Unit 01: Fundamentals of Functions

Unit Objectives

- Demonstrate understanding of functions, domain, and range
- Master linear, quadratic, and radical functions, and their graphs
- Perform transformations on functions
- Combine functions and determine inverses

Methods of Justification

- Analytically

- Graphically

- Numerically

- Verbally

Unit 01 Lesson 01: Convert Between Graphs and Equations of Lines

How do linear equations look on a graph?

Lesson Objectives

- Convert between equations of lines and graphs of lines, including horizontal and vertical lines

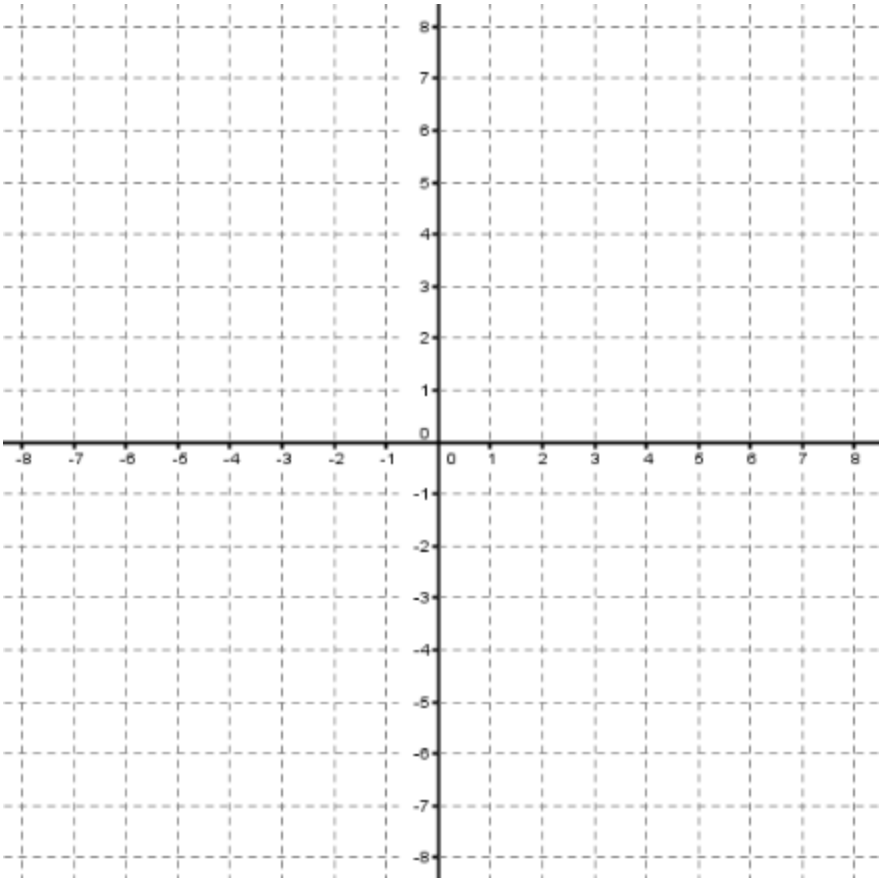
The equation of a line is:

- **m** stands for _____. **b** stands for _____.

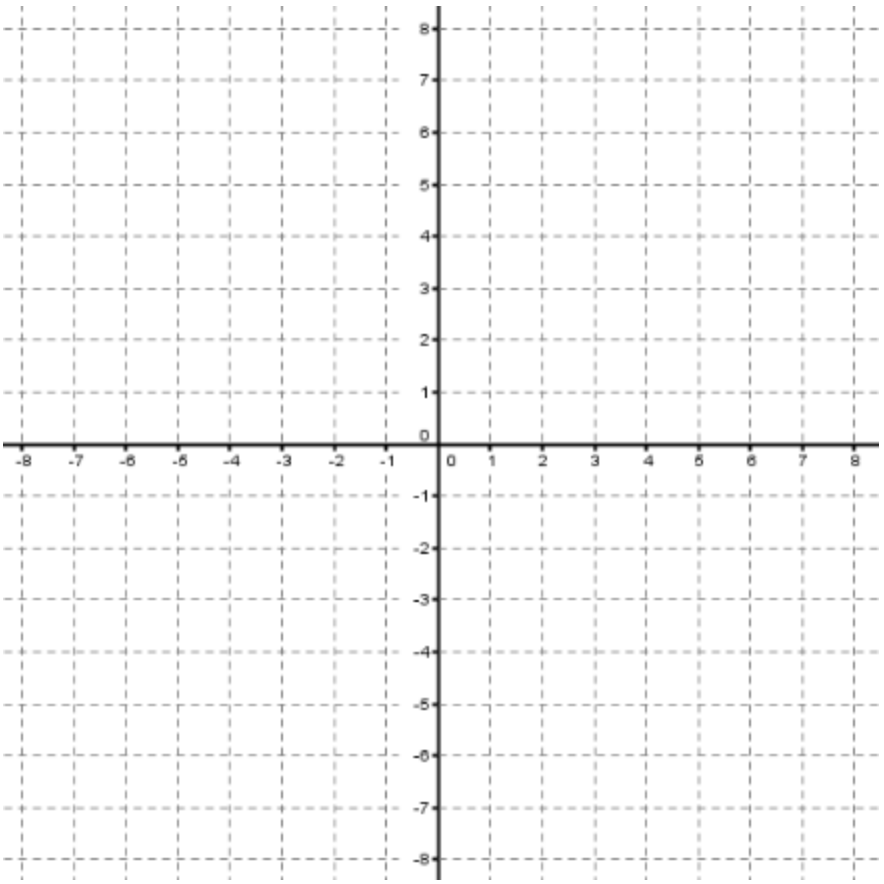
Slopes can be positive or negative

- Lines with **positive** slopes point _____. Lines with **negative** slopes point _____.
- Slopes of flatter lines are _____ _____.
- Slopes of steeper lines are _____ _____.

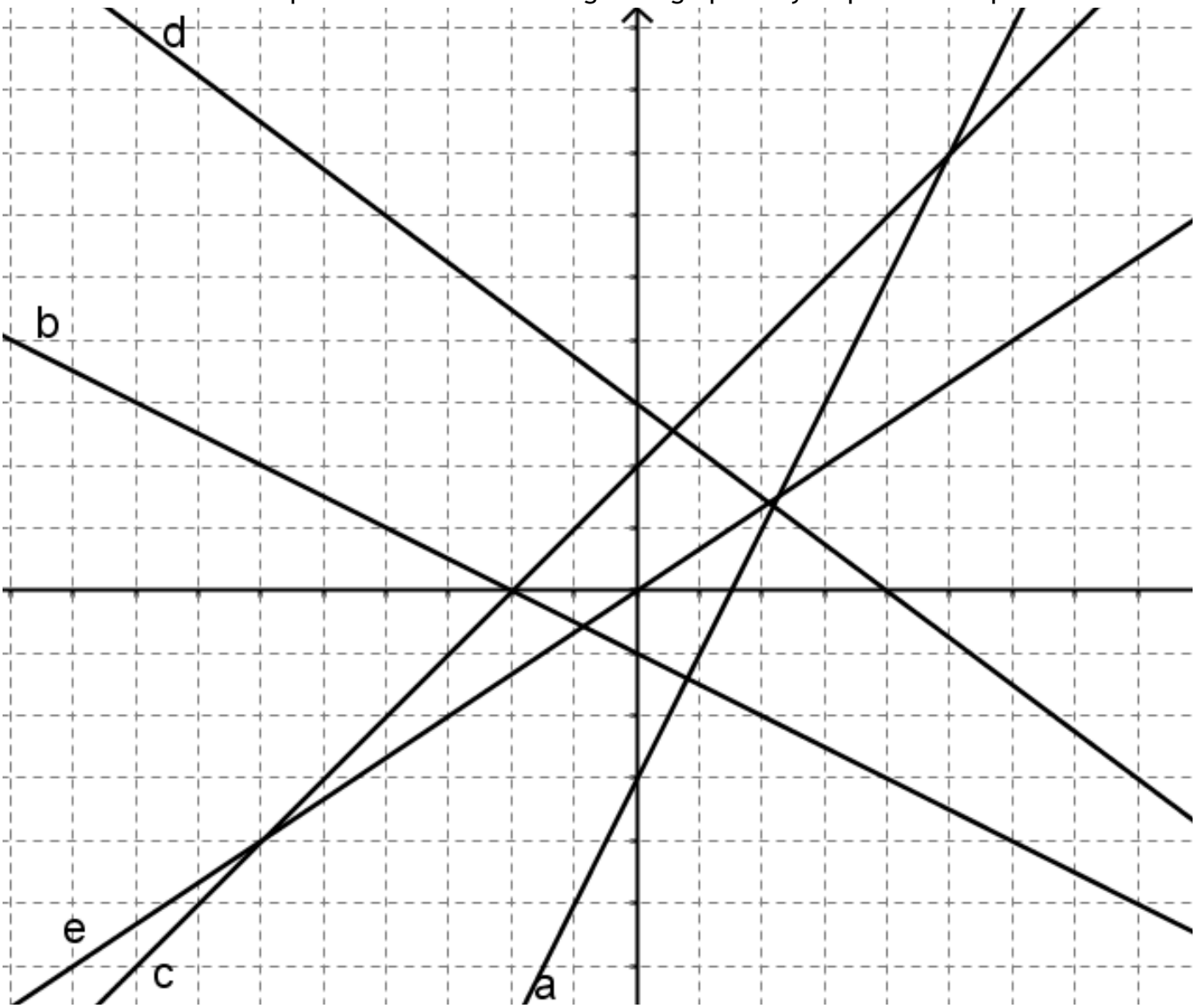
1. Graph the following lines.
   a. $y = \frac{1}{2}x + 3$
   b. $y = -3x - 2$
   c. $y = \frac{5}{2}x + 6$
   d. $y = -x$
   e. $y = 2$
   f. $x = -7$



2. Graph the following lines.
   a. $y = \frac{1}{3}x - 2$
   b. $y = -2x$
   c. $y = \frac{5}{3}x - 7$
   d. $y = x$
   e. $y = -3$
   f. $x = 0$



3. Determine the equations for the following lines graphically. Express in simplest form.



a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

~~~Unit 01 Lesson 01 Classwork~~~

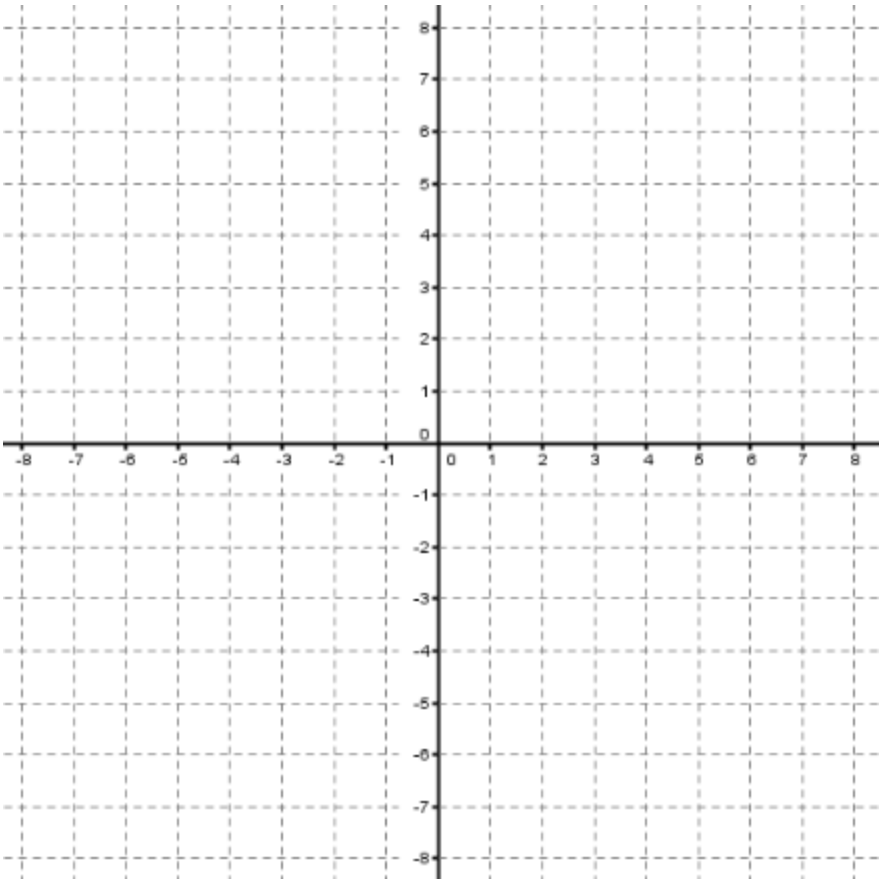
1. Graph the following lines
   a. $y = -2x - 3$

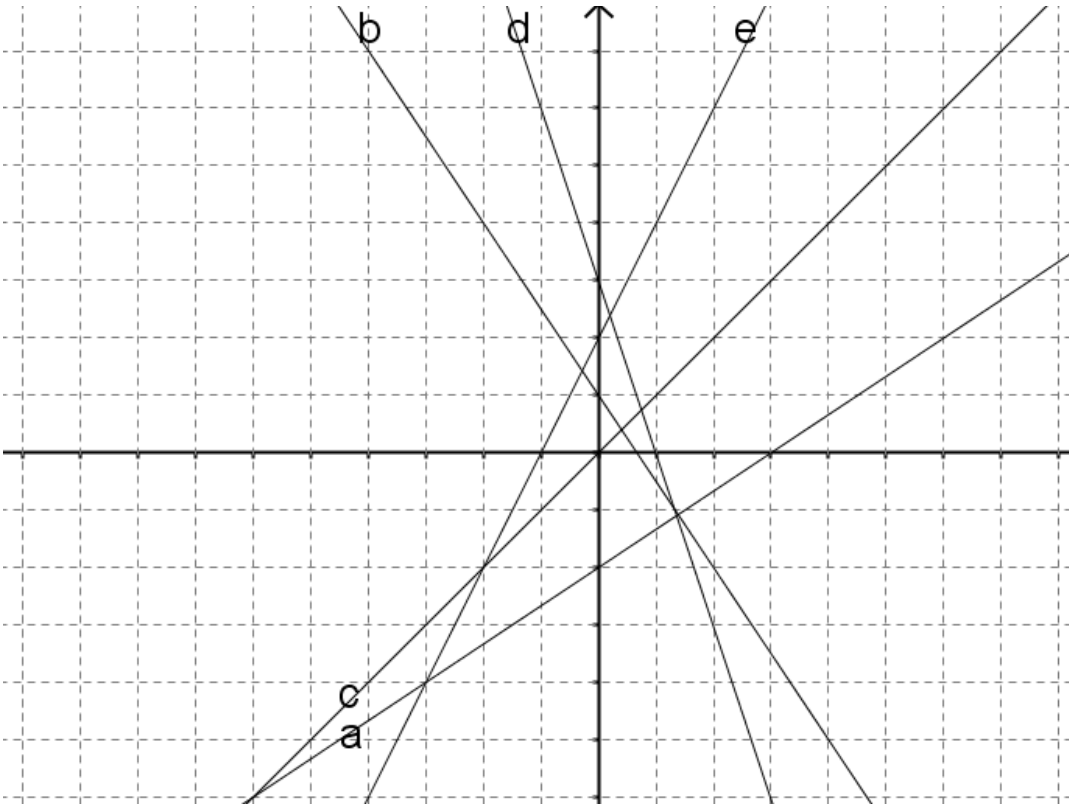
   b. $y = \frac{2}{5}x + 1$

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

   d. $y = x$

   e. $x = -4$





2. Determine the equations for the following lines graphically. Express in simplest form.

a. _____

b. _____

c. _____

d. _____

e. _____

Unit 01 Lesson 02: Create Equations of Lines Given a Description

How can I capture a situation with a linear equation?

Lesson Objectives

- Create equations of lines given information

When would one use this mathematically?

When would one use this in the real world?

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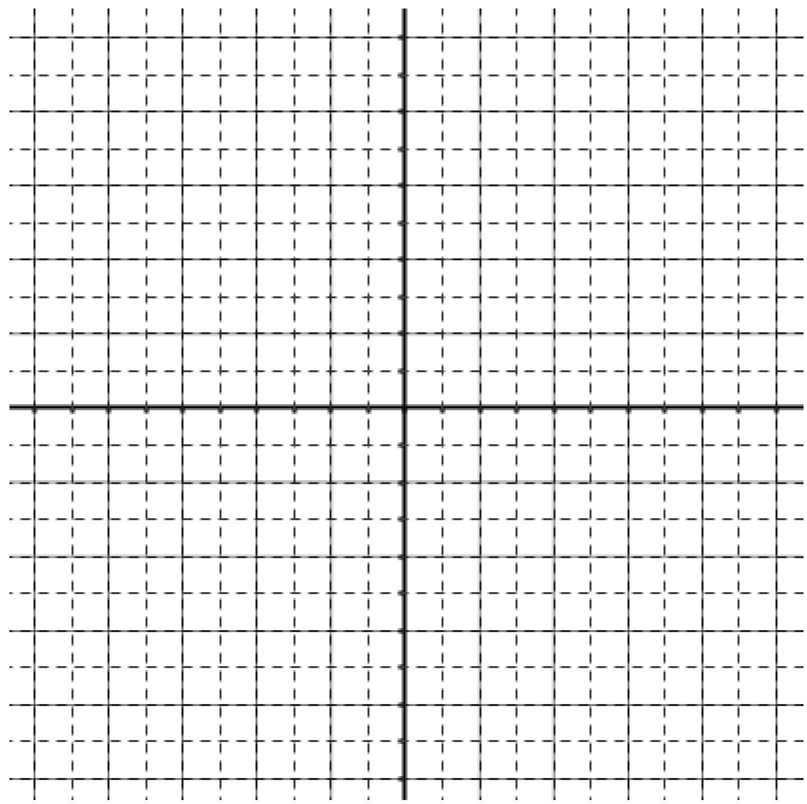
Despite all of the nonsense we hear about weight loss, the First Law of Thermodynamics cannot be broken: if you burn more calories than you eat, your body will burn fat to get the energy it needs. Max wanted to lose weight, so he created the following plan

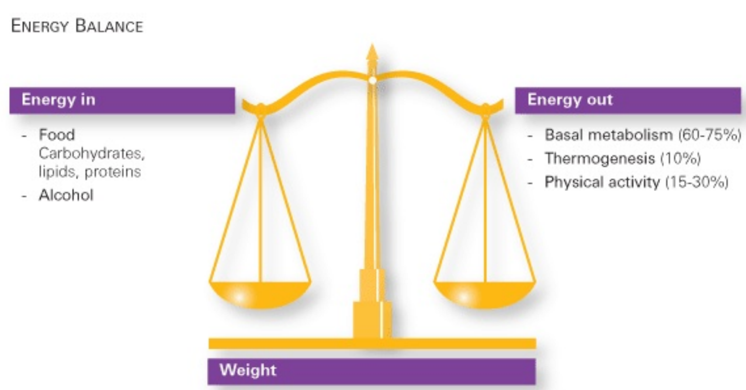
- Max saw that the average adult male burns about 2,500 calories per day
- Max saw that a pound of fat has 3,500 calories in it.
- Max currently weighs 180 pounds
- Max plans to maintain this diet for 10 weeks
- **Max decided he would eat 1,800 calories per day**



1. How much weight will Max lose every week?

2. Create an equation for Max's weight, W, in pounds, in terms of time t, in weeks.

3. Create a graph of Max's progress, with time in weeks on the x-axis and weight in pounds on the y-axis. Show calculations for your intervals on your axes here.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~~~Unit 01 Lesson 02 Homework~~~ Precalculus: Weight Loss Plan

~~~Unit 01 Lesson 02 Classwork~~~

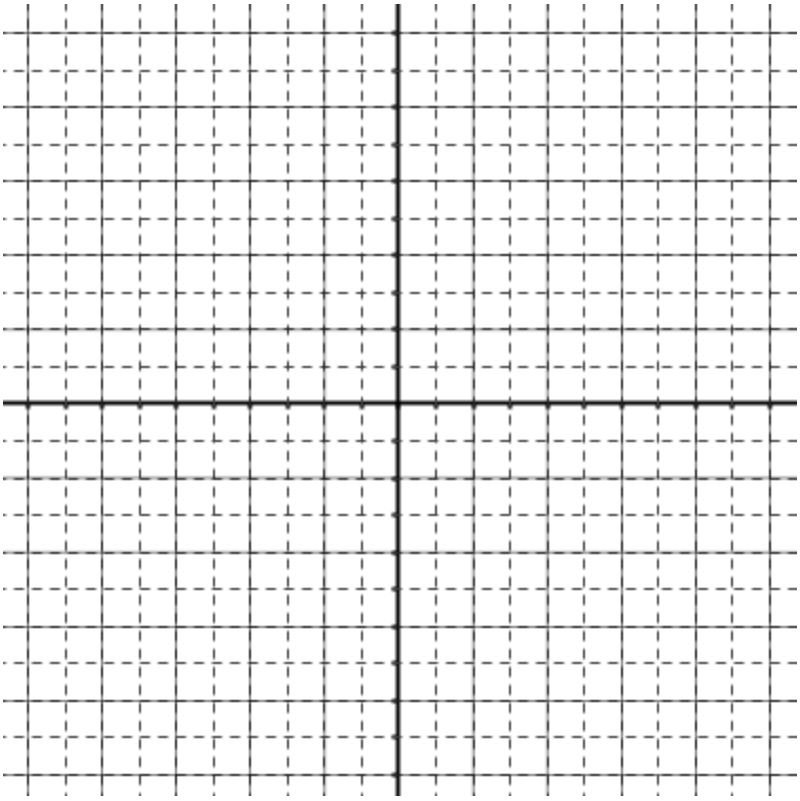
James wants to calculate the amount of money he is losing when he turns his air conditioner on.

- The average central air conditioner system runs at 4 kilowatts.
- PG&E charges 11.9 cents per kilowatt-hour (a kilowatt-hour is the amount of energy used by powering a 1 kilowatt system for 1 hour).
- James estimates that the AC will be actively running for ¼ of the day (in other words, 6 hours per day)

1. How much does the AC cost each day?

2. Create an equation for the cost C, in dollars, in terms of time t, in days, when James's AC is running.

3. Create a graph showing dollars spent on the y-axis and days using air conditioner on the x-axis. Let the x-axis go up to 30 days. Show your calculation for your y-axis intervals here.



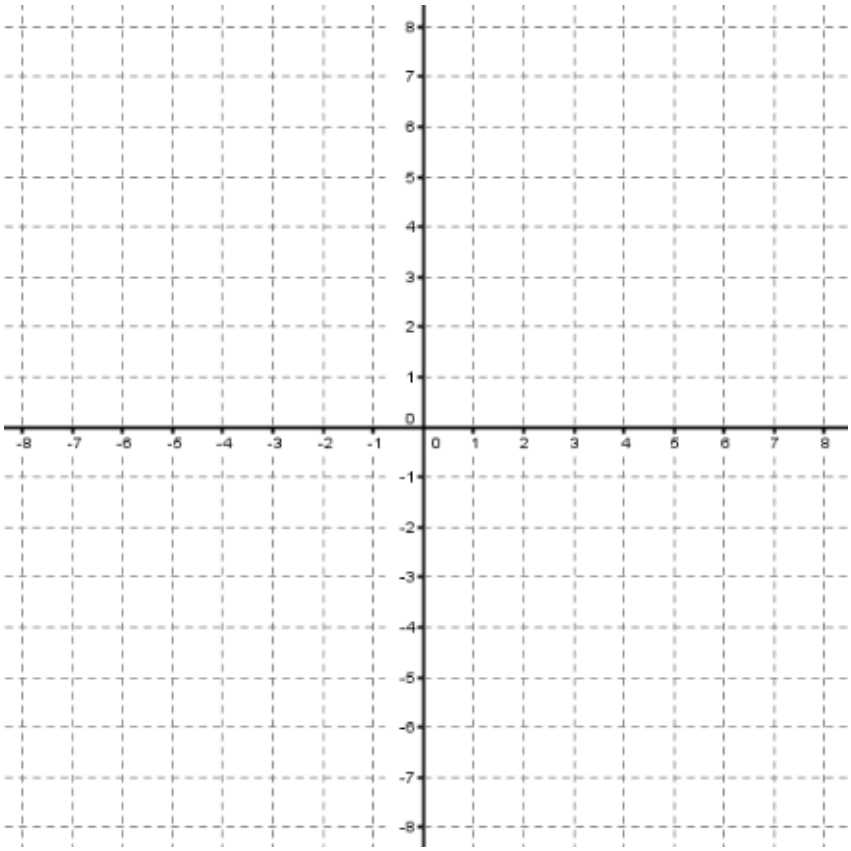
4. Check your equation in part 1 by substituting in 15 days and seeing if it agrees with your graph.

Unit 01 Lesson 03: Create Equations of Lines Given Slopes and a Point

Lesson Objectives

- Create equations of lines given information

1. For a line with a slope of $\frac{2}{4}$ passing through point C = (-6,- 4)
   a. Determine the equation of this line analytically.



   b. Graph your equation from part a.

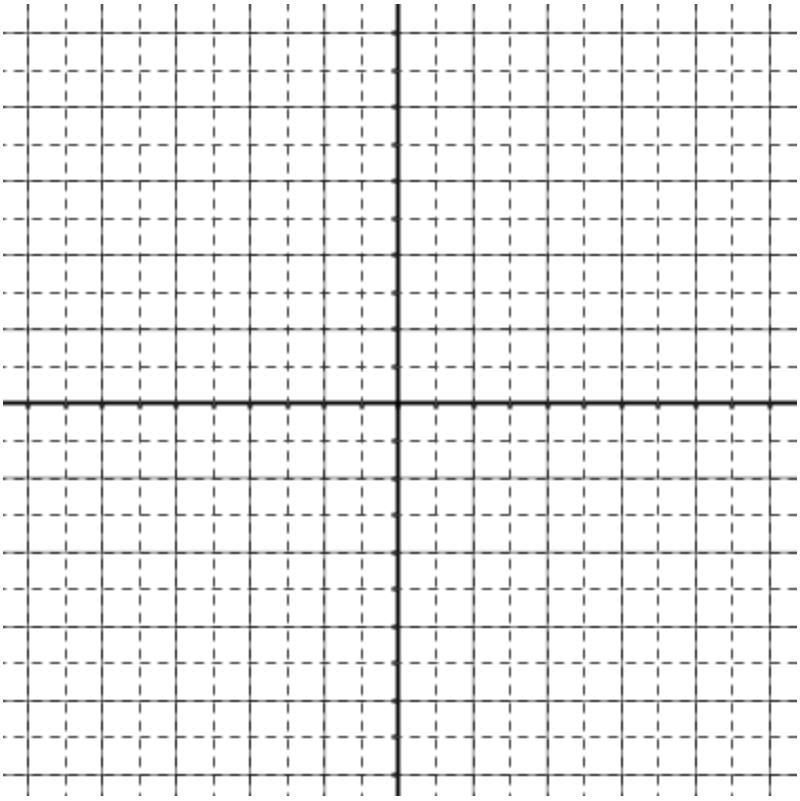
   c. What about your graph makes you think your equation is correct?

   d. Check your equation by substituting a value for **y**. What do you notice that makes you think your equation is correct?

   e. Check your equation by substituting C = (-6, -4) into the equation. What do you notice that makes you think your equation is correct?

