

Level 2 algebra – solutions

Stage 1: manipulate expressions with several connected steps.



Name _____

Date _____

Worked solutions

Each card preserves the worksheet order and shows the essential algebra.

1. Simplify $4x^2 - 3x + 7 + 2x^2 + 5x - 9$.

Solution

$$= 6x^2 + 2x - 2$$

2. Expand and simplify $3(2x-5) - 2(x+4)$.

Solution

$$\begin{aligned} &= 6x - 15 - 2x - 8 \\ &= 4x - 23 \end{aligned}$$

3. Expand $(x+4)(x-3)$.

Solution

$$\begin{aligned} &= x^2 - 3x + 4x - 12 \\ &= x^2 + x - 12 \end{aligned}$$

4. Expand and simplify $(2x-5)^2$.

Solution

$$= 4x^2 - 20x + 25$$

5. Simplify $\frac{18a^5b^3}{6a^2b}$.

Solution

$$\begin{aligned} &= 3a^{5-2}b^{3-1} \\ &= 3a^3b^2 \end{aligned}$$

6. Factorise fully $6y^2 - 15y$.

Solution

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

7. Factorise $x^2 - 9x + 20$.

Solution

$$= (x-4)(x-5)$$

8. Factorise $3x^2 + 11x + 6$.

Solution

$$\begin{aligned} &= 3x^2 + 9x + 2x + 6 \\ &= (3x+2)(x+3) \end{aligned}$$

9. Factorise $9p^2 - 16$.

Solution

$$= (3p-4)(3p+4)$$

10. Simplify $\frac{x^2-9}{x+3}$.

Solution

$$\begin{aligned} &= \frac{(x-3)(x+3)}{x+3} \\ &= x-3, \quad x \neq -3 \end{aligned}$$

11. Simplify $\frac{2x^2-8x}{2x}$.

Solution

$$\begin{aligned} &= \frac{2x(x-4)}{2x} \\ &= x-4, \quad x \neq 0 \end{aligned}$$

12. Simplify $\frac{x^2-5x+6}{x^2-4}$.

Solution

$$\begin{aligned} &= \frac{(x-2)(x-3)}{(x-2)(x+2)} \\ &= \frac{x-3}{x+2}, \quad x \neq \pm 2 \end{aligned}$$

Level 2 algebra – solutions



Stage 2: solve equations, systems, inequalities, and justify patterns.

Name _____

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Equivalent valid methods are accepted; these cards model efficient working.

13. Solve $7x - 5 = 3x + 19$.

Solution

$$4x = 24$$
$$x = 6$$

14. Solve $4(2x - 3) = 5x + 9$.

Solution

$$8x - 12 = 5x + 9$$
$$x = 7$$

15. Solve $\frac{3x - 2}{4} - \frac{x + 1}{2} = 5$.

Solution

$$3x - 2 - 2x - 2 = 20$$
$$x = 24$$

16. Solve $5 - 2(3x + 1) = 4(x - 3)$.

Solution

$$3 - 6x = 4x - 12$$
$$x = \frac{3}{2}$$

17. Solve $\frac{5}{x - 1} = 2$.

Solution

$$5 = 2x - 2$$
$$x = \frac{7}{2}$$

18. Solve $x^2 - 7x + 12 = 0$.

Solution

$$= (x - 3)(x - 4)$$
$$x = 3 \text{ or } 4$$

19. Solve $2x^2 + 7x - 4 = 0$.

Solution

$$= (2x - 1)(x + 4)$$
$$x = \frac{1}{2} \text{ or } -4$$

20. Solve $3(x - 2)(x + 1) = 18$.

Solution

$$x^2 - x - 8 = 0$$
$$x = \frac{1 \pm \sqrt{33}}{2}$$

21. Solve $2x + y = 11$ and $x - y = 1$.

Solution

$$3x = 12 \Rightarrow x = 4$$
$$y = 3$$

22. Solve $3x - 2y = 4$ and $2x + 3y = 13$.

Solution

$$13x = 38 \Rightarrow x = \frac{38}{13}$$
$$y = \frac{31}{13}$$

23. Solve $5 - 2x \leq 3x + 20$.

Solution

$$-15 \leq 5x$$
$$x \geq -3$$

24. Show three consecutive evens sum to a multiple of 6.

Solution

$$2n + (2n + 2) + (2n + 4)$$
$$= 6n + 6 = 6(n + 1)$$

Level 2 algebra – solutions



Stage 3: connect negative and fractional indices to formula rearrangement.

