

Student Name

Mathematics Stage 5 Core

EQUATIONS A

Book 1 Solve linear equations involving
up to 3 steps

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OVERVIEW

SYLLABUS CONTENT

MA5-EQU-C-01 solves linear equations of up to 3 steps, limited to one algebraic fraction

Solve linear equations involving up to 3 steps

- Solve linear equations using algebraic techniques involving up to 3 steps
- Solve linear equations with pronumerals on both sides of the equation
- Solve linear equations involving grouping symbols
- Verify solutions using substitution

REVIEW OF PRIOR KNOWLEDGE

1 Solve these equations.

a $2p + 5 = 60$

b $2p - 5 = 60$

c $5 + 2p = 60$

d $60 = 2p - 5$

e $60 = -5 + 2p$

f $60 = 5 - 2p$

g $60 = 2(p - 5)$

h $60 = 2(5 - p)$

i $60 = -2(5 - p)$

2 Solve these equations.

a $2x + 5 = x + 8$

b $3x - 6 = 2x + 5$

c $7u = 5u - 20$

d $4g - 2 = 3g + 3$

e $6x = 27 - 3x$

f $5y - 3 = 2y + 7$

3 Expand these brackets and simplify the result, if possible.

a $4(7 - x)$

b $-3(x + 2)$

c $-5(2w - 3)$

d $-2x + 3(x - 4)$

e $-2x - 3(x - 4)$

f $5 - (3 + 2x)$

4 Solve these equations.

a $18 = 5 + 2(x - 4)$

b $7(2g + 5) = 25$

c $5(2x - 4) = -60$

d $2(3x - 1) - 4 = 12$

e $3 - 8(x + 4) = 59$

f $2(5 - m) - 3m = 30$

MULTI-STEP EQUATIONS WITH PRONUMERALS ON BOTH SIDES

- If an equation has pronumerals on both sides, then **move all pronumerals to one side** by adding or subtracting a multiple of x .
 - Move all pronumerals to one side.
You should try to keep the coefficient of x positive, if possible.
 - Solve for x by applying inverse operations to both sides.

Example Solve multi-step equations involving pronumerals on both sides.

$3x + 5 = x + 8$ 1. Move x $-x$ $-x$ $2x + 5 = 8$ 2. Solve -5 -5 $2x = 3$ $\div 2$ $\div 2$ $x = 1.5$	$-3x - 6 = 4x + 5$ 1. Move x $+3x$ $+3x$ $-6 = 7x + 5$ 2. Solve -5 -5 $-11 = 7x$ $\div 7$ $\div 7$ $-\frac{11}{7} = x$
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Solve these equations.

a $3a + 6 = a + 18$

b $4m + 8 = 6m - 2$

c $5 + x = 3 - 3x$

$a = 6$

$m = 5$

$x = -0.5$

d $8x + 3 = 2x + 21$

e $10 - 3t = 2 + 5t$

f $3m - 7 = 8m + 2$

$x = 3$

$t = 1$

$m = -\frac{9}{5}$

1 Fill in the missing numbers.

a

$$\begin{array}{c}
 \boxed{} \left\{ \begin{array}{l} 6a - 5 = 4a + 5 \\ 2a - 5 = 5 \\ 2a = 10 \\ a = 5 \end{array} \right. \boxed{} \\
 \begin{array}{c} +5 \\ \div 2 \end{array} \left\{ \begin{array}{l} \\ \\ \\ \end{array} \right. \begin{array}{c} +5 \\ \div 2 \end{array} \\
 \begin{array}{c} -4a \\ \\ \\ \end{array}
 \end{array}$$

b

$$\begin{array}{c}
 \boxed{} \left\{ \begin{array}{l} 5t + 8 = 8t - 5 \\ 8 = 3t - 4 \\ 12 = 3t \\ 4 = t \end{array} \right. \boxed{} \\
 \begin{array}{c} +4 \\ \div 3 \end{array} \left\{ \begin{array}{l} \\ \\ \\ \end{array} \right. \begin{array}{c} +4 \\ \div 3 \end{array} \\
 \begin{array}{c} -5t \\ \\ \\ \end{array}
 \end{array}$$

2 Solve the following equations.

a

$$7x + 6 = 3x + 22$$

b

$$6x - 3 = 4x + 7$$

c

$$5x - 3 = -4x + 33$$

d

$$8x = 6x + 10$$

e

$$10x + 8 = -8x - 2$$

f

$$-4x + 10 = 2x + 8$$

g

$$-6r + 5 = -2r + 8$$

h

$$-2 + 9b = 4b - 7$$

i

$$-8s - 1 = -7 - 2s$$

j

$$16 + 4x = 12x$$

k

$$18 - 2x = 9 + x$$

l

$$24 - 6x = 14 + 4x$$

3 Solve the following equations. Simplify first.

a

$$5x + 7 - 3 = x - 10$$

b

$$8x + 6 - 2x = 4x + 8$$

c

$$9x + 8 + 2x = 3x - 16$$

d

$$10x + 12 - 2x = 6x + 8 - 4x$$

EQUATIONS WITH BRACKETS AND UNKNOWN ON BOTH SIDES

- If an equation has brackets and pronumerals on both sides, you should expand the brackets.
 - Expand any brackets.
 - Simplify, if possible.
 - Move x to one side.
 - Solve for x by applying inverse operations to both sides.

