A DEFINITIONS

A.1 WRITING FRACTIONS FROM WORDS

Ex 1: Write as fraction:

 $x \text{ over } 2 = \boxed{\frac{x}{2}}$

Answer:

$$x \operatorname{sur} 2 = \frac{x}{2}$$

Ex 2: Write as a fraction:

x square over
$$6 = \left\lfloor \frac{x^2}{6} \right\rfloor$$

Answer:

$$x \operatorname{carr\acute{e}} \operatorname{sur} 6 = \frac{x^2}{6}$$

Ex 3: Write as a fraction:

3 over
$$x = \boxed{\frac{3}{x}}$$

Answer:

3 over
$$x = \frac{3}{x}$$

Ex 4: Write as a fraction:

$$x+1$$
 over $2 = \left\lfloor \frac{x+1}{2} \right\rfloor$

Answer:

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

B FRACTION AS QUOTIENT

B.1 FORMULATING ALGEBRAIC EXPRESSIONS

Ex 5: Express the colored area in the following diagram:



Answer: Let's figure out the area of the colored region step by step:

• The diagram shows a square with side length x. The area of this square is:

Area of square
$$= x \times x$$

 $= x^2$

• The area of the colored region is half the area of the square:

Area of colored region $=\frac{x^2}{2}$

Ex 6: You have x marbles and want to share them equally among four friends. Express the number of marbles each friend receives.

Marbles per friend = $\left\lfloor \frac{x}{4} \right\rfloor$

Answer:

- You have a total of x marbles.
- These marbles are shared equally among 4 friends. The number of marbles each friend receives is:

$$x \div 4 = \frac{x}{4}$$

Ex 7: Express the colored area in the following diagram:



Answer:

• The area of the square is:

Area of square
$$= x \times x$$

 $= x^2$

• Since the square is divided into four equal quadrants, the area of one quadrant is:

Area of colored region
$$=\frac{x^2}{4}$$

Ex 8: Un boulanger cuit 1000 biscuits. Il veut mettre ces biscuits dans x boîtes, avec le même nombre de biscuits dans chaque boîte. Exprime le nombre de biscuits dans chaque boîte.

Biscuits par boîte =
$$\frac{1000}{x}$$

Answer:

- The total number of cookies is 1000.
- These cookies are distributed into x boxes. The number of cookies per box is:

$$1000 \div x = \frac{1000}{x}$$

C EQUIVALENT FRACTIONS

C.1 SIMPLIFYING ALGEBRAIC FRACTIONS

Ex 9:

 $\frac{6x}{9} = \frac{2x}{3}$

Answer:

Ex 10:

 $\frac{10x^2}{4} = \frac{5x^2}{2}$

Answer:

$\frac{10x^2}{4} = \frac{\cancel{2} \times 5 \times x^2}{\cancel{2} \times 2}$ $= \frac{5x^2}{2}$

Ex 11:

$$\frac{9x^3}{30x} = \frac{3x^2}{10}$$

Answer:

$\frac{9x^3}{30x} = \frac{\cancel{3} \times 3 \times x^2 \times \cancel{x}}{\cancel{3} \times 10 \times \cancel{x}}$ $= \frac{3x^2}{10}$

Ex 12:

 $\frac{3x^2}{2x} = \frac{3x}{\boxed{2}}$

Answer:

$3x^2$	$ \underline{3} \times x \times x $	
$\overline{2x}$	$-\frac{3}{\cancel{3}\times 2\times \cancel{x}}$	
	_ x	
	$-\frac{1}{2}$	

Ex 13:

 $\frac{2}{4x} = \frac{1}{2x}$

Answer:

$$\frac{2}{4x} = \frac{\cancel{2}}{\cancel{2} \times 2 \times x}$$
$$= \frac{1}{2x}$$

D SIMPLIFICATION

D.1 SIMPLIFYING ALGEBRAIC FRACTIONS

Ex 14: Simplify:

Answer:

Answer:

$$\frac{4x}{6} =$$

$$\frac{4x}{6} = \frac{2 \times 2 \times x}{2 \times 3}$$
$$= \frac{2x}{3}$$

 $\frac{2x}{3}$

Ex 15: Simplify:

 $\frac{x^2}{3x} = \boxed{\frac{x}{3}}$



Ex 16: Simplify:

