$$\frac{5 \cdot x + 3}{4 \cdot x} + \frac{x - 8}{9}$$

$$\frac{5 \cdot x + 3}{4 \cdot x} \cdot \frac{9}{9} + \frac{x - 8}{9} \cdot \frac{4x}{4x} = \frac{45 \cdot x + 27}{9(4x)} + \frac{4 \cdot x^2 - 32 \cdot x}{9(4x)}$$

Simplify numerators

$$9 \cdot (5 \cdot x + 3) = 45 \cdot x + 27$$

$$4x \cdot (x - 8) = 4 \cdot x^2 - 32 \cdot x$$

Combine numerators

$$45 \cdot x + 27 + 4 \cdot x^2 - 32 \cdot x = 4 \cdot x^2 + 13 \cdot x + 27$$

$$= \frac{45 \cdot x + 27 + 4 \cdot x^2 - 32 \cdot x}{9 \cdot 4 \cdot x} = \frac{4 \cdot x^2 + 13 \cdot x + 27}{36 \cdot x}$$

$$D = 13^2 - 4 \cdot 4 \cdot 27 \blacktriangleright {}^-263$$

(numerator is NOT factorable)

x is NOT a common factor of all terms

36 contains no factors that go into ALL of the terms of the final numerator

Step 1) can you reduce either fraction?

NO

Step 2) do the denominators have anything in common (GCF > 1)?

NO

Step 3) LCD = GCF (rest) of factors

GCF of 4x and 9 = 1   LCD $= 4 \cdot x \cdot 9 = 36 \cdot x$

Step 4) GET LCD through multiplication by 1

Step 5) Simplify numerators

Step 6) Combine numerators

Step 7) Is this the final answer?

YES

no common factor exists for the numerator and denominator

==12/15 got this problem completely simplified correctly==

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

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

$$= \frac{7 \cdot x^3 - 54 \cdot x^2 - 16 \cdot x}{4(x-8)} + \frac{4 \cdot x^2 - 12 \cdot x}{4(x-8)}$$

Simplify numerators

$$(7 \cdot x + 2) \cdot (x-8) = 7 \cdot x^2 - 54 \cdot x - 16$$

$$(x^2 - 3 \cdot x)(4) = 4 \cdot x^2 - 12 \cdot x$$

Combine numerators

$$7 \cdot x^2 - 54 \cdot x - 16 + 4 \cdot x^2 - 12 \cdot x = 11 \cdot x^2 - 66 \cdot x - 16$$

$$= \frac{11 \cdot x^2 - 66 \cdot x - 16}{9 \cdot 4 \cdot x} = \frac{11 \cdot x^2 - 66 \cdot x - 16}{36 \cdot x}$$

$$D = (-66)^2 - 4 \cdot 11 \cdot -16 \quad \blacktriangleright \quad 5060$$

(numerator is NOT factorable)

x is NOT a common factor of all terms

36 contains no factors that go into ALL of the terms of the final numerator

Step 1) can you reduce either fraction?

   YES, then reduce that fraction

Step 2) do the denominators have anything in common (GCF > 1)?

   NO (binomial and monomial share no common factors)

Step 3) LCD =GCF (rest) of factors

GCF of 4 and x−8 = 1

$$\text{LCD} = 4 \cdot (x-8) = 4 \cdot (x-8)$$

Step 4) GET LCD through multiplication by 1

Step 5) Simplify numerators

Step 6) Combine numerators

Step 7) Is this the final answer?

   YES

no common factor exists for the numerator and denominator

3/15 got this problem completely simplified correctly

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

$$= \frac{7 \cdot x^3 - 54 \cdot x^2 - 16 \cdot x}{4(x-8)} + \frac{4 \cdot x^2 - 12 \cdot x}{4(x-8)}$$

Simplify numerators

$$\left(7 \cdot x^2 + 2x\right) \cdot \left(x - 8\right) = 7 \cdot x^3 - 54 \cdot x^2 - 16 \cdot x$$

$$\left(x^2 - 3 \cdot x\right)\left(4x\right) = 4 \cdot x^3 - 12 \cdot x^2$$

Combine numerators

$$7 \cdot x^3 - 54 \cdot x^2 - 16 \cdot x + 4 \cdot x^3 - 12 \cdot x^2 = 11 \cdot x^3 - 66 \cdot x^2 - 16 \cdot x$$

$$= \frac{11 \cdot x^3 - 66 \cdot x^2 - 16 \cdot x}{9 \cdot 4 \cdot x^2} = \frac{11 \cdot x^3 - 66 \cdot x^2 - 16 \cdot x}{36 \cdot x^2}$$

$$= \frac{11 \cdot x^2 - 66 \cdot x - 16}{36 \cdot x} \cdot \frac{x}{x} = \frac{11 \cdot x^2 - 66 \cdot x - 16}{36 \cdot x}$$

$$D = \left(-66\right)^2 - 4 \cdot 11 \cdot -16$$

(numerator is NOT factorable)

x IS a common factor of all terms

36 contains no factors that go into ALL of the terms of the final numerator

Step 1) can you reduce either fraction?

