Christina School District Assignment Board

Student's First & Last Name _____ Student ID/Lunch # _____ School _____ Grade_____

Grade Level: 12th

Week of May 18th, 2020

		Day 1	Day 2	Day 3	Day 4	Day 5
ELA		This week's focus is to build upon your prior knowledge, giving you experience in reading real-world informational texts, note-taking, critical thinking, and metacognitive skills. ---------- Evaluate the Political Cartoons And answer the questions	Read the article **"Young People Are Seriously Ill**…" Follow the instructions on the article.	Answer the **Digging Deep Questions.**	**Analyzing Writer's Craft**	Write a 1-2 paragraph response to the article. Utilize 1-2 of the writer's techniques in your response **OR** Choose one of the cartoons from Day 1 and explain in a paragraph how it connects to the main idea of the article.
Math	**IM4**	*Infinite Series* Answer "Which One Doesn't Belong?" and justify your choice. (attached) Review Concept Summary: Infinite Geometric Series (attached), and complete Infinite/Geometric Series Worksheet 1 #1-9. (attached)	Complete Infinite/Geometric Series Worksheet 2 #1-5. (attached) Reference Concept Summary if needed.	Complete CC Standards Practice Week 7 Worksheet #1-3. (attached)	Read page 160. (attached) Use the examples as a guide to complete p. 161 #1-8. (attached)	Complete p. 161 #9-16. (attached) Refer to examples on p. 160 if needed. .

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	PreCalc	*Law of Sines and Cosines* Complete Law of Sines and Cosines Anticipatory Activity. (attached) Review 6.1 and 6.2 PPs and examples to complete Law of Sines and Cosines Worksheet 1 #1-2. (attached)	Use 6.1 and 6.2 PP notes and examples to complete Law of Sines and Cosines Worksheet 1 #3-9. (attached)	Use 6.1 and 6.2 PP notes and examples to complete Law of Sines and Cosines Worksheet 1 #10-15. (attached)	Use 6.1 and 6.2 PP notes and examples to complete Law of Sines and Cosines Worksheet 2 #1-5. (attached)	Use 6.1 and 6.2 PP notes and examples to complete Law of Sines and Cosines Worksheet 2 #6-9. (attached)
	Calc	*Definite Integrals and Antiderivatives*				
Science		**A Downhill Rolling Race (part 1):** Read article. Highlight, underline and/or annotate for understanding.	**A Downhill Rolling Race (part 2):** Reread article or notes as necessary. Write a claim that answers the following: How are mass and speed related to the kinetic energy of an object? Support your claim with evidence from the article. Then, explain why the evidence supports your claim.	**A Downhill Rolling Race (part 3):** Reread article and/or notes as necessary. Write your best answers to the following: a) What is the best way to explain how potential energy interacts with kinetic energy? Explain. b) What is a characterization the accurately describes BOTH solid and hollow rolling objects? c) A reader of the article suggested that the author included the section "Procedure" in order to show that the experiment can be carried out in various ways. Is this a reasonable claim? Which evidence from the article supports your answer?	**The Problem with Superman, and Other Physics Conundrums (part 1):** Read article. Highlight, underline and/or annotate for understanding.	**The Problem with Superman, and Other Physics Conundrums (part 2):** Reread article and/or notes as needed. Write your best answers to the following: a) Read the section "Question: How was the Bionic Man able to lift so many heavy things without his spine or pelvis buckling?" Write the evidence from the section that suggests filmmakers often fail to consider scientific principles when creating a movie. b) Read the selection from the introduction [paragraphs 1-3] that starts with "Have you ever been rock climbing…" and ends with "...it's good practice for scientific inquiry into real phenomena." Why did the author include this idea?
Social Studies		Complete Activity 5	Complete Activity 1, 2,	Complete Activity 4	Complete Activity 5	Complete Activity 6