$6x^3$	$2x^2$
$\overline{9x} =$	3

Answer:

$$\frac{6x^3}{9x} = \frac{\cancel{3} \times 2 \times x^2 \times \cancel{2}}{\cancel{3} \times 3 \times \cancel{2}} = \frac{2x^2}{3}$$

Ex 17: Simplify:

$$\frac{8x^4}{12x} = \boxed{\frac{2x^3}{3}}$$

 $\frac{8x^4}{12x} = \frac{\cancel{4} \times 2 \times x^3 \times \cancel{x}}{\cancel{4} \times 3 \times \cancel{x}}$ $= \frac{2x^3}{3}$

Ex 18: Simplify:

 $\frac{15x^2}{25x} = \boxed{\frac{3x}{5}}$

Answer:

Answer:

$$\frac{15x^2}{25x} = \frac{\cancel{5} \times 3 \times x \times \cancel{4}}{\cancel{5} \times 5 \times \cancel{4}}$$
$$= \frac{3x}{5}$$

 $\mathbf{Ex} \ \mathbf{19:} \ \mathbf{Simplify:}$

$$\frac{14x^5}{21x^2} = \boxed{\frac{2x^3}{3}}$$



$$\frac{14x^5}{21x^2} = \frac{\cancel{7} \times 2 \times x^3 \times \cancel{2}}{\cancel{7} \times 3 \times \cancel{2}} = \frac{2x^3}{3}$$

Ex 20: Simplify:

$$\frac{4x^3}{16x} = \boxed{\frac{x^2}{4}}$$

Answer:

$$\frac{4x^3}{16x} = \frac{\cancel{4} \times x^2 \times \cancel{p}}{\cancel{4} \times 4 \times \cancel{p}}$$
$$= \frac{x^2}{\cancel{4}}$$

E CROSS MULTIPLICATION

E.1 SOLVING PROPORTIONS USING CROSS-MULTIPLICATION

Ex 21: Solve
$$x$$
 for $\frac{12}{4} = \frac{x}{6}$:
 $x = 18$

Answer:

$$\frac{12}{4}$$

$$\frac{x}{6}$$

$$4 \times x = 12 \times 6$$
 (cross multiplication)

$$x = 12 \times 6 \div 4$$
 (dividing both sides by 4)

$$x = 18$$

Ex 22: Solve
$$x$$
 for $\frac{11}{10} = \frac{x}{5}$:
 $x = 5.5$

Answer:

$$\frac{11}{10} \times \frac{x}{5}$$

$$10 \times x = 11 \times 5 \quad \text{(cross multiplication)}$$

$$x = 11 \times 5 \div 10 \quad \text{(dividing both sides by 10)}$$

$$x = 5.5$$

Ex 23: Solve
$$x$$
 for $\frac{12}{10} = \frac{18}{x}$:
 $x = 15$

Answer:

12 - 18 - 18 $12 \times x = 18 \times 10 \quad (cross multiplication)$ $x = 18 \times 10 \div 12 \quad (dividing both sides by 12)$ x = 15

Ex 24: Solve
$$x$$
 for $\frac{27}{x} = \frac{30}{10}$:
 $x = 9$

Answer:

$$27 \xrightarrow{30}_{10} 30$$

$$30 \times x = 27 \times 10 \qquad (cross multiplication)$$

$$x = 27 \times 10 \div 30 \quad (dividing both sides by 30)$$

$$x = 9$$

E.2 SOLVING PROPORTIONS USING CROSS-MULTIPLICATION

Ex 25: Solve for x in the equation $\frac{x}{3} = \frac{x+1}{2}$.

$$x = \boxed{-3}$$

Answer:

$$\frac{x}{3} = \frac{x+1}{2}$$

$$2x = 3(x+1) \quad (\text{cross multiplication})$$

$$2x = 3x + 3 \quad (\text{distribute})$$

$$2x - 3x = 3 \quad (\text{subtract } 3x \text{ from both sides})$$

$$-x = 3$$

$$x = -3 \quad (\text{multiply both sides by -1})$$

Ex 26: Solve for x in the equation $\frac{x}{2} = \frac{x-2}{3}$.