IGNORE step 1 at your own peril

Step 2) do the denominators have anything in common (GCF > 1)?

NO (binomial and monomial share no common factors)

Step 3) LCD = GCF (rest) of factors

GCF of 4x and $x - 8 = 1$

$$LCD = 4x \cdot \left(x - 8\right)$$

Step 4) GET LCD through multiplication by 1

Step 5) Simplify numerators

Step 6) Combine numerators

Step 7) Is this the final answer?

NO

a common factor exists for the numerator and denominator (x)

<mark>3/13 got this problem completely simplified correctly</mark>

WE DO NOT SUBTRACT IN HIGH SCHOOL,
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WE CONVERT SUBTRACTION TO THE
ADDITION OF OPPOSITE

NUMBER 1 ERROR SOURCE IN MATHEMATICS
IS SIGN ERROR

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

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

$$\frac{3x+2}{5\cdot x^3} \cdot \frac{4}{4} + \frac{-2\cdot x + 3}{4} \cdot \frac{5\cdot x^3}{5\cdot x^3} = \frac{12x+8}{4(5x^3)} + \frac{15\cdot x^3 - 10\cdot x^4}{4(5x^3)}$$

Simplify numerators

$$(4x+3)(x-7) = 12\cdot x + 8$$

$$(-2x+3)\cdot (5\cdot x^3) = 15\cdot x^3 - 10\cdot x^4$$

Combine numerators

$$12\cdot x + 8 + 15\cdot x^3 - 10\cdot x^4 = -10\cdot x^4 + 15\cdot x^3 + 12\cdot x + 8$$

$$= \frac{-10\cdot x^4 + 15\cdot x^3 + 12\cdot x + 8}{4\cdot 5\cdot x^3} = \frac{-(10\cdot x^4 - 15\cdot x^3 - 12\cdot x - 8)}{20\cdot x^3}$$

x is NOT a common factor of all terms

20 contains no factors that go into ALL of the terms of the final numerator

Step 1) can you reduce either fraction?

   NO

Step 2) did you correctly rewrite subtraction as the addition of the opposite?

NO, then your chances of a silly sign error just increased!

YES, good job be careful to distribute to all terms properly

Step 3) do the denominators have anything in common (GCF > 1)?

   NO

Step 3) LCD =GCF (rest) of factors

GCF of $5x^3$ and 4 = 1 LCD = $5\cdot x^3 \cdot 4 = 20\cdot x^3$

Step 4) GET LCD through multiplication by 1

Step 5) Simplify numerators

Step 6) Combine numerators

Step 7) Is this the final answer?

   YES

no common factor exists for the numerator and denominator

6/15 got this problem completely simplified correctly

$$\frac{x^2+5x}{3x+4}-\frac{3x^2-1x}{4x}=\frac{x^2+5x}{3x+4}-\frac{3x-1}{4}=\frac{x^2+5x}{3x+4}+\frac{-(3x-1)}{4}$$

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

$$\frac{x^2+5x}{3x+4}\cdot\frac{4}{4}+\frac{-3x+1}{4}\cdot\frac{3x+4}{3x+4}=\frac{4x^2+20x}{4(3x+4)}+\frac{-5\cdot x^2+11\cdot x+4}{4(3x+4)}$$

Simplify numerators

$$\left(x^2+5x\right)(4)=4\cdot x^2+20\cdot x$$

$$(-3x+1)\cdot(3x+4)=-9\cdot x^2-9\cdot x+4$$

Combine numerators

$$4\cdot x^2+20\cdot x+-9\cdot x^2-9\cdot x+4=-5\cdot x^2+11\cdot x+4$$

$$=\frac{-5\cdot x^2+11\cdot x+4}{4(3x+4)}=\frac{-5\cdot x^2+11\cdot x+4}{12x+16}$$

$$D=11^2-4\cdot-5\cdot4 \triangleright 201$$

numerator is NOT factorable

x is NOT a common factor of all terms

4 contains no factors that go into ALL of the terms of the final numerator

Step 1) can you reduce either fraction?

    YES, then reduce that fraction

Step 2) did you correctly rewrite subtraction as the addition of the opposite?

