

Simplification



SIMPLIFICATION

Introduction

While performing simplification greatest care has to be taken to avoid mistakes. Developing ability to calculate is one of the major thrust areas. Developing the calculation speed is very important. Addition perhaps is the critical skill to develop the calculations. Try to practise adding 2 digit numbers to improve the calculation speed. Make sure that you are through with addition before attempting the process of subtraction. The multiplication methods followed in speed maths is useful for fast calculations.

For simplification BODMAS rule depicts the correct sequence in which the operations are to be executed so as to find out the value of a given expression.

B – Bracket, O – Of, D – Division, M – Multiplication, A – Addition, S – Subtraction.

When you simplify an expression, first the brackets have to be removed and then the other operations in the given order.



1. Simplify: $100 + 20 \times 55$

Solution:

$$100 + 20 \times 55 = 100 + 1100 = 1200$$

2. Simplify: $50040 \div 139 - 60$

Solution:

$$= \frac{50040}{139} - 60$$

$$= 360 - 60 = 300$$

$$\begin{array}{r|rrrrr} 13 & 5 & 0 & 0 & 4 & 0 \\ & & 1 & 1 & 5 & \\ \hline & & 3 & 6 & 0 & \end{array}$$

3. Simplify: $\frac{480 \times 15 - 12 \times 20 + 7 \times 60}{140 \times 8 + 2 \times 55}$

Solution:

$$\frac{480 \times 15 - 12 \times 20 + 7 \times 60}{140 \times 8 + 2 \times 55} = \frac{7200 - 240 + 420}{1120 + 110} = \frac{6960 + 420}{1230} = \frac{7380}{1230} = 6$$



4. Simplify $\frac{3}{5}$ of $\frac{4}{7}$ of $\frac{5}{9}$ of $\frac{21}{24}$ of 504.

Solution:

$$\frac{3}{5} \text{ of } \frac{4}{7} \text{ of } \frac{5}{9} \text{ of } \frac{21}{24} \text{ of } 504$$

$$= \frac{3}{5} \times \frac{4}{7} \times \frac{5}{9} \times \frac{21}{24} \times 504$$

$$= 84$$

5. Simplify: $4\frac{1}{2} \times 4\frac{1}{3} - 8\frac{1}{3} \div 5\frac{2}{3}$

Solution:

$$\frac{9}{2} \times \frac{13}{3} - \frac{25}{3} \times \frac{3}{17}$$

$$= \frac{39}{2} - \frac{25}{17} = \frac{663 - 50}{34} = \frac{613}{34} = 18\frac{1}{34}$$



6. Simplify: $0.008 \times 0.01 \times 0.0072 \div (0.12 \times 0.0004)$

Solution:

$$0.008 \times 0.01 \times 0.0072 \div (0.12 \times 0.0004)$$

$$= 0.00008 \times \frac{0.0072}{0.000048}$$

$$= \frac{0.8 \times 0.0072}{0.48} = \frac{8}{10} \times \frac{72}{10000} \times \frac{100}{48} = \frac{12}{1000} = 0.012$$



7. If $3 - [1.6 - \{3.2 - (3.2 + 2.25 \div x)\}] = 0.65$, find the value of x .

Solution:

$$3 - [1.6 - \{3.2 - (3.2 + 2.25 \div x)\}] = 0.65$$

$$\Rightarrow 3 - \left[1.6 - \left\{ 3.2 - \left(3.2 + \frac{2.25}{x} \right) \right\} \right] = 0.65$$

$$\Rightarrow 3 - \left[1.6 - \left(3.2 - 3.2 - \frac{2.25}{x} \right) \right] = 0.65$$

$$\Rightarrow 3 - \left[1.6 + \frac{2.25}{x} \right] = 0.65 \quad \Rightarrow 3 - 1.6 - \frac{2.25}{x} = 0.65$$

$$\Rightarrow 1.4 - \frac{2.25}{x} = 0.65 \quad \Rightarrow \frac{2.25}{x} = 1.4 - 0.65 = 0.75$$

$$\Rightarrow x = \frac{2.25}{0.75} = \frac{225}{75} = 3$$



8. Simplify: $\frac{2 + \frac{1}{3\frac{4}{5}}}{2 + \frac{1}{1 + \frac{1}{4}}}$

Solution:

$$\frac{2 + \frac{1}{3\frac{4}{5}}}{2 + \frac{1}{1 + \frac{1}{4}}} = \frac{2 + \frac{1}{\frac{19}{5}}}{2 + \frac{1}{3 + \frac{1}{5}}} = \frac{2 + \frac{5}{19}}{2 + \frac{1}{3 + \frac{4}{5}}} = \frac{2 + \frac{5}{19}}{2 + \frac{1}{\frac{19}{5}}} = \frac{2 + \frac{5}{19}}{2 + \frac{5}{19}} = 1$$



9. If $\frac{37}{13} = 2 + \frac{1}{x + \frac{1}{y + \frac{1}{z}}}$, where x, y, z are natural numbers, find x, y, z .

Solution:

$$\frac{37}{13} = 2 + \frac{1}{x + \frac{1}{y + \frac{1}{z}}} \Rightarrow \frac{37}{13} = 2 + \frac{1}{x + \frac{1}{y + \frac{1}{z}}}$$

$$\Rightarrow 2 + \frac{11}{13} = 2 + \frac{1}{x + \frac{1}{y + \frac{1}{z}}} \Rightarrow \frac{11}{13} = \frac{1}{x + \frac{1}{y + \frac{1}{z}}} \Rightarrow x + \frac{1}{y + \frac{1}{z}} = \frac{13}{11} = 1 + \frac{2}{11}$$

$$\Rightarrow x = 1, \frac{1}{y + \frac{1}{z}} = \frac{2}{11} \Rightarrow x = 1, y + \frac{1}{z} = \frac{11}{2}$$

$$\Rightarrow x = 1, y + \frac{1}{z} = 5 + \frac{1}{2} \Rightarrow x = 1, y = 5, z = 2$$

$\therefore x, y, z$ are 1, 5, 2.



10. If $4x + 5y = 83$ and $\frac{3x}{2y} = \frac{21}{22}$, find $y - x$.

Solution:

$$\left. \begin{array}{l} 4x + 5y = 83 \\ \frac{3x}{2y} = \frac{21}{22} \end{array} \right\}$$

$$\Rightarrow 66x = 42y \Rightarrow y = \frac{66}{42}x = \frac{11}{7}x$$

$$4x + 5 \times \frac{11}{7}x = 83$$

$$\Rightarrow 28x + 55x = 581$$

$$\Rightarrow 83x = 581 \Rightarrow x = 7$$

$$4x + 5y = 83 \Rightarrow 4 \times 7 + 5y = 83 \Rightarrow 5y = 55 \Rightarrow y = 11$$

$$\therefore y - x = 11 - 7 = 4$$



11. Find the sum

$$\frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \frac{1}{30} + \frac{1}{42} + \frac{1}{56} + \frac{1}{72} + \frac{1}{90} + \frac{1}{110} + \frac{1}{132}$$

Solution:

$$\frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \frac{1}{30} + \frac{1}{42} + \frac{1}{56} + \frac{1}{72} + \frac{1}{90} + \frac{1}{110} + \frac{1}{132}$$

$$= \frac{1}{2} + \frac{1}{2.3} + \frac{1}{3.4} + \frac{1}{4.5} + \frac{1}{5.6} + \frac{1}{6.7} + \frac{1}{7.8} + \frac{1}{8.9} + \frac{1}{9.10} + \frac{1}{10.11} + \frac{1}{11.12}$$

$$= \frac{1}{2} + \left(\frac{1}{2} - \frac{1}{3}\right) + \left(\frac{1}{3} - \frac{1}{4}\right) + \left(\frac{1}{4} - \frac{1}{5}\right) + \left(\frac{1}{5} - \frac{1}{6}\right) + \left(\frac{1}{6} - \frac{1}{7}\right) + \left(\frac{1}{7} - \frac{1}{8}\right) + \left(\frac{1}{8} - \frac{1}{9}\right) + \left(\frac{1}{9} - \frac{1}{10}\right) + \left(\frac{1}{10} - \frac{1}{11}\right) + \left(\frac{1}{11} - \frac{1}{12}\right)$$

$$= \frac{1}{2} + \frac{1}{2} - \frac{1}{12} = 1 - \frac{1}{12} = \frac{11}{12}$$