$$x = \boxed{-4}$$

$$\frac{x}{2} = \frac{x-2}{3}$$

$$3x = 2(x-2) \quad (\text{cross multiplication})$$

$$3x = 2x - 4 \quad (\text{distribute})$$

$$3x - 2x = -4 \quad (\text{subtract } 2x \text{ from both sides})$$

$$x = -4$$

Ex 27: Solve for x in the equation $\frac{2}{x+1} = \frac{1}{x}$. $x = \boxed{1}$

Answer:

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

$$2x = 1(x+1) \quad (\text{cross multiplication})$$

$$2x = x+1 \quad (\text{distribute})$$

$$2x - x = 1 \quad (\text{subtract } x \text{ from both sides})$$

$$x = 1$$

Ex 28: Solve x for $\frac{2x+1}{4} = \frac{x+2}{3}$. $x = \begin{bmatrix} \frac{5}{2} \end{bmatrix}$ Answer: Answer:

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

$$3(2x+1) = 4(x+2) \quad \text{(produit en croix)}$$

$$6x+3 = 4x+8 \quad \text{(développer)}$$

$$6x-4x = 8-3 \quad \text{(regrouper les termes)}$$

$$2x = 5 \quad \text{(simplifier)}$$

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

F ADDITION AND SUBTRACTION

F.1 ADDING AND SUBTRACTING ALGEBRAIC FRACTIONS

Ex 29: Calculate and simplify::

$$\frac{x}{6} + \frac{3x}{6} = \boxed{\frac{2x}{3}}$$

Answer:

$$\frac{x}{6} + \frac{3x}{6} = \frac{x+3x}{6}$$
 (combine fractions with common denominator)
$$= \frac{4x}{6}$$
$$= \frac{\cancel{2} \times 2 \times x}{\cancel{2} \times 3}$$
 (simplify by canceling common factors)
$$= \frac{2x}{3}$$

Ex 30: Calculate and simplify:

$$\frac{x}{2} + \frac{3x}{4} = \boxed{\frac{5x}{4}}$$

Answer:

$$\begin{aligned} \frac{x}{2} + \frac{3x}{4} &= \frac{x \times 2}{2 \times 2} + \frac{3x}{4} & \text{(find a common denominator, which is 4)} \\ &= \frac{2x}{4} + \frac{3x}{4} & \\ &= \frac{2x + 3x}{4} & \text{(combine fractions with common denominator)} \\ &= \frac{5x}{4} & \end{aligned}$$

Ex 31: Calculate and simplify:

$$\frac{3x^2}{2} + \frac{5x^2}{3} = \boxed{\frac{19x^2}{6}}$$

Answer:

 $\frac{3x^2}{2} + \frac{5x^2}{3} = \frac{3x^2 \times 3}{2 \times 3} + \frac{5x^2 \times 2}{3 \times 2} \quad \text{(find a common denominator, which is 6)}$ $= \frac{9x^2}{6} + \frac{10x^2}{6}$ $= \frac{9x^2 + 10x^2}{6} \quad \text{(combine fractions with common denominator)}$ $= \frac{19x^2}{6}$

Ex 32: Calculate and simplify:

 $\frac{5x}{3}$

Answer:

$$\begin{aligned} -\frac{x}{6} &= \frac{5x \times 2}{3 \times 2} - \frac{x \times 1}{6 \times 1} \quad \text{(find a common denominator, which is 6)} \\ &= \frac{10x}{6} - \frac{x}{6} \\ &= \frac{10x - x}{6} \quad \text{(combine fractions with common denominator)} \\ &= \frac{9x}{6} \\ &= \frac{\cancel{3} \times 3 \times x}{\cancel{3} \times 2} \quad \text{(simplify by canceling common factors)} \\ &= \frac{3x}{2} \end{aligned}$$

 $\frac{5x}{3} - \frac{x}{6} = \left| \frac{3x}{2} \right|$

Ex 33: Calculate and simplify:

$$\frac{2x^2}{5} + \frac{3x^2}{10} = \boxed{\frac{7x^2}{10}}$$

Answer:

$$\begin{aligned} \frac{2x^2}{5} + \frac{3x^2}{10} &= \frac{2x^2 \times 2}{5 \times 2} + \frac{3x^2 \times 1}{10 \times 1} & \text{(find a common denominator, which is 10)} \\ &= \frac{4x^2}{10} + \frac{3x^2}{10} & \\ &= \frac{4x^2 + 3x^2}{10} & \text{(combine fractions with common denominator)} \\ &= \frac{7x^2}{10} & \end{aligned}$$

