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EB Education Revision Guide

How to Work with Algebra: Part 5

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What you need to know about Algebra: Part 5

Solving Equations:

- One step equations
- Two step equations
- Letters on both sides
- Equations with brackets
- Equations with fractions

Solving Equations

How to do it:

When you are solving equations you need to find the value of a letter.

To do this you may need to rearrange the equation so the letter, or letters are on one side of the equals sign in the equation (usually the left hand side).

You always need to do the same to the left hand side of the equation as you do to the right hand side of the equation.

To get rid of something from an equation you need to do the opposite.

- The opposite of + is -
- The opposite of x is ÷
- The opposite of x^2 is $\sqrt{x}$

One Step Equations

Example 1:

Solve $x + 8 = 15$

You need to remove 8 from the left hand side to end up with $x =$
The opposite of + is - , so subtract 8.

$$x + 8 = 15$$
$$-8 \quad -8$$
$$x = 7$$

You do the same to the right of the equation as you do to the left, so subtract 8.

Solving Equations

One Step Equations

Example 2:

Solve $6y = 54$

You need to remove 6 from the left hand side to end up with y =
The opposite of x is ÷ so you divide by 6.

$$\begin{array}{rcl} 6y & = & 54 \\ \div 6 & & \div 6 \\ y & = & 9 \end{array}$$

You do the same to the right of the equation as you do to the left, so you divide by 6

Example 3:

Solve $\frac{c}{8} = 5$

You need to remove 8 from the left hand side to end up with c =
The opposite of ÷ is x so you multiply by 8.

$$\begin{array}{c} \frac{c}{8} = 5 \\ \times 8 \quad \times 8 \\ c = 40 \end{array}$$

You do the same to the right of the equation as you do to the left, so you multiply by 8

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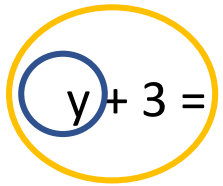
Solving Equations

Which terms should be moved first?

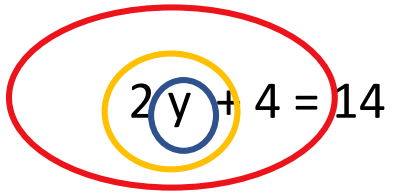
In more complicated equations there is more than 1 step involved. You need to complete these steps in the right order.

Think of it like playing pass the parcel or taking off your shoes and socks – you have to start with the outside layer first.

You need to be left with y =

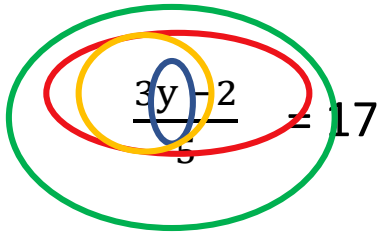


Remove the 3 **- 3**



Remove the 4 first **- 4**

Then remove the 2 **÷ 2**



Remove the 5 first **x 5**

Then remove the -2 **+2**

Finally remove the 3 **÷ 3**

Solving Equations

Two Step Equations

Example 1:

Solve $12x + 4 = 40$

You need to remove +4 and 12 from the left hand side to end up with $x =$
You subtract 4 from both sides, then divide both sides by 12.

$$12x + 4 = 40$$
$$-4 \quad -4$$
$$\div 12 \quad \div 12$$
$$x = 3$$

Example 2:

Solve $\frac{y}{3} - 4 = 5$

You need to remove - 4 and 3 from the left hand side to end up with y =
You add 4 to both sides, then multiply both sides by 3.

$$\frac{y}{3} - 4 = 5$$
$$+4 \quad +4$$
$$\times 3 \quad \times 3$$
$$y = 27$$

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Solving Equations: Letters on both sides

How to do it:

If you get an equation with letters on both sides, you need to get all the letters on one side, and all the numbers on the other side.

Move the letters first.

Then solve as you would one step or two step equations.

Example 1:

Solve $8x - 7 = 4x + 9$

$$8x - 7 = 4x + 9$$
$$-4x \quad\vdots\quad -4x$$

Remove the letters from the right hand side by subtracting $4x$.
Do the same to the left.

$$4x - 7 = 9$$
$$+7 \quad\vdots\quad +7$$
$$\div 4 \quad\vdots\quad \div 4$$
$$x = 4$$

Remove the -7 from the left by adding 7 to both sides.
Remove the 4 from the left by dividing by 4.
Do the same to the right.

Solving Equations: Letters on both sides

How to do it:

Before you get the letters onto one side of the equation, you need to remove the fraction. Do this by multiplying both sides of the equation by 2.

You then need to expand the brackets.

Now you can get the letters on one side, by subtracting d from each side.

To get the numbers on one side, add 14 on both sides.

Example 2:

$$\frac{d+3}{2} = d - 7$$

x 2 | x 2

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

$$d + 3 = 2d - 14$$

– d | – d

+14 | +14

$$17 = d$$

TOP TIP
You need to make sure you multiply every term by the same amount – so both d and -7 need to be multiplied by 2

TOP TIP
17 = d means the same as d = 17

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Solving Equations: Equations with brackets

How to do it:

If there are brackets in an equation, you need to multiply out the brackets before solving the equation.

