Algebra Learning Trajectories

Solving linear equations in one unknown

1. In the following two problems, solve for the value of x.
   (a) $2x + 3 = x + 9$
   (b) $\frac{1}{2}(11 - x) = 5$
2. Solve for x
   (a) $\frac{1}{3}x - 7 = -4$
   (b) $\frac{3}{4}x = 9$
   (c) $\frac{1}{2}(x - 7) = 12$
   (d) $\frac{2}{3}(x + 7) = x - 4$
3. Solve for the value of x.
   (a) $3x - 3 = x + 7$
   (b) $\frac{1}{2}(4x + 2) = 7$
4. Solve for the value of x.
   (a) $\frac{4}{3}(6x - 3) = x + 10$
   (b) $\frac{2}{5}(x - 1) + \frac{5}{2}(1 - x) = 0$

Functions

5. Given the linear function $f(x) = 3x + 4$.
   (a) Find $f(0)$
   (b) $f(x) = 10$. Find x.
6. Given the linear function $f(x) = 2x - 6$.
   (a) $f(x) = 0$. Find x.
   (b) Find $f(2)$
7. Given the linear function $f(x) = -2x + 14$, find x.
   (a) Find $f(4)$
   (b) $f(x) = 21$. Find x.

Quadratics

8. Practice these techniques for quadratics (x^2)
   (a) Expand $(x + 4)(x + 3)$
   (b) Convert to *standard form* (equal to zero): $x^2 + 4 = 4x$
   (c) Factor, $x^2 + 9x + 8 = 0$
9. Given $x^2 + 9x + 8 = 0$. Factor and find the roots.
10. Given $x^2 + 8x + 7 = 0$. Factor and find the roots.

11. Given $x^2 + 6x + 5 = 0$. Factor and find the roots.
12. Solve for x, $x^2 + 10x + 7 = 2x$

Simplifying expressions

13. Perform each calculation, writing down the full calculator display and then rounding to the *nearest hundredth*.

    (a) $V = \frac{1}{3}\pi(2.4)^2(5.1)$ (b) $P = 3.6 + \frac{1}{2}\pi(3.6)$

14. Solve each equation for the appropriate variable. Do not round. Simplify radicals.

    (a) $A = \pi r^2 = 27\pi$ (b) $V = \frac{1}{3}(6.0)^2 h = 153$

15. Perform each calculation, writing down the full calculator display and then rounding to the *nearest hundredth*.

    (a) $V = \frac{1}{3}\pi(2.7)^2(1.1)$ (b) $W = 5.1 + \frac{1}{2}\pi(7.1)$

16. Solve each equation for the appropriate variable. Do not round. Simplify radicals.

    (a) $A = \pi r^2 = 18\pi$ (b) $V = \frac{1}{4}(2.2)^2 h = 12.1$

17. Perform each calculation, writing down the full calculator display and then rounding to the *nearest hundredth*.

    (a) $A = 15.944732$
    (b) $W = 3.4 \times 9.8 \times 4.3 \times 0.15$
    (c) $V = \frac{1}{3}\pi(3.4)^2(6.1)$
    (d) $P = 8.6 + \frac{1}{2}\pi(8.6)$
    (e) $V = 199.19711$
    (f) $W = \frac{1}{3}(13)3.3^2 \times 1.175$
    (g) $V = \frac{1}{3}\pi(12.4)^2(8.1)$
    (h) $P = 12 + \frac{1}{4}\pi(12)$

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Trigonometric evaluation using calculator

19. Express the result to the nearest thousandth.

(a) $\sin 35° =$

(b) $\tan 70° =$

(c) $\sin 78° =$

(d) $\cos 12° =$

Do not use a calculator. Do not convert values to decimals.
Reference: Chili Math, Solving Literal Equations
https://www.chilimath.com/lessons/intermediate-algebra/literal-equations/

Simplify each expression by "collecting like terms"

20. (a) $2x + 4 - x + 11$

(b) $5y - 4 - 7y + y$

(c) $14 + 5\pi - 2\pi + 4$

(d) $2a + \sqrt{5} + 7a + 3\sqrt{5}$

(e) $x\sqrt{3} - x\sqrt{3} + x + 1$

(f) $3\pi x + 4 + 2\pi x - 7$

Solve each equation for the unknown

One step.

21. (a) $2x = 12$

(b) $4z = -8$

(c) $3a = \pi$

(d) $2y = \sqrt{5}$

Two steps.

22.