NO, then your chances of a silly sign error just increased!

YES, good job be careful to distribute to all terms properly

Step 3) do the denominators have anything in common (GCF > 1)?

    NO

Step 3) LCD =GCF (rest) of factors

GCF of 3x+4 and 4 = 1   LCD $=(3\cdot x+4)\cdot4=12\cdot x+16$

Step 4) GET LCD through multiplication by 1

Step 5) Simplify numerators

Step 6) Combine numerators

Step 7) Is this the final answer?

    YES

no common factor exists for the numerator and denominator

2/15 got this problem completely simplified correctly

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

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

$$= \frac{7 \cdot x^2+23 \cdot x+6}{(2x-5)(x+3)} + \frac{2 \cdot x^2-13 \cdot x+20}{(2x-5)(x+3)}$$

Simplify numerators

$$(7x+2)(x+3) = 7 \cdot x^2+23 \cdot x+6$$

$$(x-4)(2x-5) = 2 \cdot x^2-13 \cdot x+20$$

Combine numerators

$$7 \cdot x^2+23 \cdot x+6+2 \cdot x^2-13 \cdot x+20 = 9 \cdot x^2+10 \cdot x+26$$

$$= \frac{7 \cdot x^2+23 \cdot x+6+2 \cdot x^2-13 \cdot x+20}{(2x-5)(x+3)} = \frac{9 \cdot x^2+10 \cdot x+26}{(x+3) \cdot (2 \cdot x-5)}$$

$$D = 10^2-4 \cdot 9 \cdot 26 \triangleright \text{-}836$$

(numerator is NOT factorable)

Step 1) can you reduce either fraction?

　　　NO

Step 2) do the denominators have anything in common (GCF > 1)?

　　　NO

Step 3) LCD =GCF (rest) of factors

GCF of 2x−5 and x+3 = 1

$$\text{LCD} = (2x-5)(x+3) = 2 \cdot x^2+x-15$$

Step 4) GET LCD through multiplication by 1

Step 5) Simplify numerators

Step 6) Combine numerators

Step 7) Is this the final answer?

　　　YES

no common factor exists for the numerator and denominator

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

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

$$=\frac{x^3-x^2-6\cdot x}{(x+3)(x+7)}+\frac{x^3+3\cdot x^2-28\cdot x}{(x+3)(x+7)}$$

Simplify numerators

$$\left(x^2+2x\right)(x-3)=x^3-x^2-6\cdot x$$

$$\left(x^2-4x\right)(x+7)=x^3+3\cdot x^2-28\cdot x$$

Combine numerators

$$x^3-x^2-6\cdot x+x^3+3\cdot x^2-28\cdot x=2\cdot x^3+2\cdot x^2-34\cdot x$$

$$=\frac{x^3-x^2-6\cdot x+x^3+3\cdot x^2-28\cdot x}{(2x-5)(x+3)}=\frac{2\cdot x^3+2\cdot x^2-34\cdot x}{(2\cdot x-5)\cdot(x+3)}$$

$$\frac{2\cdot x^3+2\cdot x^2-34\cdot x}{(2\cdot x-5)\cdot(x+3)}=\frac{2\cdot x\cdot\left(x^2+x-17\right)}{(x+3)\cdot(2\cdot x-5)}$$

$$D=1^2-4\cdot1\cdot-17 \quad \blacktriangleright \quad 69$$

(quadratic factor in numerator is NOT factorable)

Step 1) can you reduce either fraction?

    NO

Step 2) do the denominators have anything in common (GCF > 1)?

    NO

Step 3) LCD =GCF (rest) of factors

GCF of x+7 and x−3 = 1

$$\text{LCD} = (x+7)\cdot(x-3)=x^2+4\cdot x-21$$

Step 4) GET LCD through multiplication by 1

Step 5) Simplify numerators

Step 6) Combine numerators

Step 7) Is this the final answer?

    YES

no common factor exists for the numerator and denominator

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$$\frac{4 \cdot x + 3}{3 \cdot x^3 + 5 \cdot x} - \frac{2 \cdot x - 3}{x - 7} = \frac{4x + 3}{3 \cdot x^3 + 5 \cdot x} + \frac{-(2 \cdot x - 3)}{x - 7}$$

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

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

$$= \frac{4 \cdot x^2 - 25 \cdot x - 21}{\left(3x^3 + 5x\right)\left(x - 7\right)} + \frac{-6 \cdot x^4 + 9 \cdot x^3 - 10 \cdot x^2 + 15 \cdot x}{\left(3x^3 + 5x\right)\left(x - 7\right)}$$

