Integrated Math 1
Module 7 Honors
Connecting Algebra and Geometry
Ready, Set, Go! Homework
Solutions

Adapted from

The Mathematics Vision Project:
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Name: **Connecting Algebra and Geometry** | **7.1H**

Ready, Set, Go!

Ready

Topic: Find range given domain

Find the value of $f(x)$ for the given domain. Write x and $f(x)$ as an ordered pair.

1. $f(x) = 3x - 2$

x	$f(x)$	$(x, f(x))$
-2	$\mathbf{-8}$	$\mathbf{(-2, -8)}$
-1	$\mathbf{-5}$	$\mathbf{(-1, -5)}$
0	$\mathbf{-2}$	$\mathbf{(0, -2)}$
1	$\mathbf{1}$	$\mathbf{(1, 1)}$
2	$\mathbf{4}$	$\mathbf{(2, 4)}$

2. $f(x) = x^2$

x	$f(x)$	$(x, f(x))$
-2	$\mathbf{4}$	$\mathbf{(-2, 4)}$
-1	$\mathbf{1}$	$\mathbf{(-1, 1)}$
0	$\mathbf{0}$	$\mathbf{(0, 0)}$
1	$\mathbf{1}$	$\mathbf{(1, 1)}$
2	$\mathbf{4}$	$\mathbf{(2, 4)}$

3. $f(x) = 5^x$

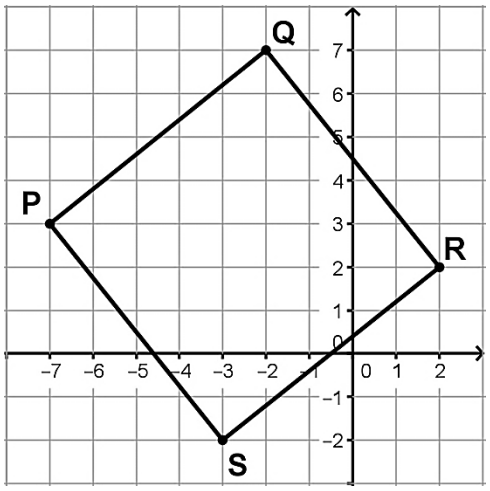
x	$f(x)$	$(x, f(x))$
-2	$\mathbf{\frac{1}{25}}$	$\mathbf{\left(-2, \frac{1}{25}\right)}$
-1	$\mathbf{\frac{1}{5}}$	$\mathbf{\left(-1, \frac{1}{5}\right)}$
0	$\mathbf{1}$	$\mathbf{(0, 1)}$
1	$\mathbf{5}$	$\mathbf{(1, 5)}$
2	$\mathbf{25}$	$\mathbf{(2, 25)}$

Set

Topic: Characteristics of rectangles and squares

4. a. Is the figure below a rectangle? Justify your answer.

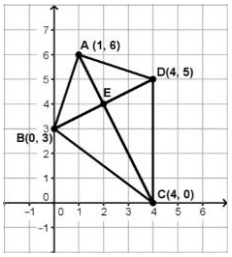
Yes, justifications may vary



b. Is the figure a square? Justify your answer.

Yes, justifications may vary

Topic: Verifying and proving geometric relationships



The quadrilateral at the right is called a **kite.**

Complete the mathematical statements about the kite using the symbols below. Prove each statement algebraically. A symbol may be used more than once.

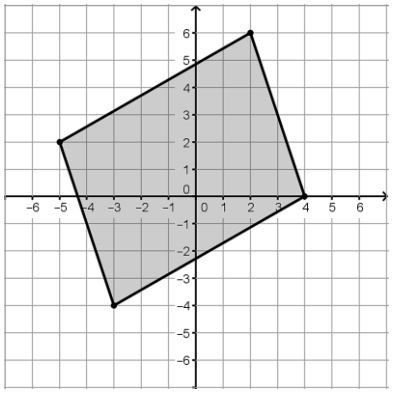
$\cong \quad \perp \quad \parallel \quad < \quad > \quad =$

	Proof
13. $\overline{BC}$ ___ ≅ ___ $\overline{DC}$	**answers vary**
14. $\overline{BD}$ __ ⊥ ___ $\overline{AC}$	**answers vary**
15. $\overline{AB}$ ___ < ___ $\overline{BC}$	**answers vary**
16. ΔABC ___ ≅ __ ΔADC	**answers vary**
17. $\overline{BE}$ ___ ≅ ___ $\overline{ED}$	**answers vary**
18. $\overline{AE}$ __ ⊥ __ $\overline{ED}$	**answers vary**

Go

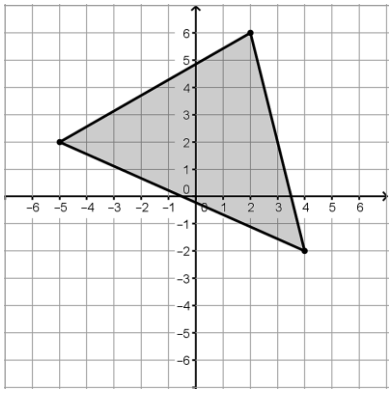
Find the perimeter of each figure below.
Give exact solutions and show solutions rounded to the nearest hundredth.

5.



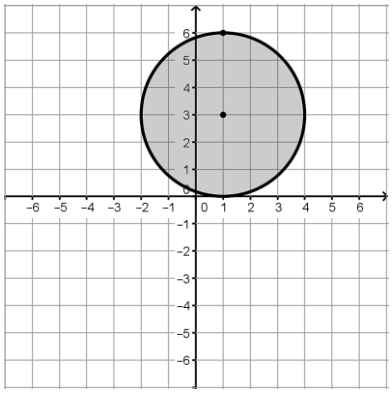
$2\sqrt{40} + 2\sqrt{65}$
28.77 units

6.



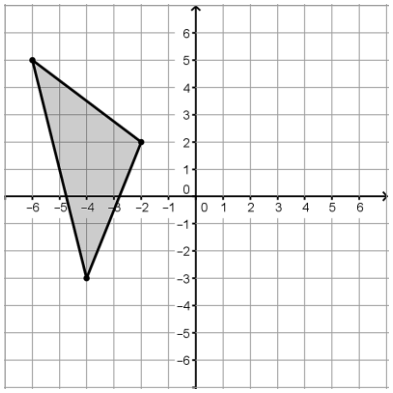
$\sqrt{68} + \sqrt{97} + \sqrt{65}$
26.16 units

7.



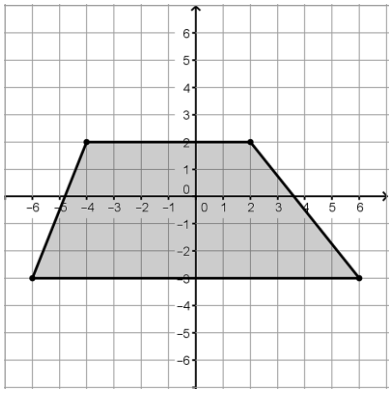
9π
18.85 units

8.



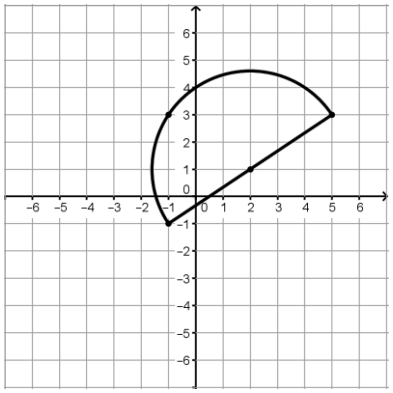
$\sqrt{68} + \sqrt{29} + 5$
18.63 units

9.



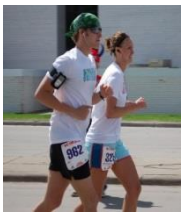
$18 + \sqrt{29} + \sqrt{41}$
28.79 units

10.



$\sqrt{52} + \pi\sqrt{13}$
18.54 units

Name: **Connecting Algebra and Geometry** **7.2H**



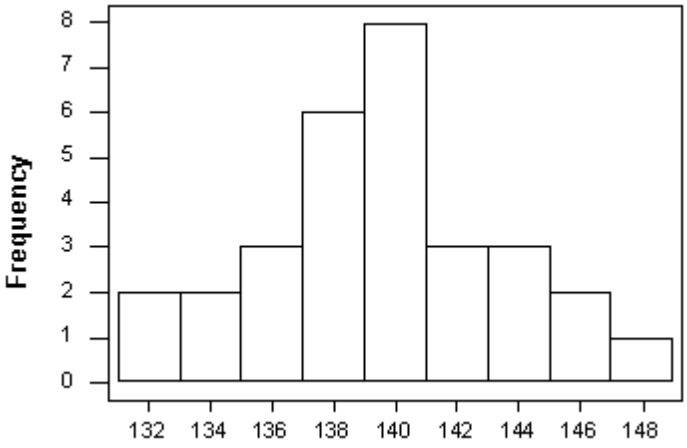
Ready, Set, Go!

Ready

Topic: Identifying center and spread.

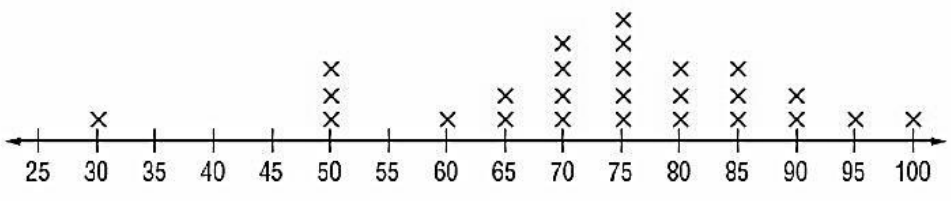
<u>Center</u> describes the central tendency of the data.
<u>Spread</u> describes how scattered the data is.

