

# Geometry Unit 6: Analytic Geometry

Bronx Early College Academy

Christopher J. Huson PhD

7 December 2022 - 13 January 2023

6.1 Midpoint formula	8 December
6.2 Slope-intercept form	9 December
6.3 Functions, standard form	12 December
6.4 Parallel and perpendicular slopes	13 December
6.5 Review linear equations	13 December
6.6 Quiz linear equations	16 December
6.7 Systems	3 January
6.8 Systems word problems	4 January
6.9 Word problems, quiz	6 January
6.10 Quiz review, midpoint application	9 January
6.11 Quiz review, midpoint application	10 January

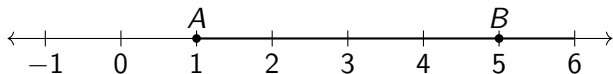
# Learning Target: I can plot a midpoint on the plane

HSG.GPE.B.6 Partition a line segment

6.1 Thursday 8 December

## Do Now

1. Review your Jumprope grades
2. Find the midpoint  $M$  of  $\overline{AB}$



Lesson: Midpoint and average, classwork practice

Homework: Deltamath midpoint practice (optional extension)

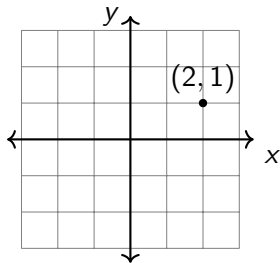
# What do you know about the coordinate plane?

**Coordinates** Values locating a point on a plane  $(x, y)$

**Axis** The two number lines,  $x$  and  $y$ -axis

**Origin** The center of the plane,  $(0, 0)$

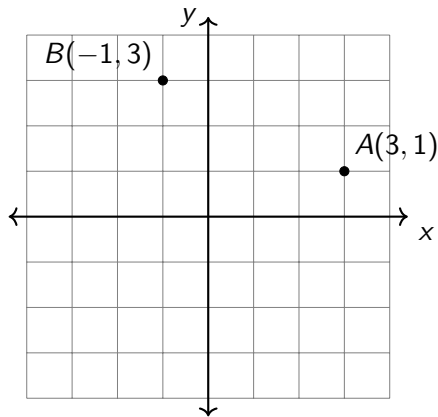
**Quadrant** The four quarters of the plane



# The midpoint formula

Given  $A(x_A, y_A)$ ,  $B(x_B, y_B)$ , midpoint

$$M = \left( \frac{x_A + x_B}{2}, \frac{y_A + y_B}{2} \right)$$



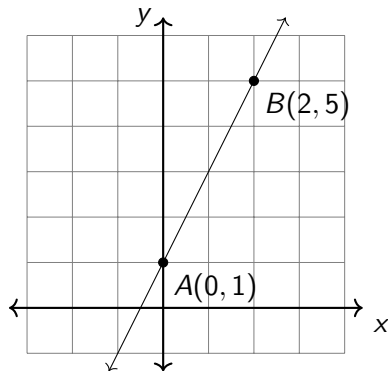
## Learning Target: I can use slope-intercept form of linear equations

8.F.A.3 Interpret  $y = mx + b$  as a linear function, whose graph is a straight line

6.2 Friday 9 December

Do Now: Find the midpoint  $M$  of  $\overline{AB}$

Lesson: Slope, y-intercept, linear equations  
Homework: Deltamath graphing practice  
(optional extension)



## Linear equations of the form $y = mx + b$

**Linear** Straight, constant rate of change

**Intercept** Where the line crosses the axis

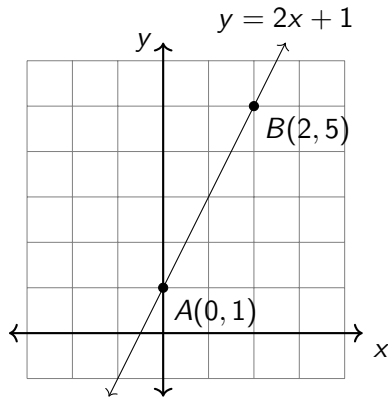
$b$  y-intercept, point  $(0, b)$  when  $x = 0$

