

Ratio - comparison by division

$\frac{\text{part}}{\text{part}}$

$\frac{\text{part}}{\text{whole}}$

$\frac{\text{whole}}{\text{part}}$

Proportion - two ratios are equal  
cross products are equal

$\frac{2}{3} \times \frac{4}{6} \quad 2 \cdot 6 = 3 \cdot 4$

Rate - ratio that compares different units

5 gal/min  
9.09 m/s  
63 words/min

$$\begin{array}{r} 5 \\ \hline 1 \\ 9.09 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 9. \\ 22 \overline{) 200.0} \\ \underline{\phantom{0}00} \\ 0 \end{array}$$

## How to solve proportions

1) Write the cross products

$$\frac{4}{11} \times \frac{x}{16.5} \quad 11x = 4(16.5)$$

2) Solve the equation

$$\frac{11x}{11} = \frac{66}{11} \quad x = 6$$

$$\frac{7}{12} \times \frac{17.5}{x}$$

$$7x = 12(17.5)$$

$$\frac{7x}{7} = \frac{210}{7}$$

$$x = 30$$

$$\$ \frac{302}{1.70} \times \frac{502}{x}$$

$$3x = 1.70(5)$$

$$\frac{3x}{3} = \frac{8.5}{3}$$

$$x = \$2.83$$

$$\frac{24}{2.5} = \frac{100}{x}$$

$$\frac{2.5}{24} = \frac{100}{x}$$

$$\frac{2.5}{24} = \frac{x}{100}$$

$$\frac{1 \text{ min}}{60 \text{ sec}} = \frac{x \text{ min}}{36 \text{ sec}}$$

percent - a ratio that compares  
a number to 100

$$\frac{5}{100} = 5\%$$

$$\frac{27}{100} = 27\%$$

$$\frac{4}{5} \times \frac{x}{100}$$

$$0.62 = 62\%$$

$$\frac{400}{5} = 5x$$

$$1.35 = 135\%$$

$$80 = x$$

$$1 \frac{35}{100}$$

$$80\%$$

$$0.623 = 62.3\%$$

$$0.00426 = .426\%$$

$$\frac{a}{6} + 9 = 13$$

$$\frac{a}{6} - 9 = -9$$


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$$6 \cdot \frac{a}{6} = 4 \cdot 6$$

$$a = 24$$

$$4b - 1 = 2$$

$$+1 \quad +1$$


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$$4b = 3$$

$$\frac{4b}{4} = \frac{3}{4}$$

$$b = \frac{3}{4}$$

$$2c + 1 = 5$$

$$-1 \quad -1$$

$$2c = 4$$

$$\frac{2c}{2} = \frac{4}{2}$$

$$c = 2$$

$$\frac{d}{3} - 10 = 5$$

$$+10 \quad +10$$

$$3 \cdot \frac{d}{3} = 15 \cdot 3$$

$$d = 45$$

$$\frac{X}{3} - 1 = 14$$


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$$3 \cdot \frac{X}{3} = 15 \cdot 3$$

$$X = 45 \text{ muffins}$$

$$3t + 1 = 14$$


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$$\frac{3t}{3} = \frac{13}{3}$$

$$t = \$4.33$$

$$(0.39)m + \$1.19 = \$3.92$$

$$9x - 2x = -42$$

$$\frac{7x}{7} = \frac{-42}{7}$$

$$x = -6$$

1.0000

1)  $\underline{1x} + \underline{3x} + \underline{1} + \underline{2x}$   
 $1+3+2$   $2x+1$

2)  $\underline{5} + \underline{x} + \underline{3x} + \underline{7}$   $-1+3=2$   
 $5+7=-2$   $2x-2$

3)  $4(3x+1)$   
 $12x+4$

4)  $3(2x-5) - 7x$   
 $6x+15+7x$

5)  $2 + 5(1-2x) + x - 3$   
 $2 + (-5) + 10x + x + 3$   
 $2+5+3=-6$   $-9x-6$

$6x+15$   
 $6x+7$   
 $-x+15$   
 $-x-15$   
 $-10+1$   
 $-9$

$$\underline{4}x + 1 + \underline{-1}x = 19$$

$$4 + (-1) = 3$$

$$\begin{array}{r} 3x + \cancel{1} = 19 \\ \cancel{-1} \quad \quad -1 \end{array}$$

$$\begin{array}{r} \cancel{3}x = \cancel{18} \\ \cancel{3} \quad \quad \quad 3 \end{array}$$

