MATHTEACH: Algebraic Thinking

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Name: _____ Date: _____ Score: / 30

Learning Objectives

- Identify and extend number patterns
- Evaluate algebraic expressions by substitution
- Solve one- and two-step equations
- Represent relationships with tables, graphs, and equations

Simplify each expression completely. Show all steps and circle your final answer.

Number patterns & sequences

1. An arithmetic sequence has first term a_1 = 4 and common difference d = 2. Find the 9th term.

$a_1 = 4,\ d = 2,\ n = 9$

Answer: _____

2. Find the common difference d of the arithmetic sequence: 2, 9, 16, ...

$2,\ 9,\ 16,\ \ldots$

Answer: _____

3. An arithmetic sequence has first term a_1 = 20 and common difference d = 8. Find the 8th term.

$a_1 = 20,\ d = 8,\ n = 8$

Answer: _____

4. Find the common difference d of the arithmetic sequence: 4, 14, 24, ...

$4,\ 14,\ 24,\ \ldots$

Answer: _____

5. An arithmetic sequence has first term a_1 = 16 and common difference d = 2. Find the 15th term.

$a_1 = 16,\ d = 2,\ n = 15$

Answer: _____

6. Find the common difference d of the arithmetic sequence: 8, 15, 22, ...

$8,\ 15,\ 22,\ \ldots$

Answer: _____

Solving one-step equations

7. Solve for x: 5x = 8

$$5x = 8$$

Answer: _____

8. Solve for x: x + 6 = 18

$$x + 6 = 18$$

Answer: _____

9. After earning $5 more, Maria has $35 in all. Write and solve an equation to find how much she started with.

$$x + 5 = 35$$

Answer: _____

10. Solve for x: 2x = 5

$$2x = 5$$

Answer: _____

11. Solve for x: x + 15 = 22

$$x + 15 = 22$$

Answer: _____

12. After earning $4 more, Maria has $33 in all. Write and solve an equation to find how much she started with.

$$x + 4 = 33$$

Answer: _____

13. Solve for x: 2x = 6

$$2x = 6$$

Answer: _____

14. Solve for x: x + 3 = 8

$$x + 3 = 8$$

Answer: _____

15. After earning $17 more, Maria has $42 in all. Write and solve an equation to find how much she started with.

$$x + 17 = 42$$

Answer: _____

Two-step equations

16. Solve for x: 3x + -6 = 3.

$$3x + -6 = 3$$

Answer: _____

17. A plumber charges $37 per hour plus a flat $40 fee. If the total bill is $133, how many hours did the job take? Solve 37x + 40 = 133.

$$37x + 40 = 133$$

Answer: _____

18. Solve for x: 2x + 1 = 8. Check your answer.

$$2x + 1 = 8$$

Answer: _____

19. Solve for x: 5x + -2 = -4.

$$5x + -2 = -4$$

Answer: _____

20. A plumber charges $27 per hour plus a flat $25 fee. If the total bill is $266, how many hours did the job take? Solve 27x + 25 = 266.

$$27x + 25 = 266$$

Answer: _____

21. Solve for x: 4x + -1 = 13. Check your answer.

$$4x + -1 = 13$$

Answer: _____

22. Solve for x: 6x + -7 = -7.

$$6x + -7 = -7$$

Answer: _____

23. A plumber charges $49 per hour plus a flat $27 fee. If the total bill is $175, how many hours did the job take? Solve 49x + 27 = 175.

$$49x + 27 = 175$$

Answer: _____

24. Solve for x: 4x + 6 = 14. Check your answer.

$$4x + 6 = 14$$

Answer: _____

Evaluating expressions

25. Evaluate 8x + 2 when x = 6.

$$8x + 2,\ x = 6$$

Answer: _____

26. A plumber charges $35 per hour plus a $74 service fee. What is the total cost for 5 hours? Evaluate 35x + 74 at x = 5.

$$35x + 74,\ x = 5$$

Answer: _____

27. Evaluate 3x^2 + -4 when x = 5.

$$3x^2 + -4,\ x = 5$$

Answer: _____

28. Evaluate 8x + -1 when x = 4.

$$8x - 1,\ x = 4$$

Answer: _____

29. A plumber charges $56 per hour plus a $32 service fee. What is the total cost for 1 hours? Evaluate 56x + 32 at x = 1.

$$56x + 32,\ x = 1$$

Answer: _____

30. Evaluate 4x^2 + 9 when x = 3.

$$4x^2 + 9,\ x = 3$$

Answer: _____

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ANSWER KEY & SOLUTIONS

Topics: Number patterns & sequences, Two-step equations, Solving one-step equations, Evaluating expressions. All answers verified by independent computation.