4

$7x + 4 = 11$

(b) $-4b + 5 = -3$

(c) $4m - \sqrt{2} = 3\sqrt{2}$

(d) $2y - 3\pi = \pi$

23. Fractional coefficients

(a) $\frac{1}{2}(6-2x)=4x$

(b) $11=\frac{1}{3}x+2x-10$

Working with polynomials

24. Simplify each expression by "collecting like terms"

(a) $4x^2+3x-7-2x^2-x+4$

(b) $3(a^2-2a+1)-2(a^2-a-4)$

Slope-intercept form

25. What is the slope and y-intercept of each equation?

(a) $y=2x-3$

(b) $4x+2y=6$

Function substitution

26. (a) Given $f(x)=4x+7$.
Simplify $f(2)$.

(b) Given $f(x)=-\dfrac{(12+4x)}{11}$.
Simplify $f(-3)$.

Parallel and perpendicular linear equations

27. What is the equation of the line with a slope of 2 passing through the point $(0, 1)$? hint: $y - y_1 = m(x - x_1)$

28. What is the equation of a line parallel to $y = -2x + 1$ with a y-intercept of 4?

29. What is the slope of a line perpendicular to the line $x - 2y = 16$?

Rounding and calculations

30. Perform each calculation, writing down the full calculator display and then rounding to the *nearest hundredth*.

    (a) $A = 15.944732$

    (b) $W = 3.4 \times 9.8 \times 4.3 \times 0.15$

    (c) $V = \frac{1}{3}\pi(3.4)^2(6.1)$

    (d) $P = 8.6 + \frac{1}{2}\pi(8.6)$

    (e) $V = 199.19711$

    (f) $W = \frac{1}{3}(13)3.3^2 \times 1.175$

    (g) $V = \frac{1}{3}\pi(12.4)^2(8.1)$

    (h) $P = 12 + \frac{1}{4}\pi(12)$

31. Oceanside Bike Rental Shop charges a 17 dollar bike fee plus 6 dollars an hour for renting a bike. Jeffrey paid 53 dollars total. How many hours did he pay to have the bike checked out?

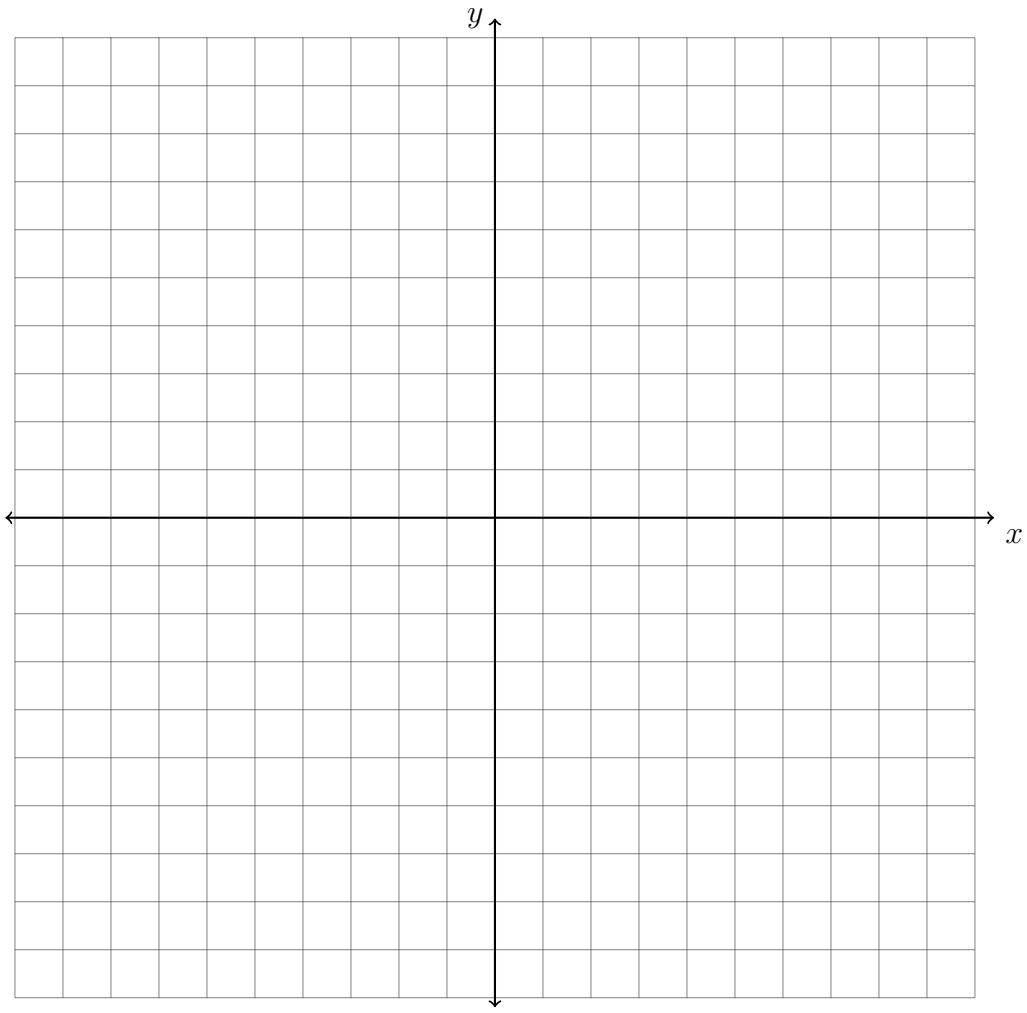
32. Three friends go bowling. The cost per person per game is \$5.30. The cost to rent shoes is \$2.50 per person. Their total cost is \$55.20. How many games did they play?