2. Mr. Rose's car is embarrassingly dirty so he doesn't want to be seen driving in it. But he needs groceries. So he decides to walk to State Foods. He begins walking from Liberty High School.
    - Mr. Rose walks at a constant pace of 3 mph
    - Save Mart is about 1.9 miles away from school
    - At 4:00 pm, Mr. Rose has already walked 0.45 miles

    a. Create an equation for distance traveled y, in miles, in terms of time t, in minutes past 4:00 pm.



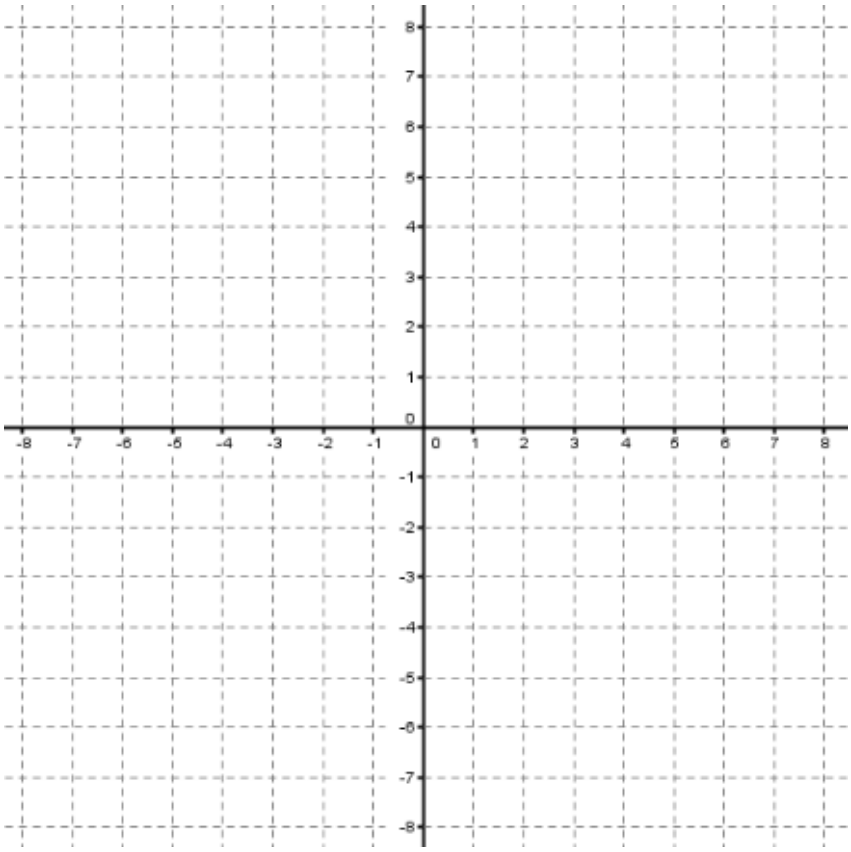
    b. Create a graph of Mr. Rose's progress, with time in minutes on the x-axis and distance in miles on the y-axis. Show calculations for your intervals on your axes here.

    c. Check your work by seeing if your equation and graph match at 4:12 pm.

    d. What time did Mr. Rose leave the school? Justify algebraically.

~~~Unit 01 Lesson 03 Classwork~~~

1. For a line with a slope of -2 passing through point E = (-3, 2)
   a. Determine the equation of this line analytically.



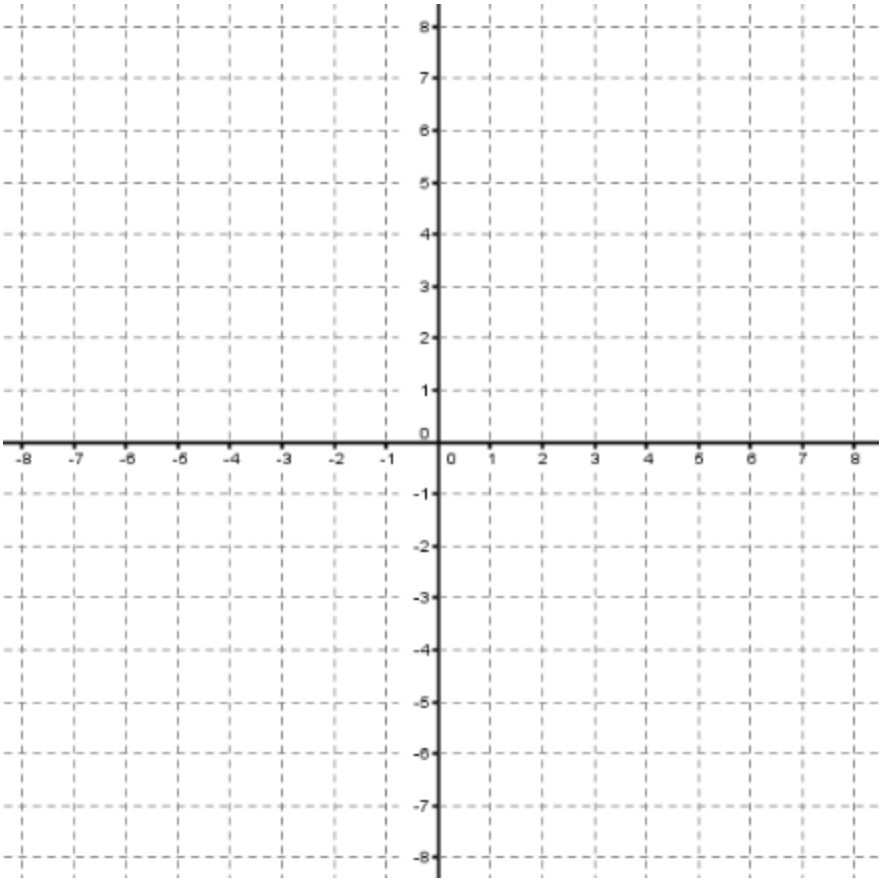
   b. Graph your equation from part a.

   c. What about your graph makes you think your equation is correct?

   d. Check your equation by substituting a value for **x**. What do you notice that makes you think your equation is correct?

   e. Check your equation by substituting C = (-6, -4) into the equation. What do you notice that makes you think your equation is correct?

2. Determine the equations of the following lines analytically. Check your answers graphically.
   a. Line with a slope of 2 passing through point E = (-1, 2)



   b. Line with a slope of 0 passing through point F = (4, -2)

   c. Line with a slope of 1 passing through point G = (7, 4)

   d. Line with a slope of $-\frac{3}{2}$ passing through point H = (-1, 1)

   e. Line with a slope of $-\frac{2}{3}$ passing through point J = (5, 0)

Unit 01 Lesson 04: Use Slope Formula, Interpolate, and Extrapolate

Lesson Objectives

- Create equations of lines given information

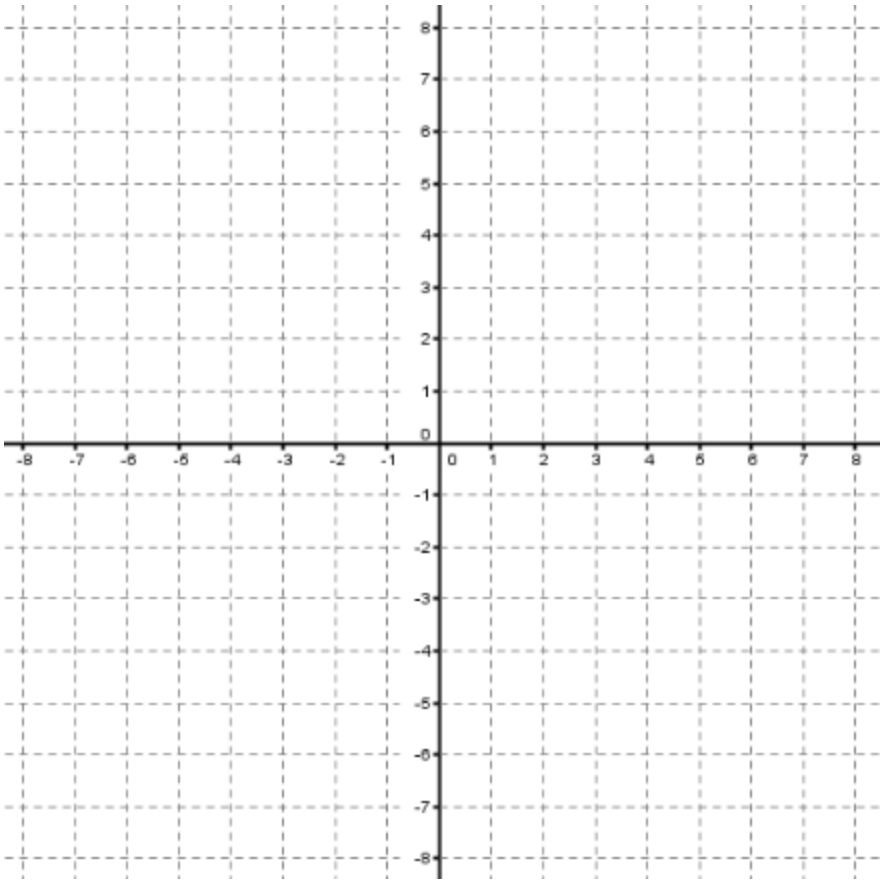
Slope Formula: Equation of a Line:

Solve analytically. Show all work. Check answers graphically.

Uku is programming NPCs for Halo 6. He needs to program the direction of the lasers for a fight scene.

Soldiers		Aliens	
Soldier A:	(-8, -3)	Alien C:	(-4, 4)
Soldier B:	(1, -6)	Alien D:	(2, 2)

1. Soldier A shoots at Alien D
    a. What is the equation of the line for the laser?



    b. Uku wants to place a rock at L = (1, 1.5). Will Rock L block Soldier A's laser?

c. During the fight scene, Alien D will dodge the laser, and the laser will explode a tree behind him. If Uku wants the tree to have an **x-coordinate** of 4, what should be the ordered pair of Tree M?

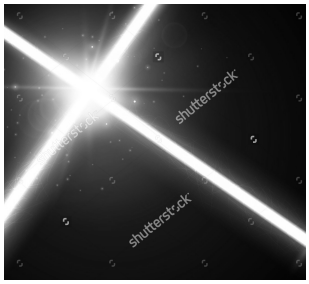
2. Soldier B shoots at Alien C
   a. What is the equation of the line for the laser?

   b. Uku wants to place a space buffalo at N = (-3, 1).
      i. Will Space Buffalo N block Soldier B's laser?

      ii. Explain your justification in part b.i. verbally. ("When I…")

   c. During the fight scene, Alien C will create a magical shield to block the laser. If Uku wants the shield to have an **y-coordinate** of 3, what should be the ordered pair of Shield O?

   d. Uku wants special effects where any lasers are crossing. At what point does Soldier A's laser cross with Soldier B's laser?

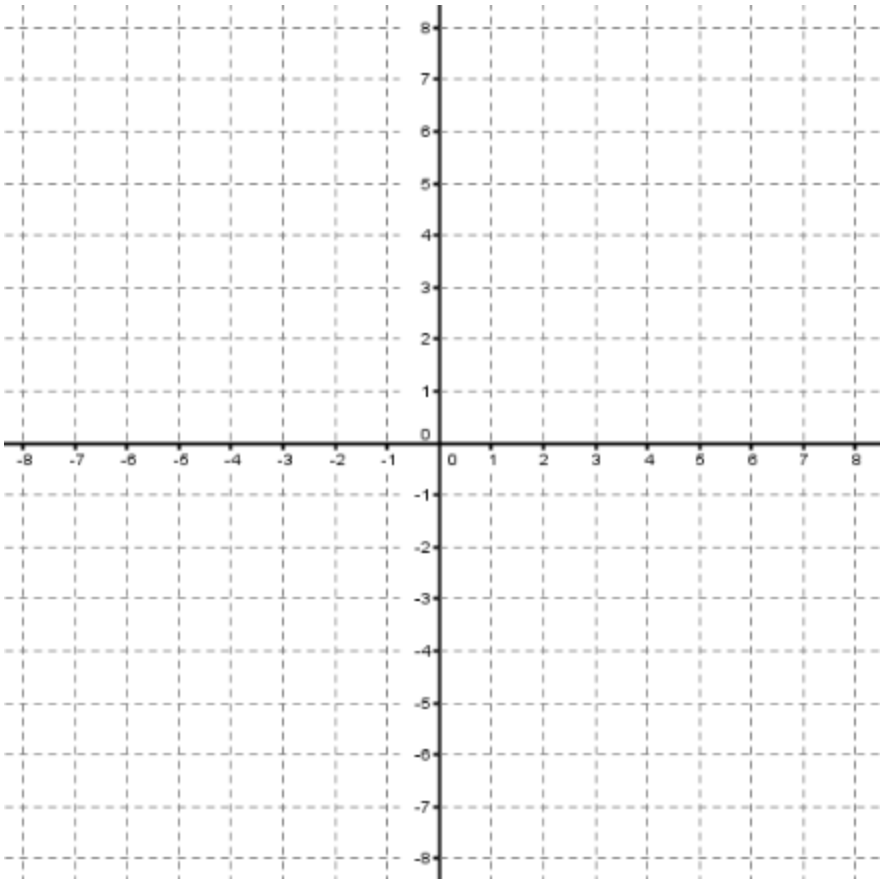


~~~Unit 01 Lesson 04 Classwork~~~

Solve analytically. Show all work. Check answers by graphing.

Soldiers		Aliens	
Soldier E:	(4, 6)	Alien H:	(-6, -5)
Soldier F:	(5, 0)	Alien J:	(-5, 2)
Soldier G:	(5, -5)	Alien K:	(-6, -4)

3. Soldier E shoots at Alien K
   a. What is the equation of the line for the laser? Explain why your graph makes you believe your equation is correct.



   b. Uku wants to place a cactus at P = (1.5, 4.5).

      i. Will the cactus block Soldier E's laser?

      iI. Explain your justification in part b.i. verbally. ("When I…")

   c. During the fight scene, Alien K will use telekinesis to move the cactus to block the laser. If Uku wants the cactus to have an **x-coordinate** of -3.1, what should be the ordered pair of the cactus Q?

4. Soldier G shoots at Alien H
    a. What is the equation of the line for the laser?

    b. Uku wants to place a rock at R = (6, -5).

        i. Will Rock R block Soldier G's laser?

        ii. Explain your justification in part b.i. verbally. ("When I…")

    c. During the fight scene, Alien H will dodge the laser, and the laser will explode a tree behind him. If Uku wants the tree to have an **y-coordinate** of -6, what should be the ordered pair of Tree S?

    d. Uku wants special effects where any lasers are crossing. At what point does Soldier G's laser cross with Soldier E's laser?

    e. Question 4 shows the importance of checking by graphing.
        i. Were there any questions with no analytical solution? Which?

        ii. Were there any questions where the analytical solution would have led you to a wrong answer if you hadn't checked by graphing? List each question and explain why.

Unit 01 Lesson 05: Create and Use Linear Models

Lesson Objectives

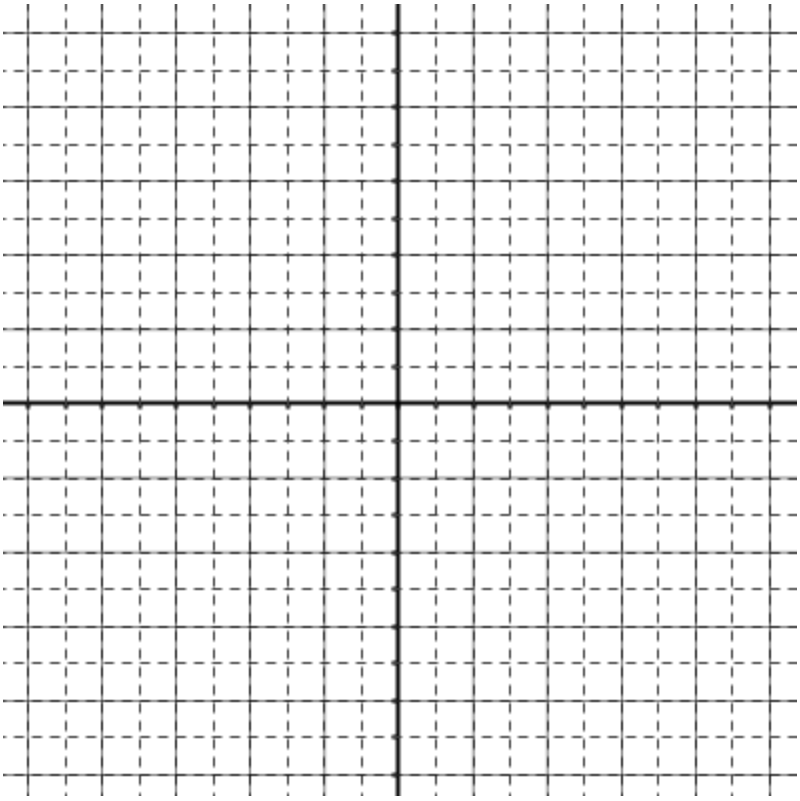
- Create equations of lines given information using graphing calculators and Desmos

1. Elastic Modulus: _____

   _____ : _____

   _____ : _____

   a. Area of cross section: _____ x _____ = _____
   b. Create a table of stresses and strains. Graph these with strain on the x-axis and stress on the y- axis



c. Use a graphing calculator to

i. create an equation which estimates the stress needed to strain a rubber band

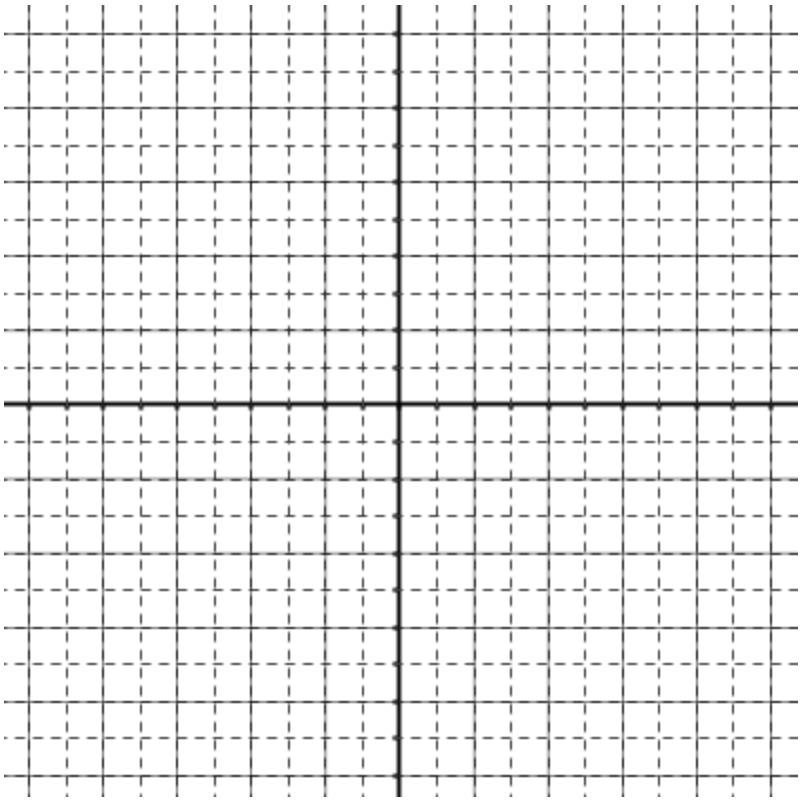
ii. What is the coefficient of determination?

d. Explain the theoretical meaning of your slope in this problem

e. Explain the theoretical meaning of your y-intercept in this problem

2. Some say that people who are good at math tend to make more money. Let's see if it's true. The following table compares average SAT Math scores with income those people eventually earn.

SAT Math score	Annual Salary
635	$50,000
395	$34,500
490	$44,000
320	$34,000
705	$60,000
430	$41,500
585	$56,500
510	$41,500
460	$43,000
545	$46,000



a. Plot the points on the graph
b. Use a graphing calculator to
   i. create an equation which estimates the annual salary of a person for a given SAT Math score.

   ii. What is the coefficient of determination?

c. Explain the theoretical meaning of your slope in this problem

d. Explain the theoretical meaning of your y-intercept in this problem

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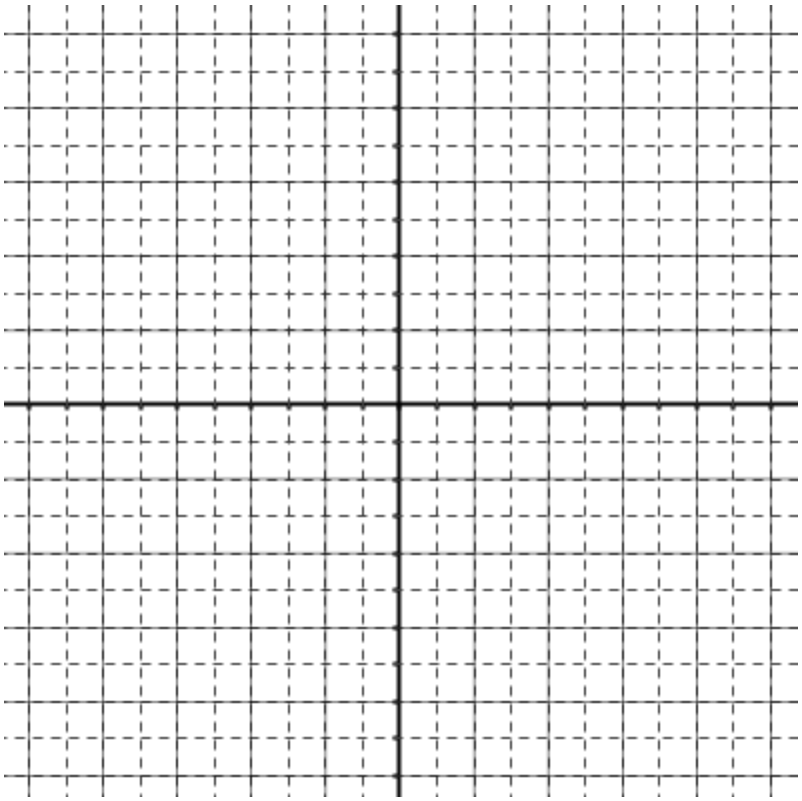
~~~Unit 01 Lesson 05 Homework~~~ Weight Loss Plan (Burn Rate)

~~~Unit 01 Lesson 05 Classwork~~~

1. Some say that people who are good at Language Arts tend to make more money. Let's see if it's true. The following table compares average SAT Verbal scores with income those people eventually earn.

SAT Verbal Score	Annual Salary
620	$49,500
390	$33,500
580	$57,000
315	$33,000
700	$42,500
520	$47,000
430	$44,000
550	$49,500
465	$45,000
490	$48,000



a. Plot the points on the graph
b. Use a graphing calculator to
    i. create an equation which estimates the annual salary of a person for a given SAT Verbal score.

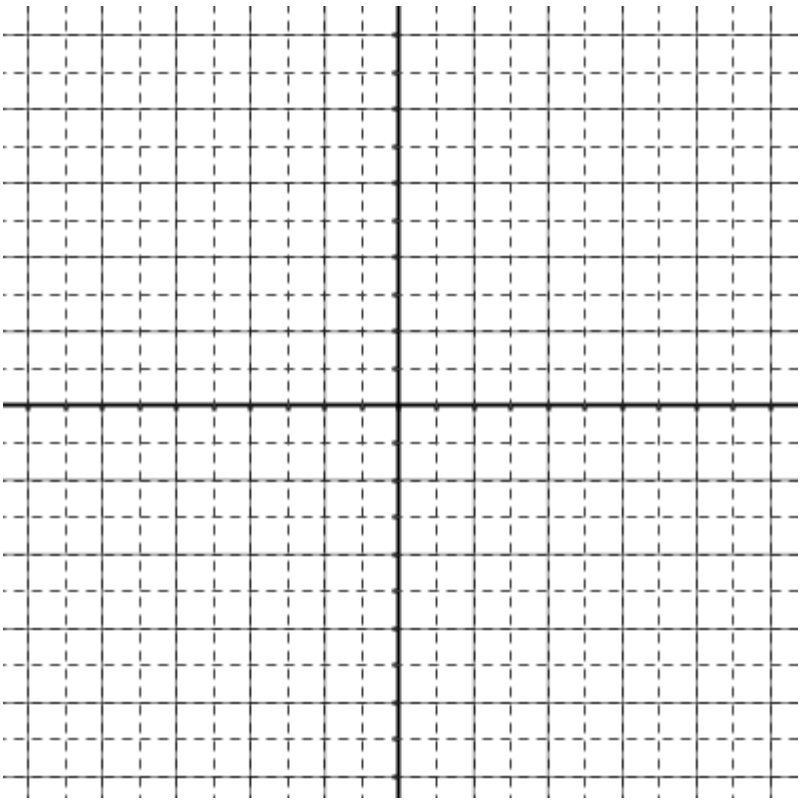
    ii. What is the coefficient of determination?

c. Explain the theoretical meaning of your slope in this problem

d. Explain the theoretical meaning of your y-intercept in this problem

2. Some say that people who do well on the ASVAB military test tend to make more money. Let's see if it's true. The following table compares average ASVAB percentiles with income eventually earned.

