Algebra 2 Review: Linear Functions & Systems

Station 1 of 4: Equations of Lines, Slope, Parallel and Perpendicular

Name: _____ Date: _____

Remember: perpendicular slopes are negative reciprocals, and $y - y_1 = m(x - x_1)$ has a minus sign in front of y_1.

1. Write the equation of the line through $(-3, 5)$ and $(4, -9)$ in slope-intercept form.

2. The table shows a linear function f. Write $f(x)$ and find $f(20)$.

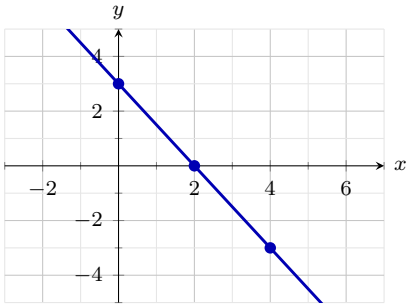
x	2	5	8	11
$f(x)$	7	13	19	25

3. A line has slope $-\frac{3}{4}$ and passes through $(8, -2)$. Write its equation in point-slope form and in slope-intercept form.

4. Write the line with slope $\frac{5}{2}$ through $(2, -3)$ in standard form $Ax + By = C$ with integer coefficients and $A > 0$.

5. Line L is $2x + 5y = 10$. Write the equations of the lines through $(5, -1)$ that are (a) parallel to L and (b) perpendicular to L.

6. Write an equation for the line shown and state its x-intercept.



7. Lines: $\ell_1:\ y = 2x - 5$, $\ell_2:\ 4x - 2y = 7$, $\ell_3:\ x + 2y = 4$. For each pair, state whether the lines are parallel, perpendicular, or neither.

8. A gym charges a \$45 joining fee plus \$28 per month. Write the total cost $C(m)$ for m months, find $C(18)$, and find how many months cost \$605.

9. The line through $(k, 4)$ and $(2, -5)$ is perpendicular to $y = \frac{1}{3}x - 7$. Find k.

10. A data plan costs \$30 for up to 5 GB, plus \$8 for each additional GB. Write a piecewise function $C(g)$ and find $C(9)$.

Algebra 2 Review: Linear Functions & Systems

Station 2 of 4: Linear Models, Scatter Plots, and Best-Fit Lines

Name: _____ Date: _____

Interpret slopes with units, and do not extend a model far beyond the data it came from.

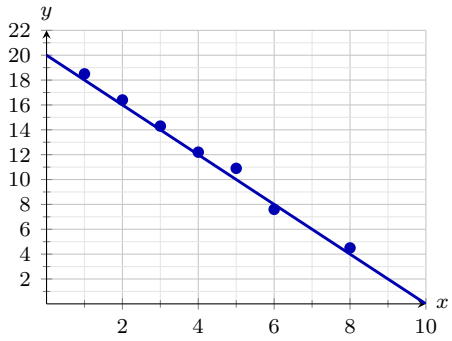
1. A town had 8,400 people in 2012 ($t = 0$) and 9,600 in 2020. Assuming linear growth, write $P(t)$, state the rate of change in context, and predict the population in 2030.

2. The volume of water in a tank is $V(t) = 560 - 35t$ gallons after t minutes. Interpret the slope and the intercept, and find when the tank is empty.

3. Use the regression feature of a calculator on the data. Give the line of best fit and correlation coefficient r to the nearest tenth and hundredth, and describe the correlation.

x	1	2	3	4	5	6
y	14	19	20	28	29	35

4. A car's value y (in thousands of dollars) is shown x years after purchase, with the line $y = -2x + 20$. Describe the correlation, interpret the slope and y-intercept, and predict the value at 7 years.



5. A line of best fit is $\hat{y} = 5.7x + 45.9$. For the data point $(4, 69)$, find the predicted value and the residual, and say what the residual means.

6. Across 40 students, $r = -0.92$ between hours of screen time and hours of sleep. Describe the relationship, find r^2, and decide whether this proves screen time reduces sleep.

7. A hiker starts at 1,000 ft and climbs 300 ft per hour for 2 hours, then descends 200 ft per hour. Write piecewise $E(t)$ for $0 \le t \le 8$ and find when she is at 1,200 ft on the way down.

8. Plant A is measured as shown. Plant B grows by $h = 1.8d + 3$ (cm after d days). Which plant grows faster, and by how much?

Day	2	6	10
Height A (cm)	4	12.4	20.8

9. Water freezes at 0°C (32°F) and boils at 100°C (212°F). Write F as a linear function of C and find the temperature where both scales agree.

10. The 100-meter record in seconds is modeled by $R(t) = 9.7 - 0.04t$, with t years after 1970 (fit to data for $0 \le t \le 50$). Find $R(250)$ and decide whether it is reasonable.