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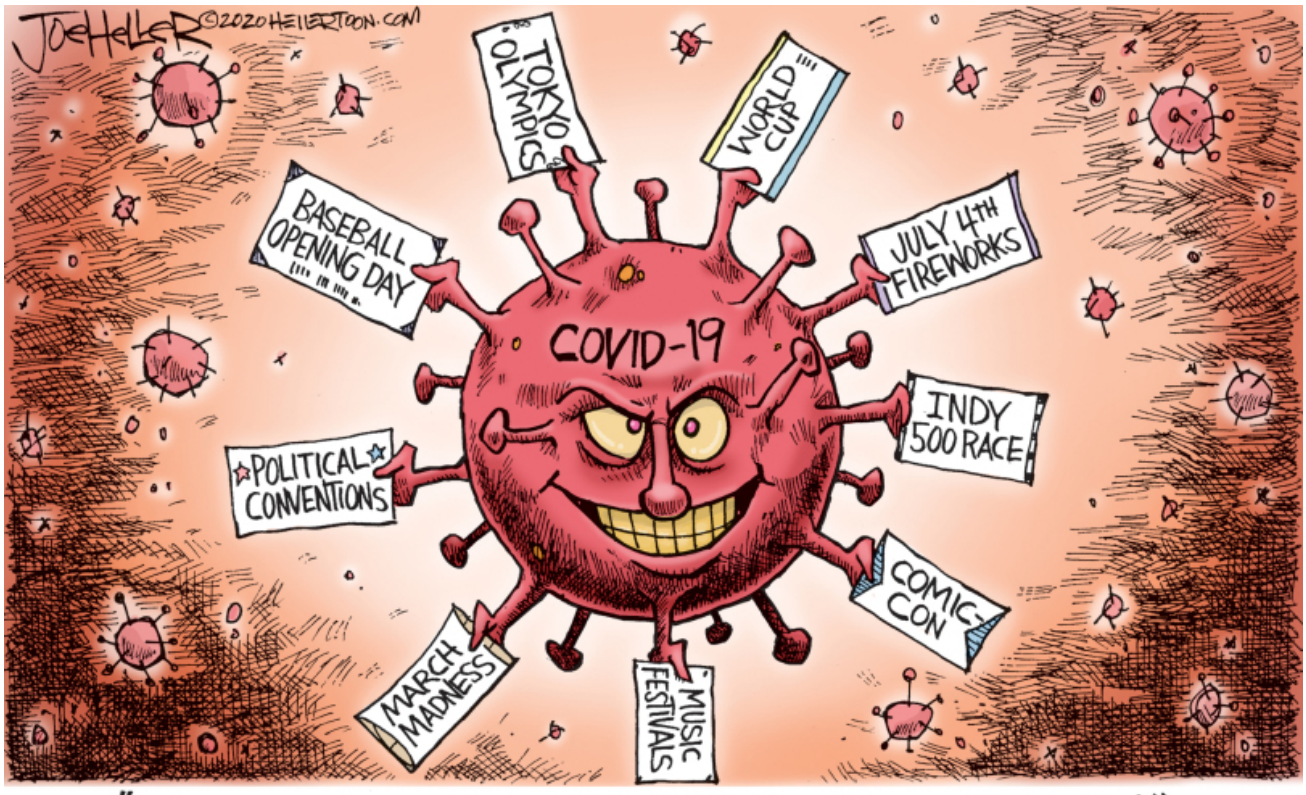
	from the document titled, "Drafting America" NOTE: You have this document from last week.	and 3 from the document titled, "The Dust Bowl"	from the document titled, "The Dust Bowl"	from the document titled, "The Dust Bowl"	from the document titled, "The Dust Bowl"

