Solving Equations

Students often are asked to solve equations. Frequently these are organised with a missing number that needs to be correctly found. Solving equations is something that many children find to be tricky.

Why is this?

$$\square - 20 = 5$$

In this example the answer is 25. **A significant number of children however would incorrectly think the answer is 15**.

So finding a solution may seem simple to an adult (parent / teacher) and because of this, sometimes children / students are asked to solve equations without any guidance. A better idea is to solve several equations with the child / student first and talk about a strategy (or strategies) that could be used to find the missing number in each case.

Children will then be able to independently solve equations on their own (with a bank of strategies to help them) rather than approach them blindly.

So what are some strategies?

Firstly, and most importantly, an important strategy is to give children lots of opportunities to express an equality in related ways. So for example, a number fact is that $14 + 6 = 20$.

How else can we express this? $6 + 14 = 20$ $20 - 14 = 6$ and $20 - 6 = 14$

Another fact is that $3 \times 4 = 12$. This means that $4 \times 3 = 12$ $12 \div 4 = 3$ and $12 \div 3 = 4$

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Secondly, being very familiar with expressing equations in related ways (as explained above) and knowing that there is a link between **addition and subtraction** (and that **multiplication and division** are linked) can be very useful in solving equations.

$$12 + \square = 20$$

We can use **subtraction** to solve this type of **addition** equation.

$20 - 12$ will give us the missing number 8

$$\square - 3 = 12$$

We can use **addition** to solve this type of **subtraction** equation.

$12 + 3$ will give us the missing number 15

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Solving Equations

$$18 - \square = 7$$

We can use **subtraction** to solve this type of subtraction equation (by switching the numbers).

18 – 7   will give us the missing number 11

$$\square \div 3 = 5$$

We can use **multiplication** to solve this type of **division** equation.

5 x 3 will give us the missing number 15

$$14 \div \square = 7$$

We can also use **multiplication** to solve this type of **division** equation.

Think to ourselves "7 times something is 14. The answer is 7 times 2 = 14"

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Thirdly, children need to understand that when we write a simple subtraction equation, the largest number will come first.   So   **12** – 4 = 8   **20** – 11 = 9   **100** – 20 = 80

The first number in each simple subtraction equation above, is the largest number in the equation.

Let's look at this example again.

$$\square - 20 = 5$$

If children at first incorrectly thought the answer was 15 (because they thought they could find an answer by calculating 20 – 5) then they would look at the equation **15** – 20 = 5 and realise that the largest number isn't the first number! Having realised their mistake they could try calculating the answer again using a different strategy. A child not aware of this fact may not realise their mistake.

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Solving Equations

Fourthly, the same fact applies with division. When we write a simple division equation, the largest number will come first. So **20** ÷ 5 = 4 **21** ÷ 3 = 7 **50** ÷ 10 = 5

The first number in each simple division equation above, is the largest number in the equation.

Let's look at this example.

$$\square \div 8 = 2$$

The correct answer is 16. If children at first incorrectly thought the answer was 4 (because they thought they could find an answer by calculating 8 ÷ 2) then they would look at the equation **4** ÷ 8 = 2 and realise that the largest number isn't the first number! Having realised their mistake they could try calculating the answer again using a different strategy. A child not aware of this fact may not realise their mistake.

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Another strategy is to solve a 'simpler problem' than the actual problem and use the information from this to solve the harder one.

Here's an example. A child may be asked to solve this: $\square - 6 = 30$

The child may not be sure how to solve it. *"Do I add?"* *"Do I take away?"*

So the strategy is, write a similar equation using much smaller numbers. For example $3 - 2 = 1$

Then make it look just like the harder question eg $\boxed{3} - 2 = 1$

From here, we work out what to do to solve the question. ie I would add 1 + 2 to get 3

Now we know how to solve the original question $\square - 6 = 30$

We will add 30 and 6 to get an answer of 36.

This strategy is a very, very useful one once children are familiar with what to do.

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Solving Equations

Sometimes the equations children solve may not be in the 'simple' format. In this case, they need an understanding of the balance which exists between the left and right sides of the 'equals' sign.

Here's an example

$$\square \times 4 = 2 + 10$$

To solve the equation, children would learn (in this example) that firstly they need to work out the right side of the equation: $2 + 10 = 12$.

So really the equation now is

$$\square \times 4 = 12$$

The answer is 3.

It may seem obvious to an adult however it won't necessarily be obvious to children. It's important to demonstrate that we are creating a balance on the left and right side of the '=' sign. If the right side has a value of 12, we need to make the left side have a value of 12 as well.