Simplify numerators

$$(4x + 3)(x - 7) = 4 \cdot x^2 - 25 \cdot x - 21$$

$$(-2x + 3)(3x^3 + 5x) = -6 \cdot x^4 + 9 \cdot x^3 - 10 \cdot x^2 + 15 \cdot x$$

Combine numerators

$$4 \cdot x^2 - 25 \cdot x - 21 + -6 \cdot x^4 + 9 \cdot x^3 - 10 \cdot x^2 + 15 \cdot x$$

$$= -6 \cdot x^4 + 9 \cdot x^3 - 6 \cdot x^2 - 10 \cdot x - 21$$

$$= \frac{-6 \cdot x^4 + 9 \cdot x^3 - 6 \cdot x^2 - 10 \cdot x - 21}{\left(3x^3 + 5x\right)\left(x - 7\right)} = \frac{-\left(6 \cdot x^4 - 9 \cdot x^3 + 6 \cdot x^2 + 10 \cdot x + 21\right)}{x \cdot (x - 7) \cdot \left(3 \cdot x^2 + 5\right)}$$

possible common factor/root test x = 7

$-6 \cdot 7^4 + 9 \cdot 7^3 - 6 \cdot 7^2 - 10 \cdot 7 - 21 \triangleright -11704$ (x−7) not a factor of numerator

since constant −21 is present x is not a common factor of all terms

Step 1) can you reduce either fraction?

   NO

Step 2) did you correctly rewrite subtraction as the addition of the opposite?

NO, then your chances of a silly sign error just increased!

YES, good job be careful to distribute to all terms properly

Step 3) do the denominators have anything in common (GCF > 1)?

   NO

Step 3) LCD = GCF (rest) of factors

GCF of $\left(3x^3 + 5x\right)$ and $(x - 7) = 1$ LCD $= \left(3x^3 + 5x\right)(x - 7)$

Step 4) GET LCD through multiplication by 1

Step 5) Simplify numerators

Step 6) Combine numerators

Step 7) Is this the final answer?

   YES

no common factor exists for the numerator and denominator

5/15 got this problem completely simplified correctly

$$\frac{x^2-8\cdot x}{4\cdot x+5} - \frac{10\cdot x^2-6\cdot x}{2\cdot x^2+8\cdot x} = \frac{x^2-8\cdot x}{4\cdot x+5} - \frac{5x-3}{x+4} = \frac{x^2-8\cdot x}{4\cdot x+5} + \frac{-5x+3}{x+4}$$

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

$$=\frac{x^3-4\cdot x^2-32\cdot x}{(4x+5)(x+4)} + \frac{-20\cdot x^2-13\cdot x+15}{(4x+5)(x+4)}$$

Simplify numerators

$$\left(x^2-8x\right)(x+4) = x^3-4\cdot x^2-32\cdot x$$

$$\left(-5x+3\right)\cdot\left(4x+5\right) = -20\cdot x^2-13\cdot x+15$$

Combine numerators

$$x^3-4\cdot x^2-32\cdot x+-20\cdot x^2-13\cdot x+15 = x^3-24\cdot x^2-45\cdot x+15$$

$$=\frac{x^3-4\cdot x^2-32\cdot x+-20\cdot x^2-13\cdot x+15}{(4x+5)(x+4)} = \frac{x^3-24\cdot x^2-45\cdot x+15}{(4x+5)(x+4)}$$

possible common factor/root test x = −4

$$(-4)^3-24\cdot(-4)^2-45\cdot(-4)+15 \rightarrow \text{-}253$$

(x+4) not a factor of numerator

possible common factor/root test x = −5/4

$$(-5/4)^3-24\cdot(-5/4)^2-45\cdot(-5/4)+15 \rightarrow \frac{2035}{64} \quad (4x+5) \text{ not a factor}$$

of numerator

Step 1) can you reduce either fraction?

    YES, then reduce that fraction

Step 2) did you correctly rewrite subtraction as the addition of the opposite?

NO, then your chances of a silly sign error just increased!

YES, good job be careful to distribute to all terms properly

Step 3) do the denominators have anything in common (GCF > 1)?

    NO

Step 3) LCD =GCF (rest) of factors

GCF of 4x+5 and $2x^2+8x = 1$

$$\text{LCD} = \left(4\cdot x+5\right)\cdot\left(2\cdot x^2+8\cdot x\right) = 8\cdot x^3+42\cdot x^2+40\cdot x$$

Step 4) GET LCD through multiplication by 1

Step 5) Simplify numerators

Step 6) Combine numerators

Step 7) Is this the final answer?

    YES

no common factor exists for the numerator and denominator

1/15 got this problem completely simplified correctly