$$x = 6$$



$$15 = x - 7x$$

$$1 - 7 = -6$$

$$\frac{15}{-6} = \frac{-6x}{-6}$$

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

$$3(n-2) = 36$$

$$\begin{array}{r} 3n - 6 = 36 \\ +6 \quad +6 \\ \hline \end{array}$$

$$\begin{array}{r} 3n = 42 \\ \hline n = 14 \end{array}$$

$$n = 14$$

$$1.2x + 2.6x = 4.56$$

$$\frac{\cancel{3.8}x}{\cancel{3.8}} = \frac{4.56}{3.8}$$

$$x = 1.2$$

$$\frac{x}{2} - \frac{x}{4} = -\frac{1}{8}$$

$$\frac{4x}{8} - \frac{2x}{8} = -\frac{1}{8}$$

$$\frac{2x}{8} = -\frac{1}{8}$$

$$2x(8) = -1(8)$$

$$\frac{-16x}{-16} = \frac{-8}{-16}$$

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

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

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

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

$$\frac{1}{5}x = 1\frac{3}{5} \cdot 5$$

$$x = 8$$

$$\begin{array}{l} 5 \cdot 1 = 5 \\ 5 \cdot \frac{3}{5} = \frac{15}{5} = 3 \end{array}$$

$$\textcircled{-4}(y-1) = 28$$

$$-4y + \cancel{4} = 28$$

$$\frac{-4y}{-4} = \frac{24}{-4}$$

$$\begin{array}{r} 4x - 9x \\ 4x = 9x + 50 \\ -9x \quad -9x \\ \hline -5x = 50 \\ \hline -5 \quad -5 \\ x = -10 \end{array}$$

$$\begin{aligned} 2x - 9 &= 27 \\ +9 &+ 9 \\ \hline 2x &= 36 \\ \div 2 & \quad \quad \quad \div 2 \\ \hline x &= 18 \end{aligned}$$

$$4+x+\textcircled{0}x=10+x-1$$

$$4+5x=10+x+1$$

$$4=5x-4x+9$$

$$4=1-x$$

$$4-4=1-x-4$$



$$3(2x - 0.3) = 15 - (x + 2)$$

$$6x + 0.9 = 15 + 1x + 2$$

$$6x + 0.9 = 17 + 1x$$

$$6x - 1x + 0.9 - 17 = 17 - 17 + 1x - 1x$$

$$\frac{-13.9}{-7} = \frac{-7}{-7} \quad x = 1.99$$

$$n + 12 = 5n$$

$$\begin{array}{r} 12 \\ - 4n \\ \hline \end{array}$$

$$\begin{array}{r} 12 \\ - 4n \\ \hline 3n \end{array}$$

$$\begin{aligned} -2r + 7 &= r - 8 \\ -3r + 7 &= -8 \\ -\cancel{3}r &= -\frac{15}{\cancel{3}} \quad r = 5 \end{aligned}$$

$$9 - (x - 4) = 3(x - 1)$$

$$9 + (-1)(x - 4) = 3(x - 1)$$

$$9 + -1x + 4 = 3(x - 1)$$

$$9 + -1x + 4 = 3x - 3$$

$$13 + \cancel{-1x} = 3x - 3$$

$$13 = 4x + 3$$

$$\frac{13}{4} = \frac{4x + 3}{4}$$

$$x = 4$$

$$\frac{1}{4}(d+2) = \frac{3}{4}d - 6$$

$$\frac{1}{4}d + \frac{1}{2} = \frac{3}{4}d - 6$$

$$\frac{1}{4}d - \frac{1}{4}d$$

$$\frac{1}{2} = \frac{1}{2}d - 6$$

$$\frac{1}{2} + 6 = \frac{1}{2}d - 6 + 6$$

$$\frac{13}{2} = \frac{1}{2}d$$

$$13 = d$$

$$\begin{array}{r}
 3x + 4 = 4x - 1 \\
 \hline
 3x = 4x - 5 \\
 -4x \quad -4x \\
 \hline
 -x = -5 \\
 \frac{-x}{-1} = \frac{-5}{-1} \\
 x = 5
 \end{array}$$

$$\begin{array}{r}
 \overset{\curvearrowright}{3(x+1)} + 1 = 4x - 1 \\
 3x + 3 + 1 = 4x - 1 \\
 3x + 4 = 4x - 1 \\
 -4x \quad -4x \\
 \hline
 -x + 4 = -1 \\
 -x \quad -4 \\
 \hline
 -x = -5 \\
 \frac{-x}{-1} = \frac{-5}{-1} \\
 x = 5
 \end{array}$$