Solutions

Number patterns & sequences

1. An arithmetic sequence has first term a_1 = 4 and common difference d = 2. Find the 9th term.

$$a_1 = 4,\ d = 2,\ n = 9$$

→ *Use the formula a_n = a_1 + (n - 1)d.*
→ *a_9 = 4 + (9 - 1)(2).*
→ *= 4 + 8 * 2 = 4 + 16 = 20.*

Answer: $a_9 = 20$

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2. Find the common difference d of the arithmetic sequence: 2, 9, 16, ...

$$2,\ 9,\ 16,\ \ldots$$

→ *Subtract consecutive terms: d = a2 - a1 = 9 - 2 = 7.*
→ *Verify: 9 - 2 = 16 - 9 = 7. The sequence is arithmetic.*

Answer: $d = 7$

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3. An arithmetic sequence has first term a_1 = 20 and common difference d = 8. Find the 8th term.

$$a_1 = 20,\ d = 8,\ n = 8$$

→ *Use the formula a_n = a_1 + (n - 1)d.*
→ *a_8 = 20 + (8 - 1)(8).*
→ *= 20 + 7 * 8 = 20 + 56 = 76.*

Answer: $a_8 = 76$

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4. Find the common difference d of the arithmetic sequence: 4, 14, 24, ...

$$4,\ 14,\ 24,\ \ldots$$

→ *Subtract consecutive terms: d = a2 - a1 = 14 - 4 = 10.*
→ *Verify: 14 - 4 = 24 - 14 = 10. The sequence is arithmetic.*

Answer: $d = 10$

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5. An arithmetic sequence has first term a_1 = 16 and common difference d = 2. Find the 15th term.

$$a_1 = 16,\ d = 2,\ n = 15$$

→ *Use the formula a_n = a_1 + (n - 1)d.*
→ *a_15 = 16 + (15 - 1)(2).*
→ *= 16 + 14 * 2 = 16 + 28 = 44.*

Answer: $a_{15} = 44$

---

6. Find the common difference d of the arithmetic sequence: 8, 15, 22, ...

$$8,\ 15,\ 22,\ \ldots$$

→ *Subtract consecutive terms: d = a2 - a1 = 15 - 8 = 7.*
→ *Verify: 15 - 8 = 22 - 15 = 7. The sequence is arithmetic.*

Answer: $d = 7$

Solving one-step equations

7. Solve for x: 5x = 8

$$5x = 8$$

→ *Divide both sides by 5 to isolate x.*
→ *x = 8 / 5 = 8/5.*

Answer: $x = 8 \div 5 = 8/5$

8. Solve for x: x + 6 = 18

$$x + 6 = 18$$

→ *Subtract 6 from both sides to isolate x.*
→ *x = 18 - 6 = 12.*
→ *Check: 12 + 6 = 18. True.*

Answer: $x = 18 - (6) = 12$

9. After earning $5 more, Maria has $35 in all. Write and solve an equation to find how much she started with.

$$x + 5 = 35$$

→ *Let x = starting amount. Equation: x + 5 = 35.*
→ *Subtract 5 from both sides: x = 35 - 5 = 30.*
→ *Maria started with $30.*

Answer: $x = 35 - (5) = 30$

10. Solve for x: 2x = 5

$$2x = 5$$

→ *Divide both sides by 2 to isolate x.*
→ *x = 5 / 2 = 5/2.*

Answer: $x = 5 \div 2 = 5/2$

11. Solve for x: x + 15 = 22

$$x + 15 = 22$$

→ *Subtract 15 from both sides to isolate x.*
→ *x = 22 - 15 = 7.*
→ *Check: 7 + 15 = 22. True.*

Answer: $x = 22 - (15) = 7$

12. After earning $4 more, Maria has $33 in all. Write and solve an equation to find how much she started with.

$$x + 4 = 33$$

→ *Let x = starting amount. Equation: x + 4 = 33.*
→ *Subtract 4 from both sides: x = 33 - 4 = 29.*
→ *Maria started with $29.*

Answer: $x = 33 - (4) = 29$

13. Solve for x: 2x = 6

$2x = 6$

→ *Divide both sides by 2 to isolate x.*
→ *x = 6 / 2 = 3.*

Answer: $x = 6 \div 2 = 3$

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14. Solve for x: x + 3 = 8

$x + 3 = 8$

→ *Subtract 3 from both sides to isolate x.*
→ *x = 8 - 3 = 5.*
→ *Check: 5 + 3 = 8. True.*

Answer: $x = 8 - (3) = 5$

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15. After earning $17 more, Maria has $42 in all. Write and solve an equation to find how much she started with.