ASVAB Score	Annual Salary
47	$37,000
27	$29,000
78	$39,500
17	$26,500
64.5	$41,000
39	$33,000
83	$42,500
20	$28,000
7.5	$24,000
92.5	$46,000
13	$28,000
87.5	$50,500



a. Plot the points on the graph (just the first column)
b. Use a graphing calculator to (use both columns)
    i. create an equation which estimates the annual salary of a person for a given ASVAB score

    ii. What is the coefficient of determination?

c. Explain the theoretical meaning of your slope in this problem

d. Explain the theoretical meaning of your y-intercept in this problem

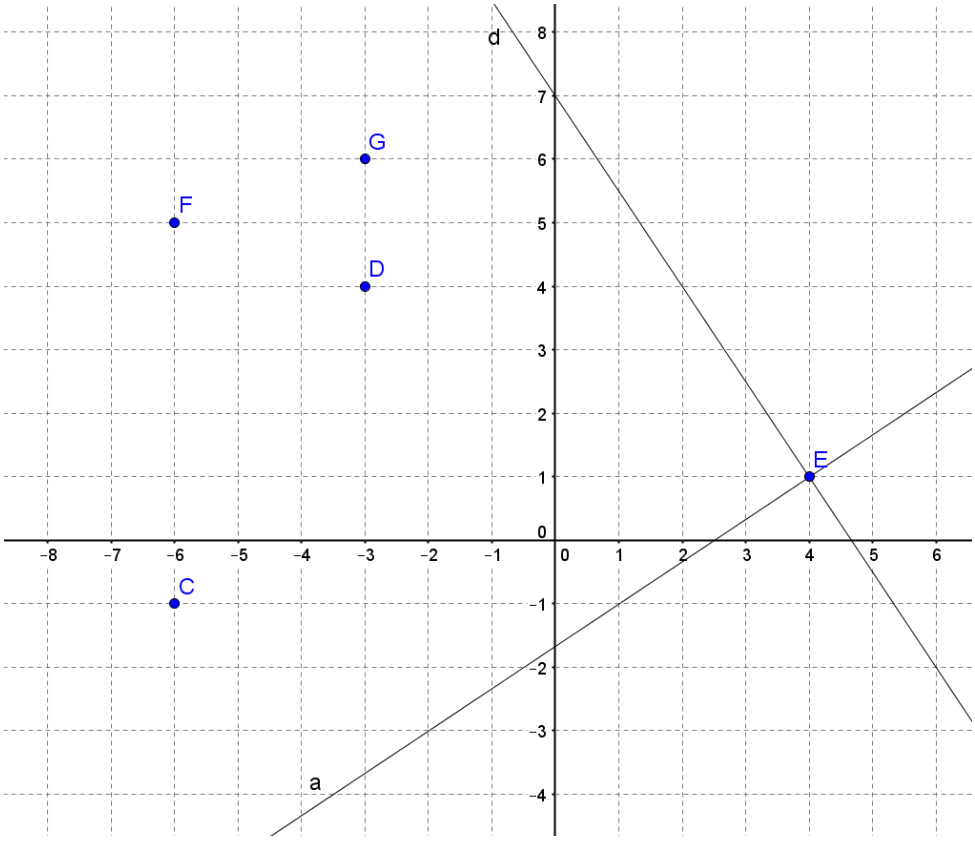
Unit 01 Lesson 06: Solve in Situations Involving Parallel Lines

Lesson Objectives

- Determine equations of parallel lines

Parallel Lines:

1. Solve the following analytically. Check graphically.
   a. What is the equation of road a, which is parallel to road a and passes through point C?



   b. What is the equation of road a, which is parallel to road d and passes through point F?

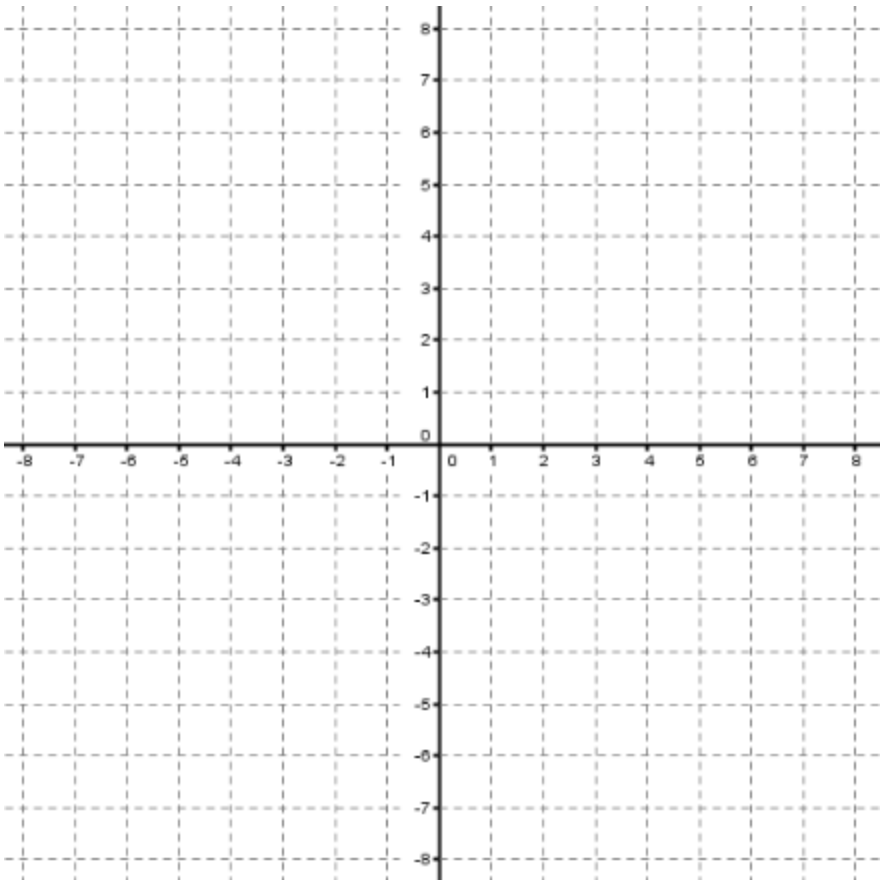
   c. What is the equation of road q, which is parallel to road a and passes through point D?

d. What is the equation of road r, which is parallel to road d and passes through point G?

2. Solve the following questions analytically
   a. A line has an equation of y = 3x + 8. What is the equation of a parallel line that passes through (3, 6)?

   b. A coordinate plane contains the points *L* = (3, -1), *M* = (5, 4), and *N* = (0, 5). What is the equation of the line passing through *M* parallel to $\overline{LN}$?

3. Once Lucian casts “The Culling”, all of his blasts are parallel for 3 seconds. Lucian begins “The Culling” standing at (-3, -1) and aims at the enemy champion standing at (5, 3). If the enemy moves to (6, 1),
    a. where should Lucian move to in order to resume hitting them? Give two possible answers, one moving left/right

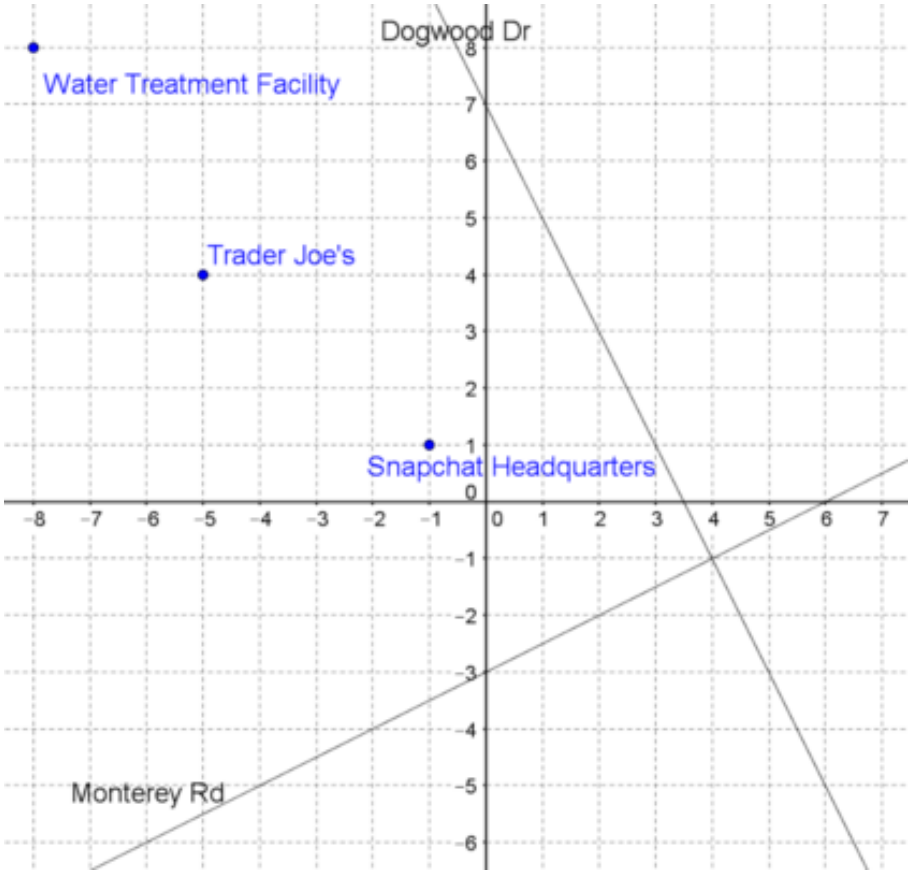


    b. and the other moving up/down.

    c. Diagram the situation on the graph provided

~~~Unit 01 Lesson 06 Classwork~~~

1. Determine the equations of Dogwood Drive and Monterey Road graphically.



2. A new town is designing new roads. Solve the following questions analytically. Check your answers graphically if possible.
   a. Tasty Avenue is parallel to Dogwood Drive and passes through Trader Joe's. Determine the equation of Tasty Ave.

   b. Yummy Lane is parallel to Monterey Road and passes through Trader Joe's. Determine the equation of Yummy Lane.

   c. Drama Street is parallel to Dogwood Drive and passes through Snapchat headquarters. Determine the equation of Drama Street.

   d. Duck Face Drive is parallel to Monterey Road. and passes through Snapchat headquarters. Determine the equation of Duck Face Drive.

e. H_2O Ave is parallel to Yummy Lane and passes through the water treatment facility. Determine the equation of H_2O Ave.

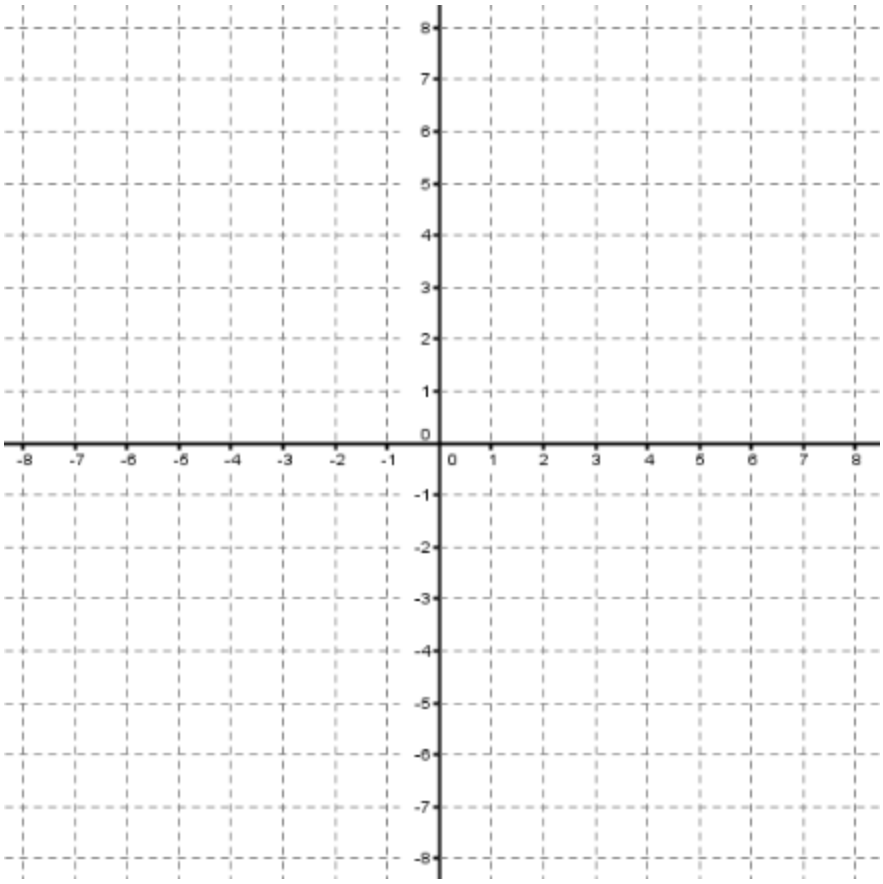
f. Aqua Boulevard is parallel to Drama Street. and passes through the water treatment facility. Determine the equation of Aqua Boulevard.

3. Apple Street has an equation of $y = 3x + 22$. Banana Street is parallel to Apple Street and passes through a fruit stand at (-3, -20). What is the equation of Banana Street?

4. Dog Avenue passes through points (-2, -1) and (1, -2). Cat Street is parallel to Dog Avenue and passes through the point (6, 7). What is the equation of Cat Street?

5. Once Taliyah casts “Threaded Volley”, she throws rocks parallel for 3 seconds. Taliyah begins “Threaded Volley” standing at (3, 1) and aims at the enemy champion standing at (-1, 7). If the enemy moves to (-3, 4).

   a. Where should Taliyah move to in order to resume hitting them? Give two possible answers, one moving left/right



   b. and the other moving up/down.

   c. Diagram the situation on the graph provided

Unit 01 Lesson 07: Solve in Situations Involving Perpendicular Lines

Lesson Objectives

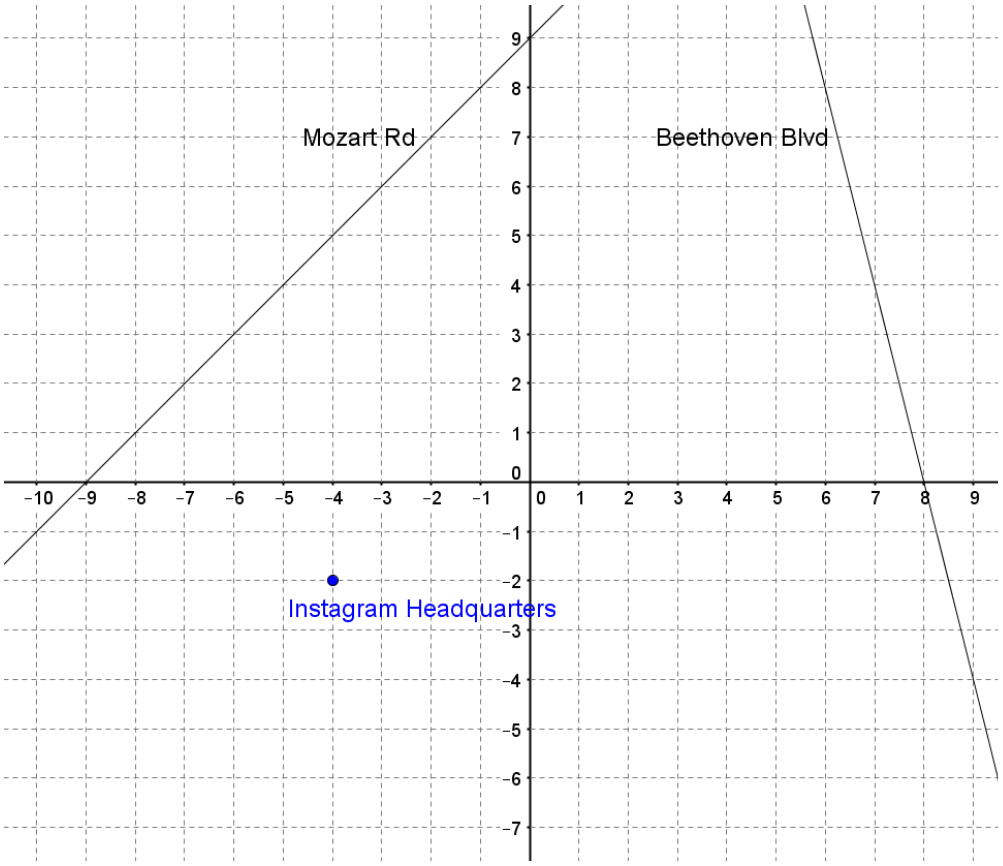
- Determine equations of perpendicular lines

Examples of slopes where $\overline{AB} \perp \overline{CD}$.

Conclusion: _____

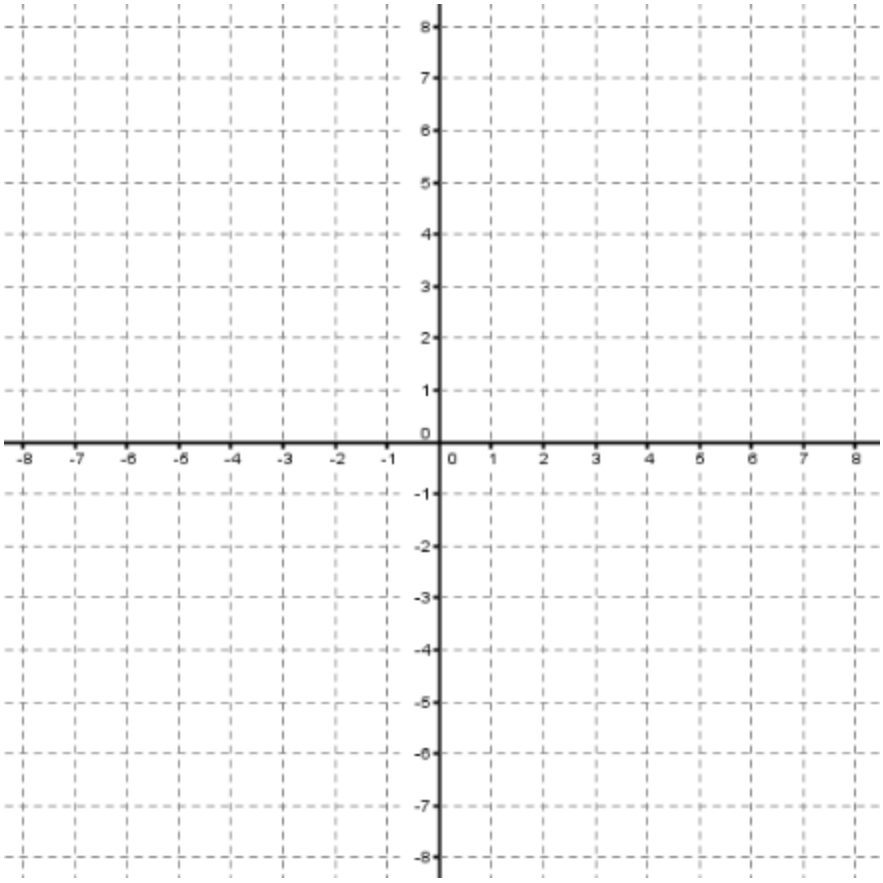
_____

1. Find the equations of the roads described analytically. Check your answers graphically.
    a. Selfie Street, which is perpendicular to Mozart Road and passes through Instagram Headquarters



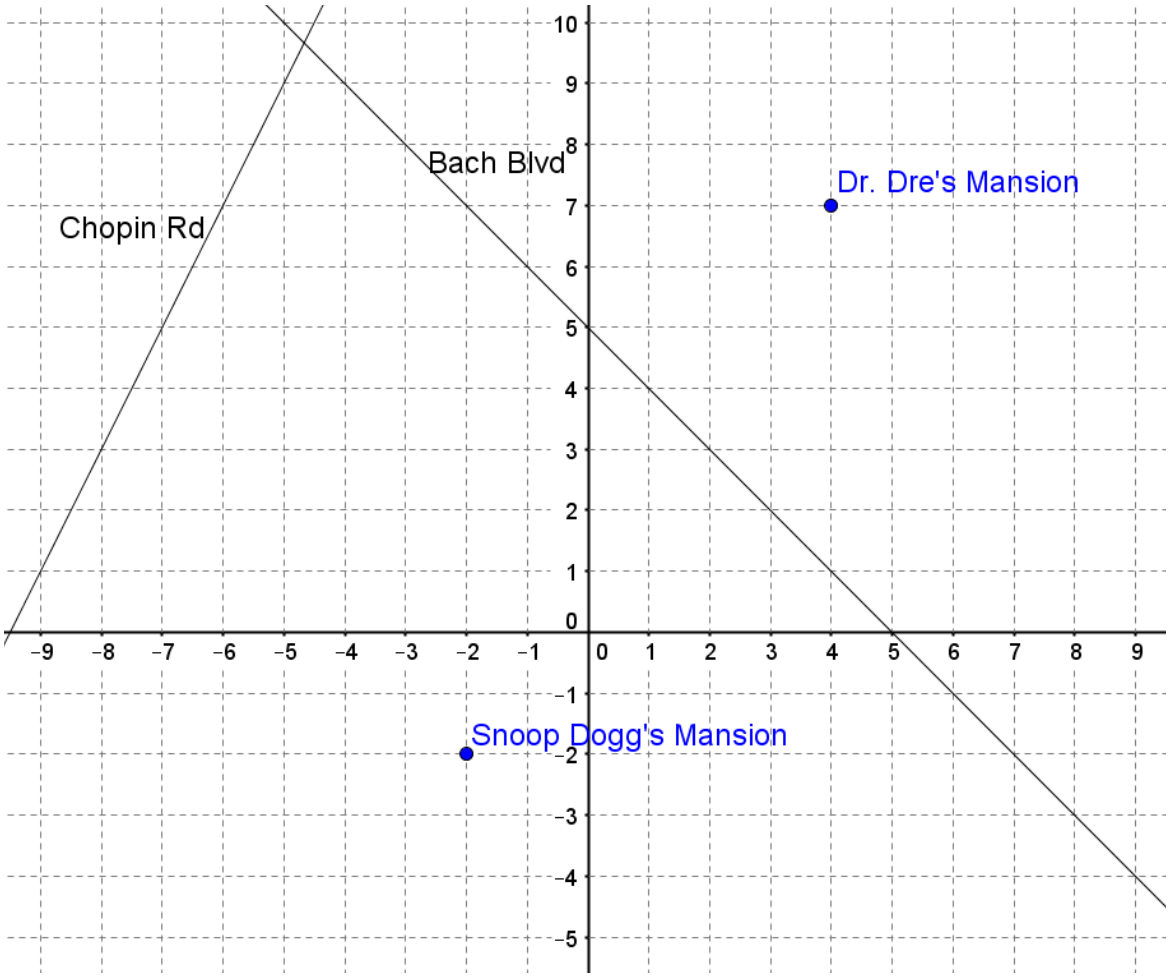
    b. OMG So Cute Street, which is perpendicular to Beethoven Boulevard and passes through Instagram Headquarters

2. Once Lucian casts “The Culling”, all of his blasts are parallel for 3 seconds. Lucian begins “The Culling” standing at (-3, -1) and aims at the enemy champion standing at (5, 3). If the enemy moves to (7, -1).
    a. Where should Lucian move to in order to resume hitting them as quickly as possible?
    b. Diagram the situation on the graph provided

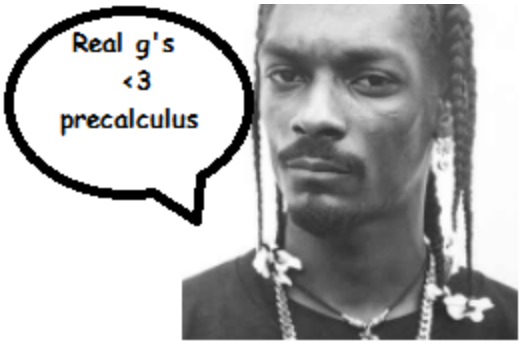


~~~Unit 01 Lesson 07 Classwork~~~

1. Find the equations of the roads described below analytically. Check your answers graphically.



a. Ice Cube Avenue, which is perpendicular to Chopin Road and passes through Snoop Dogg's Mansion.

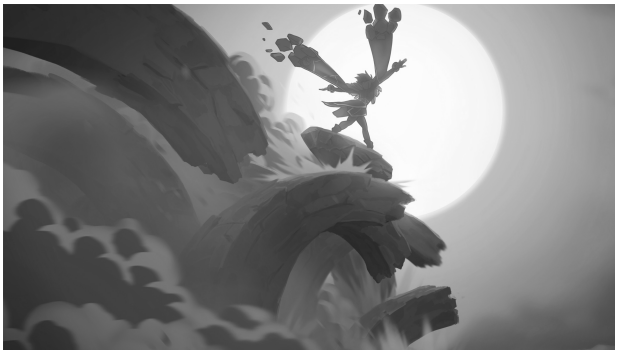


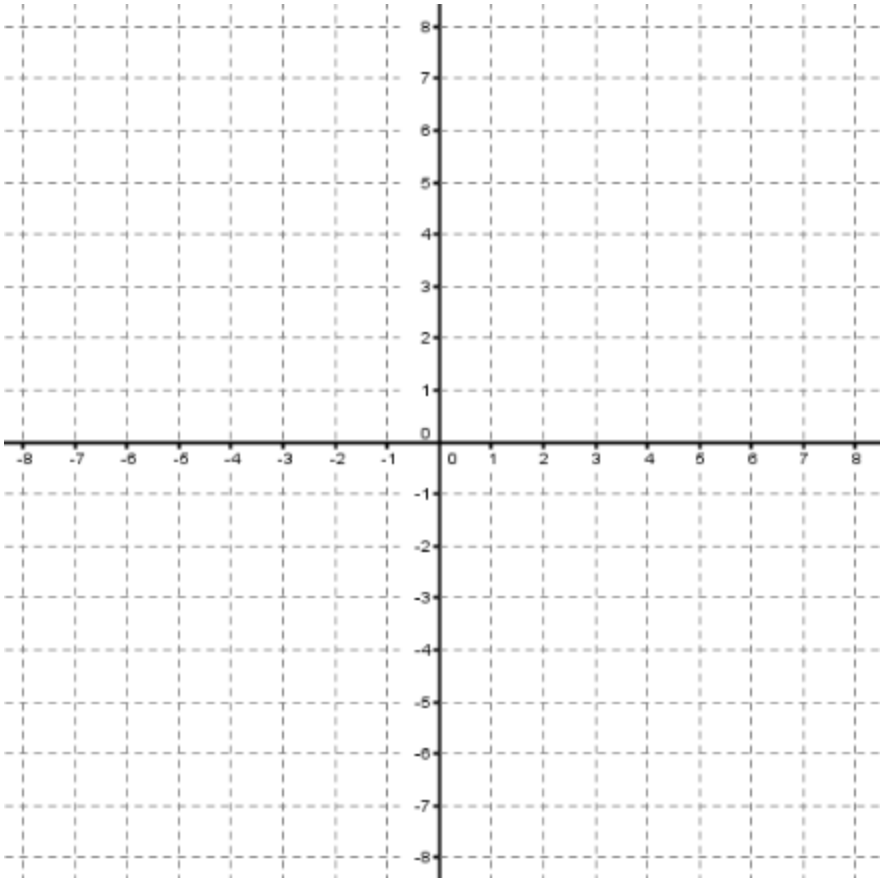
b. Eazy-E Avenue, which is perpendicular to Bach Boulevard and passes through Dr. Dre's Mansion.

c. Are Chopin Road and Bach Boulevard perpendicular? Explain why or why not.

