

# Algebra 1 Practice Problems II

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The focus of these review problems and the second midterm is on the material covered in Weeks 13 through 23, but keep in mind that prior material can still appear on the exam.

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# 1 Graphing

## 1.1 Review

1. Draw a coordinate plane and label the origin and the four quadrants.
2. Let  $A = (3, 1)$ . Find the coordinates of each of the following:
  - (a) the **reflection** of  $A$  across the  $x$ -axis
  - (b) the reflection of  $A$  across the  $y$ -axis
  - (c) the reflection of  $A$  across the line  $y = x$
  - (d) the **rotation** of  $A$  around the origin by  $180^\circ$
  - (e) the rotation of  $A$  around the origin by  $90^\circ$  counterclockwise
  - (f) the rotation of  $A$  around the point  $(2, 2)$  by  $90^\circ$  clockwise
3. Quadrilateral  $ABCD$  is positioned in the coordinate plane so that its vertices have coordinates

$$A = (5, 7); \quad B = (5, 6); \quad C = (3, 1); \quad D = (-4, -5).$$

Points  $E, F, G, H$  are the midpoints of segments  $\overline{AB}, \overline{BC}, \overline{CD}, \overline{DA}$ , respectively.

- (a) Find the coordinates of  $E, F, G$ , and  $H$ .
- (b) Compute the midpoints of segments  $\overline{EG}$  and  $\overline{FH}$ .

To check your work, the two midpoints computed in part (b) should be the same. Doing this calculation in general (rather than with specific numbers) and finding that the midpoints of the diagonals of  $EFGH$  coincide proves the following:

*The midpoints of the sides of any quadrilateral form a parallelogram.*

4. Maurine needs to get from  $(2, 3)$  to  $(17, 11)$ .
  - (a) If they take the shortest path possible, how much distance would they cover?
  - (b) Suppose Maurine gets distracted while pondering the meaning of life and goes from  $(2, 3)$  to  $(6, 6)$ , then to  $(11, 18)$ , then to  $(17, 10)$ , and finally to  $(17, 11)$ . What is the minimum distance Maurine can cover which is consistent with this information?
5. Which of the following expressions correctly finds the slope between the points  $(-1, 7)$  and  $(3, -4)$ ? Circle all valid expressions.

$$\frac{3 - (-1)}{-4 - 7} \quad \frac{7 - (-4)}{-1 - 3} \quad \frac{-4 - 7}{3 - (-1)} \quad \frac{7 - (-4)}{3 - (-1)} \quad \frac{-4 - 3}{7 - (-1)}$$

6. A line is given by the point-slope form

$$y - 4 = \frac{1}{4}(x + 1).$$

- (a) Find the slope of the line and a point on the line.

- (b) Put the equation in slope-intercept form and find the  $y$ -intercept of the line.
- (c) Put the equation in standard form and find the  $x$ -intercept of the line.

7. (a) Of the equations

$$5x + 4y = 35; \quad (x + 4)^2 + (y - 1)^2 = 10; \quad x^2 + xy + y^2 = 49; \quad x - 2y = -7,$$

which one is an equation for the blue line below?

(b) Of the equations

$$5x + 4y = 35; \quad (x + 4)^2 + (y - 1)^2 = 10; \quad x^2 + xy + y^2 = 49; \quad x - 2y = -7,$$

which one is an equation for the red curve below?



8. A line is given by the slope-intercept form

$$y = -\frac{1}{4}x - 3.$$

- (a) Find the slope of the line and the  $y$ -intercept of the line.
- (b) Put the equation in standard form and find the  $x$ -intercept of the line.
- (c) Find the point on the line with  $x$ -coordinate 2024, then put the equation in point-slope form using this point.

9. A line is given by the standard form

$$3x + y = -4.$$

- (a) Find the  $x$ -intercept and  $y$ -intercept of the line.
  - (b) Put the equation in slope-intercept form and find the slope of the line.
  - (c) Find the point on the line for which the sum of the coordinates is 10, then put the equation in point-slope form using this point.
10. A line passes through the point  $(-5, 2)$  and has slope  $1/2$ .
- (a) Write down an equation for this line in point-slope form.
  - (b) Find the slope-intercept form and the standard form of the line.
11. A line passes through the points  $(-3, 4)$  and  $(-3, -4)$ . Find an equation for this line.
12. A line passes through the points  $(-3, 3)$  and  $(0, -4)$ .
- (a) Find the slope of the line.
  - (b) For each of the two given points, find the point-slope form of the line using that point.
  - (c) Find the slope-intercept form and the standard form of the line.

As a check of your answers, rearranging either of the point-slope equations from part (b) should give you the same slope-intercept form and standard form.

13. A line with equation  $y = mx + b$  passes through the points  $(5, 7)$  and  $(8, -1)$ . Find  $m$  and  $b$ .
14. Find the point at which the line with equation  $2023x + 2022y = 2021$  intersects the line with equation  $2024x + 2023y = 2022$ .
15. Let  $\ell$  be the line with equation  $y = -4x - 2$  and let  $P = (-4, 2)$ . The point  $Q$  on line  $\ell$  which is closest to  $P$  is the point for which  $\overline{PQ} \perp \ell$ . As such, if  $\ell'$  is the line through  $P$  perpendicular to line  $\ell$ , then  $Q$  is the intersection of  $\ell$  and  $\ell'$ .
- (a) Find the slope of  $\ell'$ .
  - (b) Find an equation for  $\ell'$ .
  - (c) Find the coordinates of  $Q$ .

## 1.2 Challenge

16. Let  $A = (1, 1)$ ,  $B = (5, 2)$ , and  $C = (-4, 3)$ . In this problem, we will find the coordinates of the point  $D$  for which quadrilateral  $ABCD$  is a parallelogram.
- (a) Find the slopes of lines  $AB$  and  $BC$ .
  - (b) Write down an equation for the line through  $C$  parallel to  $AB$ .
  - (c) Write down an equation for the line through  $A$  parallel to  $BC$ .
  - (d) Since  $AB \parallel CD$  and  $AD \parallel BC$ , point  $D$  must be the intersection of the lines you found in parts (b) and (c). Use this to find the coordinates of point  $D$ .

## 2 Linear Inequalities