1. Describe the center and spread in the histogram below.



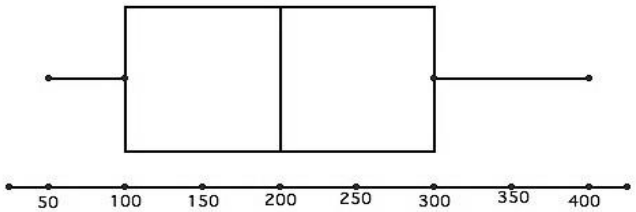
check student answers (normal distribution with center around 140)

2. Describe the center and spread in the line plot below.



check student answers (30 is outlier, skewed left, center around 75)

3. Describe the center and spread in the box and whisker plot.



check student answers (skewed slightly right, center around 200)

Set

You are given information about $f(x)$ and $g(x)$. Rewrite $g(x)$ in translation form: $g(x) = f(x) + k$

4. $f(x) = 7x + 13$
   $g(x) = 7x - 5$

   Translation form:
   $g(x) = f(x) - 18$

5. $f(x) = 22x - 12$
   $g(x) = 22x + 213$

   Translation form:
   $g(x) = f(x) + 225$

6. $f(x) = -15x + 305$
   $g(x) = -15x - 11$

   Translation form:
   $g(x) = f(x) - 316$

7.

x	$f(x)$	$g(x)$
3	11	26
10	46	61
25	121	136
40	196	211

Translation form:
$g(x) = f(x) + 15$

8.

x	$f(x)$	$g(x)$
-4	5	-42
-1	-1	-48
5	-13	-60
20	-43	-90

Translation form:
$g(x) = f(x) - 47$

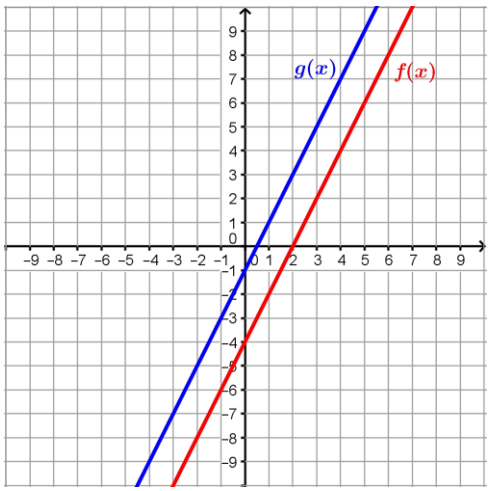
9.

x	$f(x)$	$g(x)$
-10	4	-15.5
-3	7.5	-12
22	20	0.5
41	29.5	10

Translation form:
$g(x) = f(x) - 19.5$

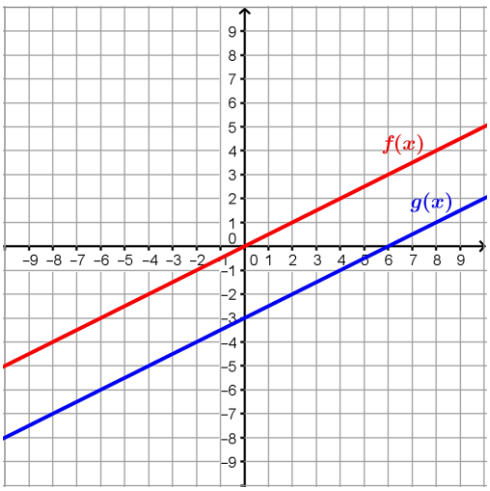
You are given the equation of $f(x)$ and the transformation $g(x) = f(x) + k$. Graph both $f(x)$ and $g(x)$ *and* write the linear equation for $g(x)$ below the graph.

10. $f(x) = 2x - 4$
    $g(x) = f(x) + 3$



Linear Equation for $g(x)$:
$g(x) = 2x - 1$

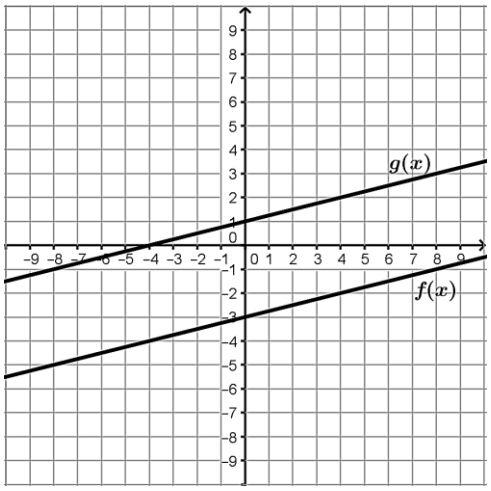
11. $f(x) = 0.5x$
    $g(x) = f(x) - 3$



Linear Equation for $g(x)$:
$g(x) = 0.5x - 3$

Based on the given graph, (a) write the equation of $g(x)$ in the form of $g(x) = f(x) + k$ and (b) simplify the equation of $g(x)$ into slope-intercept form. The equation of $f(x)$ is given.

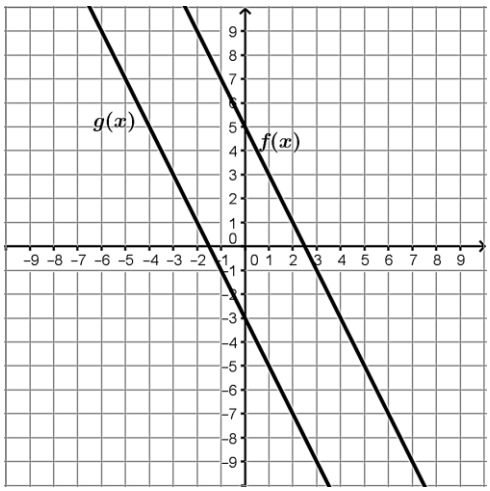
12. $f(x) = \frac{1}{4}x - 3$



a. Translation Form: $\boldsymbol{g(x) = f(x) + 4}$

b. Slope-Intercept Form: $\boldsymbol{g(x) = \frac{1}{4}x + 1}$

13. $f(x) = -2x + 5$



a. Translation Form: $\boldsymbol{g(x) = f(x) - 8}$

b. Slope-Intercept Form: $\boldsymbol{g(x) = -2x - 3}$

Go

14. Fernando and Mariah are training for a half marathon. The chart below describes their workout for the week just before the half marathon. If four laps are equal to one mile, and if there are 13.1 miles in a half marathon, do you think Mariah and Fernando are prepared for the event? Describe how you think each person will perform in the race. Include who you think will finish first and what each person's finish time will be. Use the data to inform your conclusions and to justify your answers.

Day of the week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Fernando: Distance (in laps)	34	45	52	28	49	36
Time per day (in minutes)	60	72	112	63	88	58
Mariah: Distance (in laps)	30	48	55	44	38	22
Time per day (in minutes)	59	75	119	82	70	45

Answers may vary

Name: **Connecting Algebra and Geometry** **7.3H**

Ready, Set, Go!

Ready

Topic: Finding percentages.

Mrs. Gonzalez noticed that her new chorus class had a lot more girls than boys in it. There were 32 girls (who sing soprano or alto) and 17 boys (who sing bass or tenor). Round answers to the nearest percent.

1. What percent of the class are girls?

   65%

2. What percent are boys?

   35%

3. 68% of the girls were sopranos, the rest were alto.

   a. How many girls sang soprano?

      22 girls

   b. What percent of the entire chorus sang soprano?

      About 45%

4. Only 30% of the boys could sing bass, the rest sang tenor.

   a. How many boys were in the bass section?

      5 boys

   b. What percent of the entire chorus sang bass?

      About 10%

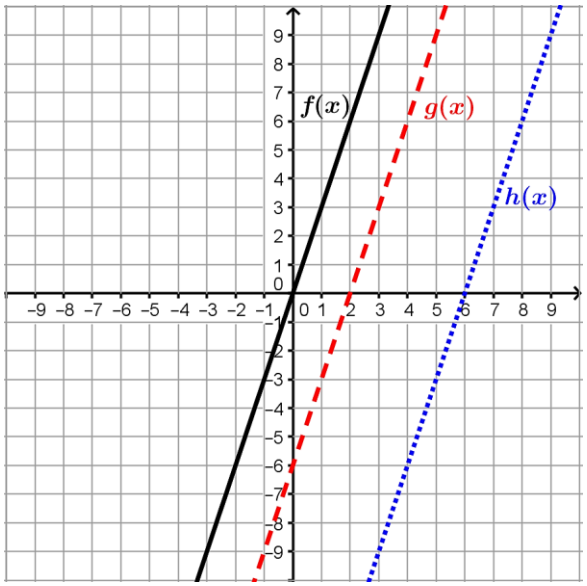
5. Compare the number of girls who sang alto to the number of boys who sang tenor. Which musical section is larger? Justify your answer.

   Answers may vary. There are 20% of the total chorus singing alto v. 24% of the chorus singing tenor.

Set

Topic: Vertical and horizontal translations of functions

6. Use the graph of $f(x) = 3x$ to answer the following questions.



   a. Sketch the graph of $g(x) = 3x - 6$ on the same grid.

      see dashed line

   b. Sketch the graph of $h(x) = 3(x - 6)$.

      see dotted line

   c. Describe how $f(x)$, $g(x)$, and $h(x)$ are different and how they are the same.

      same slope, different location

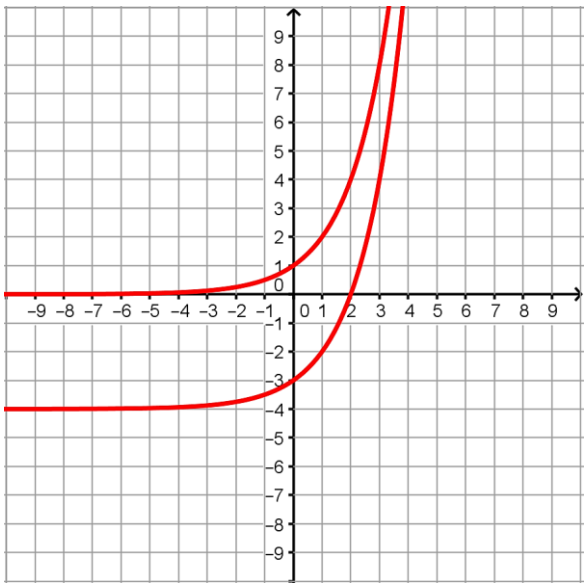
   d. Explain in what way the parentheses affect the graph. Why do you think this is so?

      the parentheses change the shift to the x-direction

Topic: Graphing exponential equations

7. Think about the graphs of $y = 2^x$ and $y = 2^x - 4$.
   a. Predict what you think is the same and what is different.

      answers vary



   b. Graph both equations on the same grid. Explain what stayed the same and what changed when you subtracted 4. Identify in what way it changed.