Ex 34: Calculate and simplify:

$$\frac{7x^3}{4} - \frac{2x^3}{3} = \boxed{\frac{13x^3}{12}}$$

Answer:

$$\frac{7x^3}{4} - \frac{2x^3}{3} = \frac{7x^3 \times 3}{4 \times 3} - \frac{2x^3 \times 4}{3 \times 4} \quad \text{(find a common denominator, which is 12)}$$
$$= \frac{21x^3}{12} - \frac{8x^3}{12}$$
$$= \frac{21x^3 - 8x^3}{12} \quad \text{(combine fractions with common denominator)}$$
$$= \frac{13x^3}{12}$$

G MULTIPLICATION OF A FRACTION BY A NUMBER

G.1 MULTIPLYING OF ALGEBRAIC FRACTIONS BY NUMBERS

Ex 35: Calculate and simplify:

$$x \times \frac{x}{2} = \boxed{\frac{x^2}{2}}$$

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$$x imes rac{x}{2} = rac{x imes x}{2}$$
 (multiply the number by the numerator) $= rac{x^2}{2}$

Ex 36: Calculate and simplify:

$$3x \times \frac{2x}{9} = \boxed{\frac{2x^2}{3}}$$

Answer:

$$3x \times \frac{2x}{9} = \frac{3x \times 2x}{9} \qquad \text{(multiply the number by the numerator)}$$
$$= \frac{6x^2}{9}$$
$$= \frac{\cancel{3} \times 2 \times x^2}{\cancel{3} \times 3} \qquad \text{(simplify by canceling common factors)}$$
$$= \frac{2x^2}{3}$$

Ex 37: Calculate and simplify:

$$2x \times \frac{x^3}{6} = \boxed{\frac{x^4}{3}}$$

Answer:

$$2x \times \frac{x^3}{6} = \frac{2x \times x^3}{6} \quad \text{(multiply the number by the numerator)}$$
$$= \frac{2x^4}{6}$$
$$= \frac{\cancel{2} \times x^4}{\cancel{2} \times 3} \quad \text{(simplify by canceling common factors)}$$
$$= \frac{x^4}{3}$$

Ex 38: Calculate and simplify:

$$4x^2 \times \frac{x}{8} = \boxed{\frac{x^3}{2}}$$

Answer:

$$4x^2 \times \frac{x}{8} = \frac{4x^2 \times x}{8} \quad \text{(multiply the number by the numerator)}$$
$$= \frac{4x^3}{8}$$
$$= \frac{\cancel{4} \times x^3}{\cancel{4} \times 2} \quad \text{(simplify by canceling common factors)}$$
$$= \frac{x^3}{2}$$

Ex 39: Calculate and simplify:

$$\frac{5}{x} \times x^2 = \boxed{5x}$$

Answer:

$$\frac{5}{x} \times x^2 = \frac{5 \times x^2}{x} \quad \text{(multiply the numerator and denominator)} \\ = \frac{5x^2}{x} \\ = 5x \quad \text{(simplify by canceling x in numerator and denominator)}$$

Ex 40: Calculate and simplify:

Answer:

 x^4

3

$$\begin{array}{l} \times \ 6 = \displaystyle \frac{x^4 \times 6}{3} \qquad \qquad (\text{multiply the numerator and denominator}) \\ = \displaystyle \frac{6x^4}{3} \\ = \displaystyle \frac{\cancel[b]{\times 2 \times x^4}}{\cancel[b]{}} \qquad (\text{simplify by canceling common factors}) \\ = \displaystyle 2x^4 \end{array}$$

 $\frac{x^4}{3} \times 6 = \boxed{2x^4}$

H MULTIPLICATION OF FRACTIONS

H.1 MULTIPLYING OF ALGEBRAIC FRACTIONS

Ex 41: Calculate and simplify:

$$\frac{2}{3} \times \frac{x}{2} = \boxed{\frac{x}{3}}$$

Answer:

$$\frac{2}{3} \times \frac{x}{2} = \frac{2 \times x}{3 \times 2} \quad \text{(multiply the numerators and denominators)}$$
$$= \frac{2x}{6}$$
$$= \frac{\cancel{2} \times x}{\cancel{2} \times 3} \quad \text{(simplify by canceling common factors)}$$
$$= \frac{x}{3}$$