**Increasing** Going up.  $y$  increases as  $x$  increases

**Decreasing** Going down.  $y$  decreases as  $x$  increases

$m$ , **slope** How steep the line is

$$m = \frac{\text{rise}}{\text{run}} = \frac{y_B - y_A}{x_B - x_A}$$



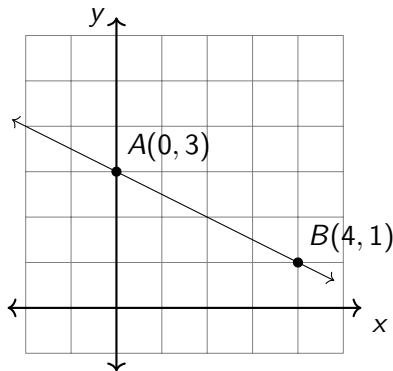
## Learning Target: I can use the standard form of linear equations

8.F.A.3 Interpret  $y = mx + b$  as a linear function, whose graph is a straight line 6.3 Monday 12 December

Do Now: Find the equation of  $\overleftrightarrow{AB}$

Lesson: Function notation, vertical and horizontal slopes, the standard form of linear equations (GraspableMath practice)

Homework: Handout problem set





## Function notation, $f(x) = mx + b$

**Function**  $(x, y)$  pairs that satisfy a rule,  
 $f(x) = y$

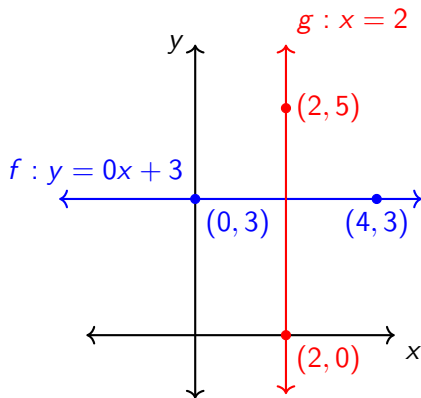
**Horizontal** Slope is zero,  $m = 0$

**Vertical** Slope is undefined,  $m = \infty$

**Domain** The set of  $x$  values that are allowed

**Range** The set of  $y$  values that are allowed

**Real numbers** The set of all numbers,  $\mathbb{R}$



## Linear equations of the form $ax + by = c$

**Standard form** A linear equation written in the form  $ax + by = c$

**Calculator form** Casios and other calculators use the form  $y = mx + b$

Convert from standard to  $y$ -intercept form. Example:

$$x + 2y = 6$$

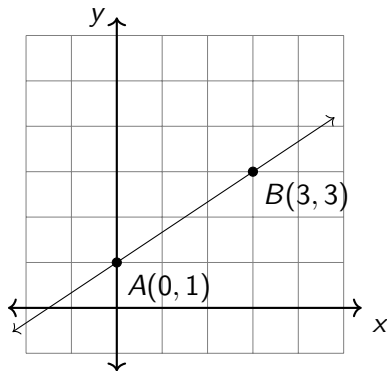
# Learning Target: I can find parallel and perpendicular slopes

HSG.GPE.B.5 The slope criteria for parallel and perpendicular lines

6.4 Tuesday 13 December

Do Now: Find the equation of  $\overleftrightarrow{AB}$   
Challenge: find the x-intercept

Lesson: Parallel and perpendicular lines,  
negative reciprocals  
Homework: Deltamath problem set

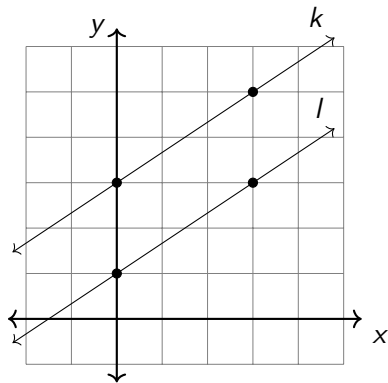


## Parallel lines have the same slope

**Parallel** Lines in the same plane that never intersect

**Skew** Lines that do not intersect and are not parallel

Lines  $k$  and  $l$  are parallel if and only if  $m_k = m_l$ , if their slopes are equal.