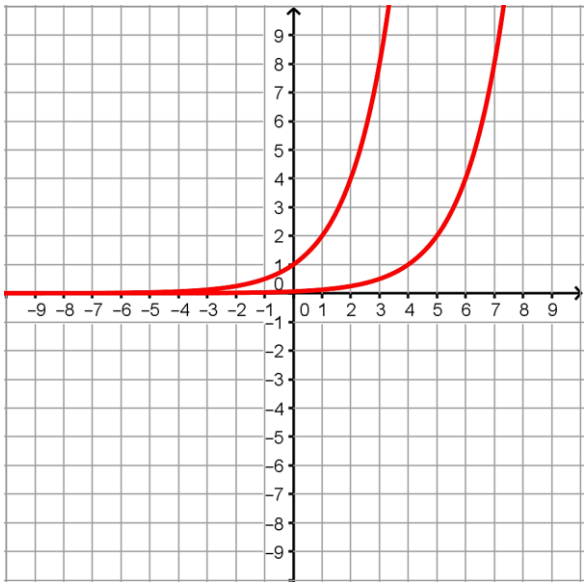
      answers vary

8. Think about the graphs of $y = 2^x$ and $y = 2^{(x-4)}$.
   a. Predict what you think is the same and what is different.

      answers vary

   b. Graph both equations on the same grid. Explain what stayed the same and what changed. Identify in what way it changed.

      answers vary

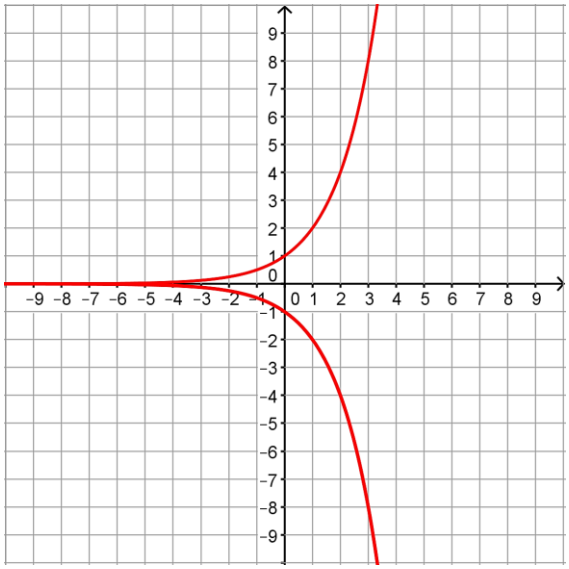


9. Think about the graphs of $y = 2^x$ and $y = -2^x$.
   a. Predict what you think is the same and what is different.

      answers vary

   b. Graph both equations on the same grid. Explain what stayed the same and what changed. Identify in what way it changed.

      answers vary

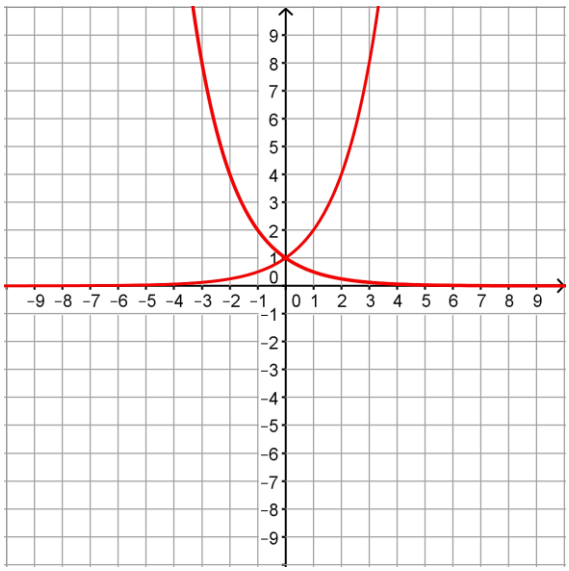


10. Think about the graphs of $y = 2^x$ and $y = 2^{-x}$.
    a. Predict what you think is the same and what is different.

       answers vary

    b. Graph both equations on the same grid. Explain what stayed the same and what changed. Identify in what way it changed.

       answers vary



11. You are going on a road trip, and $f(x) = 65x$ models the distance traveled on a road trip up the coast where x represents the time in hours since noon.

    a. Using the same variable, write a function $g(x)$, if the road trip started at 11:00 am.

    $g(x) = 65(x - 1)$

    b. Using the same variable, write a function $h(x)$, if the road trip started at 2:00pm

    $g(x) = 65(x + 2)$

    c. Using the same context, what would be the meaning of your friends function that is represented by $j(x) = 65(x + 1) + 50$?

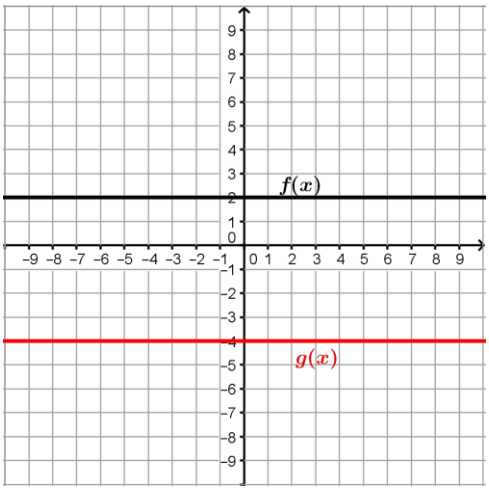
    My friend started on the road trip 50 miles ahead of me and started at 1:00pm.

Go

Topic: Vertical translations of linear equations

The graph of $f(x)$ and the translation form equation of $g(x)$ are given. Graph $g(x)$ on the same grid and write the slope-intercept equation of $f(x)$ and $g(x)$.

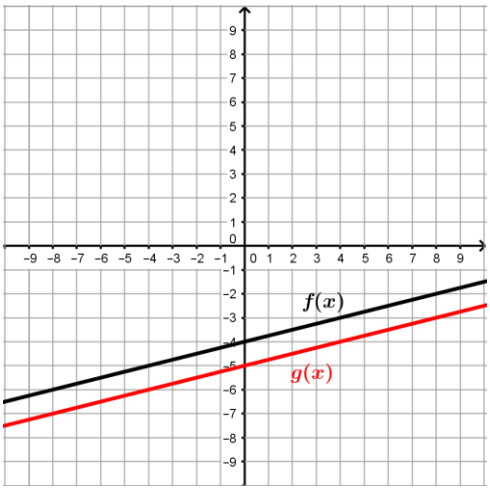
12. $g(x) = f(x) - 6$



$f(x) = 2$

$g(x) = -4$

13. $g(x) = f(x - 4)$



$f(x) = \frac{1}{4}x - 4$

$g(x) = \frac{1}{4}x - 5$

Name: **Connecting Algebra and Geometry** | **7.4H**

Ready, Set, Go!

Ready

Topic: Solving equations using properties of arithmetic

1. Here are the steps Zac used to solve the following equation. State or describe the properties of arithmetic or the properties of equality he is using in each step.

$2(x+5)+7x=4x+15$		$9x-4x=4x+5-4x$	i. **subtraction property of equality**
$(2x+10)+7x=4x+15$	the distributive property	$(9-4)x=4x+5-4x$	j. **distributive property**
$2x+(10+7x)=4x+15$	a. **associative property of addition**	$5x=4x+5-4x$	k. **associative property of addition**
$2x+(7x+10)=4x+15$	b. **commutative property of addition**	$5x=4x-4x+5$	l. **commutative property of addition**
$(2x+7x)+10=4x+15$	c. **associative property of addition**	$5x=0+5$	m. **associative property of addition**
$(2+7)x+10=4x+15$	d. **distributive property**	$5x=5$	n. **additive identity**
$9x+10=4x+15$	e. **associative property of addition**	$\frac{1}{5}\cdot 5x=\frac{1}{5}\cdot 5$	o. **multiplicative property of equality**
$9x+10-10=4x+15-10$	f. **subtraction property of equality**	$1x=1$	p. **multiplicative inverse**
$9x+0=4x+5$	g. **associative property of addition**	$x=1$	q. **multiplicative identity**
$9x=4x+5$	h. **additive identity**		

Solve each of the following equations for *x*, carefully record each step. Then state or describe the properties of arithmetic (ex: the distributive property, the associative property of multiplication, etc.) or properties of equality (ex: the addition property of equality) that justify each step.

2. $2(3x+5)=4(2x-1)$

$x=7$

Descriptions may vary

3. $\frac{4}{5}x+3=2x-1$

$x=\frac{10}{3}$

Descriptions may vary

Set

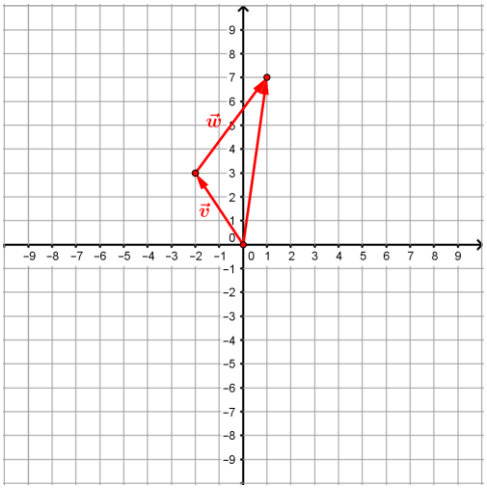
Topic: Adding vectors

Two vectors are described in component form in the following way:

$$\vec{v}: \langle -2, 3 \rangle \text{ and } \vec{w}: \langle 3, 4 \rangle$$

On the grids below, create vector diagrams to show the following. Find the magnitude and component form of the resultant vector.