Ex 42: Calculate and simplify:

$$\frac{5}{2} \times \frac{x}{5} = \boxed{\frac{x}{2}}$$

Answer:

$$\frac{5}{2} \times \frac{x}{5} = \frac{5 \times x}{2 \times 5} \quad \text{(multiply the numerators and denominators)}$$
$$= \frac{5x}{10}$$
$$= \frac{\cancel{p} \times x}{\cancel{p} \times 2} \quad \text{(simplify by canceling common factors)}$$
$$= \frac{x}{2}$$

Ex 43: Calculate and simplify:

 $\frac{x}{3} \times \frac{2}{x} = \boxed{\frac{2}{3}}$

Answer:

$$\frac{x}{3} \times \frac{2}{x} = \frac{x \times 2}{3 \times x} \quad \text{(multiply the numerators and denominators)}$$
$$= \frac{2x}{3x}$$
$$= \frac{\cancel{x} \times 2}{\cancel{x} \times 3} \quad \text{(simplify by canceling common factors)}$$
$$= \frac{2}{3}$$

(*<u>*</u>)

Ex 44: Calculate and simplify:

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$$\frac{4}{x} \times \frac{1}{2} = \boxed{\frac{2}{x}}$$

$$\frac{4}{x} \times \frac{1}{2} = \frac{4 \times 1}{x \times 2} \quad \text{(multiply the numerators and denominators)}$$
$$= \frac{4}{2x}$$
$$= \frac{2 \times 2}{2 \times x} \quad \text{(simplify by canceling common factors)}$$
$$= \frac{2}{x}$$

H.2 MULTIPLYING OF ALGEBRAIC FRACTIONS

 $\mathbf{Ex}\ \mathbf{45:}\ \mathbf{Calculate}\ \mathbf{and}\ \mathbf{simplify:}$

$$\frac{x}{2} \times \frac{2x}{3} = \boxed{\frac{x^2}{3}}$$

Answer:

$$\frac{x}{2} \times \frac{2x}{3} = \frac{x \times 2x}{2 \times 3} \quad \text{(multiply the numerators and denominators)}$$
$$= \frac{2x^2}{6}$$
$$= \frac{\cancel{2} \times x^2}{\cancel{2} \times 3} \quad \text{(simplify by canceling common factors)}$$
$$= \frac{x^2}{3}$$

Ex 46: Calculate and simplify:

$$\frac{x}{2} \times \frac{x^2}{3} = \boxed{\frac{x^3}{6}}$$

Answer:

$$\frac{x}{2} \times \frac{x^2}{3} = \frac{x \times x^2}{2 \times 3} \quad \text{(multiply the numerators and denominators)} \\ = \frac{x^3}{6}$$

Ex 47: Calculate and simplify:

$$\frac{2}{x} \times \frac{x^2}{3} = \boxed{\frac{2x}{3}}$$

Answer:

$$\frac{2}{x} \times \frac{x^2}{3} = \frac{2 \times x^2}{x \times 3} \qquad \text{(multiply the numerators and denominators)}$$
$$= \frac{2x^2}{3x}$$
$$= \frac{\cancel{x} \times 2 \times \cancel{x}}{\cancel{x} \times 3} \qquad \text{(simplify by canceling common factors)}$$
$$= \frac{2x}{3}$$

Ex 48: Calculate and simplify:

$$\left(\frac{x}{2}\right)^2 = \boxed{\frac{x^2}{4}}$$

Answer:

$$\left(rac{x}{2}
ight)^2 = rac{x imes x}{2 imes 2}$$
 (square the numerator and the denominator) $=rac{x^2}{4}$

I DIVISION OF FRACTIONS

I.1 DIVIDING ALGEBRAIC FRACTIONS

Ex 49: Calculate and simplify:

 $\frac{2}{3} \div \frac{2}{x} = \boxed{\frac{x}{3}}$

Answer:

 $\frac{2}{3}$ ÷

$$\frac{2}{x} = \frac{2}{3} \times \frac{x}{2} \quad \text{(dividing by a fraction is multiplying by its reciprocal)} \\ = \frac{2 \times x}{3 \times 2} \quad \text{(multiply the numerators and denominators)} \\ = \frac{2x}{6} \\ = \frac{\cancel{2} \times x}{\cancel{2} \times 3} \quad \text{(simplify by canceling common factors)} \\ = \frac{x}{3}$$