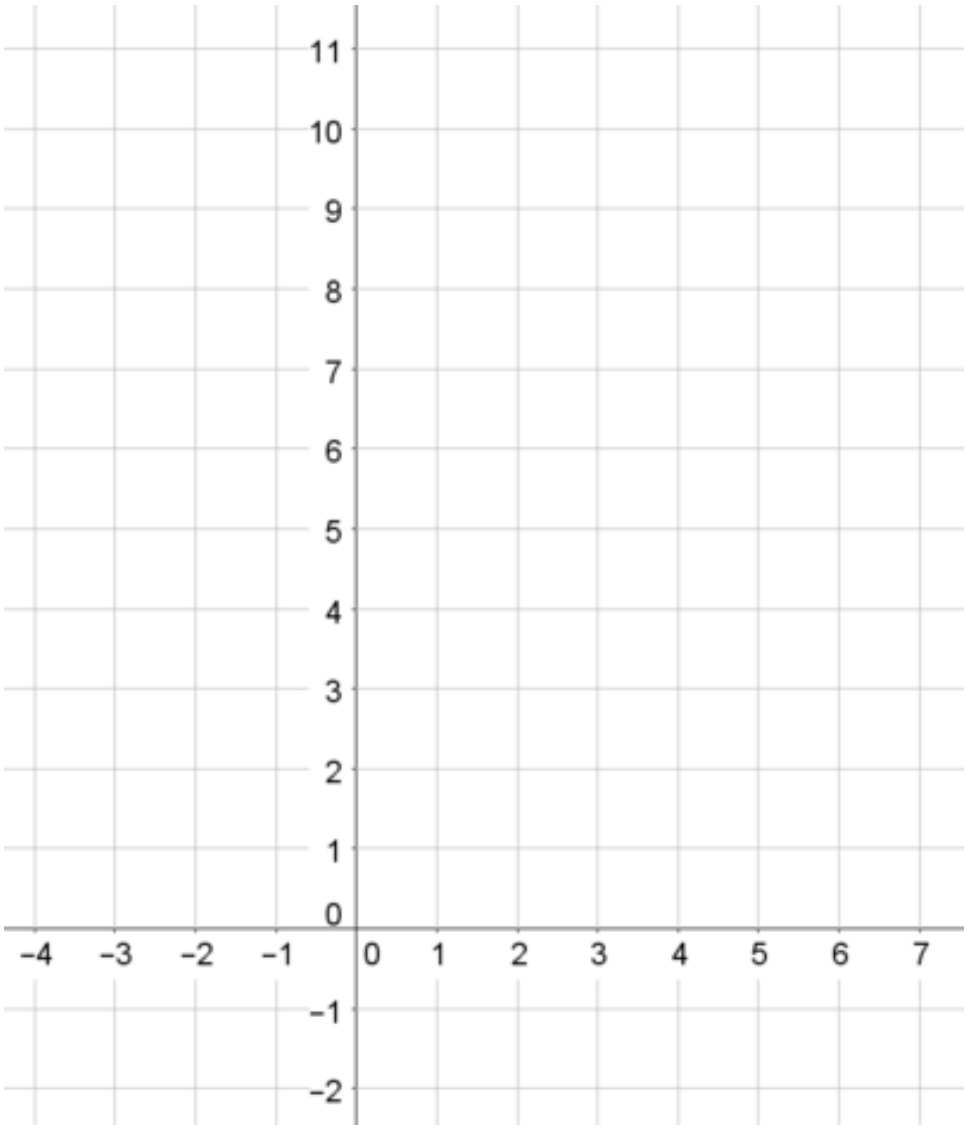
d. Big Sean Street is going to be parallel to Chopin Road and pass through Dr. Dre's Mansion. Will Big Sean Street be perpendicular to Ice Cube Avenue? Explain why or why not.

2. Once Taliyah casts “Threaded Volley”, she throws rocks parallel for 3 seconds. Taliyah begins “Threaded Volley” standing at (3, 1) and aims at the enemy champion standing at (-1, 7). If the enemy moves to (-7, 3).
    a. Where should Taliyah move to in order to resume hitting them as quickly as possible?
    b. Diagram the situation on the graph provided





3. Solve analytically. Check graphically.
    a. Find the equation of $\overline{AB}$ given A = (2, 3) and B= (4, 4) . Label this line *j*.



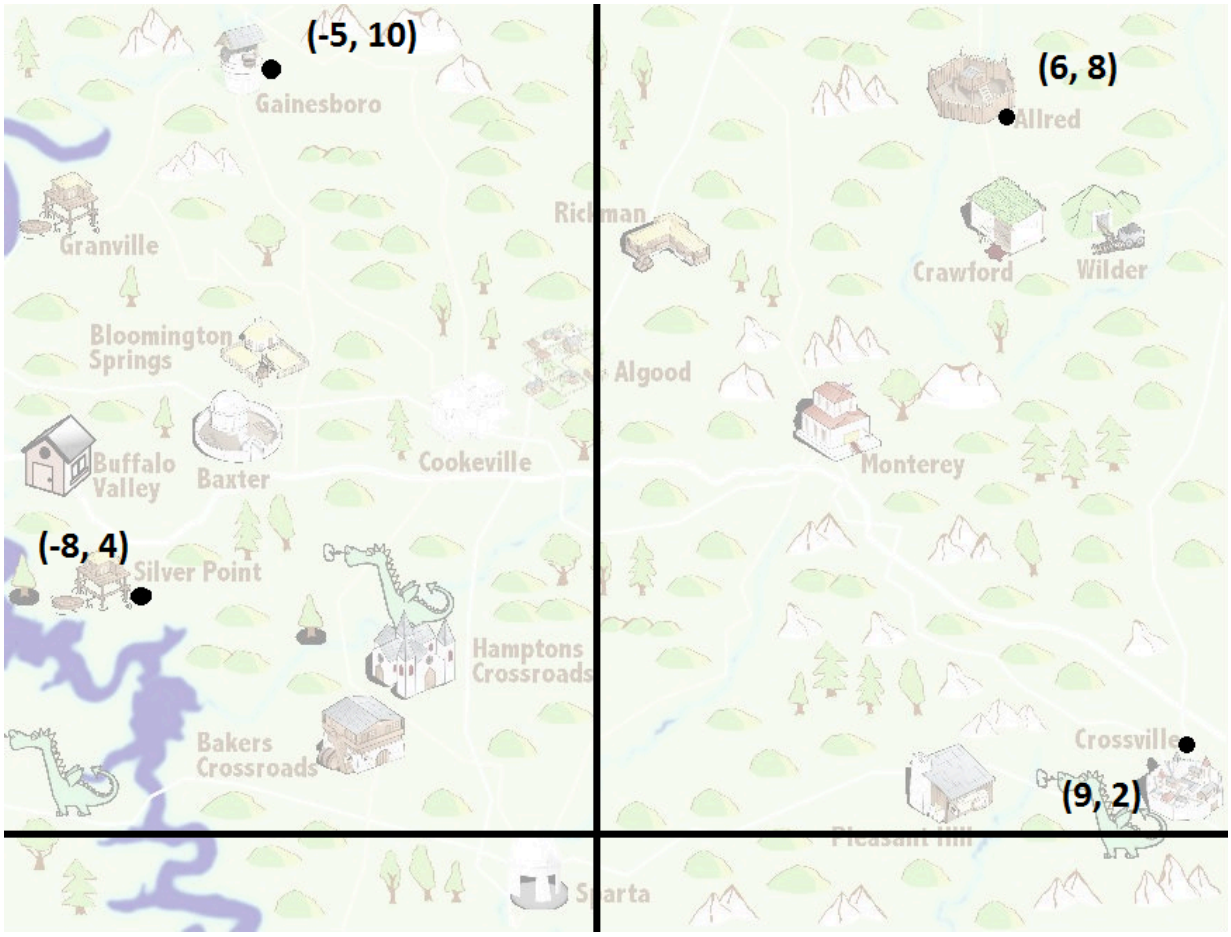
    b. Derive the equation of line *k*, which is parallel to $\overline{AB}$ and passes through point C = (4,7).

    c. Derive the equation of line *l*, which is perpendicular to $\overline{AB}$ and goes through D = (2,4).

Unit 01 Lesson 08: Determine Distances Between Two Points

Lesson Objectives

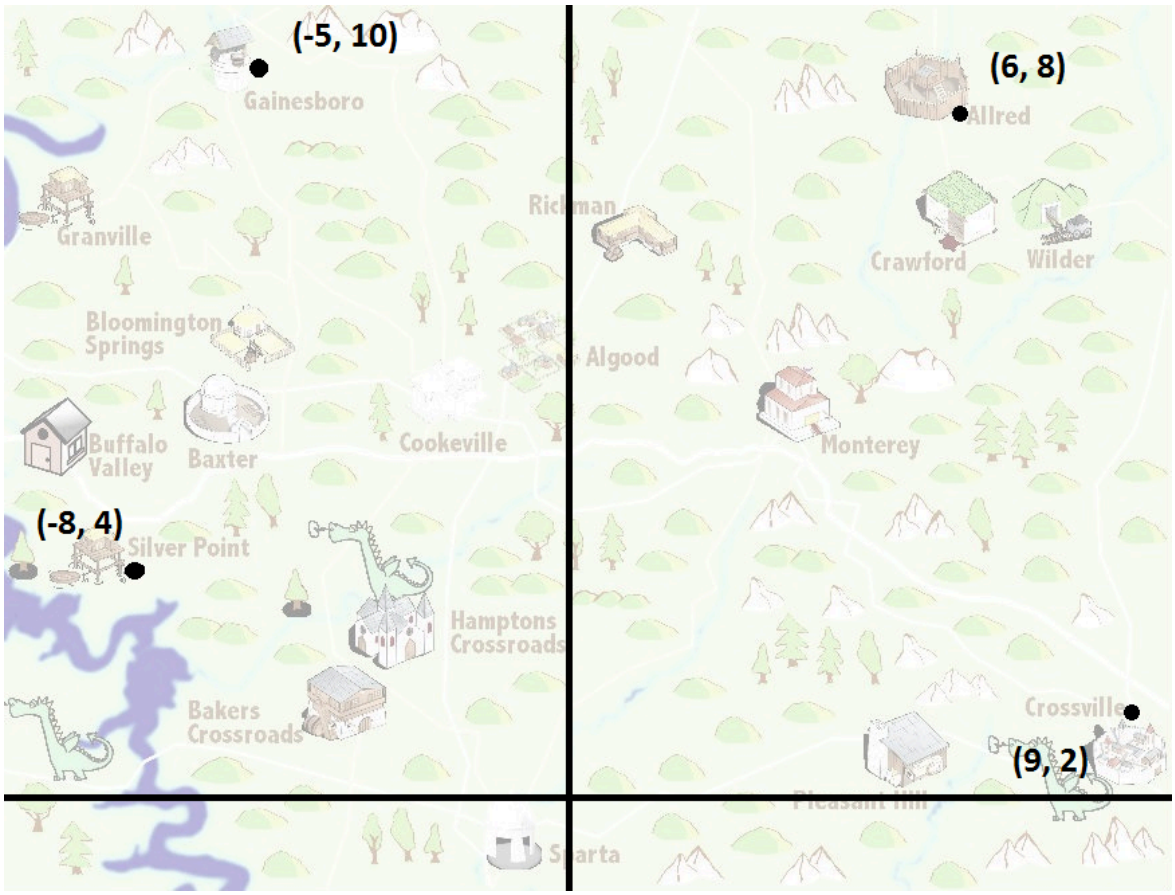
- Solve for distances between two points



1. Find the distance between Allred and Crossville

2. A dragon tamer wants to open a store on the x-axis, 5 miles away from silver point and preferably near Bakers Crossroads. What would be a good ordered pair for said store?

~~~Unit 01 Lesson 08 Homework~~~ Project: "The Culling"



3. Find the distance between Silver Point and Gainesboro

4. A cobbler wants to open a store 10 miles away from Silver Point. If he wants the store to be on the y-axis, where could he put the store?

5. A blacksmith wants to create a road from Silver Point, that is perpendicular to the road between Silver Point and Gainesboro. On this road, he wants to put a store where it crosses the x-axis. How far away would this store be from Allred?

Unit 01 Lesson 09: Finding x and y Components Given Slope and Length

Lesson Objectives

- Create equations of lines given information

Draw #1 and #2 on the same coordinate plane

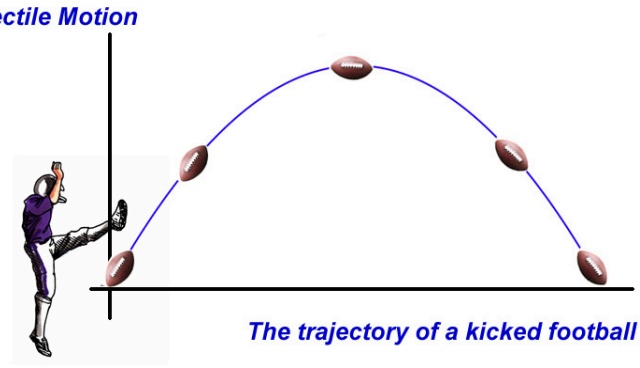
1. Johnny stands at (8, -2), then walks 10 miles northwest with a slope of $-\frac{3}{4}$. What will be Johnny's final position?

2. Sally stands at (-9, -9), then walks 12 miles northeast with a slope of $\frac{5}{12}$. What will be Sally's final position?

Projectile Motion: The x and y components of velocity behave completely _____

- The x component _____
- The y component _____

3. A helmet man kicked a sports ball. He kicked it at a slope of 2, with a velocity of 93 miles per hour (this is a normal speed). Let's see how far the kick will go.



$$t = 2\frac{v_{oy}}{g}$$

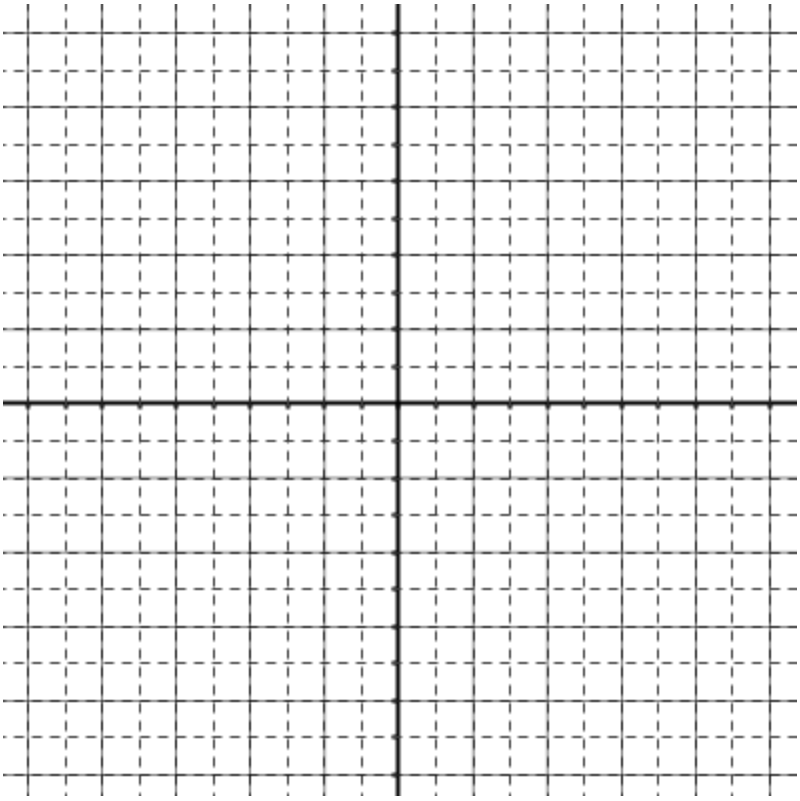
   a. The equation tells you how long an object will stay in the air, where
      - t: time until object hits the ground
      - v_{oy}: the y component of the initial velocity
      - g: the downward acceleration due to gravity, $32.2\frac{ft}{sec^2}$ aka $9.81\frac{m}{sec^2}$

      How long will the ball stay in the air?

   b. How far will the ball travel?

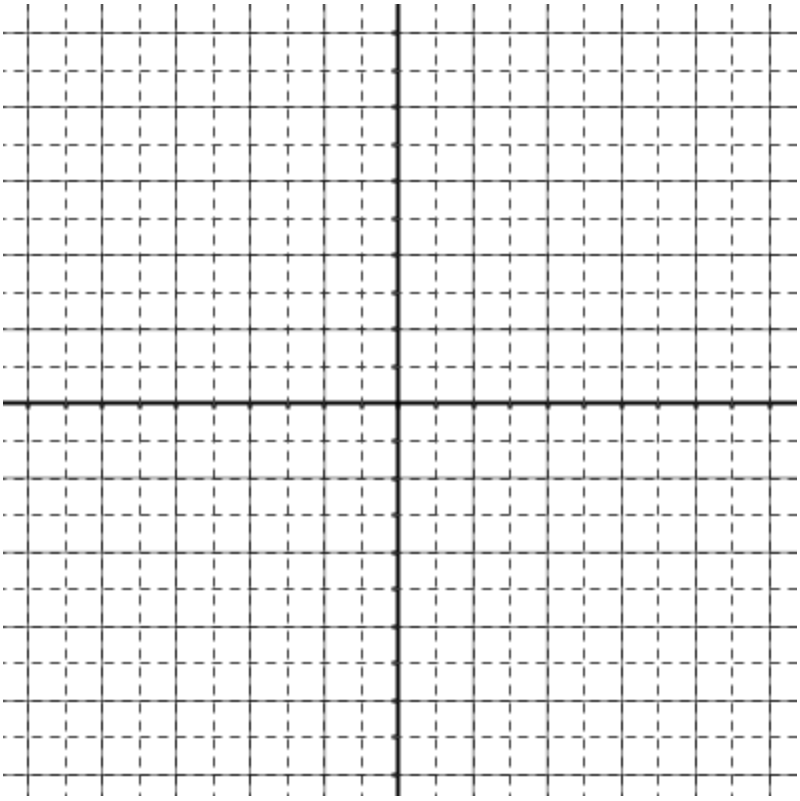
~~~Unit 01 Lesson 09 Classwork~~~

Graph #1 and #2 on the same coordinate plane



1. Ness stands at (-9, 1), then walks 8.5 miles northeast with a slope of $\frac{8}{15}$. What will be Ness's final position?

2. Paula stands at (10, -10), then walks 10 miles northwest with a slope of -2. What will be Paula's final position?

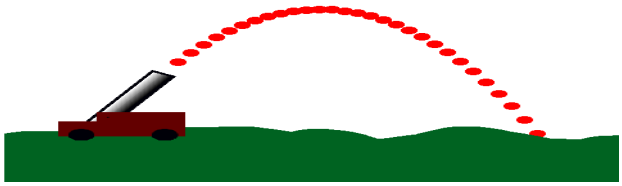


Graph #3 and #4 on the same coordinate plane

3. Jeff stands at (-10, 10), then walks 12 miles southeast with a slope of $-\frac{1}{3}$. What will be Jeff's final position?

4. Poo stands at (-4, 4), then walks 5 miles southwest with a slope of $\frac{24}{7}$. What will be Poo's final position?

5. A cannon truck launches a cannonball. It launched the ball at a slope of 2/3, with a velocity of 150 m/sec. Let's see how far the ball will go



a. The equation $t = 2\frac{v_{oy}}{g}$ tells you how long an object will stay in the air, where
   - t: time until object hits the ground
   - v_{oy}: the y component of the initial velocity
   - g: the downward acceleration due to gravity, $32.2\frac{ft}{sec^2}$ aka $9.81\frac{m}{sec^2}$

   How long will the ball stay in the air?

b. How far will the ball travel?

Unit 01 Lesson 10: Convert Between Equations and Graphs of Circles

Lesson Objectives

- Create equations of lines given information

1. What is the equation of circle d?

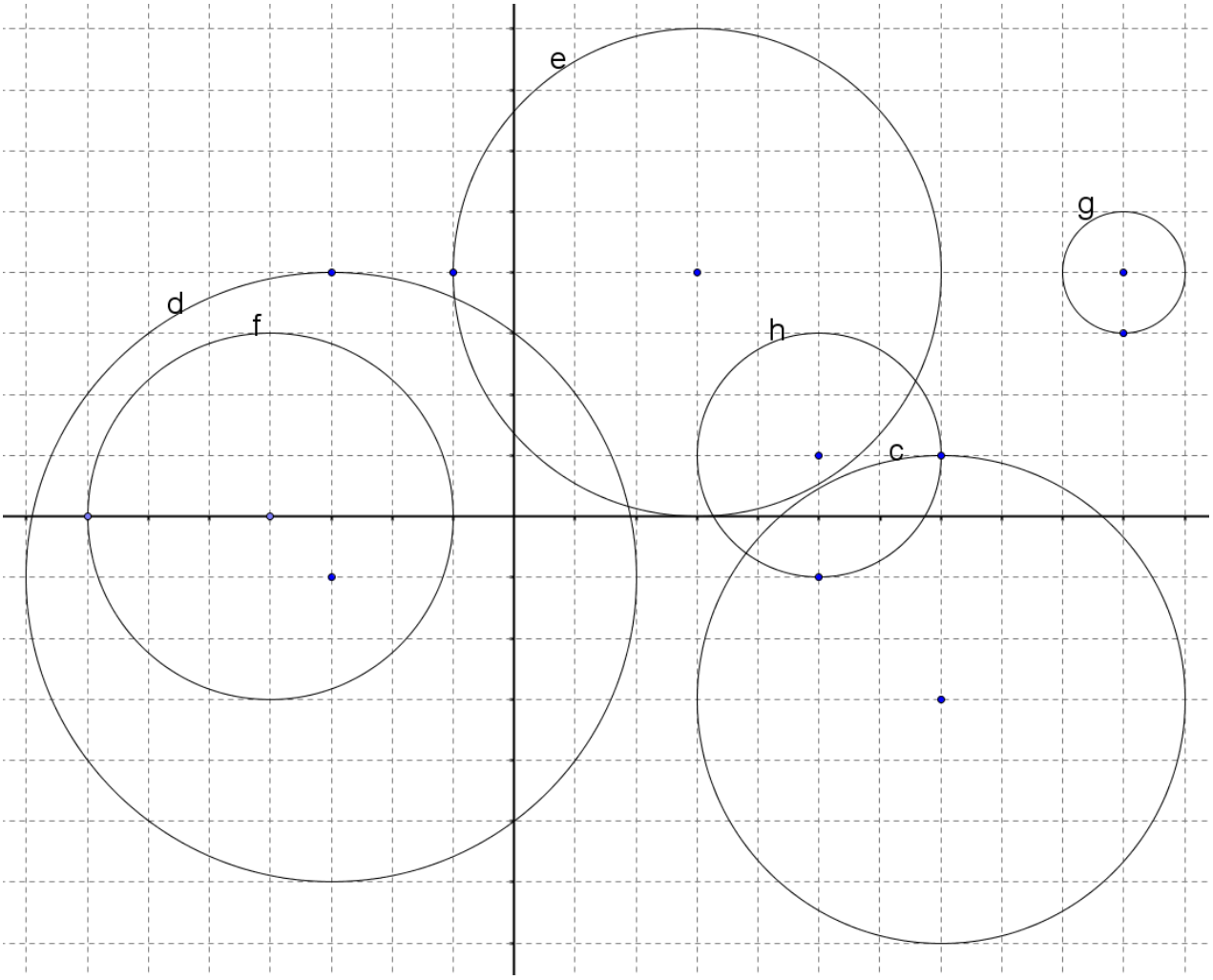
2. What is the equation of circle h?

3. What is the equation of circle f?

4. What is the equation of circle g?

5. What is the equation of circle e?

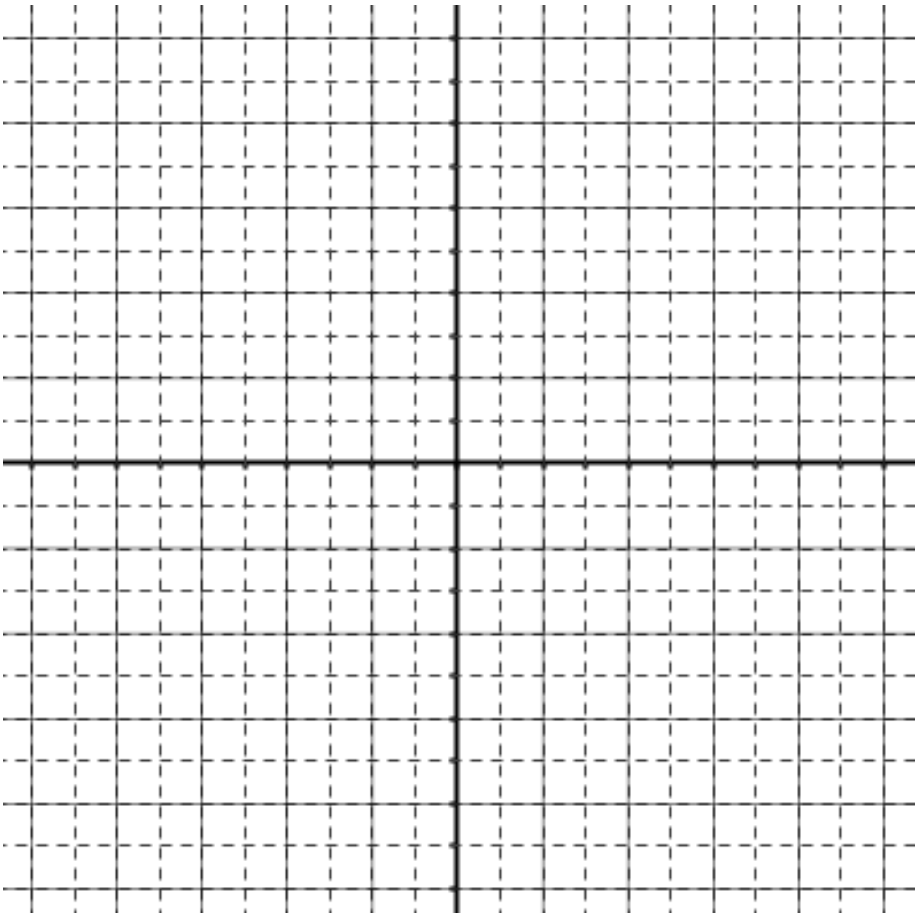
6. What is the equation of circle c?



7. In a new Mario game, the animation designer wants to have a scene where Mario walks through a room with puddles of lava, without getting burnt. She designed the animation using the following equations.