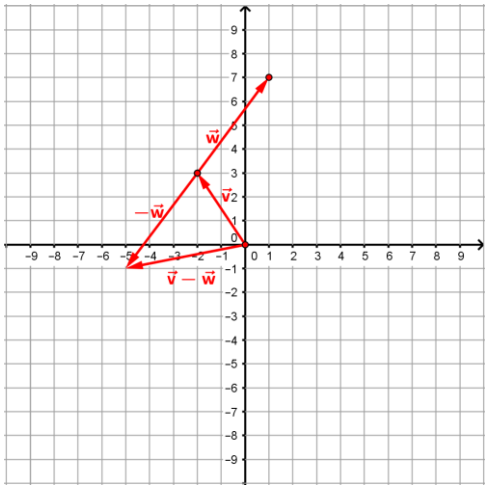
4. $\vec{v} + \vec{w} =$



magnitude: $\langle 1, 7 \rangle$

component form: $5\sqrt{2}$

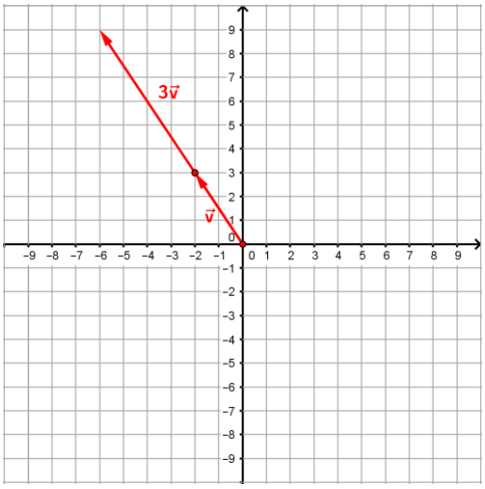
5. $\vec{v} - \vec{w} =$



magnitude: $\langle -5, 1 \rangle$

component form: $\sqrt{26}$

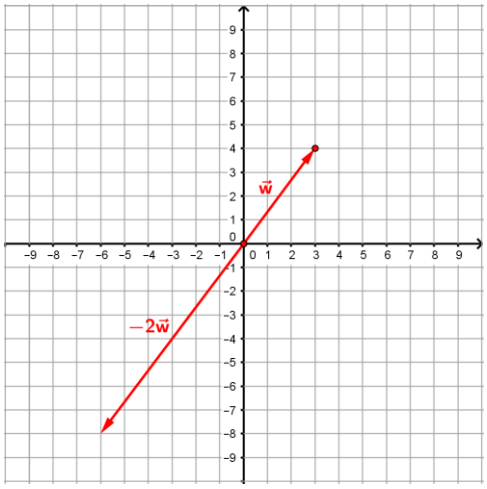
6. $3\vec{v} =$



magnitude: $\langle -6, 9 \rangle$

component form: $3\sqrt{13}$

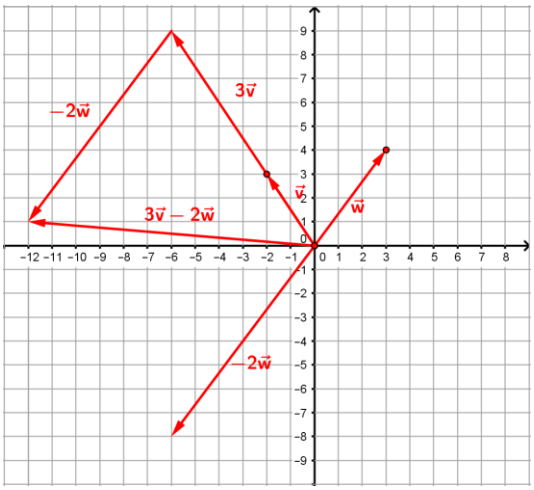
7. $-2\vec{w} =$



magnitude: $\langle -6, -8 \rangle$

component form: 10

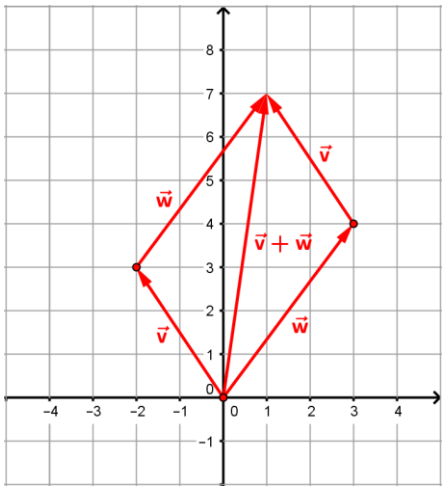
8. $3\vec{v} - 2\vec{w} =$



magnitude: $\langle -12, 1 \rangle$

component form: $\sqrt{145}$

9. Show how to find $\vec{v} + \vec{w}$ using the parallelogram rule



Go

Topic: The arithmetic of matrices

$$A = \begin{bmatrix} 2 & -3 \\ -1 & 5 \end{bmatrix}, B = \begin{bmatrix} 2 & 5 \\ -3 & 2 \end{bmatrix}, \text{and } C = \begin{bmatrix} 4 & 2 & -1 \\ 5 & 2 & 3 \end{bmatrix}$$

Find the following sums, differences, or products. If the sum, difference, or product is undefined, explain why.

10. $A + B$

$\begin{bmatrix} 4 & 2 \\ -4 & 7 \end{bmatrix}$

11. $A + C$

dimensions do not match

12. $2A - B$

$\begin{bmatrix} 2 & -11 \\ 1 & 8 \end{bmatrix}$

13. $A \cdot B$

$\begin{bmatrix} 13 & 4 \\ -17 & 5 \end{bmatrix}$

14. $B \cdot A$

$\begin{bmatrix} -1 & 19 \\ 8 & 19 \end{bmatrix}$

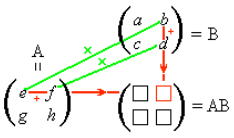
15. $A \cdot C$

$\begin{bmatrix} -7 & -2 & -11 \\ 21 & 8 & 16 \end{bmatrix}$

16. $C \cdot A$

Columns of C do match rows of A

Name: **Connecting Algebra and Geometry** | **7.5H**



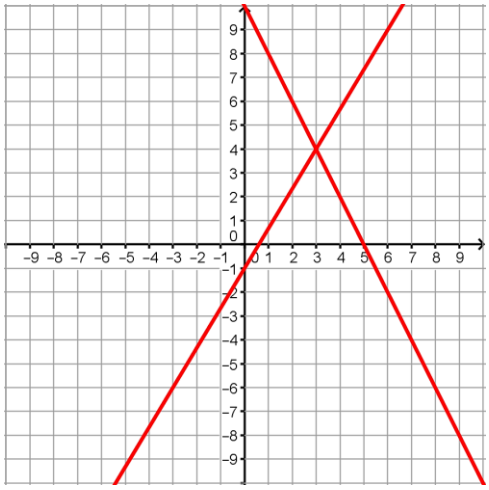
Ready, Set, Go!

Ready

Topic: Solving systems of linear equations

1. Solve the system of equations $\begin{cases} 5x - 3y = 3 \\ 2x + y = 10 \end{cases}$

   a. By graphing:



   b. By substitution: $(\mathbf{3}, \mathbf{4})$

   c. By elimination: $(\mathbf{3}, \mathbf{4})$

Set

Topic: Inverse matrices

2. Given: Matrix $A = \begin{bmatrix} 5 & 2 \\ 3 & 1 \end{bmatrix}$

   a. Find the additive inverse of matrix A

   $\begin{bmatrix} \mathbf{-5} & \mathbf{-2} \\ \mathbf{-3} & \mathbf{-1} \end{bmatrix}$

   b. Find the multiplicative inverse of matrix A

   $\begin{bmatrix} \mathbf{-1} & \mathbf{2} \\ \mathbf{3} & \mathbf{-5} \end{bmatrix}$

3. Given: Matrix $B = \begin{bmatrix} 4 & 2 \\ 3 & 2 \end{bmatrix}$

   a. Find the additive inverse of matrix B

   $\begin{bmatrix} -4 & -2 \\ -3 & -2 \end{bmatrix}$

   b. Find the multiplicative inverse of matrix B

   $\begin{bmatrix} 1 & -1 \\ -1.5 & 2 \end{bmatrix}$

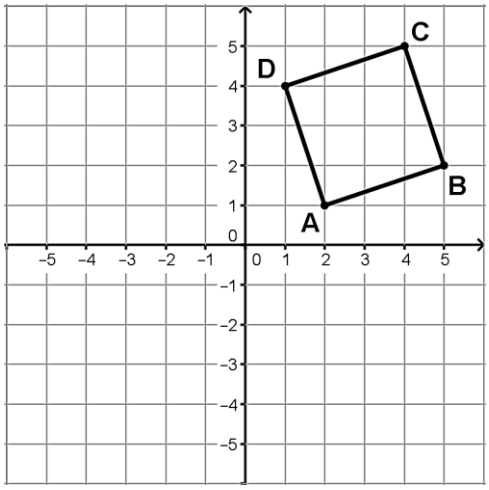
Go

Topic: Parallel lines, perpendicular lines, and length from a coordinate geometry perspective

Given the four points: $A(2,1)$, $B(5,2)$, $C(4,5)$, and $D(1,4)$

4. Is *ABCD* a parallelogram? Provide convincing evidence for your answer.

   Yes, opposite sides are parallel (slopes = -3 and $\frac{1}{3}$)



5. Is *ABCD* a rectangle? Provide convincing evidence for your answer.

   Yes, adjacent sides are perpendicular (slopes are opposite reciprocals)

6. Is *ABCD* a rhombus? Provide convincing evidence for your answer.

   Yes, each side has side length $\sqrt{10}$

7. Is *ABCD* a square? Provide convincing evidence for your answer.

   Yes, equal side lengths and 90° angles

Topic: Arithmetic of vectors and matrices

Find the component form of $\overrightarrow{AB}$. Then find the magnitude of $\overrightarrow{AB}$

8. $A(2,4),\ B(-1,3)$

   $\overrightarrow{AB} = \langle -3,-1\rangle, \left\|\overrightarrow{AB}\right\| = \sqrt{10} \approx 3.16$

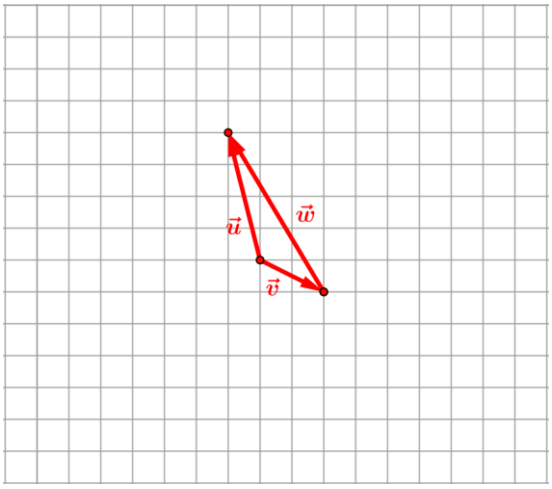
9. $A(-3,-6),\ B(8,-1)$

   $\overrightarrow{AB} = \langle 11,5\rangle, \left\|\overrightarrow{AB}\right\| = \sqrt{146} \approx 12.08$

Let $\vec{v} = \langle 2,-1\rangle$ and $\vec{w} = \langle -3,5\rangle$. Find $\vec{u}$ and sketch the vector operations geometrically.

