Worksheet - Solving linear equations

Year: Year 8 · 20

Show your working.

Question 1

Question 1 – One-step and two-step equations *(Section A · Skills practice)*

Solve each equation. Show every line of working and check each answer by substituting it back.

a. $x + 9 = 17$
b. $5x = 45$
c. $3x - 4 = 11$
d. $\frac{x}{4} + 2 = 6$
e. $7 - 2x = 1$

Question 2

Question 2 – Equations with brackets *(Section A · Skills practice)*

Expand the brackets first (or divide), then solve.

a. $2(x + 3) = 18$
b. $4(x - 5) = 12$
c. $3(2x + 1) = 27$
d. $5(x - 2) + 3 = 18$

Question 3

Question 3 – Unknowns on both sides *(Section A · Skills practice)*

Collect the x terms on one side. A good habit is to subtract the smaller x term.

a. $5x + 3 = 2x + 18$
b. $7x - 4 = 3x + 12$
c. $4x + 9 = x - 6$
d. $2(x + 4) = x + 11$

Question 4

Question 4 – Equations with fractions *(Section A · Skills practice)*

Multiply every term by the denominator to remove the fraction.

a. $\frac{x}{3} = 7$
b. $\frac{x+4}{5} = 3$
c. $\frac{2x}{3} - 1 = 5$
d. $\frac{x}{2} + \frac{x}{3} = 10$

Question 5

Question 5 – Negative answers and fractional answers *(Section A · Skills practice)*

Solve each equation. Some answers are negative or are fractions.

a. $2x + 3 = x - 4$
b. $3x + 5 = 2$
c. $5 - 4x = 17$
d. $8x + 1 = 3x + 4$

Question 6

Question 6 – Forming and solving a simple equation *(Section A · Skills practice)*

Write an equation for each statement and solve it.

a. I think of a number, multiply it by 4 and subtract 7. The answer is 29.
b. Add 5 to a number and double the result. The answer is 24.
c. A number is increased by 12, which gives three times the original number.
d. Three consecutive whole numbers add up to 51.

Question 7

Question 7 – Buying cinema tickets *(Section B · Real-life practice)*

A family goes to the cinema. Adult tickets cost £5 each. Child tickets cost £3 each. The family has 2 adults and c children and spends £19 altogether.

a. Write an equation for the total cost.
b. Solve it to find c.
c. Another family has 3 adults and c children and spends £30. Form and solve an equation.
d. A group of equal numbers of adults and children spends £56. How many adults are in the group?

Question 8

Question 8 – Comparing van hire *(Section B · Real-life practice)*

Two companies hire out vans. Company A charges £20 plus £5 per hour. Company B charges £8 plus £8 per hour.

a. Write an expression for each company's charge for h hours.
b. Form an equation and solve it to find when the charges are the same.
c. What is the charge at that time?
d. Mia needs the van for 6 hours. Which company should she choose, and how much will she save?

Question 9

Question 9 – The school trip *(Section B · Real-life practice)*

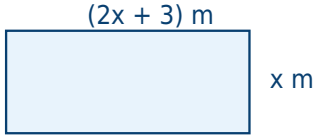
A coach company charges £150 to hire a coach plus an extra £4 for each pupil over 20. A school pays £210.

a. Let p be the number of pupils over 20. Write an equation.
b. Solve it.
c. How many pupils went on the trip?
d. The following year the cost per pupil is shared equally and each pays £7. How many pupils pay for a trip costing £210?

Question 10

Question 10 – Fencing a rectangular garden *(Section B · Real-life practice)*

A rectangular garden has length $(2x + 3)$ metres and width x metres. The perimeter is 36 metres.



a. Write an equation for the perimeter and simplify it.
b. Solve the equation to find x.
c. Find the length and width of the garden.
d. Find the area of the garden.
e. Fencing costs £9.50 per metre. How much does it cost to fence the garden?