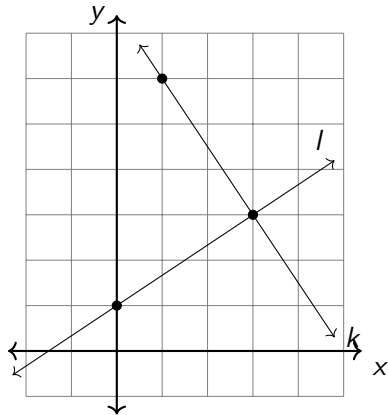
## Perpendicular lines slopes' are negative reciprocals

**Perpendicular** Lines that intersect at right angles

**Reciprocals** Two numbers whose product is 1

**Quarter turn**  $90^\circ$  rotation, reversing the sign of the slope and the  $x$  and  $y$  coordinates

Lines  $k$  and  $l$  are perpendicular if and only if  $m_k \times m_l = -1$ , if their slopes are negative reciprocals.



## Learning Target: I can graph linear equations

8.F.A.3 Interpret  $y = mx + b$  as a linear function, whose graph is a straight line 6.5 Wednesday 14 December

### Prequiz roundtable groupwork

Do Now: Organize and complete worksheets

6.5 Prequiz: Review slope-intercept form of linear equations

6.4 Classwork: Parallel and perpendicular slopes

6.3 Homework: Standard form

6.2 Classwork: Linear equations

6.1 Classwork: Midpoints

Lesson: Peer review of linear equations

Homework: Study for quiz on Thursday

Deltamath due Friday

## Quiz: Slope and linear equations

6.6 Friday 16 December

8.F.A.3 Interpret  $y = mx + b$  as a linear function, whose graph is a straight line

HSG.GPE.B.5 The slope criteria for parallel and perpendicular lines

Do Now: Turn in worksheets (Deltamath due)

Open notebook, calculator allowed

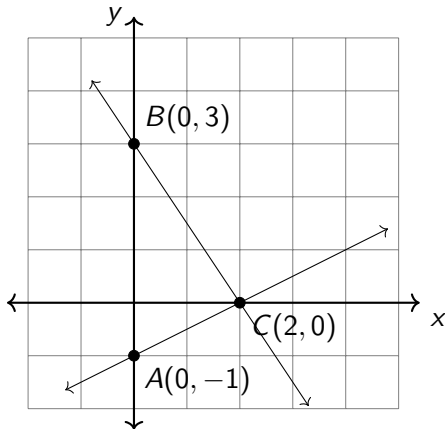
# Learning Target: I can solve two equations in two variables

HSG.REI.C.6 Solve systems of linear equations

6.7 Tuesday 3 January

Do Now: Find the equations of  $\overleftrightarrow{AC}$  and  $\overleftrightarrow{BC}$   
Are they perpendicular?

Lesson: Systems of equations, two intersecting lines  
Homework: Deltamath problem set





## Systems of equations

$$\overleftrightarrow{AC} : y = +\frac{1}{2}x - 1$$

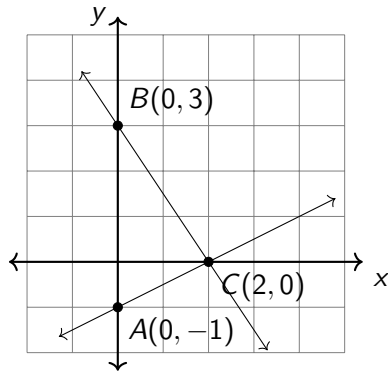
$$\overleftrightarrow{BC} : y = -\frac{3}{2}x + 3$$

Lines are not perpendicular:  $\frac{1}{2} \times -\frac{3}{2} \neq -1$  (slopes are not negative reciprocals)