$x + 17 = 42$

→ *Let x = starting amount. Equation: x + 17 = 42.*
→ *Subtract 17 from both sides: x = 42 - 17 = 25.*
→ *Maria started with $25.*

Answer: $x = 42 - (17) = 25$

Two-step equations

16. Solve for x: 3x + -6 = 3.

$$3x + -6 = 3$$

→ *Subtract -6 from both sides: 3x = 9.*
→ *Divide by 3: x = 3.*

Answer: $x = 9 \div 3 = 3$

17. A plumber charges $37 per hour plus a flat $40 fee. If the total bill is $133, how many hours did the job take? Solve 37x + 40 = 133.

$$37x + 40 = 133$$

→ *Subtract $40: 37x = 93. Divide by 37: x = 93/37 hours.*

Answer: $x = 93 \div 37 = 93/37$

18. Solve for x: 2x + 1 = 8. Check your answer.

$$2x + 1 = 8$$

→ *Subtract 1 from both sides: 2x = 7.*
→ *Divide both sides by 2: x = 7/2.*

Answer: $x = 7 \div 2 = 7/2$

19. Solve for x: 5x + -2 = -4.

$$5x + -2 = -4$$

→ *Subtract -2 from both sides: 5x = -2.*
→ *Divide by 5: x = -2/5.*

Answer: $x = -2 \div 5 = -2/5$

20. A plumber charges $27 per hour plus a flat $25 fee. If the total bill is $266, how many hours did the job take? Solve 27x + 25 = 266.

$$27x + 25 = 266$$

→ *Subtract $25: 27x = 241. Divide by 27: x = 241/27 hours.*

Answer: $x = 241 \div 27 = 241/27$

21. Solve for x: 4x + -1 = 13. Check your answer.

$$4x + -1 = 13$$

→ *Subtract -1 from both sides: 4x = 14.*
→ *Divide both sides by 4: x = 7/2.*

Answer: $x = 14 \div 4 = 7/2$

22. Solve for x: 6x + -7 = -7.

$$6x + -7 = -7$$

→ *Subtract -7 from both sides: 6x = 0.*
→ *Divide by 6: x = 0.*

Answer: $x = 0 \div 6 = 0$

23. A plumber charges $49 per hour plus a flat $27 fee. If the total bill is $175, how many hours did the job take? Solve 49x + 27 = 175.

$$49x + 27 = 175$$

→ *Subtract $27: 49x = 148. Divide by 49: x = 148/49 hours.*

Answer: $x = 148 \div 49 = 148/49$

24. Solve for x: 4x + 6 = 14. Check your answer.

$$4x + 6 = 14$$

→ *Subtract 6 from both sides: 4x = 8.*
→ *Divide both sides by 4: x = 2.*

Answer: $x = 8 \div 4 = 2$

Evaluating expressions

25. Evaluate 8x + 2 when x = 6.

$$8x + 2,\ x = 6$$

→ *Substitute x = 6: 8(6) + 2 = 48 + 2 = 50.*

Answer: $8(6) + 2 = 48 + 2 = 50$

26. A plumber charges $35 per hour plus a $74 service fee. What is the total cost for 5 hours? Evaluate 35x + 74 at x = 5.

$$35x + 74,\ x = 5$$

→ *Total = 35(5) + 74 = 175 + 74 = $249.*

Answer: $35(5) + 74 = 175 + 74 = 249$

27. Evaluate 3x^2 + -4 when x = 5.

$$3x^2 + -4,\ x = 5$$

→ *Substitute x = 5: 3(5)^2 + -4 = 3(25) + -4 = 75 + -4 = 71.*

Answer: $3(5)^2 + -4 = 75 + -4 = 71$

28. Evaluate 8x + -1 when x = 4.

$$8x - 1,\ x = 4$$

→ *Substitute x = 4: 8(4) + -1 = 32 + -1 = 31.*

Answer: $8(4) + -1 = 32 + -1 = 31$

29. A plumber charges $56 per hour plus a $32 service fee. What is the total cost for 1 hours? Evaluate 56x + 32 at x = 1.

$$56x + 32,\ x = 1$$

→ *Total = 56(1) + 32 = 56 + 32 = $88.*

Answer: $56(1) + 32 = 56 + 32 = 88$

30. Evaluate 4x^2 + 9 when x = 3.

$$4x^2 + 9,\ x = 3$$

→ *Substitute x = 3: 4(3)^2 + 9 = 4(9) + 9 = 36 + 9 = 45.*

Answer: $4(3)^2 + 9 = 36 + 9 = 45$