- Mario's x-coordinate constantly decreases, beginning at $x = 5$
- Mario's y-coordinate follows the equation $y = 0.5x - 1.5$
- lavaPuddle_1 is located at $x^2 + (y - 1)^2 = 4$
- lavaPuddle_2 is located at $(x + 1)^2 + (y + 6)^2 = 16$

a. Will Mario successfully complete the animation? Determine your answer **graphically**.



b. If not, which object(s) did Mario collide with?

c. Suggest a better equation for this object. (Many possible answers). Justify your proposition graphically.

~~~Unit 01 Lesson 10 Classwork~~~

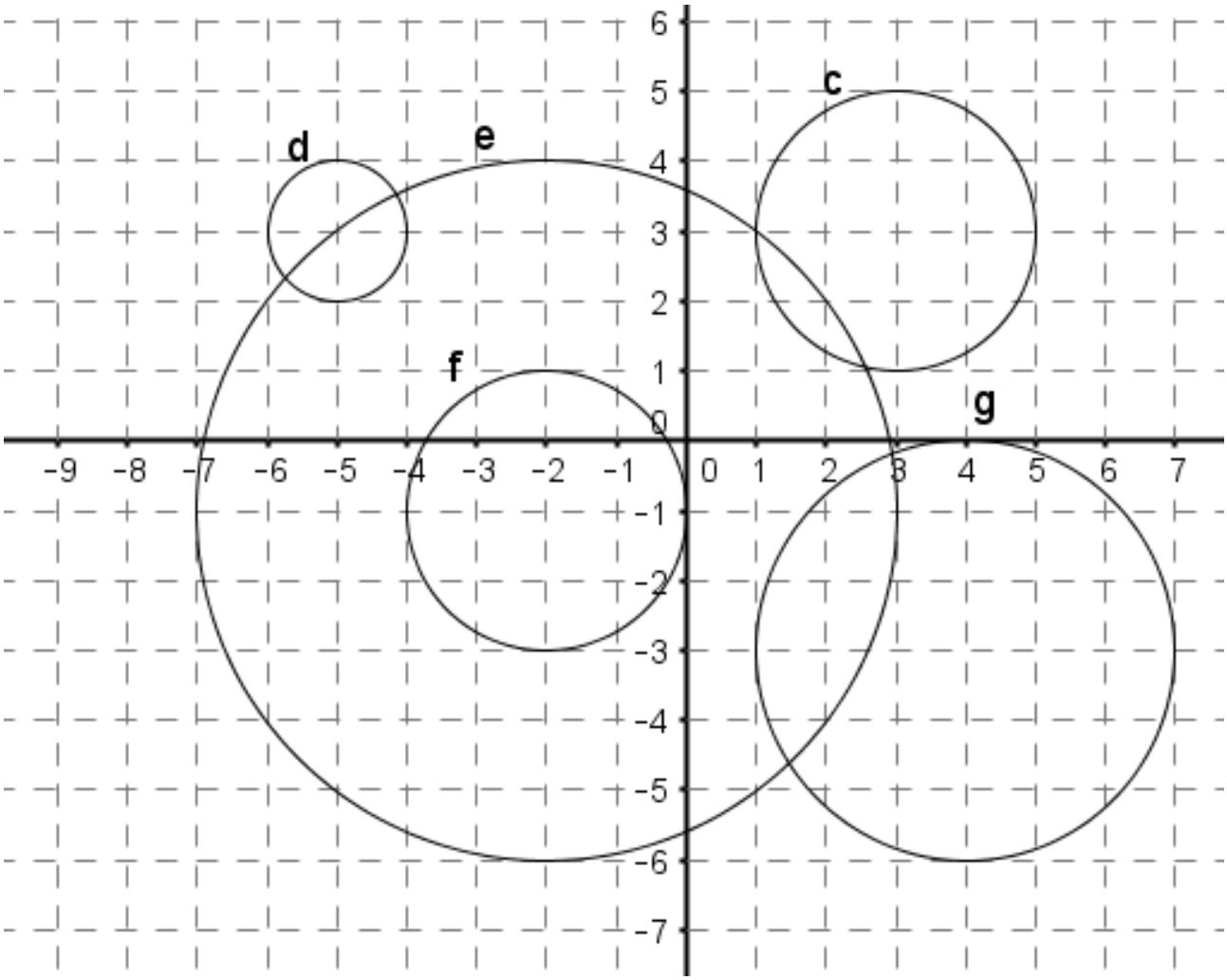
1. What is the equation of circle c?

2. What is the equation of circle d?

3. What is the equation of circle e?

4. What is the equation of circle f?

5. What is the equation of circle g?



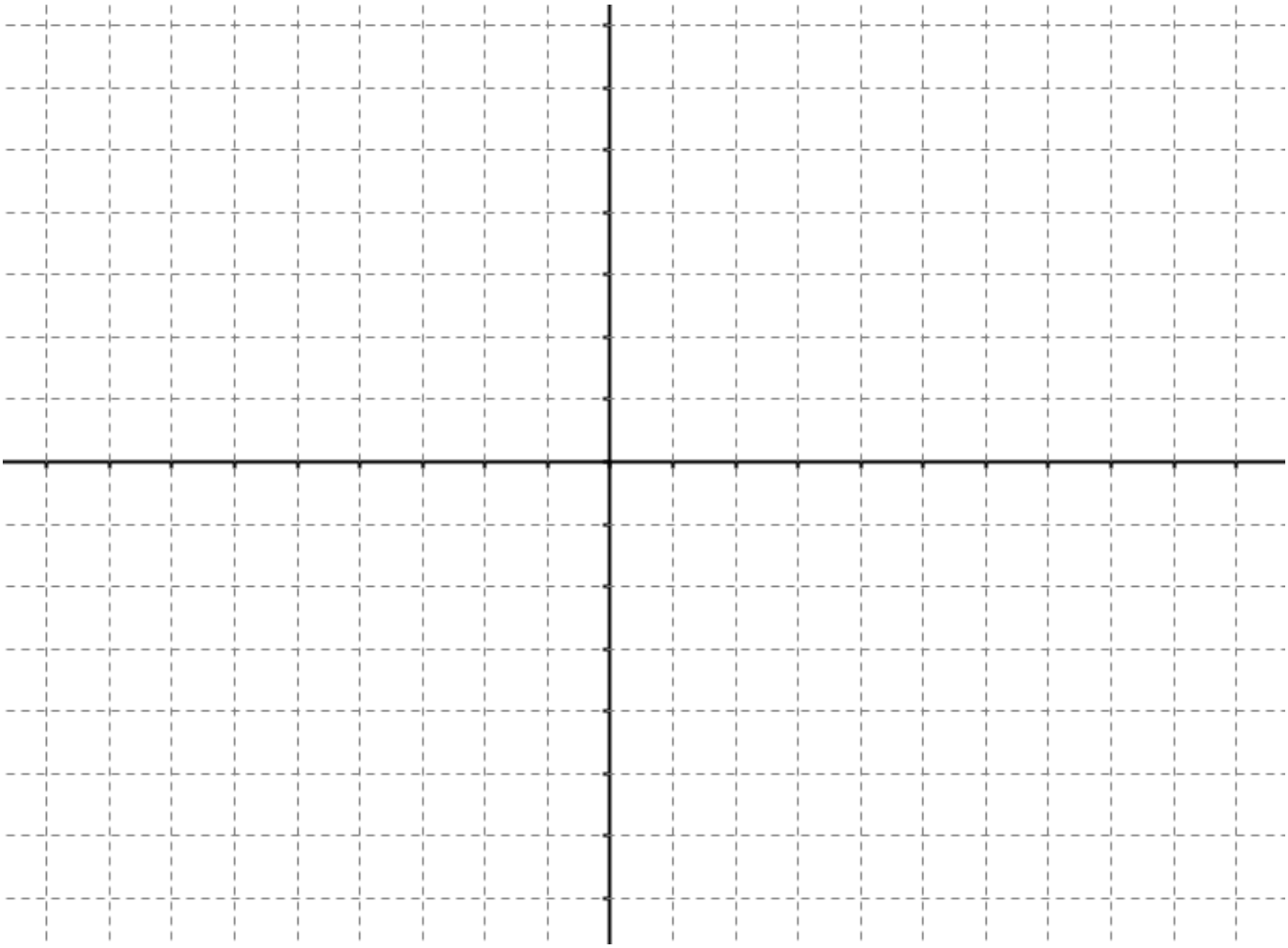
Use the grid below to help you answer the following questions.

6. A circle has its center point at E = (5 , -3), and has a radius of 3. What is the equation of this circle?

7. A circle has its center point at A = (5 , 4). Point B = (3, 4) lies on the circumference of the circle. What is the equation of this circle?

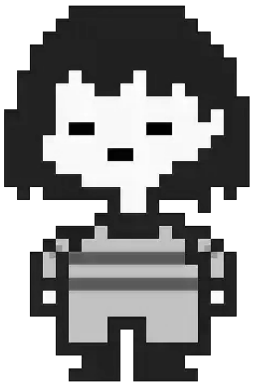
8. What is the equation of the circle centered at G = (0, -5) that passes through point H = (0, -3)

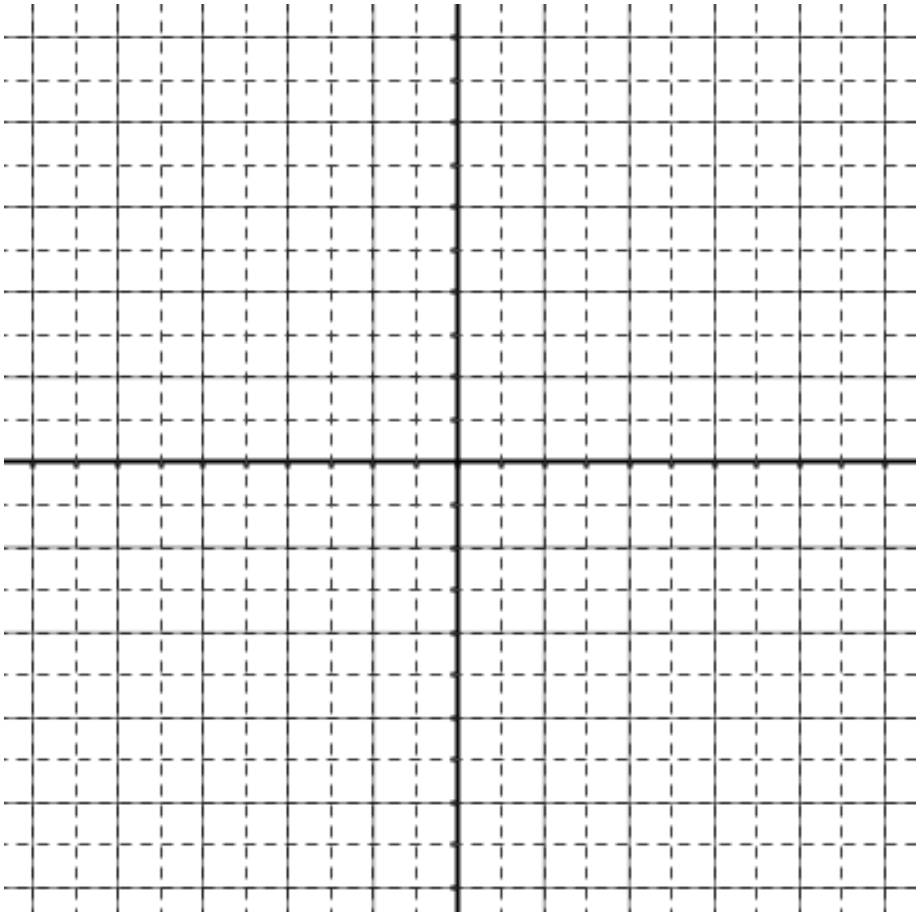
9. What is the equation of the circle centered at C = (-4, 2) that passes through point J = (-1, -2)



10. In a new Undertale game, the animation designer wants to have a scene where Frisk walks through a room with pools of quicksand, without getting sucked in. He designed the animation using the following equations.

- Frisk's x-coordinate constantly decreases, beginning at x = 3
- Frisk's y-coordinate follows the equation y = x + 2
- quicksandPool_1 is located at $(x - 2)^2 + (y - 1)^2 = 4$
- quicksandPool_2 is located at $(x + 6)^2 + y^2 = 9$





a. Will Frisk successfully complete the animation? Determine your answer **graphically**.

b. If not, which object(s) did Frisk collide with?

c. Suggest a better equation for this object. (Many possible answers). Justify your proposition graphically.

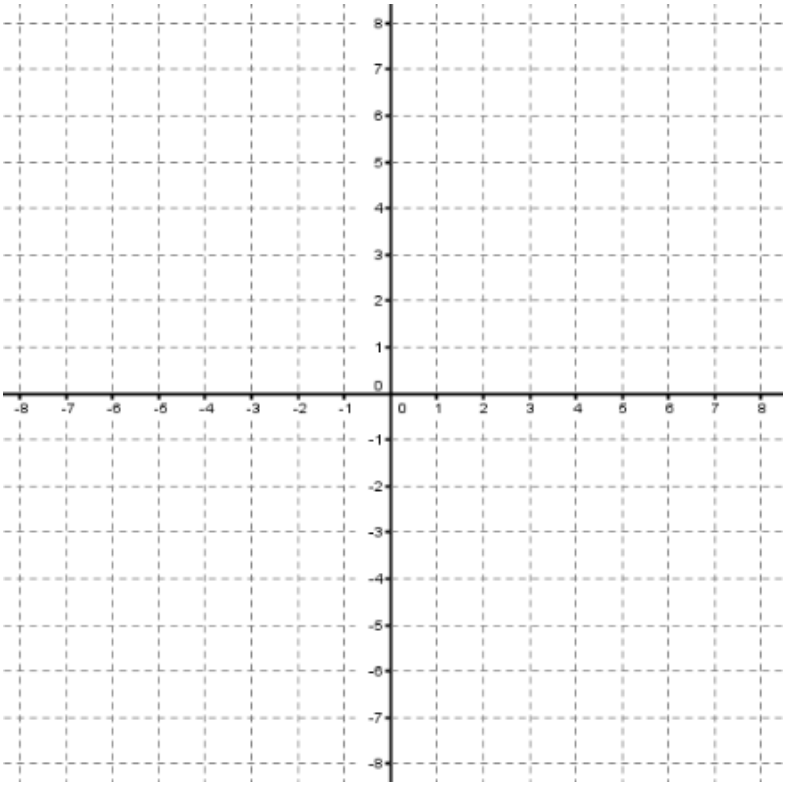
d. How confident are you in your answer for part b? What could you do to obtain your answer with more certainty?

Unit 01 Lesson 11: Determine Whether or Not a Given Relation is a Function

Lesson Objectives

- Understand the concept of a function
- Determine if situations, equations, and graphs are functions

Function:

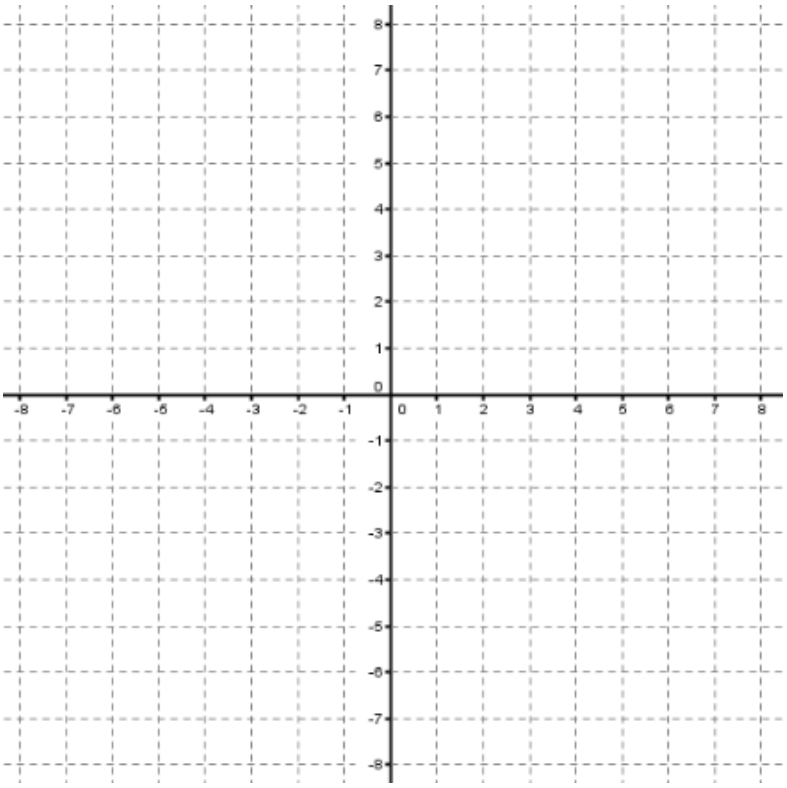


1. Determine if x is a function of y. Then determine if y is a function of x. Explain your reasoning for both.

x	-1	0	3	4	6
y	0	2	1	3	1

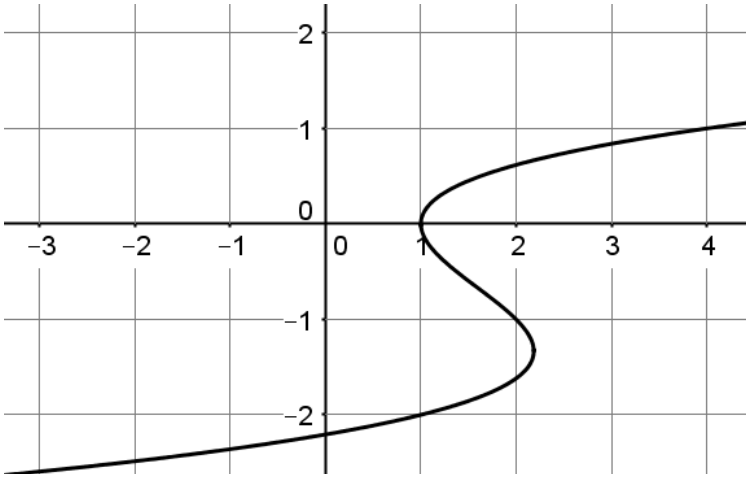
2. Determine if x is a function of y. Then determine if y is a function of x. Explain your reasoning for both.

x	-1	0	2	4	0
y	0	5	3	2	1



3. For the following equations, determine graphically if y is a function of x. Then determine if x is a function of y. If either is not a function, give an example that shows this (just give rough estimates based on the graph).

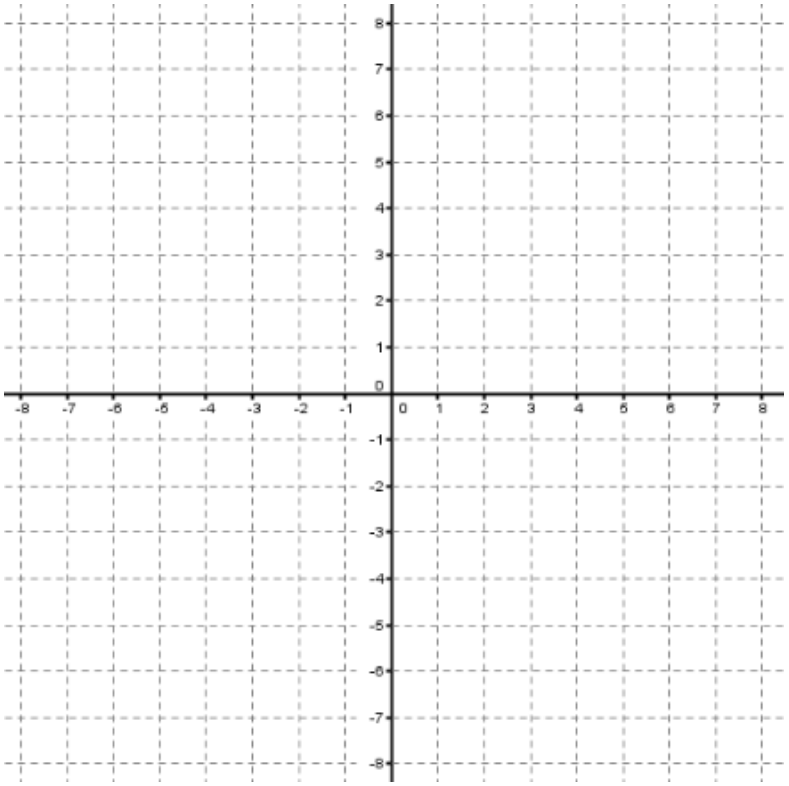
   a. $x = y^3 + 2y^2 + 1$



4. For the following equations, determine if y is a function of x. If y is not a function of x, give an example that shows this.

   a. $y^2 = x$

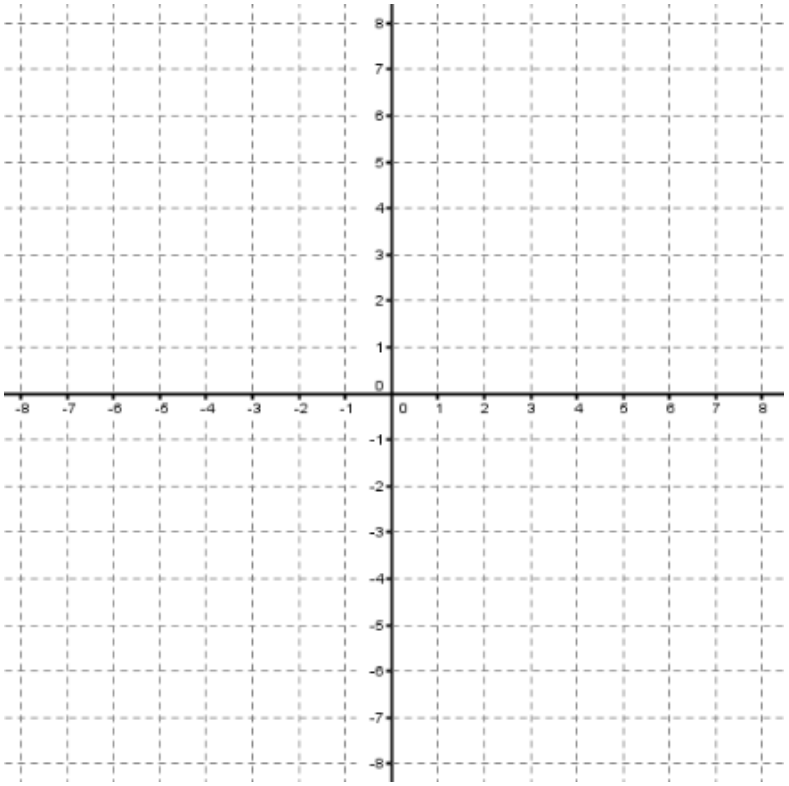
   i. Justify numerically



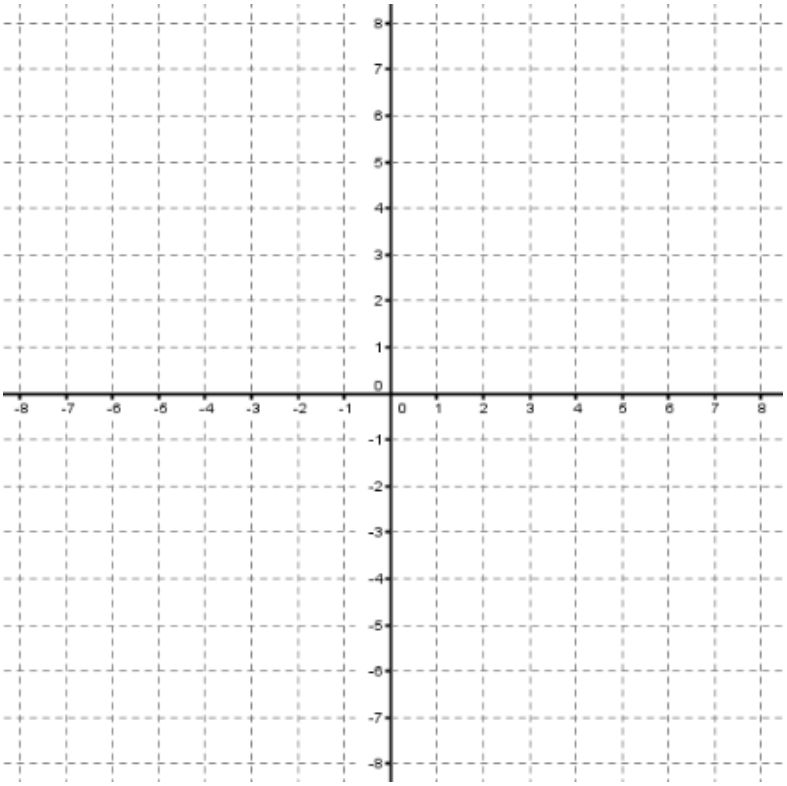
   ii. Justify graphically

   b. $y = |x - 1|$

   i. Justify numerically



   ii. Justify graphically



c. $x = 2$

i. Justify numerically

ii. Justify graphically