12. Simplify: $\frac{(856 + 167)^2 + (856 - 167)^2}{856 \times 856 + 167 \times 167}$

Solution:

$$\begin{aligned} & \frac{(856 + 167)^2 + (856 - 167)^2}{856^2 + 167^2} \\ &= \frac{2[856^2 + 167^2]}{856^2 + 167^2} \quad [\text{use the formula } (a + b)^2 + (a - b)^2 = 2(a^2 + b^2)] \\ &= 2 \end{aligned}$$



13. Simplify: $\frac{\left(3\frac{2}{3}\right)^2 - \left(2\frac{1}{2}\right)^2}{\left(4\frac{3}{4}\right)^2 - \left(3\frac{1}{3}\right)^2} \div \frac{3\frac{2}{3} - 2\frac{1}{2}}{4\frac{3}{4} - 3\frac{1}{3}}$

Solution:

$$\begin{aligned} & \frac{\left(3\frac{2}{3}\right)^2 - \left(2\frac{1}{2}\right)^2}{\left(4\frac{3}{4}\right)^2 - \left(3\frac{1}{3}\right)^2} \div \frac{3\frac{2}{3} - 2\frac{1}{2}}{4\frac{3}{4} - 3\frac{1}{3}} = \frac{\left(3\frac{2}{3}\right)^2 - \left(2\frac{1}{2}\right)^2}{\left(4\frac{3}{4}\right)^2 - \left(3\frac{1}{3}\right)^2} \times \frac{\left(4\frac{3}{4}\right) - \left(3\frac{1}{3}\right)}{\left(3\frac{2}{3}\right) - \left(2\frac{1}{2}\right)} \\ & = \frac{3\frac{2}{3} + 2\frac{1}{2}}{4\frac{3}{4} + 3\frac{1}{3}} \quad [\text{using the formula } a^2 - b^2 = (a - b)(a + b)] \\ & = \frac{\frac{11}{3} + \frac{5}{2}}{\frac{19}{4} + \frac{10}{3}} = \frac{\frac{22 + 15}{6}}{\frac{57 + 40}{12}} = \frac{37}{6} \times \frac{12}{97} = \frac{74}{97} \end{aligned}$$



14. Simplify: $\frac{\left(\frac{3}{5}\right)^3 - \left(\frac{2}{5}\right)^3}{\left(\frac{3}{5}\right)^2 - \left(\frac{2}{5}\right)^2}$

Solution:

$$\begin{aligned}\frac{\left(\frac{3}{5}\right)^3 - \left(\frac{2}{5}\right)^3}{\left(\frac{3}{5}\right)^2 - \left(\frac{2}{5}\right)^2} &= \frac{\left[\left(\frac{3}{5}\right) - \left(\frac{2}{5}\right)\right] \left[\left(\frac{3}{5}\right)^2 + \left(\frac{2}{5}\right)^2 + \frac{3}{5} \times \frac{2}{5}\right]}{\left[\left(\frac{3}{5}\right) - \left(\frac{2}{5}\right)\right] \left[\left(\frac{3}{5}\right) + \left(\frac{2}{5}\right)\right]} \\ &= \frac{\frac{9}{25} + \frac{4}{25} + \frac{6}{25}}{\frac{3}{5} + \frac{2}{5}} = \frac{\frac{19}{25}}{\frac{5}{5}} = \frac{19}{25}\end{aligned}$$



Practice Exercise

1. If $\frac{37}{13} = 2 + \frac{1}{x + \frac{1}{y + \frac{1}{z}}}$, where x, y, z are natural

numbers find x, y, z.

2. If $4x + 5y = 83$ and $\frac{3x}{2y} = \frac{21}{22}$, find $y - x$.



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3. Find the sum $\frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \frac{1}{30} + \frac{1}{42} +$
 $\frac{1}{56} + \dots + \frac{1}{132}.$

4. Simplify: $\frac{\left(\frac{3}{5}\right)^3 - \left(\frac{2}{5}\right)^3}{\left(\frac{3}{5}\right)^2 - \left(\frac{2}{5}\right)^2}$