33. The admission fee at a small fair is \$1.50 for children and \$4.00 for adults. On a certain day, 40 people enter the fair and \$85.00 is collected. How many children and how many adults attended?

34. Solve the system of equations by graphing each line and marking the intersection as an ordered pair.

$$x + y = 7$$

$$y = 3x + 3$$



Solve each system algebraically.

35. $2x - 4y = 14$
$5x + 4y = 7$

36. $2x - y = -7$
$3x + 4y = 17$

37. Which expressions must be equal to $2\sqrt{7} + 3\sqrt{7}$?

- ☐ $+\sqrt{7} + \sqrt{7}$
- ☐ $2a + \sqrt{5} + 7a + 3\sqrt{5}$
- ☐ $5y - 4 - 7y + y$
- ☐ $x\sqrt{3} - x\sqrt{3} + x + 1$
- ☐ $14 + 5\pi - 2\pi + 4$
- ☐ $3\pi x + 4 + 2\pi x - 7$

Simplify each expression by "collecting like terms"

38. (a) $2x + 4 - x + 11$ (b) $5y - 4 - 7y + y$

(c) $14 + 5\pi - 2\pi + 4$

(e) $x\sqrt{3} - x\sqrt{3} + x + 1$

(d) $2a + \sqrt{5} + 7a + 3\sqrt{5}$

(f) $3\pi x + 4 + 2\pi x - 7$

Solve each equation for the unknown

One step.

39. (a) $2x = 12$

(c) $3a = \pi$

(b) $4z = -8$

(d) $2y = \sqrt{5}$

Two steps.

40. (a) $7x + 4 = 11$

(c) $4m - \sqrt{2} = 3\sqrt{2}$

(b) $-4b + 5 = -3$

(d) $2y - 3\pi = \pi$

41. Fractional coefficients

    (a) $\frac{1}{2}(6-2x)=4x$

    (b) $11=\frac{1}{3}x+2x-10$

Working with polynomials

42. Simplify each expression by "collecting like terms"

    (a) $4x^2+3x-7-2x^2-x+4$

    (b) $3(a^2-2a+1)-2(a^2-a-4)$

Slope-intercept form

43. What is the slope and y-intercept of each equation?

    (a) $y=2x-3$

    (b) $4x+2y=6$

Function substitution

44. (a) Given $f(x)=4x+7$.
    Simplify $f(2)$.

    (b) Given $f(x)=-\dfrac{(12+4x)}{11}$.
    Simplify $f(-3)$.

Parallel and perpendicular linear equations

45. What is the equation of the line with a slope of 2 passing through the point $(0, 1)$? hint: $y - y_1 = m(x - x_1)$

46. What is the equation of a line parallel to $y = -2x + 1$ with a y-intercept of 4?

47. What is the slope of a line perpendicular to the line $x - 2y = 16$?

Rounding and calculations

48. Perform each calculation, writing down the full calculator display and then rounding to the *nearest hundredth*.

    (a) $A = 15.944732$

    (b) $W = 3.4 \times 9.8 \times 4.3 \times 0.15$

    (c) $V = \frac{1}{3}\pi(3.4)^2(6.1)$

    (d) $P = 8.6 + \frac{1}{2}\pi(8.6)$

    (e) $V = 199.19711$

    (f) $W = \frac{1}{3}(13)3.3^2 \times 1.175$

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49. Oceanside Bike Rental Shop charges a 17 dollar bike fee plus 6 dollars an hour for renting a bike. Jeffrey paid 53 dollars total. How many hours did he pay to have the bike checked out?