Name _____

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Final forms use positive indices and principal roots where the question specifies them.

25. Simplify $x^{-3} \times x^7$.

Solution

$$= x^4$$

26. Simplify $\frac{a^{5/2}}{a^{-1/2}}$.

Solution

$$= a^{5/2+1/2} = a^3$$

27. Simplify $(8m^6n^{-3})^{2/3}$.

Solution

$$\begin{aligned} &= 4m^4n^{-2} \\ &= \frac{4m^4}{n^2} \end{aligned}$$

28. Evaluate $81^{-3/4}$.

Solution

$$\begin{aligned} &= (3^4)^{-3/4} = 3^{-3} \\ &= \frac{1}{27} \end{aligned}$$

29. Solve $x^{3/2} = 64$, where $x \geq 0$.

Solution

$$\begin{aligned} x &= 64^{2/3} \\ x &= 16 \end{aligned}$$

30. Solve $x^{-1/2} = \frac{1}{5}$, where $x > 0$.

Solution

$$\begin{aligned} \frac{1}{\sqrt{x}} &= \frac{1}{5} \\ x &= 25 \end{aligned}$$

31. Simplify $\left(\frac{x^{-2}y^{1/2}}{x^{1/2}y^{-1}}\right)^2$.

Solution

$$\begin{aligned} &= (x^{-5/2}y^{3/2})^2 \\ &= \frac{y^3}{x^5} \end{aligned}$$

32. Simplify $\frac{(4a^{-2}b^3)^{1/2}}{2a^{-1}b^{-1/2}}$.

Solution

$$\begin{aligned} &= \frac{2a^{-1}b^{3/2}}{2a^{-1}b^{-1/2}} \\ &= b^2 \end{aligned}$$

33. Make t the subject: $v = u + at$.

Solution

$$\begin{aligned} v - u &= at \\ t &= \frac{v - u}{a} \end{aligned}$$

34. Make r the subject: $A = \pi r^2$.

Solution

$$\begin{aligned} r^2 &= \frac{A}{\pi} \\ r &= \sqrt{\frac{A}{\pi}} \end{aligned}$$

35. Make x the subject: $y = \frac{3x - 5}{2x + 1}$.

Solution

$$\begin{aligned} 2xy + y &= 3x - 5 \\ x &= \frac{y + 5}{3 - 2y} \end{aligned}$$

36. Make L the subject: $T = 2\pi\sqrt{\frac{L}{g}}$.

Solution

$$\begin{aligned} T^2 &= 4\pi^2 L/g \\ L &= \frac{gT^2}{4\pi^2} \end{aligned}$$

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Stage 4: combine methods in unfamiliar, multi-step algebra.



Name _____

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Restrictions and rejected solutions are part of a complete solution.

37. Make a the subject: $k = \frac{3a - b}{2a + b}$.

Solution
$$a = \frac{b(k+1)}{3-2k}$$

40. Solve $\frac{x+1}{x-2} = \frac{4}{x}$.

Solution
$$x = \frac{3 \pm \sqrt{41}}{2}$$

43. Show the expression is a multiple of 6.

Solution
$$= 6(3n^2 + 4n + 4)$$

46. Make x the subject: $\frac{1}{y} = \frac{1}{x} + \frac{1}{c}$.

Solution
$$x = \frac{cy}{c-y}$$

38. Make b the subject: $P = ka^{-1/2}b^{3/2}$.

Solution
$$b = \left(\frac{P\sqrt{a}}{k} \right)^{2/3}$$

41. Simplify $\frac{2x^2 + x - 3}{5x^2 - 3x - 2}$.

Solution
$$= \frac{2x+3}{5x+2}, x \neq 1, -\frac{2}{5}$$

44. Rectangle area 90; find $x > 0$.

Solution
$$3x^2 + 13x - 100 = 0 \Rightarrow x = 4$$

47. Solve $\sqrt{x+5} = x-1$.

Solution
$$x = 4; \text{reject } -1$$

39. Solve $4(x-2)(x+3) = 24$.

Solution
$$x = -4 \text{ or } 3$$

42. Solve $9^x = 27$.

Solution
$$x = \frac{3}{2}$$

45. Make a the subject: $s = ut + \frac{1}{2}at^2$.

Solution
$$a = \frac{2(s-ut)}{t^2}$$

48. Make x the subject: $Q = (ax^{-1/2} + b)^3$.

Solution
$$x = \frac{a^2}{(\sqrt[3]{Q} - b)^2}$$