**Systems** Multiple equations with the same variables

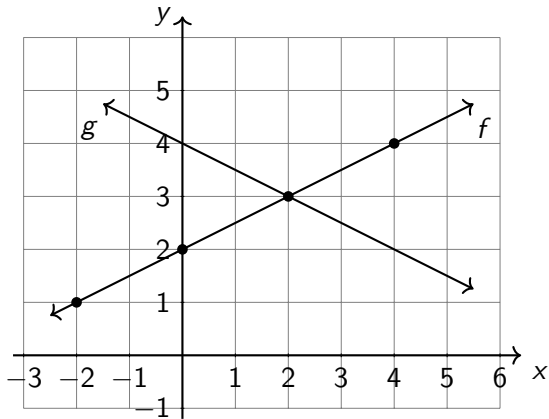
**Intersection** Point that satisfies both equations

**Solution** Values  $(x, y)$  that satisfy both equations



## *T-chart* list of $(x, y)$ pairs satisfying a equation

$f(x)$	
$x$	$y$
-2	
0	
2	
	4



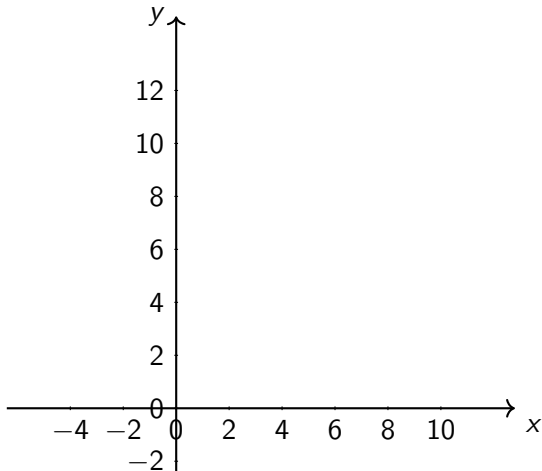
$g(x)$	

# Solve the system for its solution, the intersection

[link to Graspable Math calculator](#)

$$f(x) = \frac{2}{3}x + 4$$

$x$	$y$



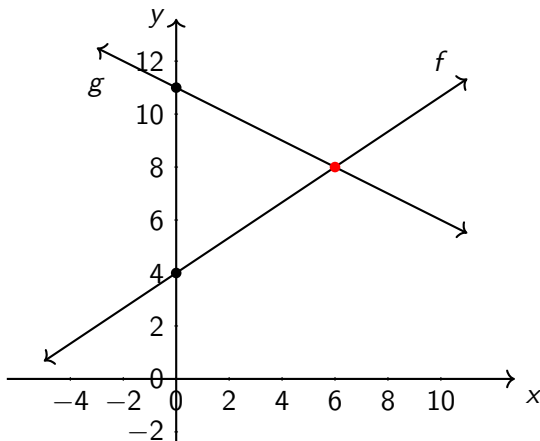
$$g(x) = -\frac{1}{2}x + 11$$

$x$	$y$

Solution: the intersection is  $(6, 8)$

$$f(x) = \frac{2}{3}x + 4$$

$x$	$y$
0	4
6	8



$$g(x) = -\frac{1}{2}x + 11$$

$x$	$y$
0	11
6	8

# Learning Target: I can solve linear systems in context

HSG.REI.C.6 Solve systems of linear equations

6.8 Wednesday 4 January

Do Now:

- ▶ Laptop check: Raise your hand if your laptop has a 75+ % charge.
- ▶ Notebook check: find these formulas in your notebook

1. Slopes are perpendicular when  $m \times m_{\perp} = -1$

2. Distance  $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

3. Midpoint  $M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

Lesson: Solving word problems with systems of equations (Deltamath)

# Learning Target: I can solve linear systems in context

HSG.REI.C.6 Solve systems of linear equations

6.9 Friday 6 January

Do Now: Write two equations that model the following situation

- ▶ The total of two values is 10
- ▶ Twice one value plus five times the other totals 26.