Example Solve multi-step equations involving pronumerals on both sides.

$4(x + 3) = 7x + 15$ 1. Expand $4x + 12 = 7x + 15$ 3. Move x $-4x \quad -4x$ $12 = 3x + 15$ 4. Solve $-15 \quad -15$ $-3 = 3x$ $\div 3 \quad \div 3$ $-1 = x$	$5(6x + 5) - 12 = 4x + 1$ 1. Expand $30x + 25 - 12 = 4x + 1$ 2. Simplify $30x + 13 = 4x + 1$ 3. Move x $-4x \quad -4x$ $26x + 13 = 1$ 4. Solve $-13 \quad -13$ $26x = -12$ $\div 26 \quad \div 26$ $x = -\frac{6}{13}$
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a $2(2v + 3) = 27 - 3v$
 $4v + 6 = 27 - 3v$

$v = 3$

b $2(4j + 5) = 9j$

$j = 10$

c $7d = 3(2d - 3)$

$d = -9$

d $3(k - 5) = 2(k - 1)$

$k = 13$

e $2(k + 5) + 3 = 3k$

$k = 13$

f $3(5z + 2) - 10z = 16$

$z = 2$

1

a Consider the equation:

$5(2x + 7) = 40$

Solve this equation by:
Dividing by 5 first

Expanding first

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

b Consider the equation:

$6(2x + 7) = 40$

Solve this equation by:
Dividing by 6 first

Expanding first

$x = -\frac{1}{6}$

c Consider the equation:

$5(x + 7) + 6 = 41$

Solve this equation by:
Subtracting 6 first

Expanding first

$x = 0$

d By considering your answers above, how do you know whether to expand first?

You should expand if dividing would lead to a fraction.

2 Solve these equations. For some, it will be easier to expand first.

a $5(2x - 4) = -70$

b $3(x + 1) + 2 = -1$

c $-2(x + 2) - 4 = 4$

d $-8(-5 + 3v) = 54.4$

e $-2(-9e + 7) = 12.2$

f $3(x - 1) - 5 = -11$

$-\frac{3}{5}$

$\frac{131}{90}$

-1

3 Solve these equations by expanding then simplifying first.

a $2(3x - 1) + 4x = 12$

b $2(3x + 1) - 4x = 12$

c $2(3x - 1) - 4 = 12$

d $2(3x - 1) + 4 = 12$

e $18 = 5 + 2(x - 4)$

f $4(x + 6) - 8 = 48$

g $-5(g + 4) + 9 = -41$

h $-7(x + 5) + 4 = -17$

i $6(q + 1) - 5 = -23$

j $-2(x + 2) - 4 = 4$

k $-8(x + 4) - 3 = -59$

l $-2(x - 2) - 7 = -29$

m $5(y + 7) - 2y = 42$

n $4k + 6(3k + 1) = -38$

o $9(3 - n) + n = 7$

p $2(5 - m) - 3m = 30$

4 Solve the following equations. Expand any brackets first.

a $4(w + 3) = 7w + 15$

b $2(2v + 3) = 27 - 3v$

c $2(4j + 5) = 9j$

d $7d = -3(2d - 3)$

e $3(5z + 2) = -2(5z + 8)$

f $3(4 + 2y) = 2(-4 - 2y)$

a $5(2x + 5) = 2x + 13$

b $6(3x + 1) = 4x + 20$

c $3x + 4 = 5(6x + 5) + 60$

d $3x + 4 = 6(5x - 5) + 88$

e $4x - 6 = -8(6x - 7) + 42$

f $8(8x + 5) = 3(6x + 8) + 108$

g $5(4x - 3) = 3(-4x + 4) + 101$

h $-5(-5x + 5) = 7(4x - 8) + 37$

i $7(x - 8) = 4(3x + 5) + 24$

j $5(6x + 7) = 25x + 2(11 - 4x)$

4 Read the example carefully and answer the questions:

Solve:

$$\begin{aligned}4 - 2(x + 2) &= 8 \\4 - 2x + 4 &= 8 \\8 - 2x &= 8 \\-2x &= 0 \\x &= 0\end{aligned}$$



By substituting $x = 0$ into the original equation, show that this solution is incorrect.

Explain the mistake this student made when expanding, then solve the equation correctly.

They didn't correctly expand. $-2(x + 2) = -2x - 4$

5 Solve the following equations:

a $2 - 3(x + 1) = -1$

b $5 - 3(x - 1) = -11$

c $-4 - 2(x + 2) = 4$

0

$\frac{19}{3}$

-6

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Fred tried to solve this equation and made a mistake in Line 2

$$\begin{aligned}4(y + 2) - 3(y + 1) &= -3 && \text{Line 1} \\4y + 8 - 3y + 3 &= -3 && \text{Line 2} \\y + 11 &= -3 && \text{Line 3} \\y &= -14 && \text{Line 3}\end{aligned}$$

Copy the equation in line 1:

Rewrite line 2 correcting his mistake:

$$4y + 8 - 3y - 3 = -3$$

Continue your solution to solve for y

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$$y = -8$$