Ex 50: Calculate and simplify:

$$\frac{2x}{3} \div 2 = \boxed{\frac{x}{3}}$$

Answer:

$$\frac{2x}{3} \div 2 = \frac{2x}{3} \div \frac{2}{1} \quad \text{(dividing by a number is multiplying by its reciprocal)} \\ = \frac{2x}{3} \times \frac{1}{2} \quad \text{(multiply the numerators and denominators)} \\ = \frac{2x \times 1}{3 \times 2} \\ = \frac{2x}{6} \\ = \frac{\cancel{2} \times x}{\cancel{2} \times 3} \quad \text{(simplify by canceling common factors)} \\ = \frac{x}{3} \end{aligned}$$

Ex 51: Calculate and simplify:

$$\frac{3}{x} \div \frac{6}{x} = \boxed{\frac{1}{2}}$$

Answer:

 $\frac{3}{x} \div$

$$\frac{6}{x} = \frac{3}{x} \times \frac{x}{6} \quad \text{(dividing by a fraction is multiplying by its reciprocal)} \\
= \frac{3 \times x}{x \times 6} \quad \text{(multiply the numerators and denominators)} \\
= \frac{3x}{6x} \\
= \frac{\cancel{x} \times 3}{\cancel{x} \times 6} \quad \text{(simplify by canceling common factors)} \\
= \frac{3}{6} \\
= \frac{\cancel{x}}{\cancel{x} \times 2} \quad \text{(simplify by canceling common factors)} \\
= \frac{1}{2}$$



$$\frac{4x}{5} \div x = \boxed{\frac{4}{5}}$$

$$\frac{4x}{5} \div x = \frac{4x}{5} \div \frac{x}{1} \quad \text{(dividing by a number is multiplying by its reciprocal)} \\ = \frac{4x}{5} \times \frac{1}{x} \quad \text{(multiply the numerators and denominators)} \\ = \frac{4x \times 1}{5 \times x} \\ = \frac{4x}{5x} \\ = \frac{\frac{4x}{5x}}{\frac{1}{\frac{1}{x} \times 5}} \quad \text{(simplify by canceling common factors)} \\ = \frac{4}{5}$$

Ex 53: Calculate and simplify:

$$\frac{x^2}{2} \div \frac{x}{4} = \boxed{2x}$$

Answer:

$$\frac{x^2}{2} \div \frac{x}{4} = \frac{x^2}{2} \times \frac{4}{x}$$
 (dividing by a fraction is multiplying by its reciprocal)
$$= \frac{x^2 \times 4}{2 \times x}$$
 (multiply the numerators and denominators)
$$= \frac{4x^2}{2x}$$

$$= \frac{\cancel{2} \times 2 \times x \times \cancel{2}}{\cancel{2} \times x}$$
 (simplify by canceling common factors)
$$= \frac{2x}{x}$$

$$= 2$$

I.2 DIVIDING ALGEBRAIC FRACTIONS

Ex 54: Calculate and simplify:

$$\frac{\frac{2}{3}}{\frac{2}{x}} = \boxed{\frac{x}{3}}$$

Answer:

$$\frac{\frac{2}{3}}{\frac{2}{x}} = \frac{2}{3} \times \frac{x}{2}$$
 (dividing by a fraction is multiplying by its reciprocal)
$$= \frac{2 \times x}{3 \times 2}$$
 (multiply the numerators and denominators)
$$= \frac{2x}{6}$$

$$= \frac{\cancel{2} \times x}{\cancel{2} \times 3}$$
 (simplify by canceling common factors)
$$= \frac{x}{3}$$

 $\mathbf{Ex}\ \mathbf{55:}$ Calculate and simplify:

$$\frac{\frac{2x}{3}}{2} = \boxed{\frac{x}{3}}$$

2r 2

Answer:





 $\frac{\frac{3}{x}}{\frac{6}{x}} = \boxed{\frac{1}{2}}$



Ex 57: Calculate and simplify:

$$\frac{\frac{4x^2}{5}}{2} = \boxed{\frac{2x^2}{5}}$$

Answer:

$$\frac{\frac{4x^2}{5}}{2} = \frac{4x^2}{5} \div \frac{2}{1}$$
 (dividing by a number is multiplying by its reciprocal)
$$= \frac{4x^2}{5} \times \frac{1}{2}$$
 (multiply the numerators and denominators)
$$= \frac{4x^2 \times 1}{5 \times 2}$$
$$= \frac{4x^2}{10}$$
$$= \frac{2 \times 2 \times x^2}{2 \times 5}$$
 (simplify by canceling common factors)
$$= \frac{2x^2}{5}$$

