Pre Calculus: At Home Learning March 19th - April 3rd

How At Home Learning will work:

Check Google Classroom regularly for scheduled review to be posted every few days. The review is meant for you to continue to practice your skills and stay up-to-date as much as possible.

The work you complete will count for **positive credit only**, this means it cannot hurt your overall grade if you are unable to complete it. Submit your work through Google Classroom as you finish by taking pictures of your paper and posting it to the appropriate assignment.

If you have questions, please post those questions to Google Classroom. We also strongly encourage you to seek out other students to form study groups via Google Meet, Zoom, etc. for additional support. We will be checking our Google Classrooms regularly to answer any questions that you may have. You may also email us directly. Attached is a guideline for appropriate interaction when communicating with other students and staff through technology.

Sincerely,

OHS Math

Remote Learning Guidelines

Dear students,

As we move to learning remotely it is important to remind ourselves that our reason for being together as a class and school is to support each others' learning. As such, our interactions online, like our interactions in person, are opportunities to present our best selves.

Before writing or posting anything online make certain what you write or post contributes to our learning. It should be on topic. It should not distract. Humor should only be used when it helps learning and engagement. If you are unsure whether you should write or post something in a public forum (google classroom, shared doc, group email thread, social media, etc.) check with a trusted adult (such as a parent or teacher) first.

Jefferson Union High School District has a detailed technology use policy, but if you always check that what you are doing...
...is on topic,
...is respectful,
...and motivated by an interest in learning and helping others learn,
you will likely never violate that policy and face consequences.

Remember, when we interact face-to-face we are able to read physical cues that provide additional meaning and context to what we are saying and doing. Face-to-face interactions allow for clarification and forgiveness. Online actions and statements do not reliably do this. Things you write and post online may not be interpreted as intended, they exist indefinitely, and can be taken out of context. Please be mindful, and pause to consider if misunderstanding is possible before you hit send/post/enter.

OHS Staff

Table of Contents

Matrix Operations

Let $P = \begin{bmatrix} -7 & 3 \\ 2 & 0 \end{bmatrix}$, $Q = \begin{bmatrix} 1 & 2 \\ 8 & 18 \end{bmatrix}$, $S = \begin{bmatrix} 3 & -5 \\ 4 & 9 \\ 0 & 7 \end{bmatrix}$, $T = \begin{bmatrix} 12 & 7 & 1 \\ -1 & 8 & 3 \end{bmatrix}$, $U = \begin{bmatrix} 3 & -5 & 0 \\ 11 & 6 & 2 \end{bmatrix}$ and $W = \begin{bmatrix} 4 & 2 & 10 \\ 6 & 4 & 1 \\ -7 & -3 & 0 \end{bmatrix}$.

Compute each of the following matrices or values, if possible.

1. $\det(P)$
2. P^{-1}
3. $2P + Q$
4. $3T - 2U$
5. QT
6. TU
7. $W + S$
8. WS
9. PQ
10. QP
11. S^{-1}
12. $|Q|$
13. Q^{-1}
14. $UW - T$
15. $TS + |Q|P$
16. $Q^{-1}T - QT$

Solving Matrix Equations

Use a matrix equation to solve each system of equations.

1) $5x - 5y = -15$
$-4x + 9y = 2$

2) $-48x - 30y = 6$
$-40x - 25y = 5$

3) $-8x + 8y = 6$
$-18x + 18y = 18$

Solve each equation or state if there is no unique solution.

4) $\begin{bmatrix} -3 & -1 \\ 3 & 4 \end{bmatrix} C - \begin{bmatrix} -6 \\ -8 \end{bmatrix} = \begin{bmatrix} 31 \\ -29 \end{bmatrix}$

5) Wilbur and Castel each improved their yards by planting daylilies and geraniums. They bought their supplies from the same store. Wilbur spent $88.32 on 9 daylilies and 3 geraniums. Castel spent $134.72 on 8 daylilies and 8 geraniums. Find the cost of one daylily and the cost of one geranium.

6) A boat traveled 123.12 miles downstream and back. The trip downstream took 5.7 hours. The trip back took 8.1 hours. What is the speed of the boat in still water? What is the speed of the current?