~~~Unit 01 Lesson 11 Homework~~~ 1.2: 5-8 all, 13-23 odd

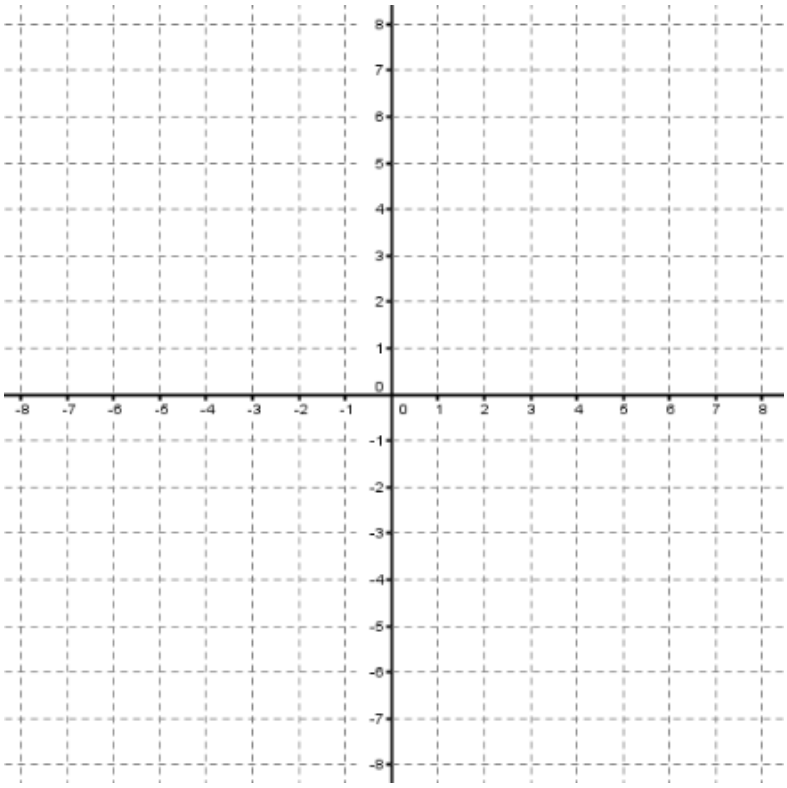
~~~Unit 01 Lesson 11 Classwork~~~

Determine if

- x is a function of y.
- y is a function of x.
- If either is not a function, give a numerical example of why not.
- If either is not a function, draw a line on the graph to show this.

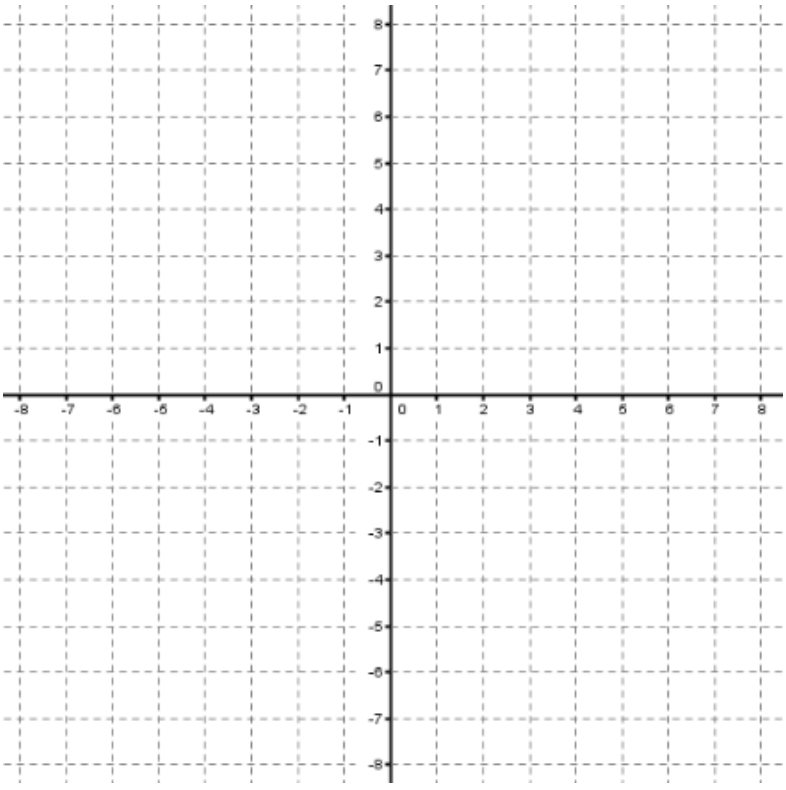
1.

x	-1	1	4	-2	-1
y	0	2	1	3	1



2.

y	-1	0	2	4	2
x	0	2	1	2	1

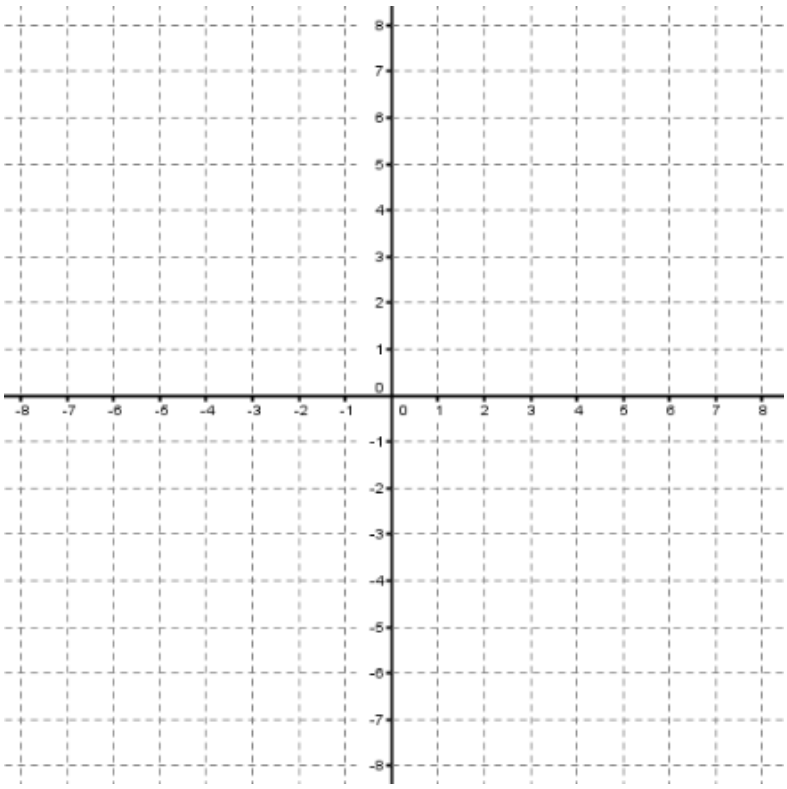


3. Determine the slope and length of the line that connects A = (-1, 2) and B (7, 8).

For the following equations, determine if y is a function of x.

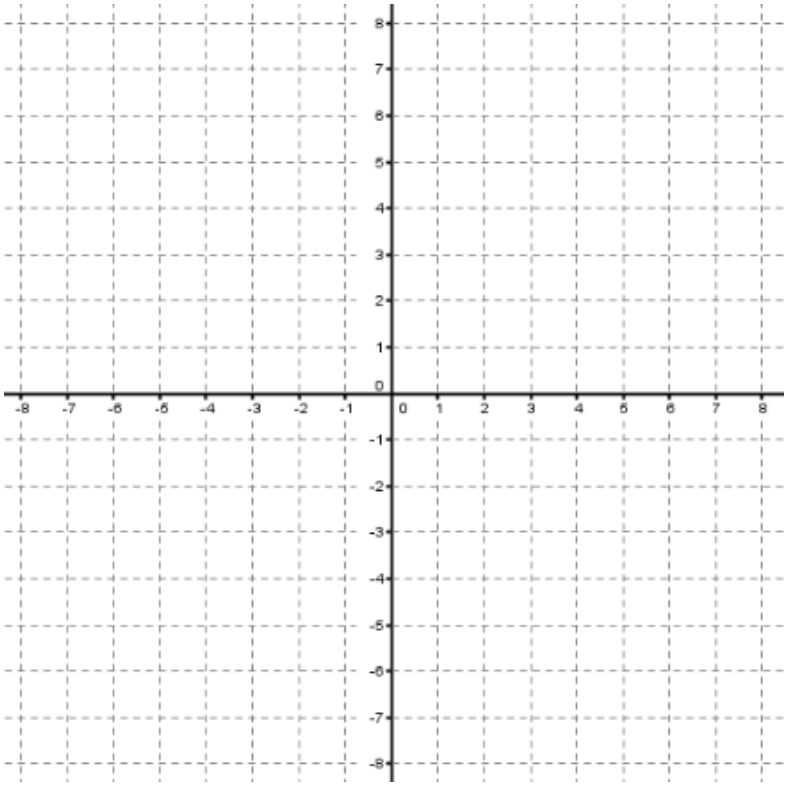
- Use the justification requested.
- If y is not a function of x, give an example that shows this.
- You may need to isolate a variable before starting.

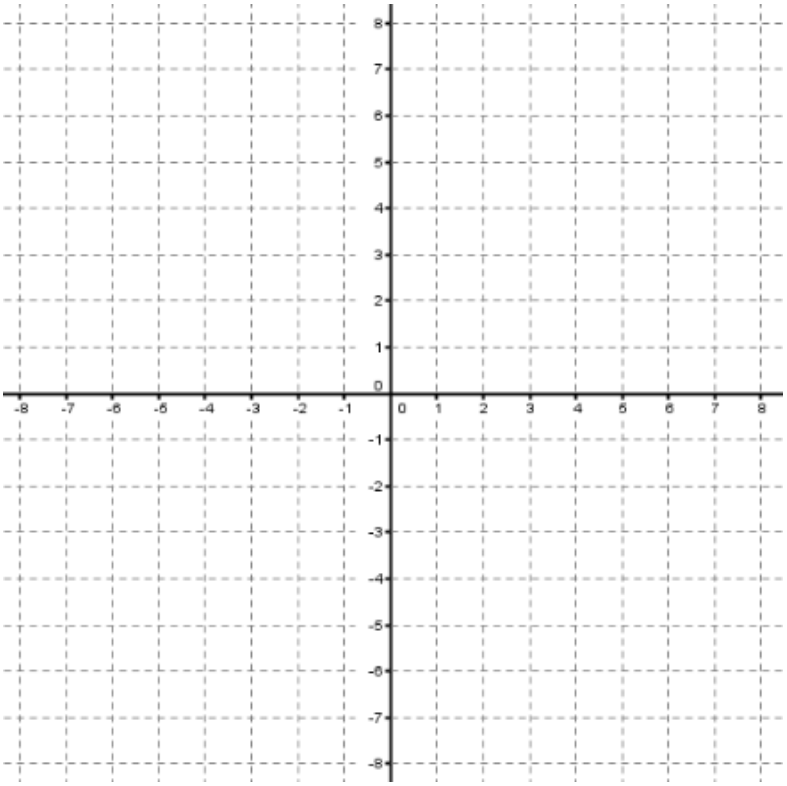
4. $(y - 1)^2 + (x + 2)^2 = 25$
   (justify graphically only)



5. $5y = 10x - 20$
   a. Justify numerically

   b. Justify graphically



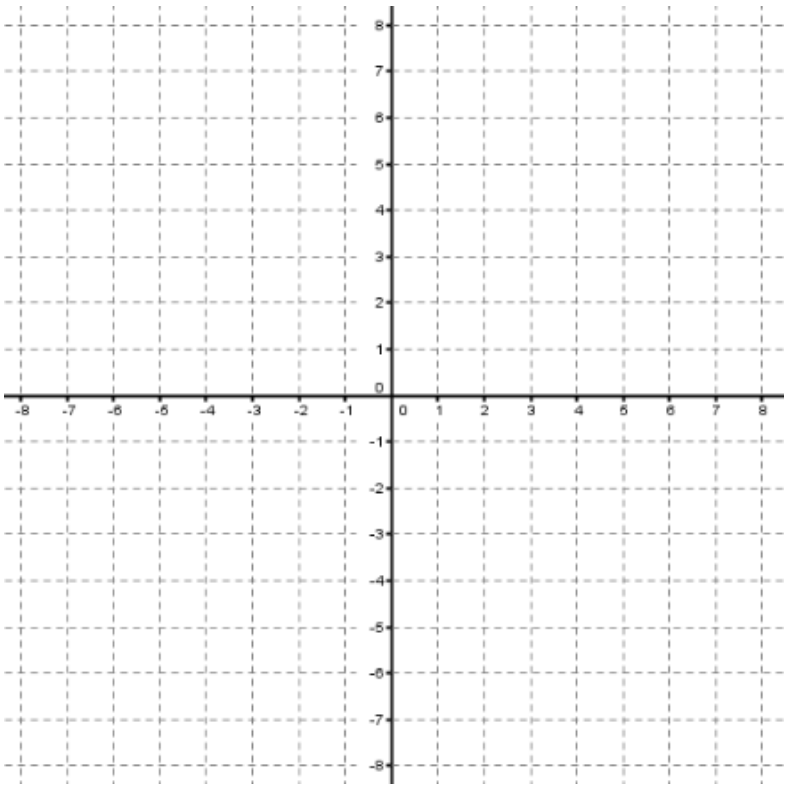


6. $|y| = x - 1$
    a. Justify numerically

    b. Justify graphically

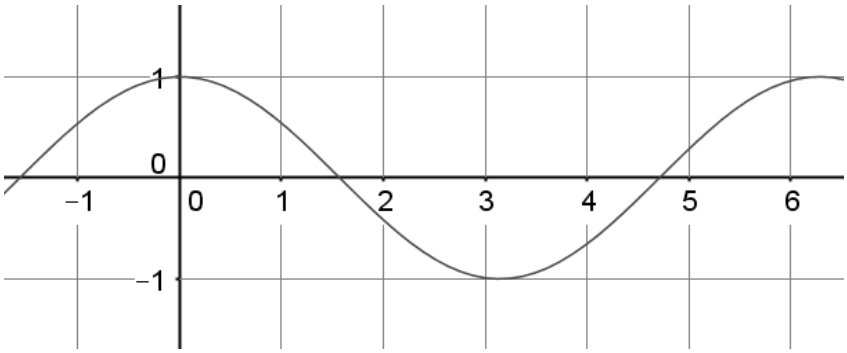
7. $y = 3$
    a. Justify numerically

    b. Justify graphically

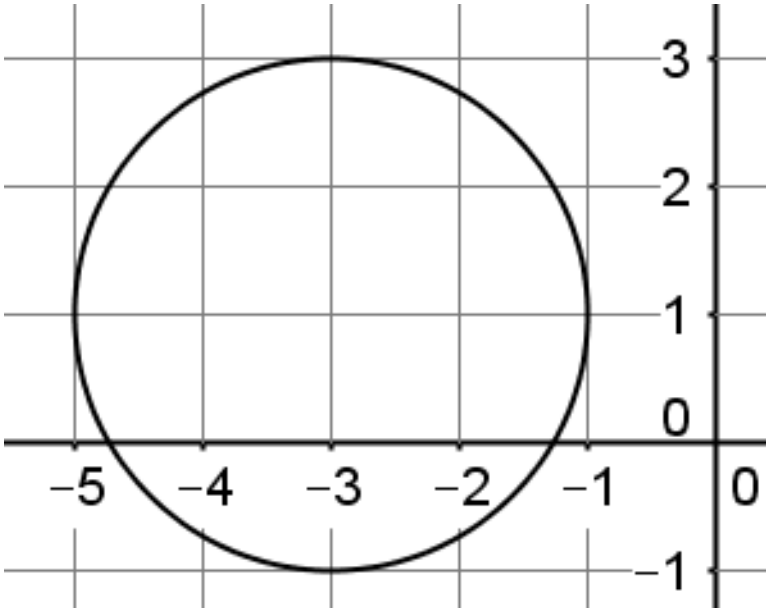


8. For the following equations, determine graphically if y is a function of x. Then determine if x is a function of y. If either is not a function, give a graphical and a numerical (just give rough estimates based on the graph) example that shows this.

a. $y = \cos(x)$



b. $(x+3)^2 + (y-1)^2 = 4$



Unit 01 Lesson 12: Evaluate Functions

Lesson Objectives

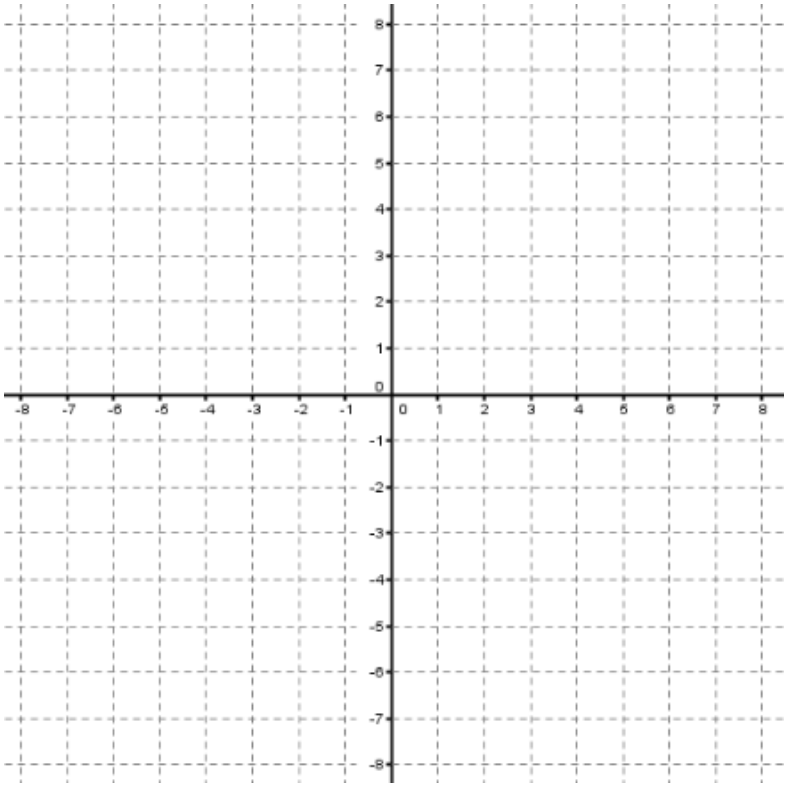
- Evaluate linear, piecewise-defined, and non-linear rational functions
- Use functions to determine values

Function notation:

Piecewise-defined functions:

For the following functions:

- Evaluate the following functions for the given values. Express answers in simplest form.
- Use your answers to graph the function



1. f(x) = 2x -1
    a. f(0)

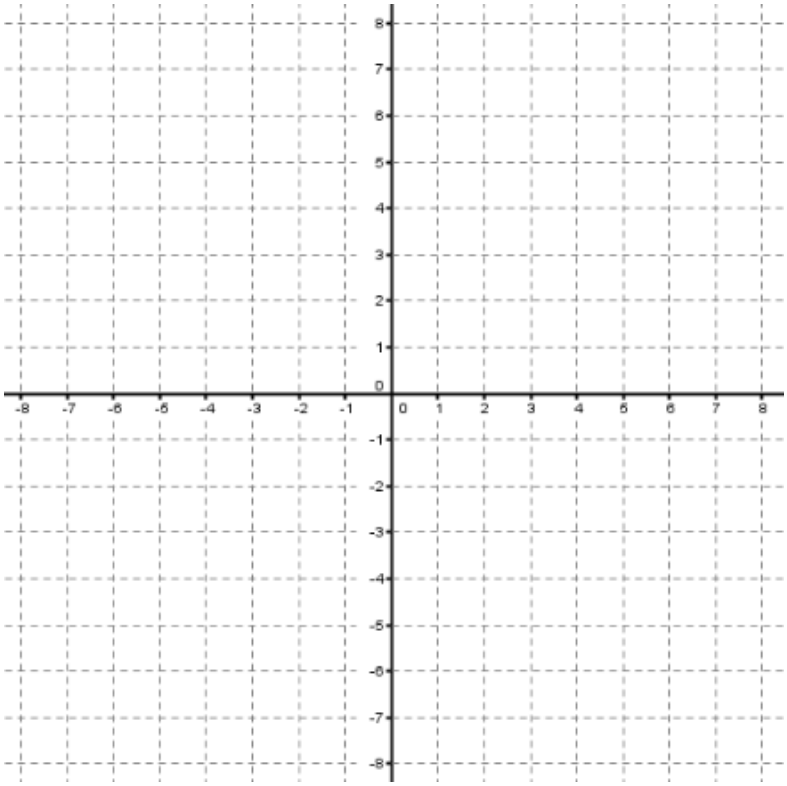
    b. f(3)

    c. c. f(-1)

    d. $f(x^2)$

    e. Is f(x) a linear function, a piecewise function, or neither?

2. $g(x) = \begin{cases} 2\sqrt{x}, & x < 4 \\ -x + 6, & x \geq 4 \end{cases}$



a. g(0)

b. g(2)

c. g(-1)

d. g(1)

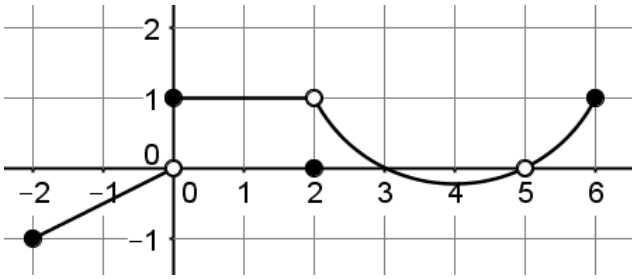
e. g(4)

f. g(3.9999) g. g(4.0001) h. g(5) i. g(7)

j. $g(x^2)$ (Express in simplest form.)

k. Is g(x) a linear function, a piecewise function, or neither?

3. Use the graph of *f* below to evaluate the following expressions.



a. f(-2)

b. f(0)

c. f(1)

d. f(2)

e. f(3)

f. f(5)

g. f(-1)

h. f(-0.000001)

i. f(0.000001)

j. f(1.999999)

k. f(2.000001)

l. f(4.999999)

m. f(5.000001)

n. f(5.999999)

o. f(6.000001)

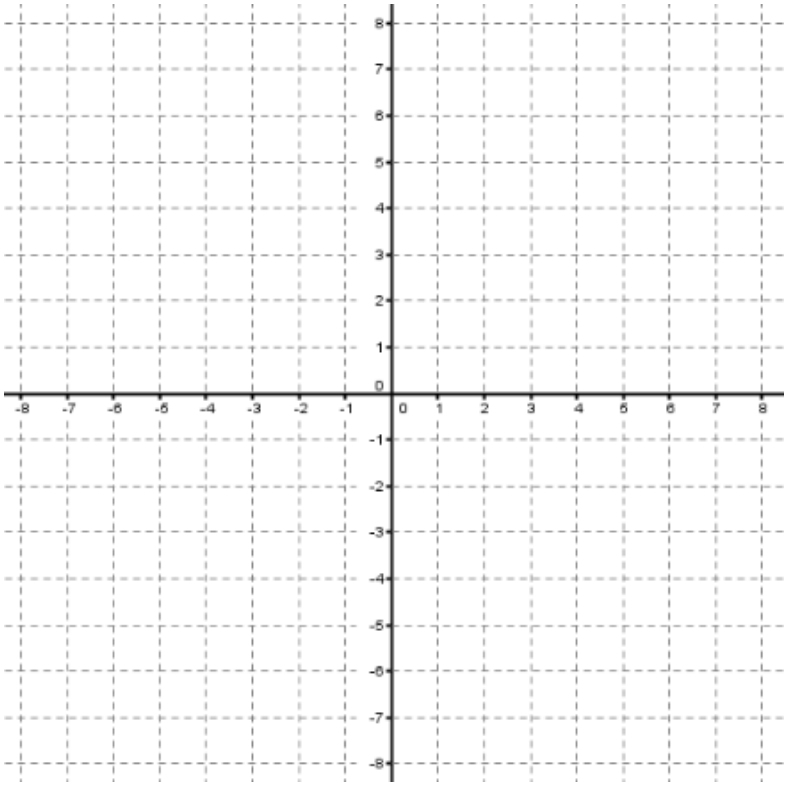
~~~Unit 01 Lesson 12 Homework~~~ 1.2: 33, 35, 37

~~~Unit 01 Lesson 12 Classwork~~~

For the following functions:

- Evaluate the following functions for the given values.
- Use your answers to graph the function

4. $h(x) = \begin{cases} -x - 2, & x \leq 0 \\ x^2 - 2, & x > 0 \end{cases}$