Ex 58: Calculate and simplify:

$$\frac{\frac{4x}{5}}{x} = \boxed{\frac{4}{5}}$$

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4x

$$\frac{-12x^4}{-2x^2} = \boxed{6x^2}$$

$$\frac{\frac{4x}{5}}{x} = \frac{4x}{5} \div \frac{x}{1} \quad \text{(dividing by a number is multiplying by its reciprocal)} \\
= \frac{4x}{5} \times \frac{1}{x} \quad \text{(multiply the numerators and denominators)} \\
= \frac{4x \times 1}{5 \times x} \\
= \frac{4x}{5x} \\
= \frac{\cancel{x} \times 4}{\cancel{x} \times 5} \quad \text{(simplify by canceling common factors)} \\
= \frac{4}{5}$$

2

Ex 59: Calculate and simplify:

$$\frac{\frac{x^2}{2}}{\frac{x}{4}} = \boxed{2x}$$

Answer:



Answer:

$$\frac{-12x^4}{-2x^2} = \frac{\cancel{2} \times 6 \times x^2 \times \cancel{2}}{\cancel{2} \times 1 \times \cancel{2}} \quad \text{(simplify by canceling common factors)}$$
$$= \frac{6x^2}{1}$$
$$= 6x^2$$

Ex 63: Simplify:

$$\frac{3x^3}{-9x} = \boxed{-\frac{x^2}{3}}$$

Answer:

$$\frac{3x^3}{-9x} = \frac{\cancel{3} \times x^2 \times \cancel{x}}{\cancel{3} \times -3 \times \cancel{x}} \quad \text{(simplify by canceling common factors)}$$
$$= \frac{x^2}{-3}$$
$$= -\frac{x^2}{3}$$

Ex 64: Simplify:

Answer:

J SIGN RULES

J.1 SIMPLIFYING ALGEBRAIC FRACTIONS WITH **RELATIVE NUMBERS**

Ex 60: Simplify:

$$\frac{-15x}{-30} = \boxed{\frac{x}{2}}$$

Answer:

$$\frac{-15x}{-30} = \frac{-15 \times x}{-15 \times 2} \quad \text{(simplify by canceling common factors)} \\ = \frac{x}{2}$$

Ex 61: Simplify:

$$\frac{-6x}{12} = \boxed{-\frac{x}{2}}$$

Answer:

$$\frac{-6x}{12} = \frac{-\cancel{6} \times x}{\cancel{6} \times 2} \quad \text{(simplify by canceling common factors)}$$
$$= \frac{-x}{2}$$
$$= -\frac{x}{2}$$

Ex 62: Simplify:

$$\frac{-21x^3}{-7x} = \frac{\cancel{7} \times 3 \times x^2 \times \cancel{x}}{\cancel{7} \times 1 \times \cancel{x}} \quad \text{(simplify by canceling common factors)} \\ = \frac{3x^2}{1} \\ = 3x^2$$

 $\frac{-21x^3}{-7x} = \boxed{3x^2}$

Ex 65: Simplify:

$$\frac{-4x^4}{8x^2} = \boxed{-\frac{x^2}{2}}$$

Answer:

$$\frac{-4x^4}{8x^2} = \frac{-\cancel{4} \times x^2 \times \cancel{x^2}}{\cancel{4} \times 2 \times \cancel{x^2}} \quad \text{(simplify by canceling common factors)}$$
$$= \frac{x^2}{2}$$
$$= -\frac{x^2}{2}$$

K ORDER OF OPERATIONS

K.1 CALCULATING ALGEBRAIC EXPRESSIONS

Ex 66: Calculate and simplify:

$$\frac{x+7x}{3\times4} = \boxed{\frac{2x}{3}}$$

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$$\frac{x+7x}{3\times4} = \frac{8x}{12}$$
 (simplify numerator and denominator)
$$= \frac{\cancel{4}\times2\times x}{\cancel{4}\times3}$$
 (simplify by canceling common factors)
$$= \frac{2x}{3}$$