Vector Operations

1. Given $\vec{u}$, shown at right, write $\vec{u}$ in component form then determine the magnitude and direction.

2. Let $\vec{v} = \langle 6, -4 \rangle$. Calculate $\|\vec{v}\|$ and $\arg(\vec{v})$.

3. The magnitude of $\vec{w}$ is 8 and the direction is $140°$. Write $\vec{w}$ in component form.

4. Let $\vec{u} = \langle -8, 14 \rangle$ and $\vec{v} = \langle 1, -2 \rangle$. If $\vec{w} = \frac{1}{2}\vec{u} - 3\vec{v}$, calculate $||\vec{w}||$.

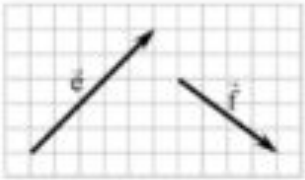
5. Let $\vec{a}$ be a vector from the point $(-5, 7)$ to the point $(-8, -6)$. Write $\vec{a}$ in component form and state its magnitude and direction.

6. State the magnitude and direction of the vector $-11\mathbf{i} + 12\mathbf{j}$.

7. Let $\vec{b} = 7\mathbf{i} - 4\mathbf{j}$ and $\vec{c} = \langle 9, -2 \rangle$. State the magnitude and direction of $\vec{b} + \vec{c}$.

8. Let $\vec{d} = \langle 9, -2 \rangle$. State a vector with the same magnitude as $\vec{d}$, but a different direction. Then state another vector with the same direction as $\vec{d}$, but a different magnitude.

9. On graph paper, copy the vectors shown at right. Draw and label each of the following vectors.



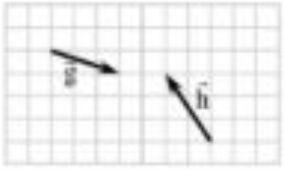
   a. $\vec{e} + \vec{f}$

   b. $\vec{e} - \vec{f}$

   c. $2\vec{f} + \vec{e}$

   d. $\frac{1}{2}\vec{f} - \frac{1}{2}\vec{e}$

10. On graph paper, copy the vectors shown at right. Draw and label each of the following vectors.



   a. $\vec{h} + \vec{g}$

   b. $\vec{g} - \vec{h}$

   c. $3\vec{g} - 2\vec{h}$

   d. $\frac{3}{2}\vec{h} - \frac{5}{2}\vec{g}$

Vector Word Problems

For each problem draw a diagram to represent the scenario and solve. Clearly show your steps.

1. An airplane travels north with an airspeed of 300 mph. There is a wind from the Southwest at 50 mph. What is the resulting course of the plane? (magnitude and direction)
2. A motorboat with a speed of 9 mph in still water must aim upstream at an angle of 25.5 degrees in order to travel directly across the stream. What is the speed of the current? What is the resultant speed of the boat?
3. A swimmer can travel 2.8 mph in still water. She heads directly across a river whose current is 1.2 mph. What is the resultant magnitude and direction (be specific) of the swimmer?
4. An airplane ends up 540 miles and 20 degrees north of east from its departure point. If there was a steady wind of 30 mph from the northwest during the entire flight, then find the magnitude and direction that the plane would have gone if there had been no wind.
5. A bear travels 70 miles in a northeasterly direction from his den. It then travels 150 miles 60 degrees north of west. Determine how far and in what direction the bear is from his den.

Answers

1) 337.21 mph
≈ 84°

2) 3.87 mph - c
8.12 mph - b

3) 3.05 mph
23.2° downstream

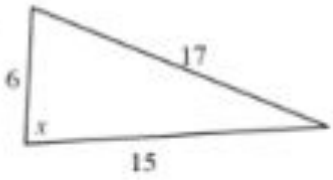
4) 528.02 mph
23°

5) 181.2 mi
98.1°

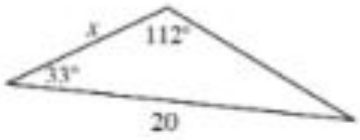
Law of Sines and Cosines

Solve for the value of x in each triangle below.

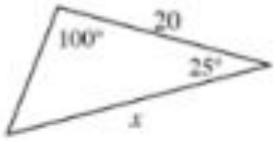
1.