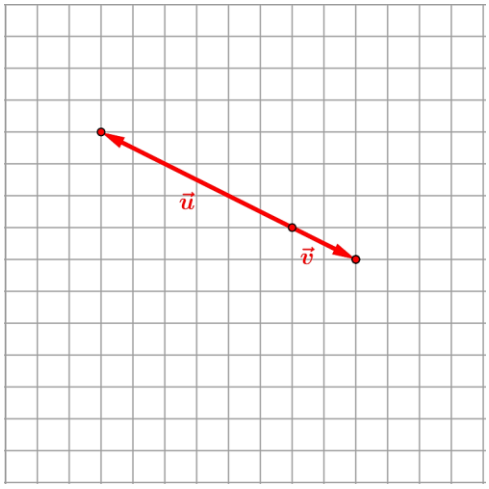
10. $\vec{u} = \vec{v} + \vec{w}$

    $\vec{u} = \langle -1,4\rangle$



11. $\vec{u} = -3\vec{v}$

    $\vec{u} = \langle -6,3\rangle$

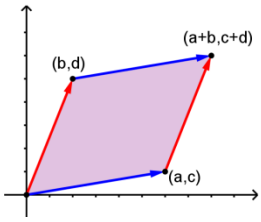


Simplify the following:

12. $\left(\begin{bmatrix} -4 & 2 \\ 2 & 3 \end{bmatrix} + \begin{bmatrix} 2 & 6 \\ -1 & 2 \end{bmatrix}\right) \cdot \begin{bmatrix} 5 \\ -5 \end{bmatrix}$

    $\begin{bmatrix} -50 \\ -20 \end{bmatrix}$

Name: **Connecting Algebra and Geometry** | **7.6H**



Ready, Set, Go!

Ready

Topic: Solving systems of linear equations using row reduction

Given the system of equations $\begin{cases} 5x - 3y = 3 \\ 2x + y = 10 \end{cases}$

1. Zac started solving this problem by writing $\begin{bmatrix} 5 & -3 & 3 \\ 2 & 1 & 10 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & -5 & -17 \\ 2 & 1 & 10 \end{bmatrix}$. Describe what Zac did to get from the matrix on the left to the matrix on the right.

   $-2R_2 + R_1 \rightarrow R_1$

2. Lea started solving this problem by writing $\begin{bmatrix} 5 & -3 & 3 \\ 2 & 1 & 10 \end{bmatrix} \rightarrow \begin{bmatrix} 5 & -3 & 3 \\ 1 & \frac{1}{2} & 5 \end{bmatrix}$. Describe what Lea did to get from the matrix on the left to the matrix on the right.

   $\frac{1}{2}R_2 \rightarrow R_2$

3. Using either Zac's or Lea's first step, continue solving the system using row reduction. Show each matrix along with notation indicating how you got from one matrix to another. Be sure to check your solution.

   $\begin{bmatrix} 1 & 0 & 3 \\ 0 & 1 & 4 \end{bmatrix}$ *or* $(3, 4)$

Set

Topic: The determinant of a 2×2 matrix

4. Use the determinant of each 2×2 matrix to decide which matrices have multiplicative inverses, and which do not.

a. $\begin{bmatrix} 8 & -2 \\ 4 & 1 \end{bmatrix}$

16, yes

b. $\begin{bmatrix} 3 & 2 \\ 6 & 4 \end{bmatrix}$

0, no

c. $\begin{bmatrix} 4 & 2 \\ 3 & 1 \end{bmatrix}$

-2, yes

5. Find the multiplicative inverse of each of the matrices in 4, provided the inverse matrix exists.

a. $\begin{bmatrix} \frac{1}{16} & \frac{1}{8} \\ -\frac{1}{4} & \frac{1}{2} \end{bmatrix}$

b. **no inverse**

c. $\begin{bmatrix} -\frac{1}{2} & 1 \\ \frac{3}{2} & -2 \end{bmatrix}$

6. Generally matrix multiplication is not commutative. That is, if A and B are matrices, typically $A \cdot B \neq B \cdot A$. However, multiplication of inverse matrices is commutative. Test this out by showing that the pairs of inverse matrices you found in question 7 give the same result when multiplied in either order.

Yes, both pairs give the product $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Go

Topic: Parallel and perpendicular lines

Determine if the following pairs of lines are parallel, perpendicular or neither. Explain how you arrived at your answer.

7. $3x + 2y = 7$ and $6x + 4y = 9$

Parallel, slopes are equal

8. $y = \frac{2}{3}x - 5$ and $y = -\frac{2}{3}x + 7$

Neither

9. $y = \frac{3}{4}x - 2$ and $4x + 3y = 3$

Perpendicular, slopes are opposite reciprocals

10. Write the equation of a line that is parallel to $y = \frac{4}{5}x - 2$ and has a y-intercept at $(0, 4)$.

$\boldsymbol{y = \frac{4}{5}x + 4}$

11. Write the equation of a line that is perpendicular to $y = -\frac{2}{3}x + 3$ and passes through the point $(2, 5)$.

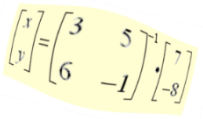
$\boldsymbol{y = \frac{3}{2}x + 2}$

12. Write the equation of a line that is parallel to $y = -\frac{2}{3}x + 3$ and passes through the point $(2, 5)$.

$\boldsymbol{y = -\frac{2}{3}x + \frac{19}{3}}$

Name: **Connecting Algebra and Geometry** | **7.7H**

Ready, Set, Go!

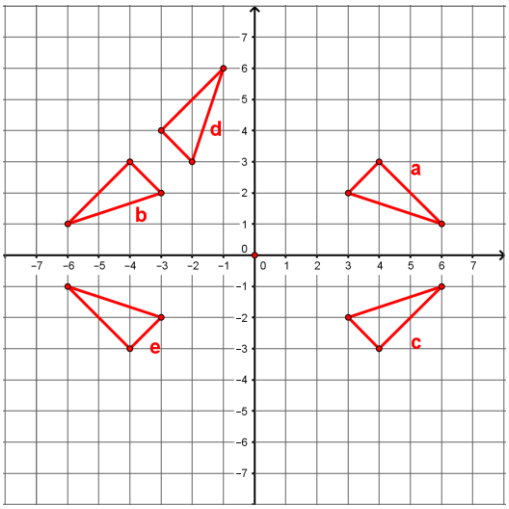


Ready

Topic: Reflections and rotations

1. The following three points form the vertices of a triangle: $(3, 2), (6, 1), (4, 3)$

   a. Plot these three points on the coordinate grid and connect them to form a triangle.

   b. Reflect the original triangle over the *y*-axis and record the coordinates of the vertices here:
   $(-3, 2), (-6, 1), (-4, 3)$

   c. Reflect the original triangle over the *x*-axis and record the coordinates of the vertices here:
   $(3, -2), (6, -1), (4, -3)$

   d. Rotate the original triangle 90° counter-clockwise about the origin and record the coordinates of the vertices here:
   $(-2, 3), (-1, 6), (-3, 4)$

   e. Rotate the original triangle 180° about the origin and record the coordinates of the vertices here:
   $(-3, -2), (-6, -1), (-4, -3)$

Set

Topic: Solving systems using inverse matrices

Two of the following systems have unique solutions (i.e.: the lines intersect at a single point).

2. Use the determinant of a 2 × 2 matrix to decide which systems have unique solutions, and which one does not.

   a. $\begin{cases} 8x - 2y = -2 \\ 4x + y = 5 \end{cases}$ **$d = 16$, yes**

   b. $\begin{cases} 3x + 2y = 7 \\ 6x + 4y = -5 \end{cases}$ **$d = 0$, no**

   c. $\begin{cases} 4x + 2y = 0 \\ 3x + y = 2 \end{cases}$ **$d = -2$, yes**

3. For each of the systems in question #2 above, find the solution to the system by solving a matrix equation using an ***inverse matrix.***

   a. **$\left(\frac{1}{2}, 3\right)$**

   b. **no solution**

   c. **$(2, -4)$**

Topic: Solving systems with three unknowns.

Solve the system of equations using matrices. Create a matrix equation for the system of equations that can be used to find the solution. Then find the inverse matrix and use it to solve the system.