Lesson: Solving word problems with systems of equations Assessment: Pop Quiz 6.9  
Graphing Systems of Equations

## Solution: Graphing a system of equations to solve a word problem

The total of two values is 10

Twice one value plus five times the other totals 26.

$$x + y = 10$$

$$2x + 5y = 26$$

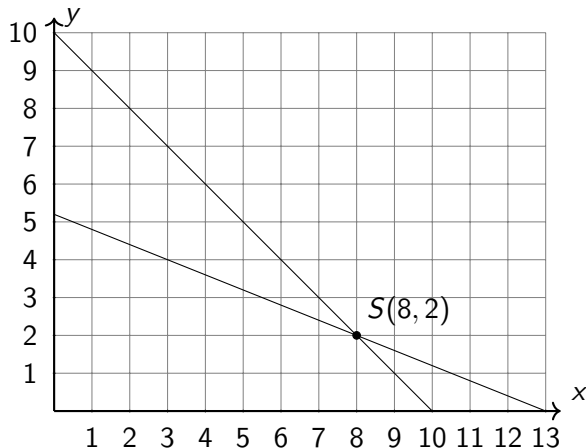
Solution  $x = 8, y = 2$

Check:

$$(8) + (2) = 10\checkmark$$

$$2(8) + 5(2) = 26$$

$$16 + 10 = 26\checkmark$$



## Learning Target: I can apply the midpoint formula

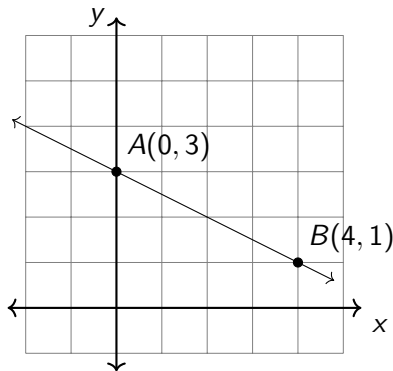
8.F.A.3 Interpret  $y = mx + b$  as a linear function, whose graph is a straight line

6.10 Monday 9 January

Do Now: Find the equation of  $\overleftrightarrow{AB}$

Lesson: Quiz review of linear equations,  
midpoint formula, distance calculation

Homework: Deltamath practice problem set





# Learning Target: I can use the point-slope form of linear equations

HSG.GPE.B.6 Partition a line segment

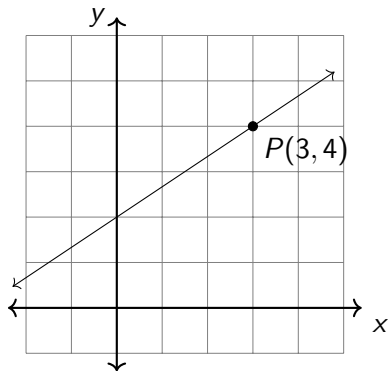
6.11 Tuesday 10 January

Do Now: Find the equation of the line through  $P(3, 4)$  with slope  $m = \frac{2}{3}$

Lesson: Point-slope form

Homework: Deltamath practice problem set

Test Friday



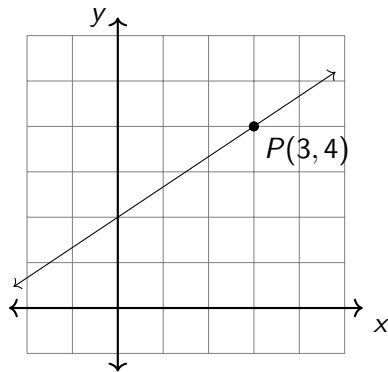
## Point-slope form

A line through  $P(x_0, y_0)$  with slope  $m$  has equation  $y - y_0 = m(x - x_0)$

$$y - 4 = \frac{2}{3}(x - 3)$$

$$y - 4 = \frac{2}{3}x - 2$$

$$y = \frac{2}{3}x + 2$$



Point-slope  $y - y_0 = m(x - x_0)$

Standard form  $ax + by = c$

Slope-intercept  $y = mx + b$