 \mathbf{Ex} 67: Calculate and simplify:

$$x \times \frac{3x+x}{4+2} = \boxed{\frac{2x^2}{3}}$$

Answer:

$$x \times \frac{3x + x}{4 + 2} = x \times \frac{4x}{6}$$
 (simplify the numerator and the denominator)

$$= \frac{x \times 4x}{6}$$
 (multiply the numerators and denominators)

$$= \frac{4x^2}{6}$$

$$= \frac{\cancel{2} \times 2 \times x^2}{\cancel{2} \times 3}$$
 (simplify by canceling common factors)

$$= \frac{2x^2}{3}$$

Ex 68: Calculate and simplify:

$$\frac{2x^3}{2x-x} = \boxed{2x^2}$$

Answer:

$$\frac{2x^3}{2x-x} = \frac{2x^3}{x}$$
 (combine like terms in the denominator)
$$= \frac{2 \times x^2 \times \cancel{x}}{\cancel{x}}$$
 (simplify by canceling common factors)
$$= 2x^2$$

 \mathbf{Ex} 69: Calculate and simplify:

$$4x \times \frac{6x - 2x}{2 \times 8} = \boxed{x^2}$$

Answer:

$$\begin{aligned} 4x \times \frac{6x - 2x}{2 \times 8} &= 4x \times \frac{4x}{16} & \text{(simplify the numerator and the denominator)} \\ &= \frac{4x \times 4x}{16} & \text{(multiply the numerators and denominators)} \\ &= \frac{16x^2}{16} \\ &= \frac{16 \times x^2}{16 \times 1} & \text{(simplify by canceling common factors)} \\ &= x^2 \end{aligned}$$

K.2 CALCULATING ALGEBRAIC EXPRESSIONS

Ex 70: Write as a single fraction:

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

Answer:

2

$$-\frac{x+1}{3} = \frac{2\times3}{3} - \frac{x+1}{3} \quad \text{(common denominator=3)}$$
$$= \frac{6}{3} - \frac{x+1}{3}$$
$$= \frac{6 - (x+1)}{3} \quad \text{(combine fractions with common denominator)}$$
$$= \frac{6 - x - 1}{3} \quad \text{(distribute the negative sign)}$$
$$= \frac{5 - x}{3}$$

Ex 71: Write as a single fraction:

$$3x - \frac{2-x}{4} = \frac{13x-2}{4}$$

Answer:

$$3x - \frac{2-x}{4} = \frac{3x \times 4}{4} - \frac{2-x}{4} \quad (\text{common denominator } =4)$$
$$= \frac{12x}{4} - \frac{2-x}{4}$$
$$= \frac{12x - (2-x)}{4} \quad (\text{combine fractions with common denominator})$$
$$= \frac{12x - 2 + x}{4} \quad (\text{distribute the negative sign})$$
$$= \frac{13x - 2}{4}$$

Ex 72: Write as a single fraction:

$$\frac{x}{2} - \frac{x+1}{3} = \boxed{\frac{x-2}{6}}$$

Answer:

$$\frac{x}{2} - \frac{x+1}{3} = \frac{x \times 3}{2 \times 3} - \frac{(x+1) \times 2}{3 \times 2} \quad (\text{common denominator}=6)$$

$$= \frac{3x}{6} - \frac{2(x+1)}{6} \quad (\text{combine fractions with common denominator})$$

$$= \frac{3x - 2(x+1)}{6} \quad (\text{combine fractions with common denominator})$$

$$= \frac{3x - 2x - 2}{6} \quad (\text{distribute the negative sign})$$

$$= \frac{x-2}{6} \quad (\text{combine like terms})$$

Ex 73: Write as a single fraction:

$$\frac{x+1}{3} - \frac{x+4}{2} = \boxed{\frac{-x-10}{6}}$$

Answer:

$$\frac{x+1}{3} - \frac{x+4}{2} = \frac{(x+1) \times 2}{3 \times 2} - \frac{(x+4) \times 3}{2 \times 3} \quad \text{(common denominator=6)}$$
$$= \frac{2(x+1)}{6} - \frac{3(x+4)}{6}$$
$$= \frac{2(x+1) - 3(x+4)}{6}$$
$$= \frac{2x+2 - 3x - 12}{6} \quad \text{(distribute the negative sign)}$$
$$= \frac{-x - 10}{6} \quad \text{(combine like terms)}$$

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