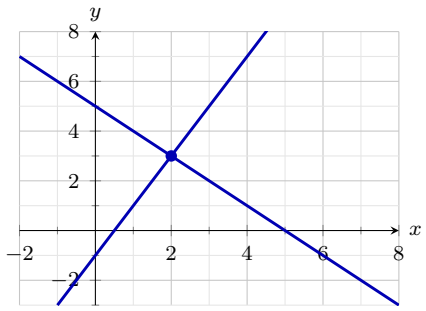
Algebra 2 Review: Linear Functions & Systems

Station 3 of 4: Systems of Equations and Inequalities

Name: _____ Date: _____

Check every solution in all equations. For inequalities, decide solid or dashed and test a point in each region.

1. The graph shows a system of two lines. Write the system and its solution, then check the solution in both equations.



2. Solve by substitution: $y = 2x - 4$ and $3x + 4y = 17$.

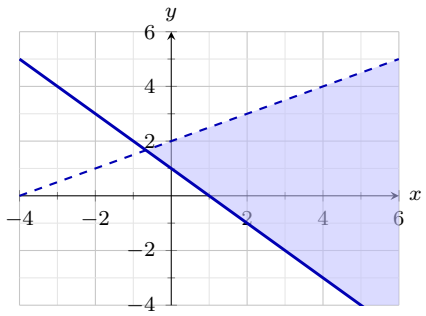
3. Solve by elimination: $3x + 2y = 4$ and $5x + 4y = 5$.

4. Without graphing, classify each system as one solution, no solution, or infinitely many solutions. (a) $-2x + 6y = 9$, $x - 3y = 4$ (b) $4x - 6y = 10$, $y = \frac{2}{3}x - \frac{5}{3}$.

5. A boat goes 24 miles upstream in 3 hours and 24 miles downstream in 2 hours. Write a system and find the boat's speed in still water and the speed of the current.

6. A company has costs $C = 1200 + 15n$ and revenue $R = 40n$ for n items. Find the break-even point and say what it means.

7. The shaded region is the solution of a system of two linear inequalities (one boundary is dashed). Write the system, then decide whether $(2, 4)$ is a solution.



8. Which of $(1, 4)$, $(3, 1)$, $(0, 0)$, $(-2, 5)$ satisfy both $3x - y \geq 2$ and $x + 2y < 6$? Show that $(0, 0)$ fails.

9. A bake sale sells cookies for \$2 and brownies for \$3. The class wants at least \$60 and has at most 30 items. Write a system for c cookies and b brownies, and test (15 cookies, 10 brownies) and (10, 10).

10. For what value of k does $2x + ky = 5$, $6x + 9y = 8$ have no solution? What would the right side of the second equation need to be for infinitely many?

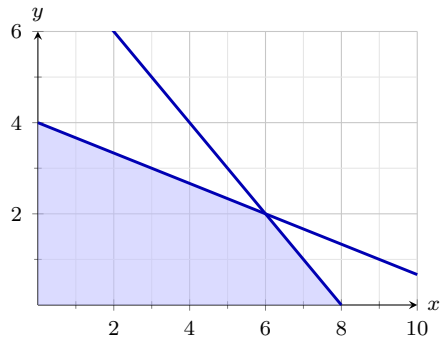
Algebra 2 Review: Linear Functions & Systems

Station 4 of 4: Linear Programming and Three-Variable Systems

Name: _____ Date: _____

Test every vertex of the feasible region. For three variables, eliminate the same variable twice.

1. The feasible region for $x \geq 0$, $y \geq 0$, $x+y \leq 8$, $x+3y \leq 12$ is shaded. Find its four vertices.



2. Use the region from problem 1. Find the maximum of $P = 3x + 5y$ and where it occurs.

3. Minimize $C = 4x + 3y$ subject to $x + y \geq 6$, $x + 2y \geq 8$, $x \geq 0$, $y \geq 0$.

4. A bakery makes cakes (profit \$12, 2 oven-hours, 1 lb flour) and pies (profit \$9, 1 oven-hour, 3 lb flour). It has 40 oven-hours and 45 lb of flour per day. Write the constraints and find the maximum daily profit and the numbers of each.

5. A feasible region has vertices $(1, 1)$, $(1, 5)$, $(4, 4)$, and $(6, 1)$. Find the maximum and minimum of $P = x + 2y$.

6. Solve the system: $x + y + z = 2$, $2x - y + 3z = -1$, $x + 2y - z = 7$.

7. A jar holds 60 coins (nickels, dimes, quarters) worth \$10.75. There are 5 more dimes than nickels. How many of each coin?

8. Classify each system. (a) $x+y+z = 4$, $2x+2y+2z = 9$, $x-y = 1$ (b) $x+y+z = 4$, $2x+2y+2z = 8$, $x - y = 1$. For (b), describe the solutions in terms of x.

9. Find the quadratic $y = ax^2 + bx + c$ through $(1, 2)$, $(2, 3)$, and $(3, 6)$ by writing a system of three equations.

10. Use the region from problem 1 again. Find the maximum of $P = x + 3y$. How many points give that maximum? Name one other than a vertex.