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Equations

A simple equation can be expressed in related ways. Here are two examples:

12 + 8 = 20 can be expressed as 8 + 12 = 20 20 — 8 = 12 and 20 — 12 = 8

7 x 2 = 14 can be expressed as 2 x 7 = 14 14 ÷ 7 = 2 and 14 ÷ 2 = 7

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Express each of these equations in related ways:

15 + 3 = 18 therefore ...... + ... = ... — ...... = ... and ...... — ...... = ...

14 + 6 = 20 therefore ...... + ... = ... — ...... = ... and ...... — ...... = ...

20 — 9 = 11 therefore ...... — ...... = ... + ... = ... and ...... + ... = ...

17 — 8 = 9 therefore ...... — ...... = ... + ... = ... and ...... + ... = ...

5 x 6 = 30 therefore ...... x ...... = ... ÷ ...... = ... and ...... ÷ ...... = ...

7 x 4 = 28 therefore ...... x ...... = ... ÷ ...... = ... and ...... ÷ ...... = ...

18 ÷ 3 = 6 therefore ...... ÷ ...... = ... x ...... = ... and ...... x ...... = ...

24 ÷ 6 = 4 therefore ...... ÷ ...... = ... x ...... = ... and ...... x ...... = ...

14 + 9 = 23 therefore ...... + ... = ... — ...... = ... and ...... — ...... = ...

40 — 21 = 19 therefore ...... — ...... = ... + ... = ... and ...... + ... = ...

8 x 5 = 40 therefore ...... x ...... = ... ÷ ...... = ... and ...... ÷ ...... = ...

56 ÷ 8 = 7 therefore ...... ÷ ...... = ... x ...... = ... and ...... x ...... = ...

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Equations

A simple equation can be expressed in related ways. Here are two examples:

20 − 17 = 3 can be expressed as 20 − 3 = 17 17 + 3 = 20 and 3 + 17 = 20

12 ÷ 2 = 6 can be expressed as 12 ÷ 6 = 2 2 x 6 = 12 and 6 x 2 = 12

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Express each of these equations in related ways:

19 + 6 = 25 therefore ...... + ... = ... — ...... = ... and ...... — ...... = ...

13 + 9 = 22 therefore ...... + ... = ... — ...... = ... and ...... — ...... = ...

30 — 17 = 13 therefore ...... — ...... = ... + ... = ... and ...... + ... = ...

21 — 5 = 16 therefore ...... — ...... = ... + ... = ... and ...... + ... = ...

4 x 9 = 36 therefore ...... x ...... = ... ÷ ...... = ... and ...... ÷ ...... = ...

5 x 7 = 35 therefore ...... x ...... = ... ÷ ...... = ... and ...... ÷ ...... = ...

42 ÷ 6 = 7 therefore ...... ÷ ...... = ... x ...... = ... and ...... x ...... = ...

18 ÷ 2 = 9 therefore ...... ÷ ...... = ... x ...... = ... and ...... x ...... = ...

12 + 7 = 19 therefore ...... + ... = ... — ...... = ... and ...... — ...... = ...

60 — 24 = 36 therefore ...... — ...... = ... + ... = ... and ...... + ... = ...

3 x 9 = 27 therefore ...... x ...... = ... ÷ ...... = ... and ...... ÷ ...... = ...

48 ÷ 6 = 8 therefore ...... ÷ ...... = ... x ...... = ... and ...... x ...... = ...

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Equations

Work out the missing numbers in each of these equations:

14 − ☐ = 11	20 − ☐ = 5	31 − ☐ = 25
12 + ☐ = 30	24 + ☐ = 35	9 + ☐ = 22
3 x ☐ = 18	5 x ☐ = 20	4 x ☐ = 12
24 ÷ ☐ = 6	16 ÷ ☐ = 8	30 ÷ ☐ = 6
☐ − 6 = 12	☐ − 10 = 15	☐ − 8 = 32
☐ + 9 = 30	☐ + 2 = 29	☐ + 15 = 21
☐ x 2 = 22	☐ x 4 = 16	☐ x 3 = 21
☐ ÷ 4 = 20	☐ ÷ 3 = 12	☐ ÷ 6 = 2

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Equations

Work out the missing numbers in each of these equations:

19 – □ = 4	30 – □ = 9	25 – □ = 19
15 + □ = 40	21 + □ = 32	7 + □ = 20
4 x □ = 32	5 x □ = 25	3 x □ = 18
40 ÷ □ = 8	36 ÷ □ = 6	24 ÷ □ = 4
□ – 9 = 10	□ – 20 = 4	□ – 5 = 28
□ + 6 = 30	□ + 3 = 31	□ + 14 = 26
□ x 7 = 21	□ x 5 = 45	□ x 4 = 20
□ ÷ 3 = 15	□ ÷ 2 = 14	□ ÷ 5 = 5