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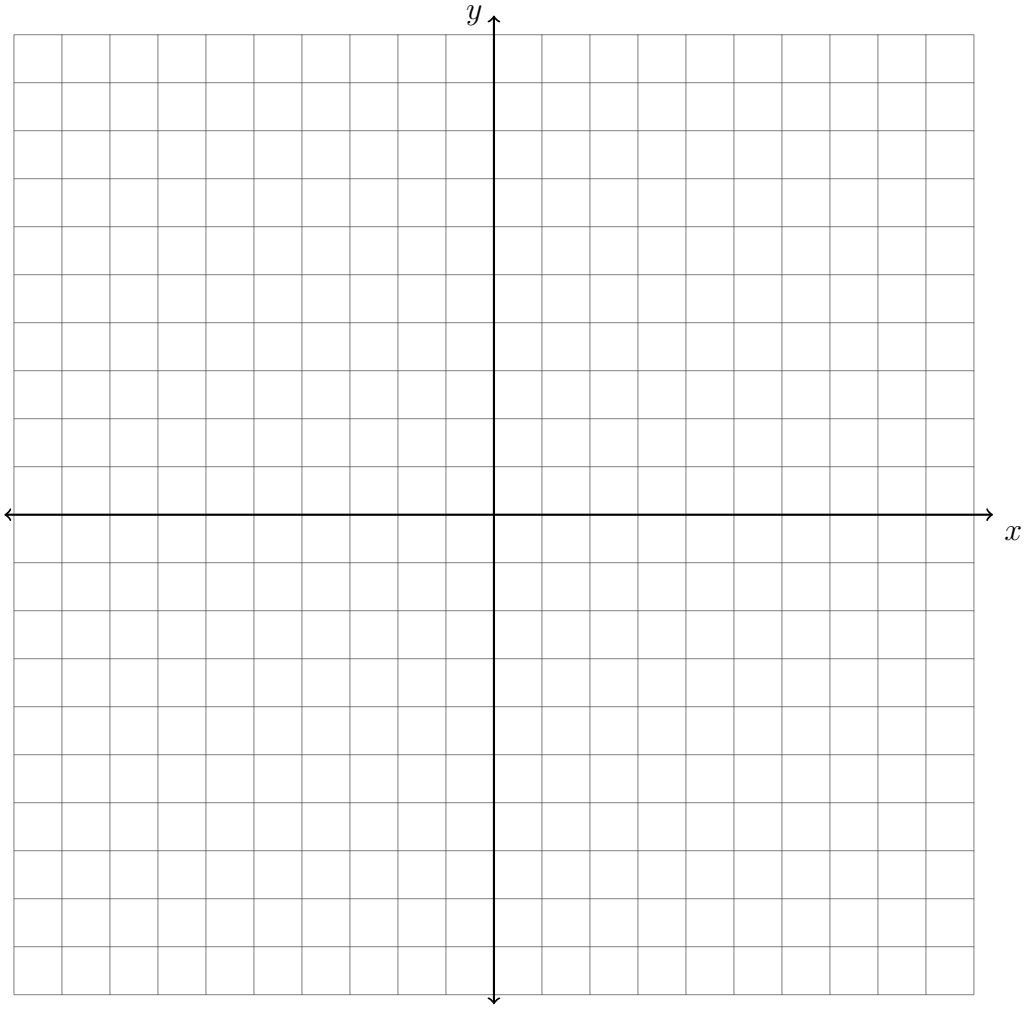
51. The admission fee at a small fair is $1.50 for children and $4.00 for adults. On a certain day, 40 people enter the fair and $85.00 is collected. How many children and how many adults attended?

52. Solve the system of equations by graphing each line and marking the intersection as an ordered pair.

$$x + y = 7$$

$$y = 3x + 3$$



53. Do Now: Which expressions are equivalent to $3\sqrt{5} + \sqrt{5}$?

- ☐ $\sqrt{5} + \sqrt{5} + \sqrt{5} + \sqrt{5}$
- ☐ $\sqrt{8} + \sqrt{5}$
- ☐ $3\sqrt{10}$
- ☐ $(3 + 1)\sqrt{5}$
- ☐ $\sqrt{3}\sqrt{5}$

Function substitution

54.

Given $f(x) = 4x + 7$.
Simplify $f(2)$.