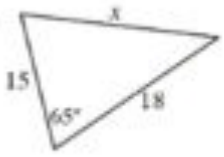
2.



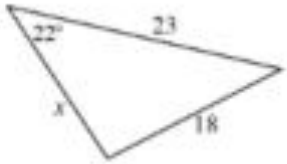
3.



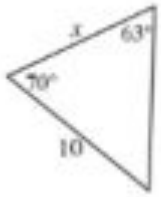
4.



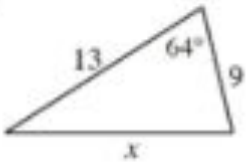
5.



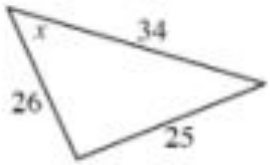
6.



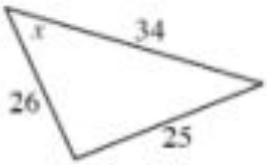
7.



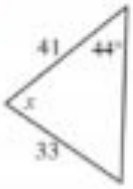
8.



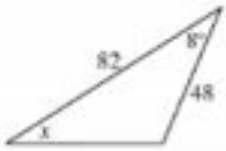
9.



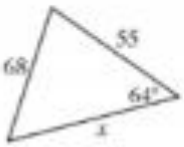
10.



11.



12.



13. Determine the measures of the angles of an isosceles triangle whose sides are of lengths 6, 6, and 8.

14. A plane flies 454 miles due east. It turns 32° towards north and flies another 395 miles. How far is the plane from its original location?

15. Two posts are 78 feet apart. A third post is located such that it makes an angle of 32° with the first post and an angle of 67° with the first post. If a triangular fence is to be constructed using the three posts, how many linear feet of fencing is needed?

16. A triangular frame is to be built with side lengths of 5, 7, and 9. What are the angles?

Law of Sines and Cosines Word Problems

1. During a figure skating routine, Jackie and Peter skate apart with an angle of 15° between them. Jackie skates for 5 meters and Peter skates for 7 meters. How far apart are the skaters?

2. A bridge is supported by triangular braces. If the sides of each brace have lengths 63 feet, 46 feet, and 40 feet, find the measure of the angle opposite the 46 foot side.

3. Two observers are standing on shore ½ mile apart at points A and B and measure the angle to a sailboat at a point C at the same time. Angle A is 63° and angle B is 56°. Find the distance from each observer to the sailboat.

4. A vertical flagpole is attached to the top edge of a building. A man stands 400 feet from the base of the building. From his viewpoint, the angle of elevation to the bottom of the flagpole is 60°; to the top is 62.5°. Determine the height of the flagpole.

5. On a map, Orlando is 178 mm due south of Niagara Falls, Denver is 273 mm from Orlando, and Denver is 235 mm from Niagara Falls. Find the angle at Niagara Falls.

6. Nicole shines a light from a window of a lighthouse on a cliff 250 feet above the water level. Nick, 10 feet above the water level in a ship off shore, finds that the angle of elevation of the light is 3°. Find the length of the line of sight (light beam) from the ship to Nicole. Round to the nearest tenth.

7. Fire towers A and B are located 10 miles apart. Rangers at fire tower A spot a fire at 42°, and rangers at fire tower B spot the same fire at 64°. How far from tower A is the fire to the nearest tenth of a mile?

Simplify and Verify Trigonometric Expressions

Simplify each of the following trigonometric expressions.

1. $\sin(\alpha)\cot(\alpha)\sec(\alpha)$

2. $\sin(\beta)\left(\csc(\beta)-\sin(\beta)\right)$

3. $1-\frac{\cos^2(\theta)}{1+\sin(\theta)}$

4. $\frac{\sin(d)-\cos(d)}{\cos(d)}+1$

5. $\frac{\sin(\varphi)}{1-\cos(\varphi)}-\cot(\varphi)$

6. $\frac{\tan^2(x)}{\sec(x)-1}-1$

7. $\frac{\csc(y)-\sin(y)}{\cos(y)}$

8. $\frac{\sec(\gamma)}{\cot(\gamma)+\tan(\gamma)}$

Verify each of the following trigonometric identities.