a. h(0)

b. h(0.001)

c. h(2)

d. h(-1)

e. h(1)

f. h(-2)

g. h(3)

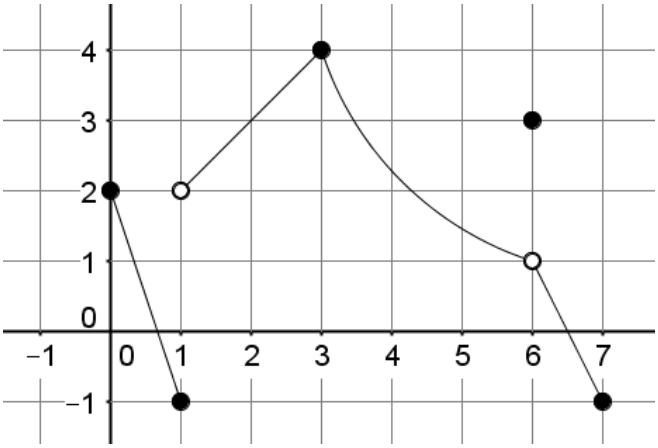
h. h($\sqrt{3}$)

i. h($\sqrt{5}$)

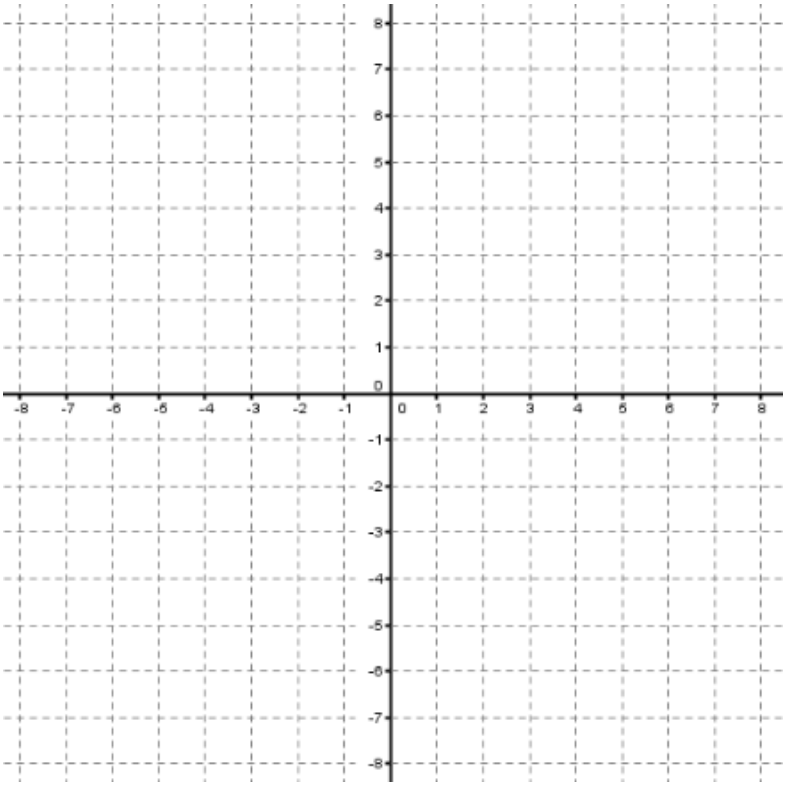
j. h($\sqrt{x}$) (Express in simplest form.)

k. Is h(x) a linear function, a piecewise function, or neither?

5. Use the graph below to evaluate the following expressions.
   a. f(7)
   b. f(6)
   c. f(3)
   d. f(2)
   e. f(1)
   f. f(0.5)
   g. f(0)
   h. f(-1) i. f(0.999999) j. f(1.000001) k. f(5.999999) l. f(6.000001)



6. g(x) = |x-1|-1
   a. g(0)
   b. g(2)
   c. g(-1)
   d. d. g(1)
   e. e. $g(x^2)$ (Express in simplest form.)



   f. Is g(x) a linear function, a piecewise function, or neither?

7. Ex Cred: Rewrite the absolute value function from the previous question as a piecewise-defined function with no absolute values. (Use your graph to help you)

Unit 01 Lesson 13: Determine Domain

Lesson Objectives

- Use a graphing calculator to solve problems
- Determine domains

Domain:

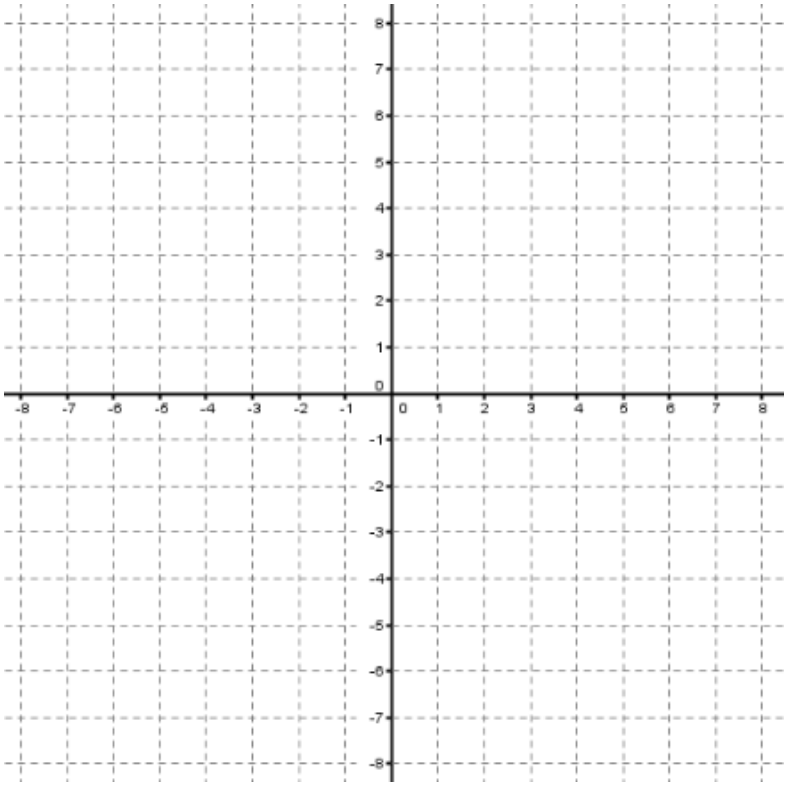
Domain of Rational Functions:

1. Determine the domains of the following functions. Express domains with and without bracket notation.

   a. $r(x) = \dfrac{5}{x+2}$

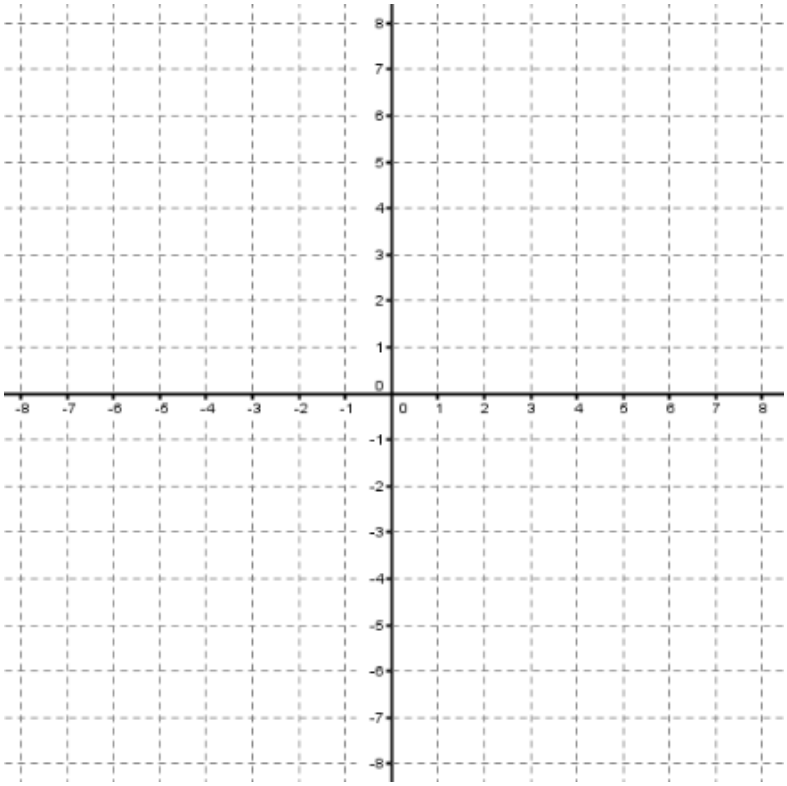
   i. Justify analytically

   ii. Justify graphically



b. $r(x) = \dfrac{x}{x^2 + 2x - 8}$

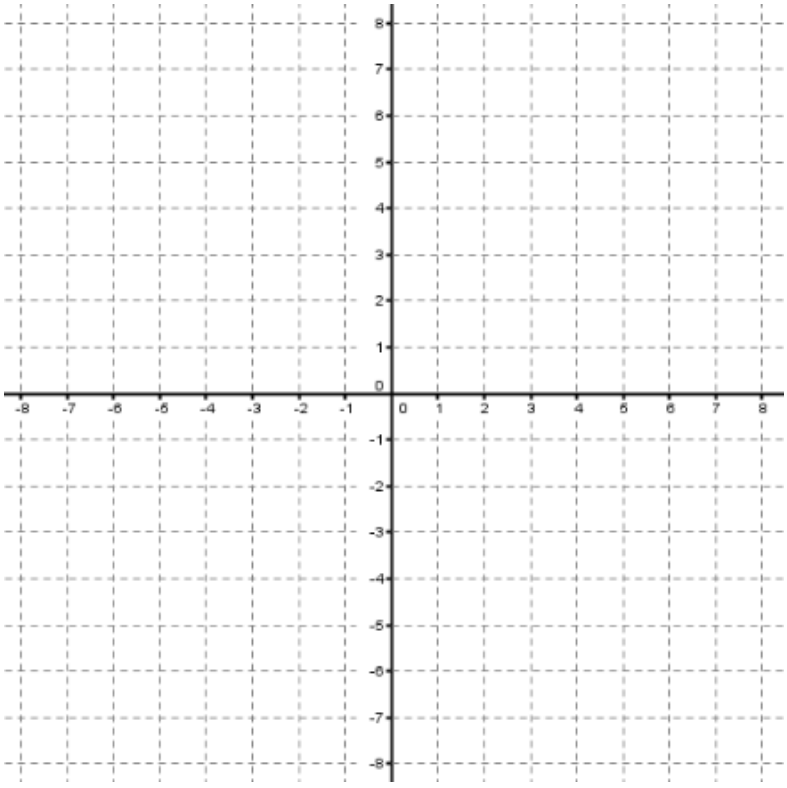
i. Justify analytically



ii. Justify graphically

c. p(t) = $t + \sqrt{t - 7}$

i. Justify analytically



ii. Justify graphically

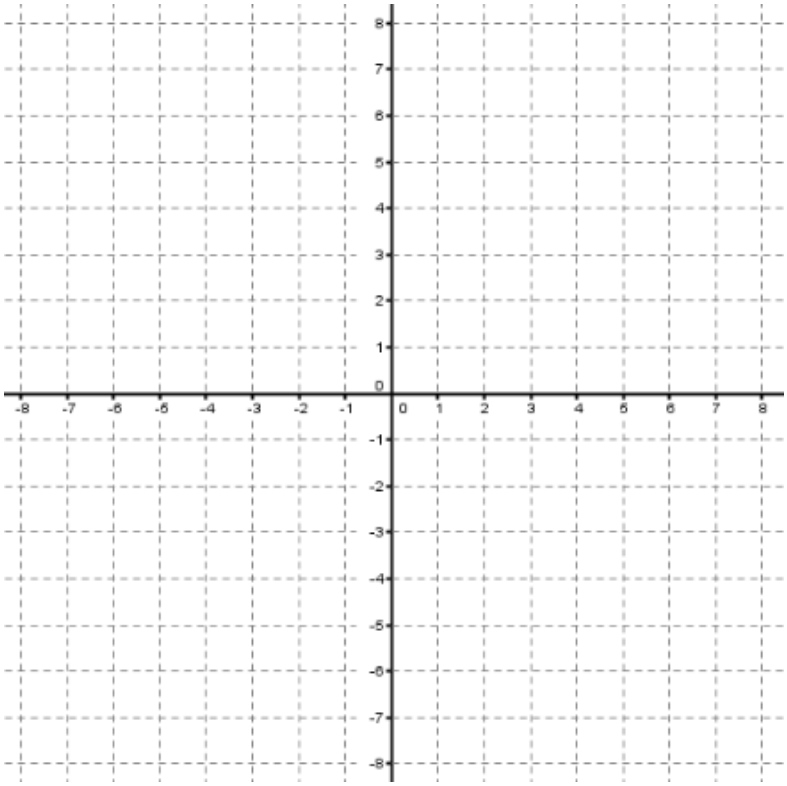
2. For the function $f(x) = x^2 - 1$, find all x such that $f(x) = 0$

3. Determine the domains of the following functions. Express domains with and without bracket notation.

a. $f(x) = \dfrac{x-4}{x^2-1}$

i. Justify analytically

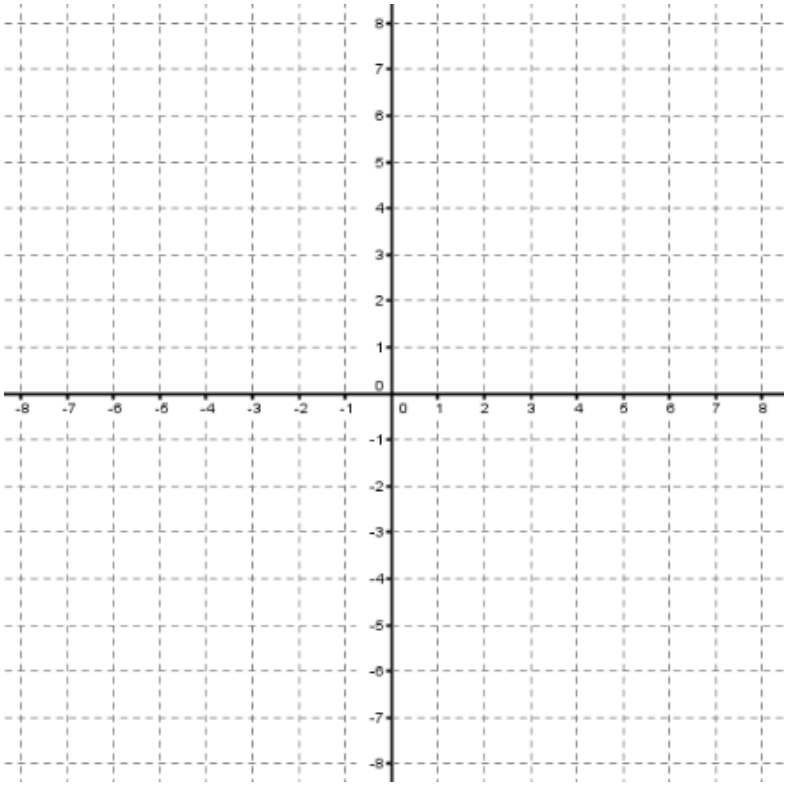
ii. Justify graphically



b. g(n) = $2 - \sqrt{8-n}$

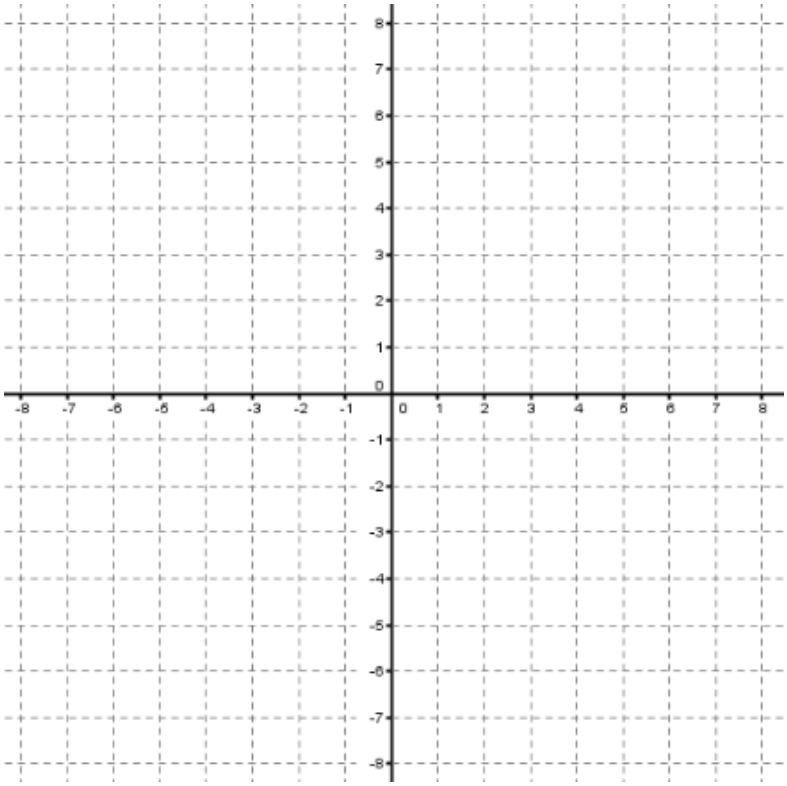
i. Justify analytically

ii. Justify graphically



c. $h(x) = 2 - \sqrt{9 - x^2}$

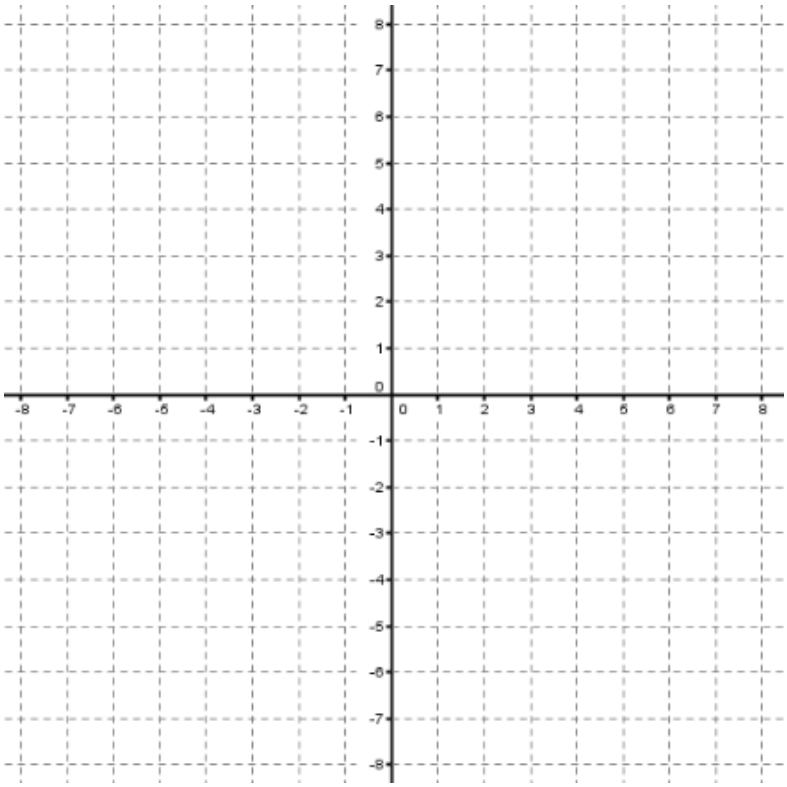
i. Justify analytically



ii. Justify graphically

d. $f(x) = 2 - \sqrt{x^2 - 9}$

i. Justify graphically



ii. Justify analytically

Unit 01 Lesson 14: Determine Domain and Range

Lesson Objectives

- Determine domains and ranges numerically, graphically, and analytically

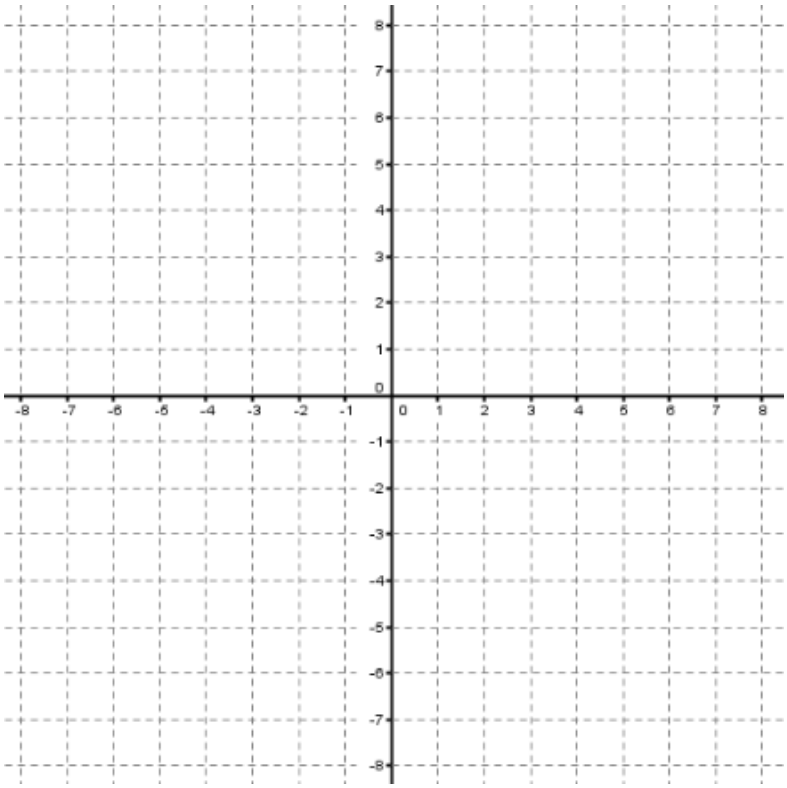
Domain:

Range:

4. For the following functions, numerically, graphically, and analytically,
    - Determine the domain. Express with and without bracket notation.
    - Determine the range. Express with and without bracket notation.

    a. $h(x) = 2 - \sqrt{9 - x^2}$

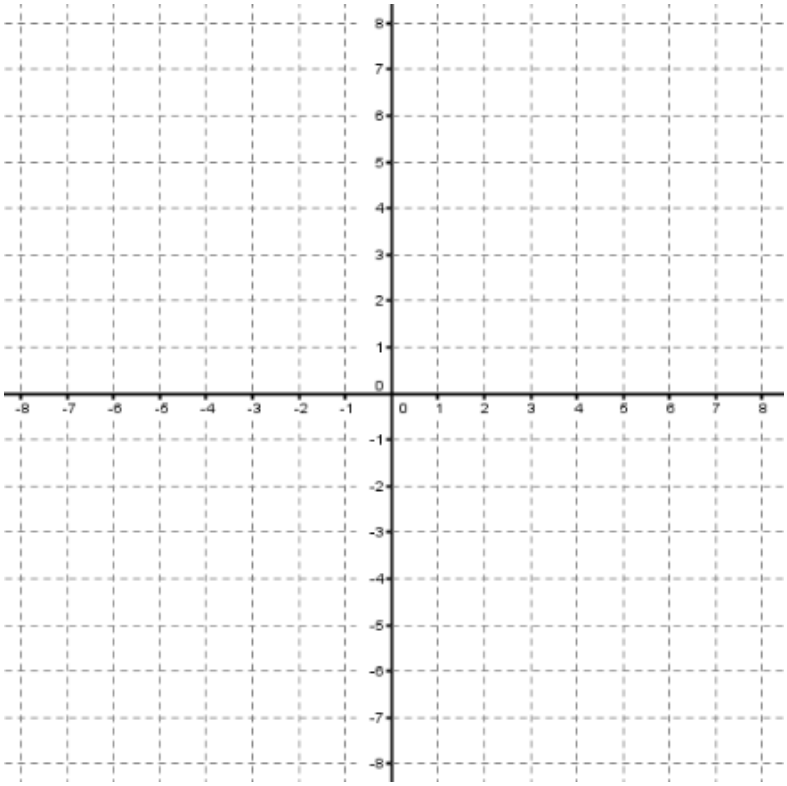
    i. Justify domain analytically



    ii. Justify range graphically

b. $f(x) = 2 - \sqrt{x^2 - 9}$ such that -5 ≤ x ≤ 5

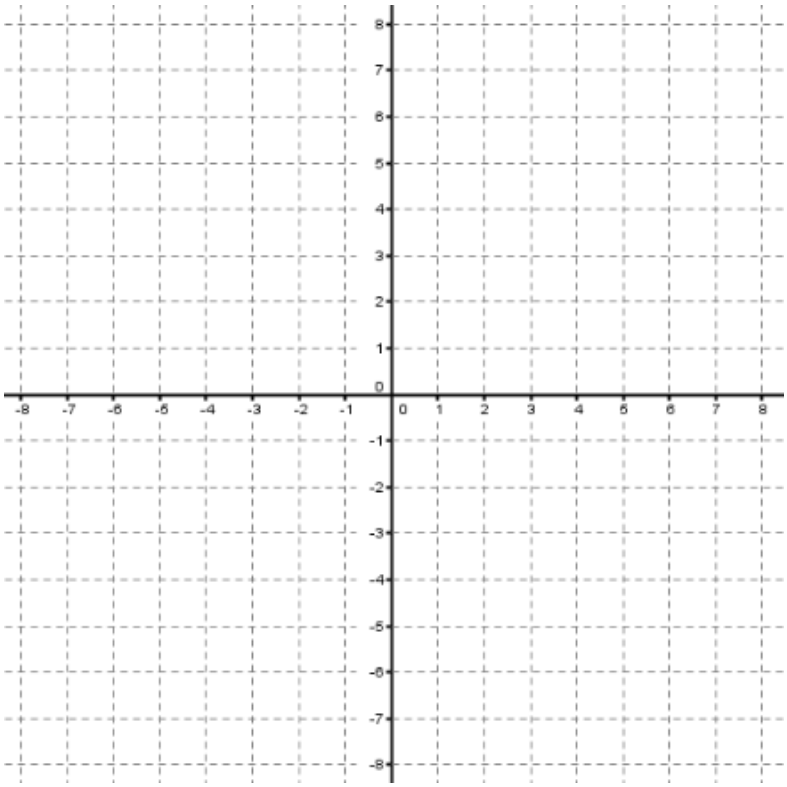
i. Justify domain graphically



ii. Justify range graphically

c. f(t) = |5 - t| - 2

i. Justify domain analytically



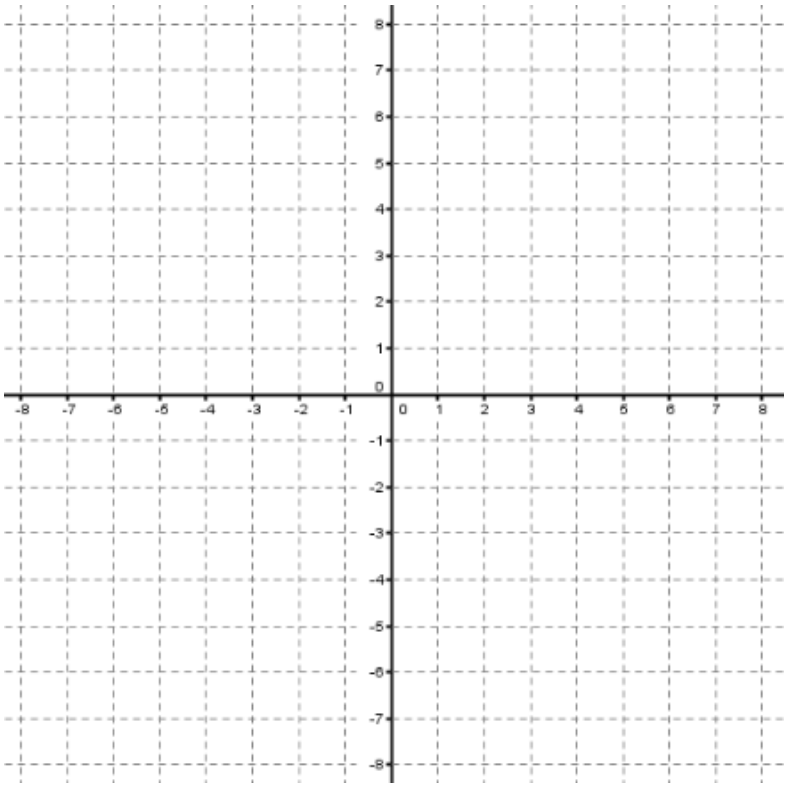
ii. Justify range graphically