4. $\begin{cases} 2x - 4y + z = 0 \\ 5x - 4y - 5z = 12 \\ 4x + 4y + z = 24 \end{cases}$

(4, 2, 0)

5. $\begin{cases} x + 2y + 5z = -15 \\ x + y - 4z = 12 \\ x - 6y + 4z = -12 \end{cases}$

(0, 0, −3)

6. $\begin{cases} 4p + q - 2r = 5 \\ -3p - 3q - 4r = -16 \\ 4p - 4q + 4r = -4 \end{cases}$

(1, 3, 1)

7. $\begin{cases} -6x - 4y + z = -20 \\ -3x - y - 3z = -8 \\ -5x + 3y + 6z = -4 \end{cases}$

(2, 2, 0)

Go

Topic: Properties of arithmetic

Match each example on the left with the name of a property of arithmetic on the right. Not all answers will be used.

i_____8. $2(x + 3y) = 2x + 6y$

g_____9. $(2x + 3y) + 4y = 2x + (3x + 4y)$

e_____10. $2x + 3y = 3y + 2x$

h_____11. $2(3y) = (2 \cdot 3)y = 6y$

c_____12. $\frac{2}{3} \cdot \frac{3}{2} x = 1x$

d_____13. $x + -x = 0$

f_____14. $xy = yx$

a. multiplicative inverses

b. additive inverses

c. multiplicative identity

d. additive identity

e. commutative property of addition

f. commutative property of multiplication

g. associative property of addition

h. associative property of multiplication

i. distributive property of multiplication over addition

Name: **Connecting Algebra and Geometry** | **7.8H**

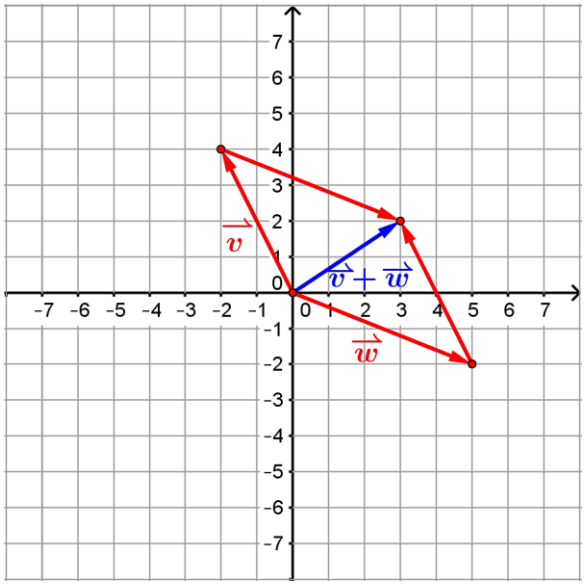
Ready, Set, Go!

Ready

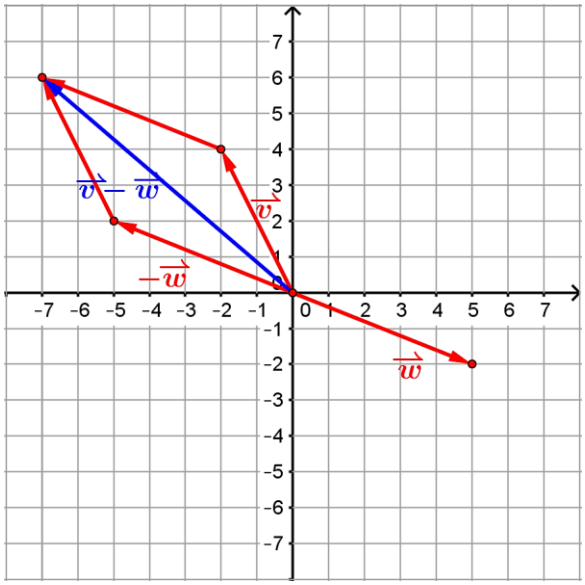
Topic: Adding vectors

Given vectors $\vec{v}$: $\langle -2, 4 \rangle$ and $\vec{w}$: $\langle 5, -2 \rangle$, find the following using the parallelogram rule:

1. $\vec{v} + \vec{w} =$



2. $\vec{v} - \vec{w} =$



Set

Topic: Matrices and transformations of the plane

3. List the coordinates of the four vertices of the parallelogram you drew in question 1 as a matrix. Use columns to represent each coordinate (*x*-values across the top row with corresponding *y*-values across the bottom row).

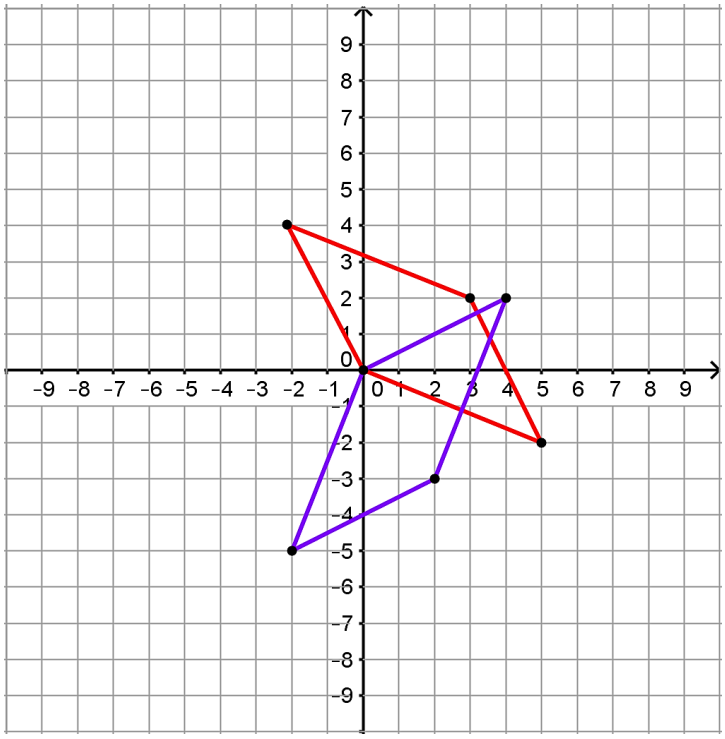
	Point 1	Point 2	Point 3	Point 4
x-values				
y-values				

$$\begin{bmatrix} \mathbf{0} & \mathbf{5} & \mathbf{3} & \mathbf{-2} \\ \mathbf{0} & \mathbf{-2} & \mathbf{2} & \mathbf{4} \end{bmatrix}$$

4. Multiply the matrix you wrote in question 3 by the following matrix: $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$

$$\begin{bmatrix} \mathbf{0} & \mathbf{-2} & \mathbf{2} & \mathbf{4} \\ \mathbf{0} & \mathbf{-5} & \mathbf{-3} & \mathbf{2} \end{bmatrix}$$

5. Plot the original parallelogram formed by the ordered pairs from your answer in question 3. Then plot the parallelogram using the points from the matrix in number 4.



What transformation occurred between your original parallelogram and the new one?

The parallelogram was rotated 270° about the origin.

6. List the coordinates of the four vertices of the parallelogram you drew in question 2 as a matrix. Use columns to represent each coordinate (*x*-values down the first column with corresponding *y*-values down the second column).

	x-values	*y*-values
Point 1		
Point 2		
Point 3		
Point 4		

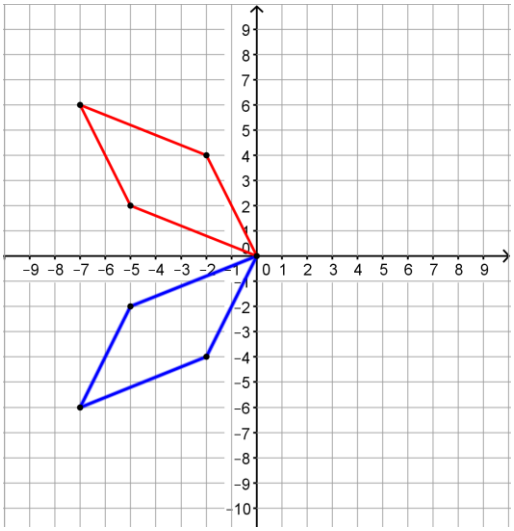
$$\begin{bmatrix} \mathbf{0} & \mathbf{0} \\ \mathbf{-2} & \mathbf{4} \\ \mathbf{-5} & \mathbf{2} \\ \mathbf{-7} & \mathbf{6} \end{bmatrix}$$

7. Multiply the matrix you wrote in question 6 by the following matrix: $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$

$$\begin{bmatrix} \mathbf{0} & \mathbf{0} \\ \mathbf{-2} & \mathbf{-4} \\ \mathbf{-5} & \mathbf{-2} \\ \mathbf{-7} & \mathbf{-6} \end{bmatrix}$$

8. How did the orientation of your multiplication in question 7 differ from question 4? Why?

9. Plot the original parallelogram formed by the ordered pairs from your answer in question 3. Then plot the parallelogram using the points from the matrix in number 4. What transformation occurred between your original parallelogram and the new one?



What transformation occurred between your original parallelogram and the new one?
The parallelogram was reflected over the *x*-axis.

Go

Topic: Transformations of functions

Function $f(x)$ is defined by the following table below:

x	2	4	6	8	10	12	14	16
$f(x)$	-8	-3	2	7	12	17	22	27
$g(x)$	**-5**	**0**	**5**	**10**	**15**	**20**	**25**	**30**
$h(x)$	**-16**	**-6**	**4**	**14**	**24**	**34**	**44**	**54**

10. Write an equation for $f(x)$.

$\boldsymbol{f(x) = \frac{5}{2}x - 13}$

11. a. Fill in the values, in the table above, for $g(x)$ assuming that $g(x) = f(x) + 3$

b. Write an equation for $g(x)$.

$\boldsymbol{g(x) = \frac{5}{2}x - 10}$

12. a. Fill in the values, in the table above, for $h(x)$ assuming that $h(x) = 2f(x)$

b. Write an equation for $h(x)$.

$\boldsymbol{h(x) = 5x - 26}$

Topic: Find the inverse of the following matrices:

Find the inverse of each of the following matrices.

13. $\begin{bmatrix} 11 & -5 \\ 2 & -1 \end{bmatrix}$

$\begin{bmatrix} \mathbf{1} & \mathbf{-5} \\ \mathbf{2} & \mathbf{-11} \end{bmatrix}$

14. $\begin{bmatrix} 0 & -2 \\ -1 & -9 \end{bmatrix}$

$\begin{bmatrix} \frac{9}{2} & \mathbf{-1} \\ -\frac{1}{2} & \mathbf{0} \end{bmatrix}$

Name: **Connecting Algebra and Geometry** | **7.9H**

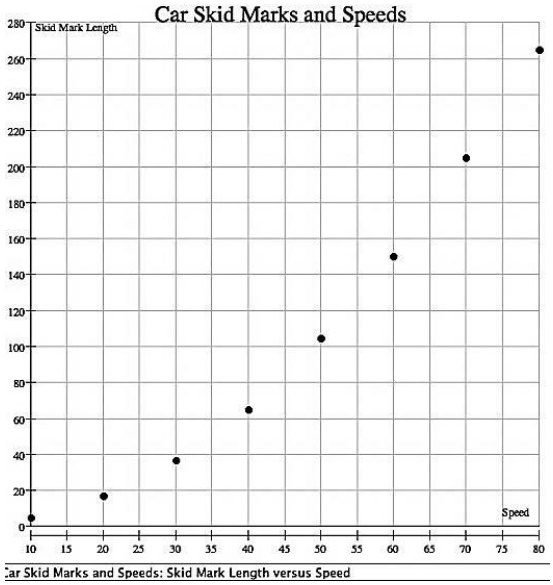
Ready, Set, Go!