9. $\left(1-\sin^2(\theta)\right)\sec^2(\theta)=1$

10. $\sin(\theta)\cos(\theta)\cot(\theta)=1-\sin^2(\theta)$

11. $\cos^4(x)-\sin^4(x)=1-2\sin^2(x)$

12. $\frac{1}{\cos^2(\theta)}+1+\frac{\sin^2(\theta)}{\cos^2(\theta)}=2\sec^2(\theta)$

13. $\frac{\sin(y)}{\csc(y)-\cot(y)}=1+\cos(y)$

14. $\frac{\sin(x)}{2\cos(x)}+\frac{\sec(x)}{2\csc(x)}=\tan(x)$

15. $\frac{1+\sin(z)}{\cos(z)}=\frac{\cos(z)}{1-\sin(z)}$

16. $\frac{\sin(w)}{\sin(w)-\cos(w)}=\frac{1}{1-\cot(w)}$

Graphing Sine and Cosine

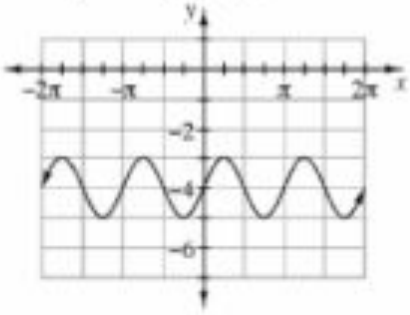
1. Graph two cycles of $y = \cos(x + \frac{\pi}{3}) - 3$.

2. Graph two cycles of $y = -3\sin(\pi x)$.

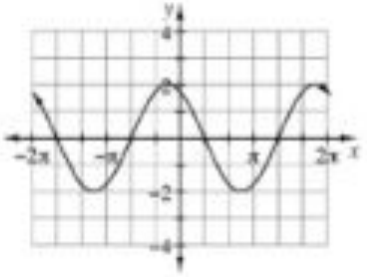
3. Write a possible equation for a cosine function that has a maximum point at $(1, 11)$ and a minimum point at $(8, 3)$.

4. Write a possible equation for a sine function that has a minimum point at $(-3, 0)$ and a maximum point at $(-9, 6)$.

5. Write two equations that represent the graph shown at right—one equation using sine, and one equation using cosine.



6. Write two equations that represent the graph shown at right—one equation using sine, and one equation using cosine.



Graph each of the following functions. Then write an equation using the other sine/cosine function for the curve.

7. $y = \sin(x - \frac{\pi}{6}) + 5$

8. $y = 7\cos(4x)$

9. $y = \cos(8x) - 3$

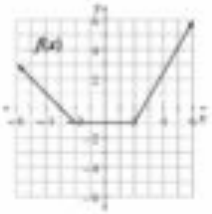
10. $y = -\sin(x - \frac{\pi}{4})$

11. $y = 5\sin(x - \pi)$

12. $y = -\cos(x) - 7$

Graphing Transformations of Functions

1. Given the graph of $y = f(x)$ at right, sketch the following transformations.

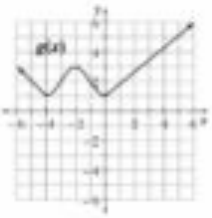


a. $y = -f(x) + 5$

b. $y = f\left(\frac{1}{2}(x-3)\right)$

c. $y = 4f(x+3)$

2. Given the graph of $y = g(x)$ at right, sketch the following transformations.

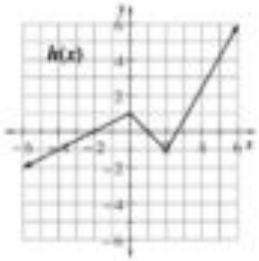


a. $y = 2g(-x)$

b. $y = g(2x) - 1$

c. $y = g(x-4) + 2$

3. Given the graph of $y = h(x)$ at right, sketch the following transformations.



a. $y = -h\left(\frac{1}{2}(x+2)\right)$

b. $y = 3h(2x) + 1$

c. $y = 2h(x-1) - 2$

d. $y = h(2(x+4)) - 3$