# Equations with fractions

**Starter**

1. **(Review of last lesson)**

Solve: (a) $5x - 3(x - 1) = 39$ (b) $7 - (x + 1) = 9 + 4(2x - 1)$

***Working:*** (a)

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|---|---|
| | $5x - 3(x - 1) = 39$ |
| ***Expand the brackets:*** | $5x - 3x + 3 = 39$ |
| ***Collect like terms:*** | $2x + 3 = 39$ |
| ***Subtract $3$ from both sides:*** | $2x = 36$ |
| ***Divide both sides by $18$:*** | $x = 18$ |

(b)

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|---|---|
| | $7 - (x + 1) = 9 + 4(2x - 1)$ |
| | $7 - 1(x + 1) = 9 + 4(2x - 1)$ |
| ***Expand the brackets:*** | $7 - x - 1 = 9 + 8x - 4$ |
| ***Collect like terms:*** | $6 - x = 5 + 8x$ |
| ***Add $x$ to both sides:*** | $6 = 5 + 9x$ |
| ***Subtract $5$ from both sides:*** | $1 = 9x$ |
| ***Divide both sides by $8$:*** | $\frac{1}{9} = x$ |
| ***Make sure the unknown is on the LHS:*** | $x = \frac{1}{9}$ |

2. Solve the equation $\frac{2x - 5}{3} = 12$.

***Working:***

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| | $\frac{2x - 5}{3} = 12$ |
| ***Multiply both sides by $3$:*** | $2x - 5 = 36$ |
| ***Add $5$ to both sides:*** | $2x = 41$ |
| ***Divide both sides by $2$:*** | $x = \frac{41}{2} = 20.5$ |

***E.g. 1*** Solve: (a) $\frac{x + 1}{3} = \frac{x - 1}{5}$ (b) $\frac{12}{2x - 3} = \frac{7}{x}$

(c) $\frac{7x + 3}{2} = \frac{2x - 9}{5}$ (d) $\frac{5}{x - 1} = \frac{10}{4x + 3}$

***Working:*** (a)

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|---|---|
| | $\frac{x + 1}{3} = \frac{x - 1}{5}$ |
| ***Cross-multiply:*** | $5(x + 1) = 3(x - 1)$ |
| ***Expand the brackets:*** | $5x + 5 = 3x - 3$ |
| ***Subtract $3x$ from both sides:*** | $2x + 5 = -3$ |
| ***Subtract $5$ from both sides:*** | $2x = -8$ |
| ***Divide both sides by $2$:*** | $x = -4$ |

(b) $\dfrac{12}{2x-3} = \dfrac{7}{x}$

***Cross-multiply:*** $12x = 7(2x-3)$

***Expand the brackets:*** $12x = 14x - 21$

***Subtract*** $12x$ ***from both sides:*** $0 = 2x - 21$

***Add*** $21$ ***from both sides:*** $21 = 2x$

***Divide both sides by*** $2$***:*** $10.5 = x$

***Make sure the unknown is on the LHS:*** $x = \dfrac{21}{2} = 10.5$

(c) $\dfrac{7x+3}{2} = \dfrac{2x-9}{5}$

***Cross-multiply:*** $5(7x+3) = 2(2x-9)$

***Expand the brackets:*** $35x + 15 = 4x - 18$

***Subtract*** $4x$ ***from both sides:*** $31x + 15 = -18$

***Subtract*** $15$ ***from both sides:*** $31x = -33$

***Divide both sides by*** $2$***:*** $x = -\dfrac{33}{31}$

(d) $\dfrac{5}{x-1} = \dfrac{10}{4x+3}$

***Cross-multiply:*** $5(4x+3) = 10(x-1)$

***Expand the brackets:*** $20x + 15 = 10x - 10$

***Subtract*** $10x$ ***from both sides:*** $10x + 15 = -10$

***Subtract*** $15$ ***from both sides:*** $10x = -25$

***Divide both sides by*** $10$***:*** $x = -2.5$

***E.g. 2*** Solve: (a) $\dfrac{1}{7}(2x-1) = \dfrac{1}{2}x$ (b) $\dfrac{1}{5}(2x-1) = \dfrac{3}{4}(x+7)$

***Working:*** (a) $\dfrac{1}{7}(2x-1) = \dfrac{1}{2}x$

$\dfrac{2x-1}{7} = \dfrac{x}{2}$

***Cross-multiply:*** $2(2x-1) = 7x$

***Expand the brackets:*** $4x - 2 = 7x$

***Subtract*** $4x$ ***from both sides:*** $-2 = 3x$

***Divide both sides by*** $3$***:*** $-\dfrac{2}{3} = x$

***Make sure the unknown is on the LHS:*** $x = -\dfrac{2}{3}$

(b) $\frac{1}{5}(2x-1)=\frac{3}{4}(x+7)$

$\frac{2x-1}{5}=\frac{3(x+7)}{4}$

***Cross-multiply:*** $4(2x-1)=15(x+7)$

***Expand the brackets:*** $8x-4=15x+105$

***Subtract*** $8x$ ***from both sides:*** $-4=7x+105$

***Subtract*** $105$ ***from both sides:*** $-109=7x$

***Divide both sides by*** $7$***:*** $-\frac{109}{7}=x$

***Make sure the unknown is on the LHS:*** $x=-\frac{109}{7}=-15\frac{4}{7}$

***E.g. 3*** Solve: (a) $\frac{3}{4}x+6=18$ (b) $\frac{4}{x}+2=13$

(c) $\frac{2}{3}x+\frac{3}{4}=-\frac{1}{4}$ (d) $\frac{6}{5x}-3=7$

***Working:*** (a) $\frac{3}{4}x+6=18$

$\frac{3x}{4}+6=18$

***Subtract*** $6$ ***from both sides:*** $\frac{3x}{4}=12$

***Multiply both sides by*** $4$***:*** $3x=48$

***Divide both sides by*** $3$***:*** $x=16$

(b) $\frac{4}{x}+2=13$

***Subtract*** $2$ ***from both sides:*** $\frac{4}{x}=11$

***Multiply both sides by*** $x$***:*** $4=11x$

***Divide both sides by*** $3$***:*** $\frac{4}{11}=x$

***Make sure the unknown is on the LHS:*** $x=\frac{4}{11}$

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

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

***Subtract*** $\frac{3}{4}$ ***from both sides:*** $\frac{2x}{3}=-1$

***Multiply both sides by*** $3$***:*** $2x=-3$

***Divide both sides by*** $3$***:*** $x=-\frac{3}{2}$

(d) $\frac{6}{5x} - 3 = 7$

***Add*** $3$ ***to both sides:*** $\frac{6}{5x} = 10$

***Multiply both sides by*** $5x$***:*** $6 = 50x$

***Divide both sides by*** $50$***:*** $\frac{6}{50} = x$

***Make sure the unknown is on the LHS:*** $x = \frac{3}{25}$

**Video:** Linear equations with fractions

Solutions to Starter and E.g.s

**Exercise**

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|---|---|
| 9-1 class textbook: | p161 M6.3 Qu 1-33 odd |
| A*-G class textbook: | p151 M6.3 Qu 1-33 odd |
| 9-1 homework book: | p56 M6.3 Qu 1-23 odd |
| A*-G homework book: | p41 M6.3 Qu 1-23 odd |