Ready

Topic: Scatterplots and trend lines

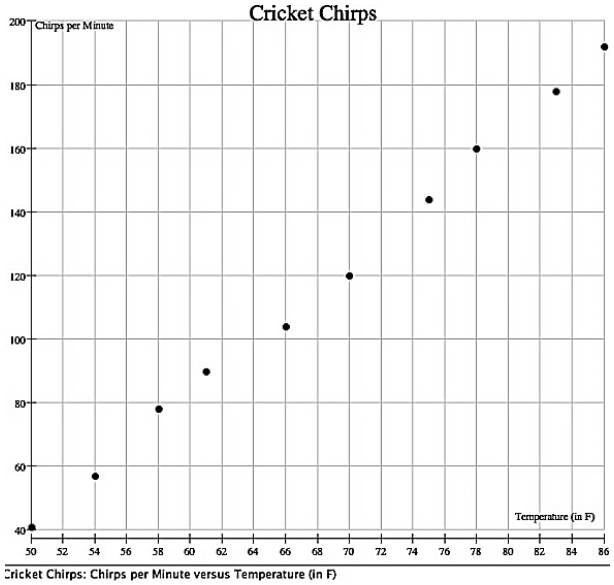
Examine each of the scatterplots shown below. If possible, make a statement about relationships between the two quantities depicted in the scatterplot.

1.



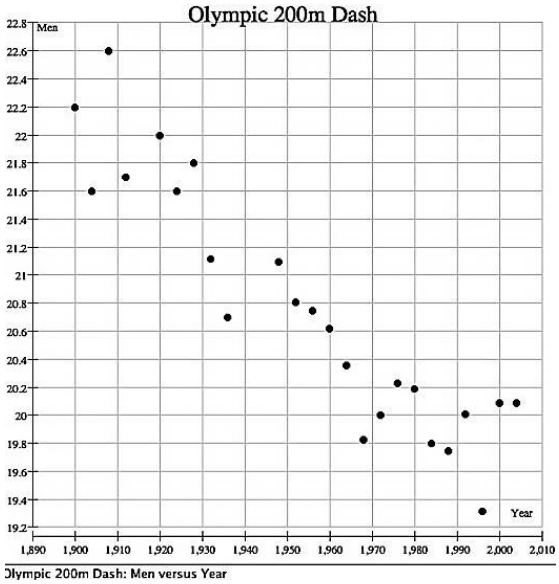
exponential, increasing

2.



linear, increasing

3.



linear, decreasing, weak

4. For each scatterplot, write the equation of a trend line that you think best fits the data.

   a. Trend line #1

   b. Trend line #2

   c. Trend line #3

equations for a – c will vary

Set

Topic: Applications of vectors

Given: $\vec{u}$: $\langle -5, 1\rangle$, $\vec{v}$: $\langle 3, 5\rangle$, $\vec{w}$: $\langle 4, -3\rangle$. Each of these three vectors represents a force pulling on an object—such as in a three-way tug of war—with force exerted in each direction being measured in pounds.

5. Find the magnitude of each vector. That is, how many pounds of force are being exerted on the object by each tug? Round to the nearest hundredth.

   a. $\|\vec{u}\| =$

   $\sqrt{26} \approx 5.10$

   b. $\|\vec{v}\| =$

   $\sqrt{34} \approx 5.83$

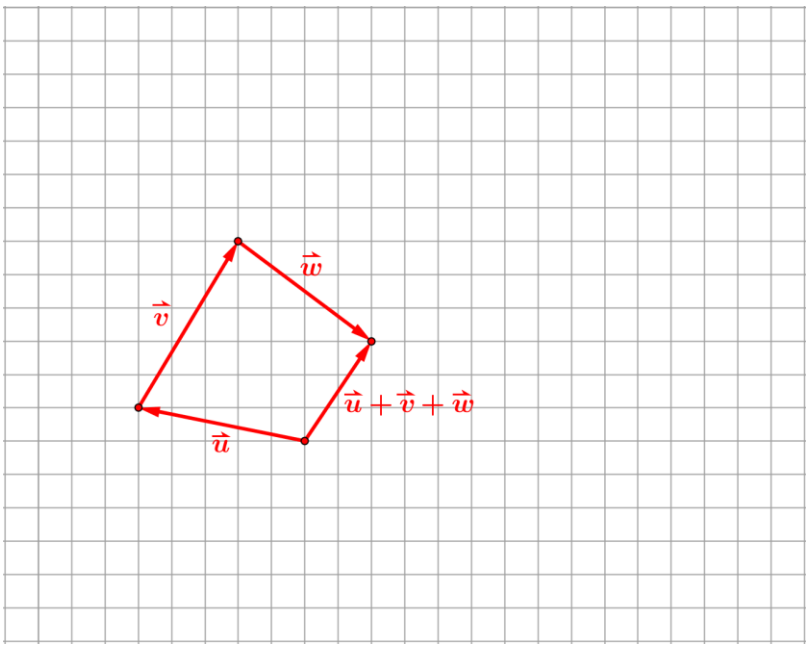
   c. $\|\vec{w}\| =$

   5

6. Find the magnitude of the sum of the three forces on the object.
   $\|\vec{u} + \vec{v} + \vec{w}\| =$

   $\sqrt{13} \approx 3.61$

7. Draw a vector diagram showing the resultant direction and magnitude of the motion resulting from this three-way tug of war.



Go

Topic: Solving systems

Given: $\begin{cases} 4x - 4y = 7 \\ 6x - 8y = 9 \end{cases}$

8. Solve the given system in each of the following ways. $\left(\frac{5}{2}, \frac{3}{4}\right)$

a. By substitution

b. By elimination

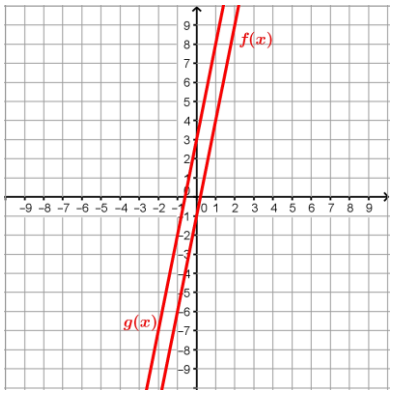
c. Using matrix row reduction

d. Using an inverse matrix

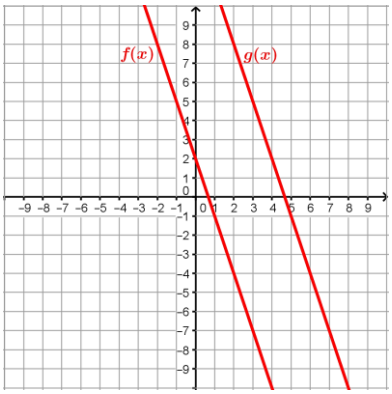
Module 7H Review

You are given the equation of $f(x)$ and the transformation $g(x)$. Graph both $f(x)$ and $g(x)$ *and* write the linear equation for $g(x)$ below the graph.

1. $f(x) = 5x - 1$
   $g(x) = f(x) + 4 = \mathbf{5x + 3}$

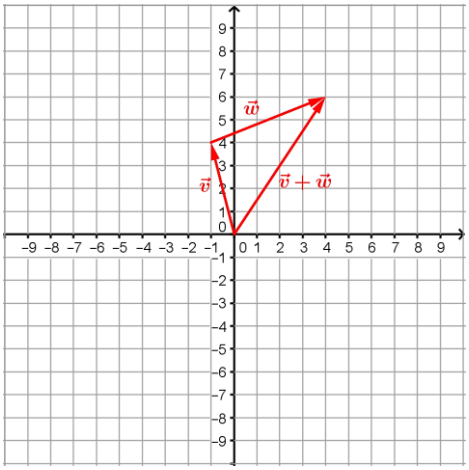


2. $f(x) = -3x + 2$
   $g(x) = f(x - 4) = \mathbf{-3(x - 4) + 2}$

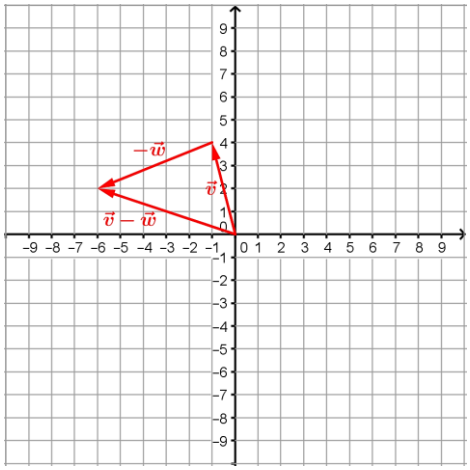


Two vectors are described in component form in the following way $\vec{v}$: $\langle -1, 4 \rangle$ and $\vec{w}$: $\langle 5, 2 \rangle$. On the grids below, create vector diagrams to show:

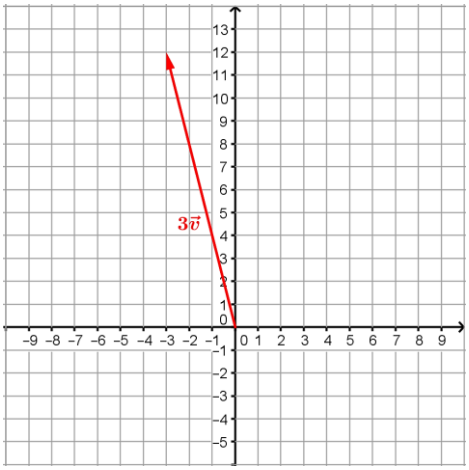
3. $\vec{v} + \vec{w} =$



4. $\vec{v} - \vec{w} =$



5. $3\vec{v} =$



6. a. Find the additive identity of matrix A
   b. Find the additive inverse of matrix A

   $A = \begin{bmatrix} 4 & -2 \\ 1 & 2 \end{bmatrix}$

   a. $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

   b. $\begin{bmatrix} -4 & -2 \\ 1 & 2 \end{bmatrix}$

7. a. Find the multiplicative identity of matrix B
   b. Find the multiplicative inverse of matrix B
   c. Find the determinant of matrix B

   $B = \begin{bmatrix} -3 & 1 \\ 7 & 2 \end{bmatrix}$

   a. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

   b. $\begin{bmatrix} -\frac{2}{13} & \frac{1}{13} \\ \frac{7}{13} & \frac{3}{13} \end{bmatrix}$

   c. -13

Solve the following systems using matrices and an inverse matrix.

