then $x =$

A. -1

B. $-1, -4$

C. $-2, -3$

D. none of these

Answer: C

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24. The expression $\frac{x^2 - 5x}{x^2 - 2x - 15} \times \frac{x^2 - 9}{x^2 - 3x}$ is equivalent to

A. 1

B. 0

C. 2

D. None

Answer: A



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25. The expression $\frac{a^2 - 8a + 16}{a} \times \frac{a^3}{4 - a}$ is equivalent to

A. $a^2(a - 4)$

B. $a^2(4 - a)$

C. $a^2(a - 1)$

D. $-a^2(a - 1)$

Answer: B



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26. $\frac{x^2 - 4x - 21}{x^2 - 49} + \frac{x^2 + 8x + 15}{x^2 + 2x - 35} =$

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

B. $\frac{x + 5}{x - 5}$

C. $\frac{x + 5}{x - 3}$

D. $\frac{x - 5}{x + 5}$

Answer: D



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Olympiad And Ntse Level Exercises

1. If $a + b + c = 0$, then the value of

$$\frac{(a + b)^2}{ab} + \frac{(b + c)^2}{bc} + \frac{(c + a)^2}{ca} \text{ is}$$

A. 0

B. 1

C. 2

D. 3

Answer: D



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2. The simplified form of $\frac{a}{x+a} + \frac{b}{x-a} - \frac{c}{x^2-a^2}$ is

A. $\frac{a(x-a) + b(x+a) - c}{x^2 - a^2}$

B. $\frac{b(x-a) + a(x+a) - c}{(x-a)^2}$

C. $\frac{b(x-a) + a(x+a) - c}{x^2 - a^2}$

D. $\frac{a(x-a) + b(x+a) + c}{x^2 - a^2}$

Answer: D



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3. Simplify

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

A. $\frac{1}{(x+1)(x+3)}$

B. $\frac{2}{(x+1)(x+3)}$

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

D. $\frac{3}{(x+1)(x+3)}$

Answer: D



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4. Simplify $\frac{x^3 - 3x^2}{9x^2 - x^4}$

A. $\frac{1}{x + 3}$

B. $-\frac{1}{x + 3}$

C. $\frac{1}{3x + 3}$

D. $\frac{1}{3x - 3}$

Answer: D



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5. Simplify $\frac{x^2 - y^2}{(x + y)^2}$

A. $\frac{x + y}{x - y}$

B. $\frac{(x + y)^2}{x - y}$

C. $\frac{x + y}{x^2 - y^2}$

D. $\frac{x - y}{x + y}$

Answer: D



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6. Write $\frac{a^2 - b^2}{a^2 - 3ab + 2b^2}$ in the simplest form

A. $\frac{(a + b)^2}{(a - 2b)}$

B. $\frac{a + b}{a - b}$

C. $\frac{(a - b)}{a - 2b}$

D. $\frac{(a + b)}{(a + 2b)}$

Answer: B



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7. Simplify $\frac{x^2 + 2x - 8}{x^2 - x - 20}$

A. $\frac{x - 2}{x - 5}$

B. $\frac{x + 2}{x - 5}$

C. $\frac{x + 4}{x + 5}$

D. $\frac{x - 4}{x - 5}$

Answer: A



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$$8. \frac{x - 5}{x + 2} - \frac{3}{2 - x} - \frac{14 - x}{x^2 - 4} =$$

A. $\frac{x + 2}{x - 1}$

B. $\frac{x - 1}{x + 2}$

C. $\frac{x + 1}{x - 2}$

D. $\frac{-x - 1}{-x}$

Answer: B



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$$9. \frac{2(m + 2)}{4m + m^2 - 12} - \frac{1}{m - 2} =$$

A. $\frac{1}{m - 2}$

B. $\frac{m - 2}{m + 6}$

C. $\frac{1}{m + 6}$

D. $\frac{m + 6}{m - 2}$

Answer: C



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10. Let a , b and x be non-zero real number such that

$\frac{5}{x} = \frac{2}{a} + \frac{3}{b}$. Then x is equal to

A. $\frac{-5ab}{2b + 3a}$

B. $\frac{5ab}{2b + 3a}$

C. $\frac{b}{2b - 3a}$

D. none of these

Answer: B



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