~~~Unit 01 Lesson 14 Homework~~~

5. For the following functions
   - Determine the domain. Express with and without bracket notation.
   - Determine the range. Express with and without bracket notation.

a. $f(z) = z^2 + 1$

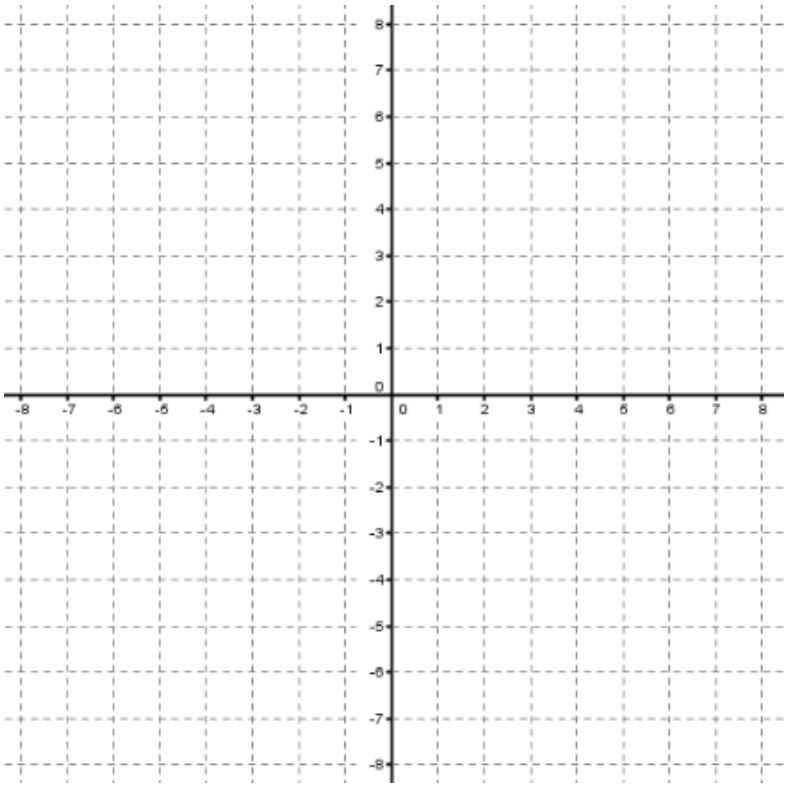
i. Justify domain analytically



ii. Justify range graphically

b. $q(t) = |t - 5|$

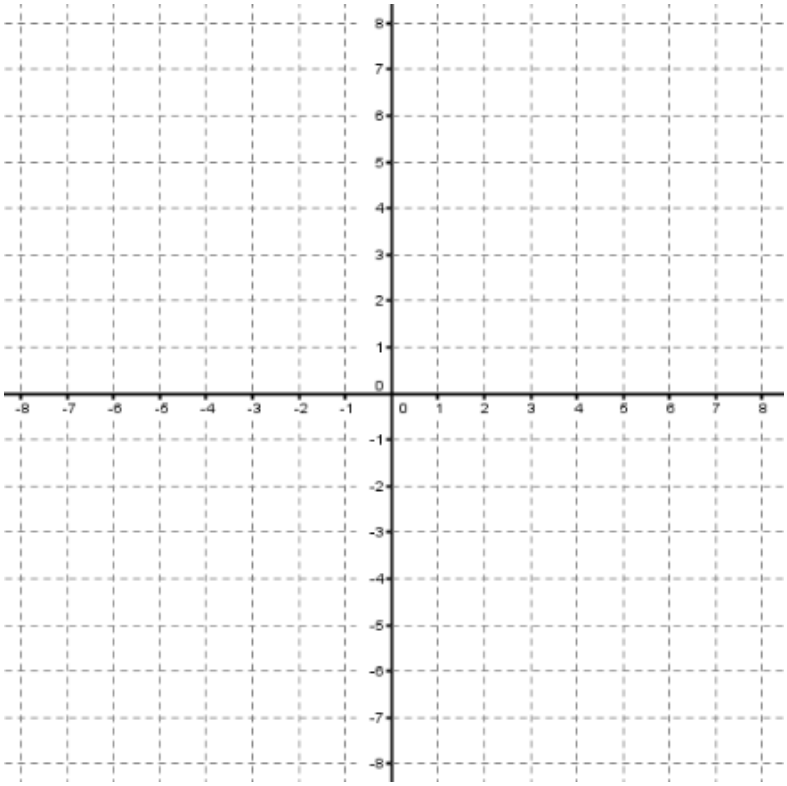
i. Justify domain analytically



ii. Justify range numerically

c. $f(t) = |5 - t| + 1$

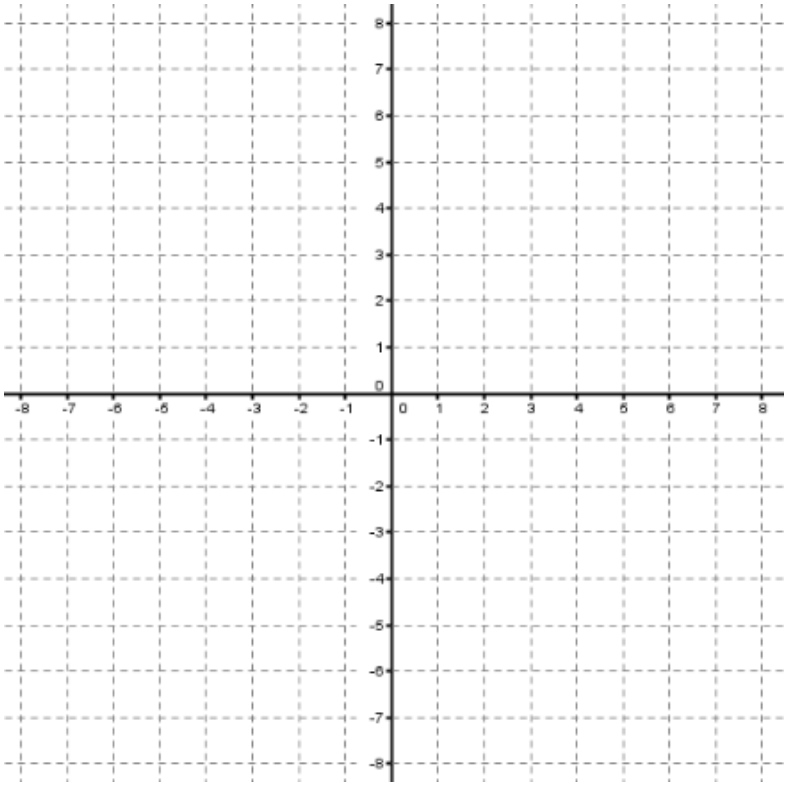
i. Justify domain graphically



ii. Justify range numerically

d. $g(a) = 2a + 1$

i. Justify domain analytically



ii. Justify range numerically

Unit 01 Lesson 15: Use Technology to Solve Algebra/Geometry Problems

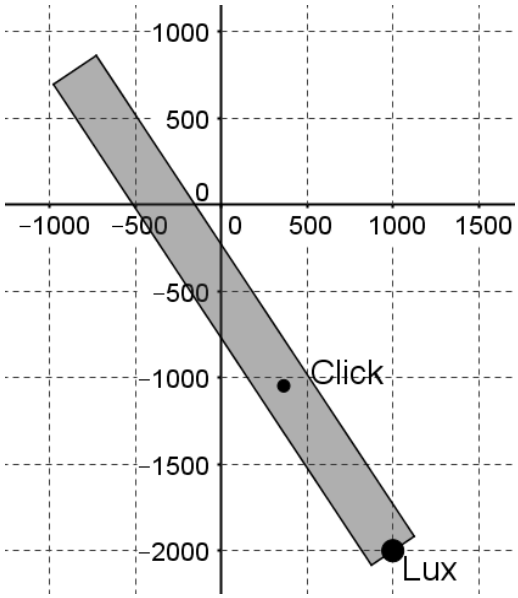
Lesson Objectives

-

1. Lux's "Final Spark" works as follows
   - Lux shoots a laser 3340 units long in the direction the player clicks
   - The laser is 300 units thick

   See example to the right

   The following situation occurs
   - Lux stands at (1000, -2000)
   - Lux clicks at (0, -500)
   - The enemy champion stands at (-600, 1000)
   - The enemy champion's hitbox is a circle 400 units wide



Determine the following

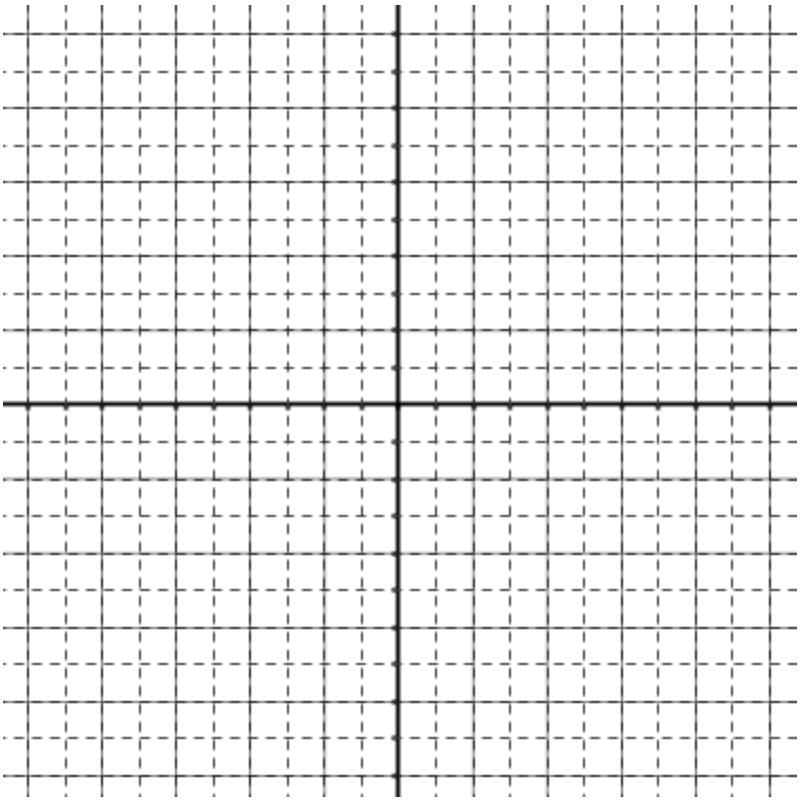
a. The equation of the laser

b. The domain of the laser

c. The range of the laser

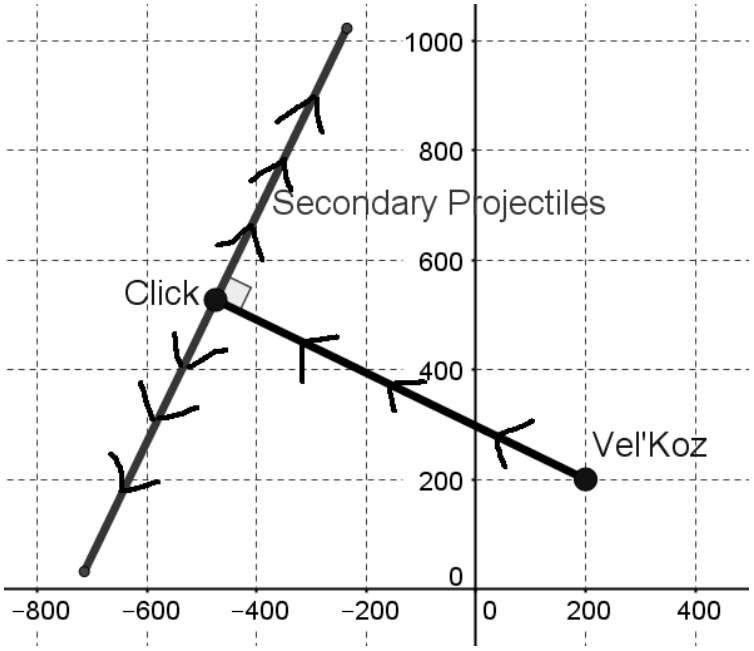
d. Will the laser hit the enemy?

e. Diagram the situation on the coordinate plane provided



2. Vel'Koz's "Plasma Fission" works as follows
- Vel'Koz shoots a blob wherever the player clicks
- When the blob reaches the location the player clicked, it splits into two blobs that travel perpendicular to the original trajectory
- These secondary blobs travel 550 units before disappearing

See example to the right



The following situation occurs
- Vel'Koz stands at (100, -200)
- The player clicks at (300, 600)
- The enemy champion stands at (900, 400)
- The enemy champion's hitbox is circle 200 units wide

Determine the following

a. The equation of the trajectory of the original blob

b. The equation of the trajectory of the secondary blobs

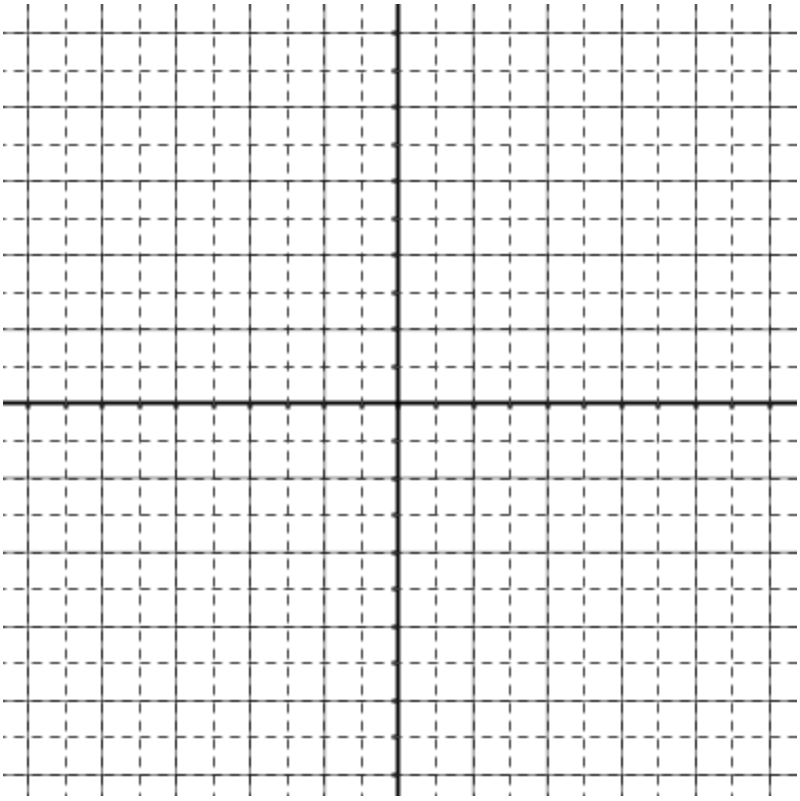
c. The domain of the original blob

d. The domain of the secondary blobs

e. Whether or not the ability will hit the enemy.

f. If so, determine the ordered pair of the intersection

g. Sketch the situation on the graph provided



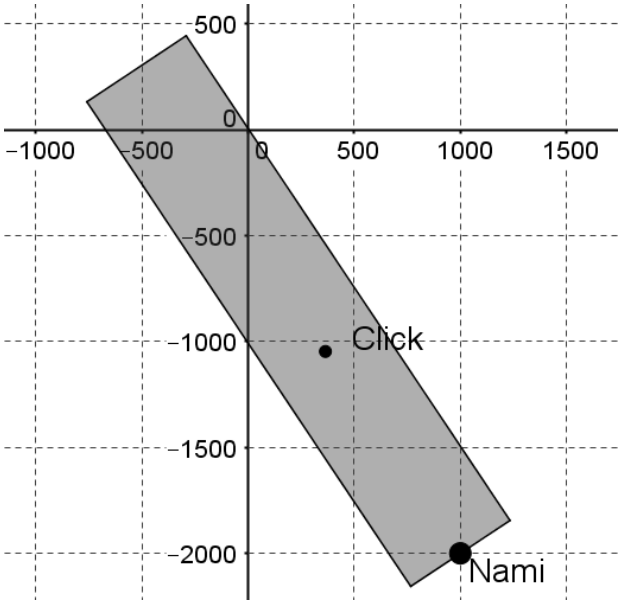
~~~Unit 01 Lesson 15 Homework~~~ Wall of Pain

~~~Unit 01 Lesson 15 Classwork~~~

1. Nami's "Tidal Wave" works as follows
    - Nami sends a tidal wave 2750 units long in the direction the player clicks
    - The wave is 562 units wide

    See example to the right

    The following situation occurs
    - Nami stands at (-2000, -1000)
    - Nami clicks at (-800, -600)
    - The enemy champion stands at (700, 250)
    - The enemy champion's hitbox is a circle 400 units wide



Determine the following

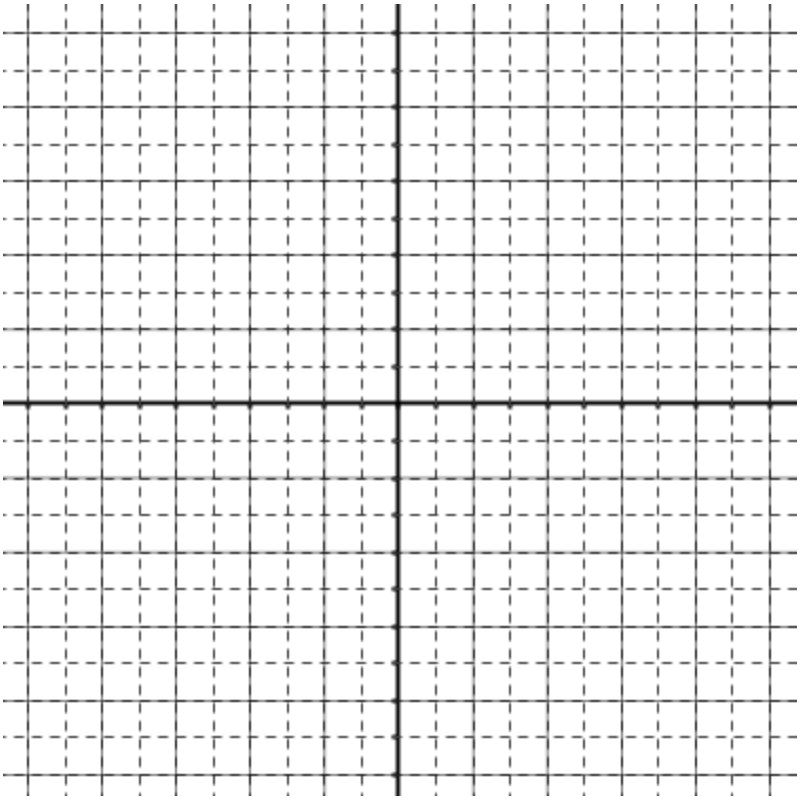
f. The equation of the path of the wave

g. The domain of the wave

h. The range of the wave

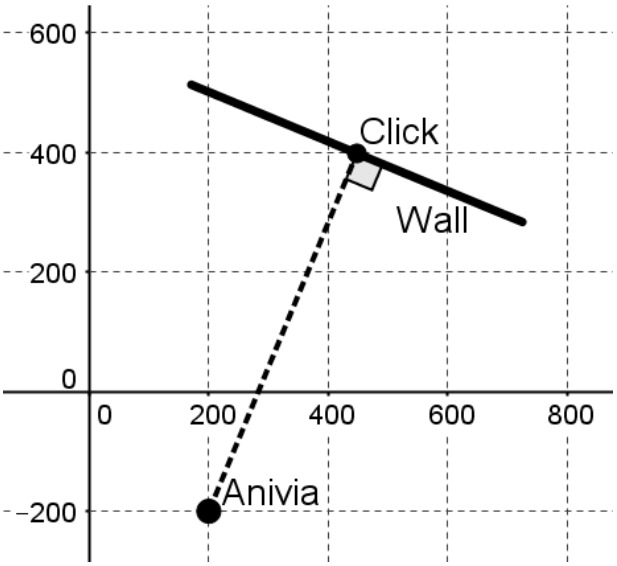
i. Will the wave hit the enemy?

j. Diagram the situation on the coordinate plane provided



2. Anivia's "Crystallize" works as follows
- The center of the wall is created wherever the player clicks
- The wall is 600 units wide
- The wall is oriented perpendicular to the line that connects Anivia and the location she clicked

See example to the right



The following situation occurs
- Anivia stands at (200, -200)
- The player clicks at (1000, -800)
- The enemy champion stands at (1050, -600)
- The enemy champion's hitbox is circle 200 units wide

Determine the following

h. The equation of the wall

i. The ordered pairs of the endpoints of the wall

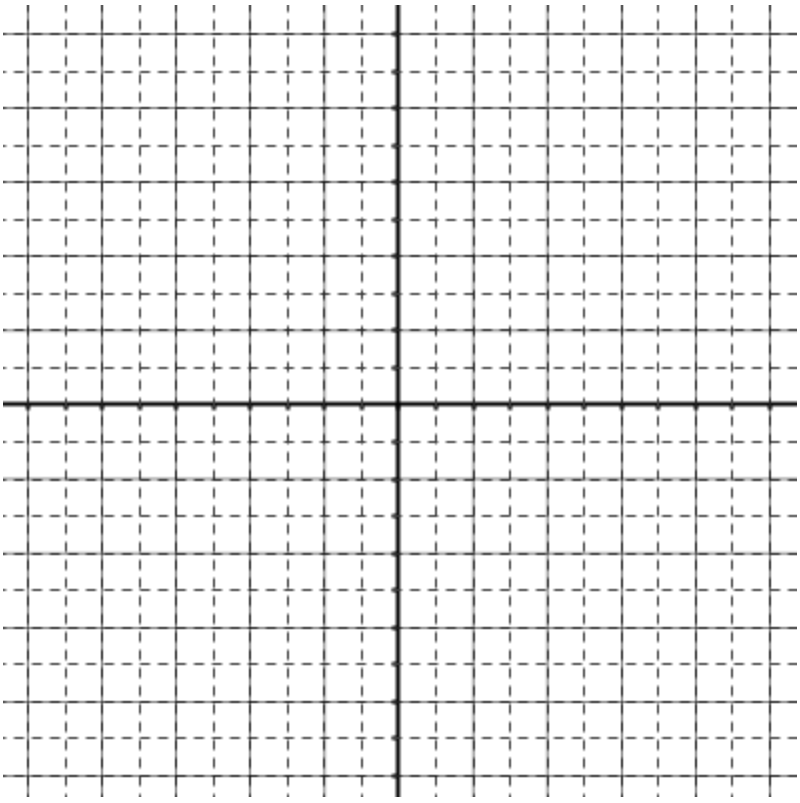
j. The domain of the wall

k. The range of the wall

l. Whether or not the wall will hit the enemy.

m. If so, determine the ordered pair of the intersection(s)

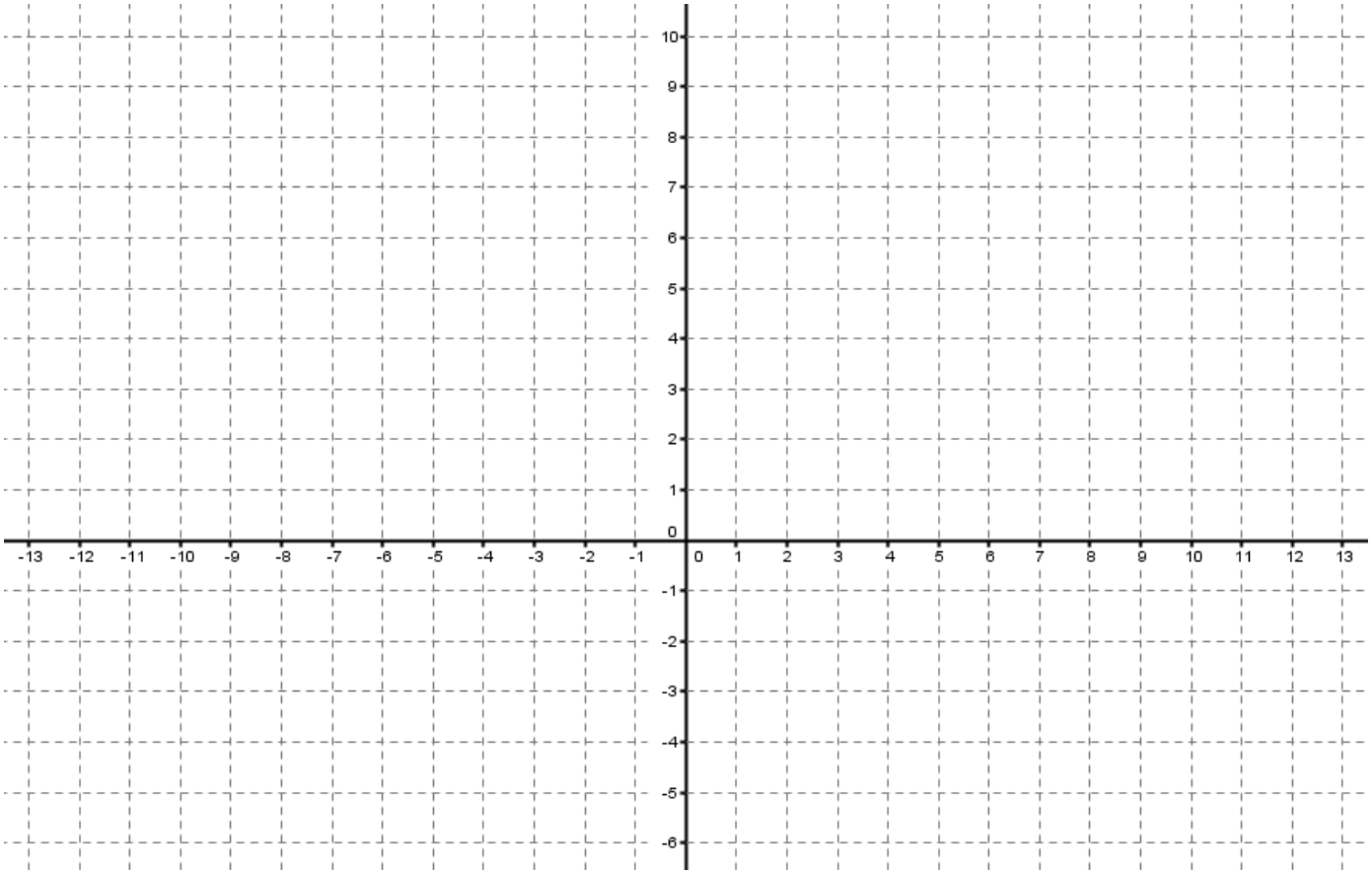
n. Sketch the situation on the graph provided



Unit 01 Lesson 16: Quiz Study Guide

For questions 1-4, solve analytically and graphically.

Penodjira is creating a path for a pokemon animation.



1. In her animation, Charmander starts at point A = (3, -4), and walks left with a slope of -2 until he reaches point B. Point B has an **x-value** of -1.
    a. What is the equation of $\overline{AB}$?

    b. What is the ordered pair of point B?

2. Next, Charmander goes up to point C = (-7, 8)
    a. What is the equation of $\overline{BC}$?

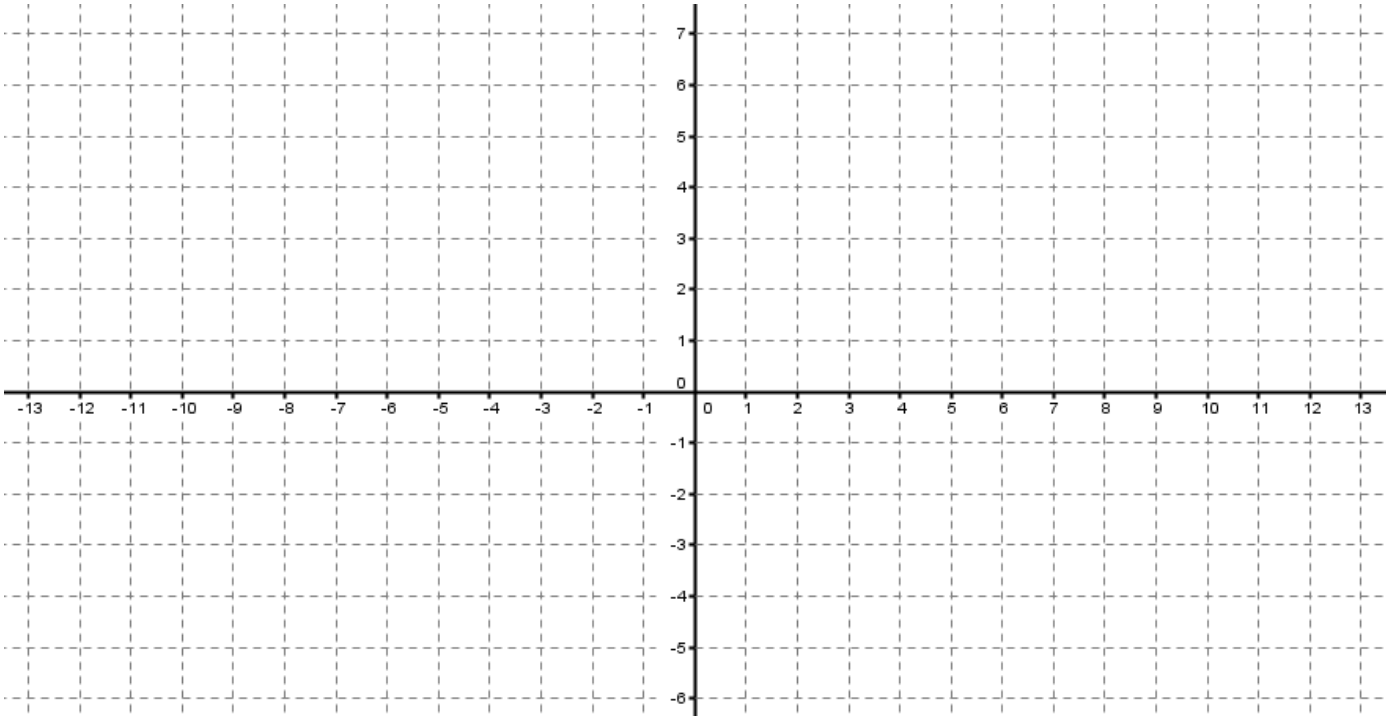
3. Then, Charmander heads right parallel to $\overline{AB}$ until he hits the y-axis at point D.
    a. What is the equation of $\overline{CD}$?

    b. What is the ordered pair of point D?

4. Finally, Charmander heads right perpendicular to $\overline{BC}$ until he hits the x-axis at point E.
    a. What is the equation of $\overline{DE}$?

    b. What is the ordered pair of point E?

5. y = f(x) such that $f(x) = \dfrac{-x^4 + 25}{x^2 - 5} + 9$



a. Graph the function
b. Is x a function of y? If not, give an example that proves your answer (justify graphically, rough estimates are fine)

c. Analytically, determine f(0) and f($-\sqrt{5}$)

d. State the domain and range of f(x) using bracket notation

e. Find all values of x such that f(x) = 0 graphically. Challenge: determine these values analytically as well.