Example:

Solve $5(y - 2) = 2(2y + 3)$

$$5(y - 2) = 2(2y + 3)$$

$$5y - 10 = 4y + 6$$

$$-4y \quad -4y$$

$$+10 \quad +10$$

$$y = 16$$

Remove -10 from the left hand side by adding 10. Do the same to the right hand side.

Remove the letters from the right hand side by subtracting 4y – do the same to the left.

Solving Equations: Removing fractions

How to do it:

If you ever get an equation to complete with fractions in it, usually the first thing you need to do is remove the fraction.

You need to multiply every term in the equation by the bottom of the fraction (denominator).

If there are 2 fractions – you need to multiply by both denominators.

Example 1:

Solve $\frac{3y-14}{4} = 7$

$$\frac{3y-14}{4} = 7$$

Multiply both sides by 4 to remove the fraction.

$$3y - 14 = 28$$

$$+14 \quad +14$$

$$\div 3 \quad \div 3$$

$$y = 14$$

Follow the usual steps to solve the equation.

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Solving Equations: Removing fractions

How to do it:

Multiply both sides by 3 and then by 2 to remove the fractions.

Multiply out the brackets.

Remove 3p from the right hand side by subtracting 3p. Do the same to the left hand side.

Remove the + 2 from the left hand side by subtracting 2. Do the same the right hand side

Example 2:

Solve $\frac{2p+1}{3} = \frac{p+4}{2}$

$\frac{2p+1}{3}$ (x 2) (x 3) = $2(2p + 1)$

$\frac{p+4}{2}$ (x 2) (x 3) = 3(p+4)

$2(2p + 1) = 3(p + 4)$

$4p + 2 = 3p + 12$

$-3p \quad -3p$

$-2 \quad -2$

$p = 10$

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Your turn:

Set 1:

Solve these equations

1. $2y = 8$
2. $t - 4 = 7$
3. $4w = 20$
4. $b - 6 = 3$
5. $\frac{h}{4} = 3$
6. $3a = 18$

Set 2:

Solve these equations

1. $2t - 5 = 9$
2. $3m + 6 = 15$
3. $4w - 6 = 10$
4. $\frac{h}{4} + 2 = 7$
5. $\frac{p}{7} - 8 = 3$
6. $2a - 5 = 4$

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Your turn:

Set 1:

1. $5y + 1 = 3y + 13$
2. $3y + 10 = 5y + 3$
3. $8n - 3 = 2n + 39$
4. $5(t - 3) = 25$
5. $4(5y - 3) = 48$

Set 2:

1. $\frac{10+2y}{3} = 7$
2. $\frac{9a-15}{4} = 2a + 3$
3. $3(2d - 1) - 2(d - 4) = 19$
4. $\frac{4(3y-2)}{3} + 2y = 4(1 - y)$
5. $\frac{y-4}{3} = \frac{2y-3}{5}$

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Answers:

Set 1:

1. y = 4
2. t = 11
3. w = 5
4. b = 9
5. h = 12
6. a = 6

Set 2:

1. t = 7
2. m = 3
3. w = 4
4. h = 20
5. p = 77
6. a = 4.5

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Answers:

Set 1:

1. y = 6

5y + 1 = 3y + 13
Minus 3y Minus 1 from both sides
2y = 12

2. y = 3.5

3y + 10 = 5y + 3
Minus 3y Minus 3 from both sides
7 = 2y

3. n = 7

8n – 3 = 2n + 39
Minus 2n Add 3 to both sides
6n = 42

4. t = 8

5(t – 3) = 25 5t – 15 = 25
Add 15 Divide by 5 on both sides
OR
5(t-3) = 25
Divide by 5 on both sides
t- 3 = 5

5. y = 3

4(5y – 3) = 48
20y – 12 = 48
Add 12 Divide by 20 on both sides
OR
4(5y – 3) = 48
Divide by 4 on both sides
5y – 3 = 12

Set 2:

1. y = 5.5

$(10+2y)/3 = 7$
Multiply by 3
10 + 2y = 21
Minus 10 Divide by 2 both sides

2. a = 27

$(9a-15)/4 = 2a + 3$
Multiply by 4
9a - 15 = 8a + 12
Minus 8a Add 15 on both sides

3. d = 3.5

3(2d – 1) – 2(d – 4) = 19
6d – 3 – 2d + 8 = 19
4d +5 = 19
Subtract 5 Divide by 4 on both sides

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Answers:

Set 2:

4. $y = \frac{2}{3}$

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

Expand brackets

$\frac{12y-8}{3} + 2y = 4 - 4y$

Multiply every term by 3
$12y - 8 + 6y = 12 - 12y$

Add 12y Add 8 to both sides
$30y = 20$

Divide both sides by 30

Set 2:

5. y = -11

$\frac{y-4}{3} = \frac{2y-3}{5}$

Multiply by both denominators
$\frac{y-4}{3}$ x 3 x 5 = 5y – 20
$\frac{2y-3}{5}$ x 3 x 5 = 6y – 9

5y – 20 = 6y – 9
Subtract 5y Add 9 on both sides

-11 = y

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For more help and resources, or to work with us as a tutor, please contact us

www.ebeducationservices.co.uk

contact@ebeducationservices.co.uk

0161 442 5270

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