8. $\begin{cases} 3x + 5y = -1 \\ 2x + 4y = 4 \end{cases}$

   $(-12, 7)$

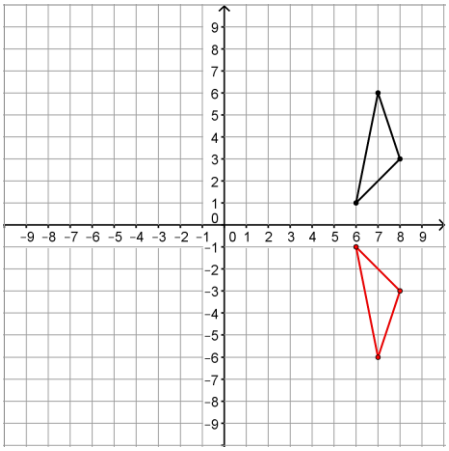
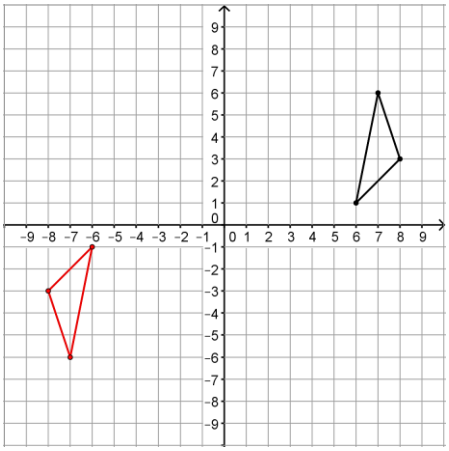
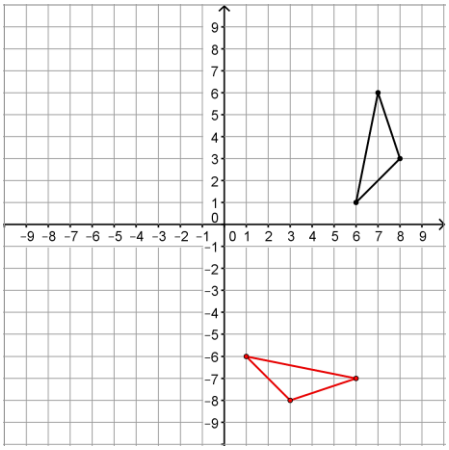
9. $\begin{cases} 4x + 2y = 0 \\ 3x + y = 2 \end{cases}$

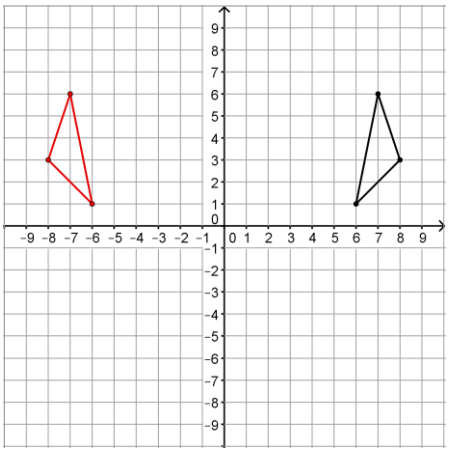
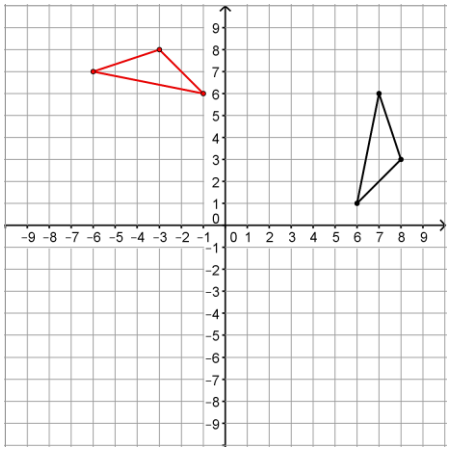
   $(2, -4)$

10. $\begin{cases} 6y + 6z = -30 \\ 4x - 6y - 3z = 26 \\ x + y + z = -3 \end{cases}$

    $(2, -1, -4)$

Multiply each of the indicated transformation matricies to the triangle represented by $\begin{bmatrix} 6 & 8 & 7 \\ 1 & 3 & 6 \end{bmatrix}$. Then graph each transformation and describe the type of transformation that occurred.

	Multiply the matrices	Graph	Type of Transformation
11. $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$	$\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \cdot \begin{bmatrix} 6 & 8 & 7 \\ 1 & 3 & 6 \end{bmatrix}$ $\begin{bmatrix} \mathbf{6} & \mathbf{8} & \mathbf{7} \\ \mathbf{-1} & \mathbf{-3} & \mathbf{-6} \end{bmatrix}$		**Reflection over the *x*-axis.**
12. $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$	$\begin{bmatrix} \mathbf{-6} & \mathbf{-8} & \mathbf{-7} \\ \mathbf{-1} & \mathbf{-3} & \mathbf{-6} \end{bmatrix}$		**180° rotation**
13. $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$	$\begin{bmatrix} \mathbf{1} & \mathbf{3} & \mathbf{6} \\ \mathbf{-6} & \mathbf{-8} & \mathbf{-7} \end{bmatrix}$		**270° rotation**

14. $\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$	$\begin{bmatrix} -6 & -8 & -7 \\ 1 & 3 & 6 \end{bmatrix}$		**Reflection over the *y*-axis.**
15. $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$	$\begin{bmatrix} -1 & -3 & -6 \\ 6 & 8 & 7 \end{bmatrix}$		**90° rotation**

16. Using $\vec{v}: \langle -5, 6 \rangle$ and $\vec{w}: \langle 2, 1 \rangle$, Calculate $\|\vec{v} + \vec{w}\|$

$\sqrt{58}$

17. Using $\vec{v}: \langle -3, 4 \rangle$ and $\vec{w}: \langle 5, 1 \rangle$, Calculate $\|\vec{v} - \vec{w}\|$

$\sqrt{73}$

18. Find the area of the parallelogram made when graphing $\vec{v} + \vec{w}$. Use $\vec{v}: \langle -3, 5 \rangle$ and $\vec{w}: \langle 7, 10 \rangle$

65

Statistics Review **Name:**

Module 8 Preview (use available resources to help answer each question)

1. Using the frequency table below, determine how many students received a score of 70 or better on anEnglish exam.

Score	Frquency
50-59	3
60-69	8
70-79	10
80-89	9
90-100	3

22 students

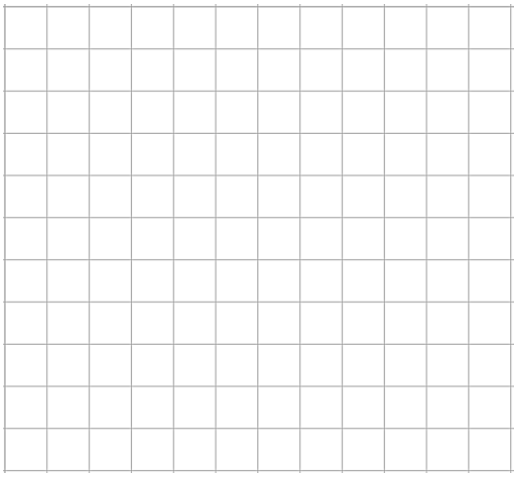
2. The students' scores on a math test are shown on the following frequency table. How many students scored below 21?

Score	16	17	18	19	20	21	22	23	24	25
Number of Students	4	1	2	3	3	1	3	4	2	4

13 students

3. Create a histogram for the following data.

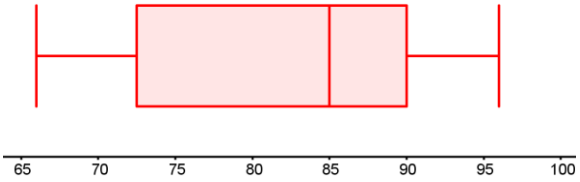
Class Interval	Frequency
4-6	7
7-9	3
10-12	5
13-15	5



4. Name two differences between a histogram and a bar graph.

5. The test scores from Mrs. Anderson's math class are shown below:.
   72, 73, 66, 71, 82, 85, 96, 85, 86, 89, 91, 92

   a. Construct a box plot to display the data. Show all necessary values (min, max, median, quartiles, etc.).



   b. What is the value of the upper quartile?

90

Outliers are values that stand away from a body of distribution. An example of how to find any outliers in a set of data is shown below:

10.2, 14.1, 14.4, 14.4, 14.4, 14.5, 14.5, 14.6, 14.7, 14.7, 14.7, 14.9, 15.1, 15.9, 16.4

To find out if there are any outliers, I first have to find the Inner Quartile Range (IQR). There are fifteen data points, so the median will be at position $(15 + 1) \div 2 = 8$. Then $Q_2 = 14.6$. There are seven data points on either side of the median, so Q_1 is the fourth value in the list and Q_3 is the twelfth: $Q_1 = 14.4$ and $Q_3 = 14.9$. Then IQR=14.9– 14.4 = 0.5.

Any points below $Q_1 - 1.5 \times IQR = 14.4 - 0.75 = 13.65$ or above $Q_3 + 1.5 \times IQR = 14.9 + 0.75 = 15.65$ are outliers.

So, 10.2, 15.9, and 16.4 are outliers in the data.

6. Given the following data set: {63,88,89,89,95,98,99,99,100,100}

   a. Find any outliers.

63

   b. Create a modified box plot to show any outliers.