Question 11

Question 11 – Temperature and time *(Section B · Real-life practice)*

A pizza oven is heating up. The temperature is $T = 60 + 15m$ degrees Celsius after m minutes. A pizza needs 240°C.

a. How many minutes does it take to reach 240°C?
b. The oven switches off and the temperature falls by 20°C each minute from

240°C. After how many minutes is it 100°C?
c. Another oven starts at 100°C and heats by 10°C each minute. When do the two ovens have the same temperature?
d. What is that temperature?

Question 12

Question 12 – The mobile phone plan *(Section B · Real-life practice)*

Fatima's phone plan costs £12 per month plus 8p for every text message over her allowance. In March her bill was £16.40.

a. Write an equation using t for the number of extra texts. Remember to use pounds or pence consistently.
b. Solve it.
c. In April she sent 30 fewer extra texts. How much was her bill?
d. Her friend pays £10 plus 12p per extra text. How many extra texts make the two bills equal, and what is the bill?

Question 13

Question 13 – Pocket money *(Section B · Real-life practice)*

Tom has £35 and saves £6 every week. Jess has £80 and spends £3 every week.

a. Write expressions for how much each has after w weeks.
b. After how many weeks do they have the same amount?
c. How much do they each have then?
d. After how many weeks does Jess have less than £20?

Question 14

Question 14 – Saving for a bike *(Section B · Real-life practice)*

Noah wants a bike that costs £189. He has £45 saved. He earns £12 each week from a paper round and spends £3 each week on sweets.

a. Write an expression for the amount he has saved after w weeks.
b. Form and solve an equation to find when he has exactly £189.
c. His uncle gives him £30 as a present. How many weeks does he now need?
d. Noah says "I will have saved £189 after 15 weeks." Is he correct? Explain.

Question 15

Question 15 – Think of a number puzzles *(Section C · Problem solving)*

Three pupils set puzzles using equations. Write an equation for each puzzle and solve it.

a. Ali: "I think of a number, multiply it by 3, then add 8. This is the same as multiplying the number by 5 and subtracting 6."
b. Bea: "I add 4 to a number and multiply by 5. This gives the same answer as multiplying the number by 3 and adding 30."
c. Cal: "The sum of my number and half my number is 27."
d. Dev says that the answer to Ali's puzzle is a negative number. Is he right?

Question 16

Question 16 – Spot the mistake *(Section C · Problem solving)*

Four pupils solved $4(x-3)=2x+6$. Their final answers are shown.

Pupil	Answer
Ali	$x=9$
Bea	$x=-3$
Cal	$x=3$
Dev	$x=\frac{9}{2}$

a. Solve the equation correctly.
b. Check the correct answer by substituting.
c. Find the mistake each of the other pupils might have made.

Question 17

Question 17 – Angles in a triangle *(Section C · Problem solving)*

The angles of a triangle are x, $2x+10$ and $3x-10$ degrees.

a. Write an equation using the angle sum of a triangle.
b. Solve it.
c. Find the three angles.
d. What type of triangle is it?
e. Another triangle has angles y, y and $2y+20$. Find them.

Question 18

Question 18 – Equal areas *(Section C · Problem solving)*

A rectangle measures $(x+4)$ cm by 5 cm. A square has side $(x-1)$ cm. Their perimeters are equal.

a. Write an equation for the perimeters.
b. Solve it for x.
c. Find the side of the square and the dimensions of the rectangle.
d. Compare the areas of the two shapes.

Question 19

Question 19 – Ticket sales *(Section C · Problem solving)*

A school play sold 240 tickets. Adult tickets cost £6 and child tickets cost £4. The total income was £1 180.

a. Let a be the number of adult tickets. Write the number of child tickets in terms of a.
b. Form an equation for the total income.
c. Solve it to find a.
d. How many child tickets were sold?

Question 20

Question 20 – Challenge: algebraic age puzzle *(Section D · Challenge)*

Ben is x years old. His mother is 4 times his age. In 6 years' time his mother will be 3 times his age then.

a. Write expressions for their ages in 6 years.
b. Form an equation.
c. Solve it to find Ben's age now.
d. How old is his mother now, and how old will she be in 6 years?