

Chapter 5 - Unraveling Linear Equations

A. Slope as Rate of Change

Objective: Calculate and interpret positive, negative, zero, and undefined slopes.

Directions: Show substitutions and simplification steps. Follow the order of operations, preserve units in applications, and explain all error-analysis, proof, and challenge responses.

Slope $m = (y_2 - y_1) / (x_2 - x_1)$ positive: rises; negative: falls	Equation forms $y = mx + b$ $y - y_1 = m(x - x_1)$ $Ax + By = C$
1. Find the slope through (2,3) and (7,13).	2. Find the slope through (-4,5) and (2,-1).
3. Find the slope of the horizontal line through (-3,6) and (8,6).	4. Find the slope of the vertical line through (4,-2) and (4,9).
5. A line falls 12 units while moving 5 units right. State its slope and describe its direction.	6. The points are listed in reverse order: (6,1) and (-2,9). Show that either consistent subtraction order gives the same slope.

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B. Slope-Intercept Form

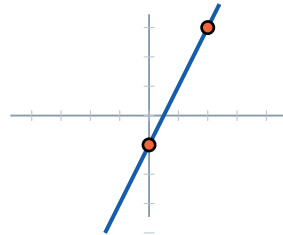
Objective: Identify, write, and graph equations in $y=mx+b$ form.

7. For $y=4x-7$, state the slope and y-intercept.

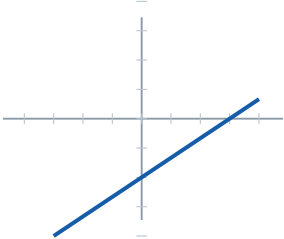
8. Rewrite $3x+2y=10$ in slope-intercept form and identify slope and y-intercept.

9. Write an equation with slope -3 and y-intercept 5.

10. Write an equation of the line shown in the graph.



11. Graph $y=(2/3)x-2$ using the y-intercept and slope. State three points.



12. Explain why $y=6$ is a linear equation and state its slope and y-intercept.

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C. Point-Slope and Two-Point Forms

Objective: Write linear equations from a slope and point or from two points.

13. Write point-slope form for the line with slope 4 through (3,-2).

14. Convert $y+5=-2(x-1)$ to slope-intercept form.

15. Write an equation through (2,7) with slope $-1/2$ in slope-intercept form.

16. Write an equation through (-4,3) and (2,15).

17. Write an equation through (5,-1) and (5,8). Explain why slope-intercept form is impossible.

18. A line passes through (a,b) with slope m. Explain why $y-b=m(x-a)$ represents every point on the line.

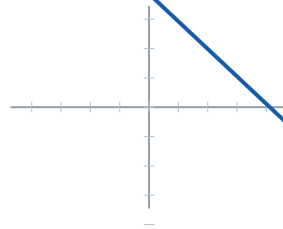
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D. Standard Form and Intercepts

Objective: Convert forms and use axis intercepts in algebraic and contextual problems.

19. Rewrite $y = -3x + 8$ in standard form $Ax + By = C$ using integer coefficients and $A > 0$.

20. Find both intercepts of $4x + 5y = 20$ and use them to sketch the line.



21. Write the line through intercepts $(6, 0)$ and $(0, -3)$ in standard form.

22. Convert $2y - 6 = 5(x + 4)$ to standard form.

23. A theater sells adult tickets x and student tickets y . A total of 180 tickets earn \$1,620, with prices \$12 and \$6. Write the revenue equation in standard form and interpret both intercepts.

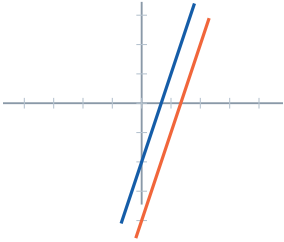
24. Explain when intercept form $x/a + y/b = 1$ is useful, then write the line with intercepts 8 and 4.

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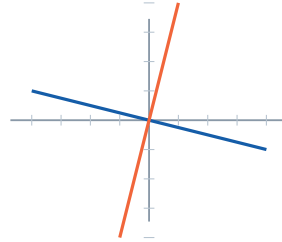
E. Parallel and Perpendicular Lines

Objective: Compare slopes and construct lines with geometric constraints.

25. Determine whether $y=3x-2$ and $6x-2y=9$ are parallel, perpendicular, or neither.



26. Determine whether $y=(-1/4)x+7$ and $y=4x-3$ are parallel, perpendicular, or neither.



27. Write an equation parallel to $2x-3y=12$ through $(6,-1)$.

28. Write an equation perpendicular to $y=(2/5)x+4$ through $(4,3)$.

29. Find k so that the line through $(k,2)$ and $(4,8)$ is parallel to $y=3x-1$.

30. Two distinct lines have equal slopes. Prove algebraically that they cannot intersect.

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F. Transformations and Families of Lines

Objective: Explain how slope and intercept changes transform a linear graph.

31. Compare $y=2x+5$ and $y=2x-3$. Describe the transformation from the first graph to the second.

32. How does $y=-3(x-4)+2$ relate to $y=-3x$? State slope and the point emphasized by the form.

33. Describe the changes from $y=x$ to $y=-2x+6$.

34. A line is shifted up 7 units. Which feature remains unchanged, and which coefficient changes in $y=mx+b$?

35. The graph of $y=mx+b$ is reflected across the x-axis. Write the new equation and describe its slope and intercept.

36. Explain why changing only b in $y=mx+b$ creates a family of parallel lines.

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G. Linear Modeling

Objective: Build, interpret, and compare linear models with units and practical domains.

37. A rental bike costs \$14 plus \$6.50 per hour. Write $C(h)$, interpret slope and intercept, and find $C(4.5)$.

38. A reservoir contains 8,400 gallons and drains at 175 gallons per minute. Write $V(t)$, find when it is empty, and state the practical domain.

39. A temperature is 68°F at time 0 and rises 2.5°F per hour. Predict the temperature after 7 hours.

40. A line of best fit for study time x and score y is $y=4.8x+61$. Interpret both coefficients and predict the score at 5 hours.

41. A taxi company charges \$3.75 plus \$2.40 per mile; a competitor charges \$7.35 plus \$1.80 per mile. Write and solve an equation for the break-even distance.

42. A student account begins with \$250 and decreases linearly to \$130 after 8 weeks. Find the weekly rate and write a model.

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H. Advanced Equation Construction

Objective: Recover linear rules from tables, intercepts, and function values.

43. The table x : -2,0,3,7 has y : 11,7,1,-7. Verify constant slope and write the equation.

44. A line has x -intercept 9 and slope $-2/3$. Find its y -intercept and equation.

45. For what value of p are the points $(p,4)$, $(2,10)$, and $(5,19)$ collinear?

46. A linear function satisfies $f(-3)=14$ and $f(5)=-2$. Find $f(x)$ and solve $f(x)=6$.

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I. Reasoning, Proof, and Challenge

Objective: Correct slope errors, prove structural claims, analyze parameters, and critique extrapolation.

47. Error analysis: A student finds the slope through $(-2, 5)$ and $(4, -7)$ as $(4 - (-2)) / (-7 - 5) = -1/2$. Identify the issue and give the correct slope.

48. Prove that the midpoint of any two points on a nonvertical line $y = mx + b$ also lies on that line.

49. Find all values of k for which $kx + 3y = 12$ is perpendicular to $6x - 2y = 5$. State any restriction.

50. A town's population was 24,000 in 2018 and 28,500 in 2024. Build a linear model using years since 2018, predict the 2030 population, and discuss one limitation of the prediction.