(b) Given $g(x) = \frac{3}{2}x - 5$.
Simplify $g(4)$.

(c) Given $h(x) = x^2 - 4x + 1$.
Simplify $h(0)$.

(d) Given $j(x) = x - 11$.
Find x such that $j(x) = 5$.

Rounding

55. (a) Round to the *nearest hundredth*
15.944732

(b) Round to the *nearest thousandth*
$\sqrt{2}$

(c) Round to the *nearest hundredth*
$\theta = \frac{\pi}{3}$

(d) Round to the *nearest tenth*
$\alpha = \frac{3}{2}\pi$

(e) Round to *three significant figures*
19.49711

(f) Round to *three significant figures*
6.56501

Simplify each expression by "collecting like terms"

56. (a) $2x + 4 - x + 11$

(b) $5y - 4 - 7y + y$

(c) $14 + 5\pi - 2\pi + 4$

(d) $2a + \sqrt{5} + 7a + 3\sqrt{5}$

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Solve each equation for the unknown

One step.

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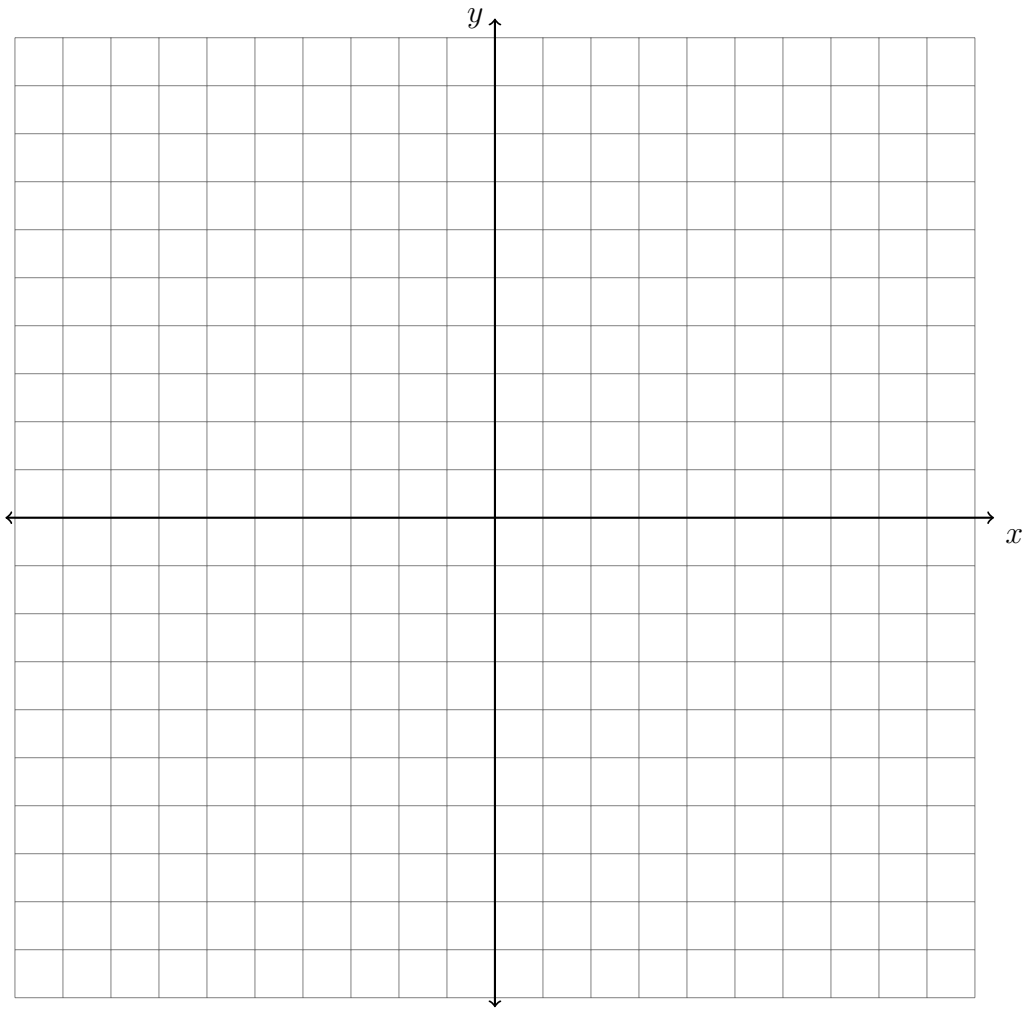

Systems

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