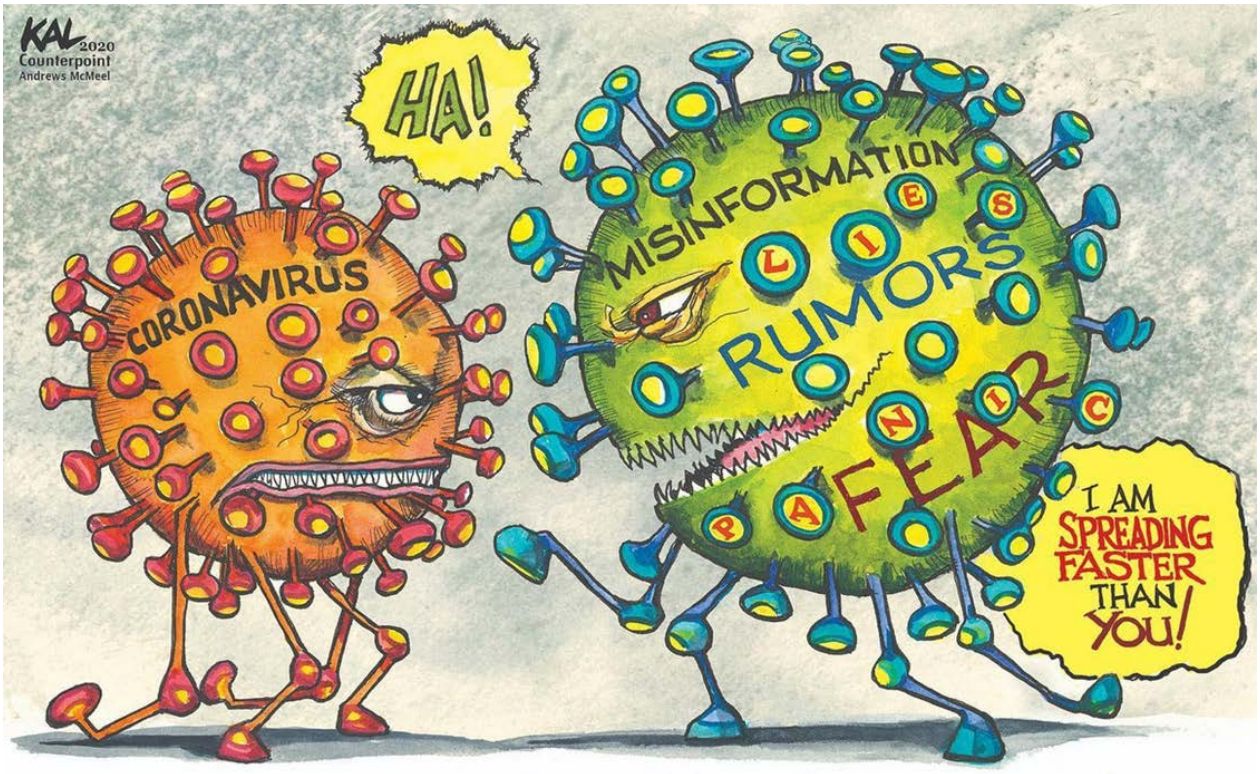
Evaluate this Political Cartoons:

1



"I HAVE TICKETS TO ALL THE MAJOR EVENTS THIS YEAR!"

2



	What does this cartoon mean?	What does it mean for Americans? Explain in detail – based on your evaluation of all parts of the cartoon:
Cartoon 1		
Cartoon 2		

1. Referring to cartoon 2, explain the following; misinformation, rumors, fear.
   _____
   _____
   _____

2. Explain why misinformation, rumors, and fear are spreading faster than COVID-19
   _____
   _____
   _____

Instructions

Step 1: Number the paragraphs
Step 2: Skim the article using these symbols as you read:
(+) agree, (-) disagree, (*) important, (!) surprising, (?) wondering
Step 3: Read the article now carefully and make notes in the margin. Try to mark each paragraph with an important note, idea or question.
Step 4: Answer the following.

1. What surprised you as you read?
2. What did the author think you already knew?
3. What challenged, changed or confirmed what you knew?

Step 5: Write a 1-2 sentence summary of the article.

Yes, Young People Are Falling Seriously Ill From Covid-19 the U.S., 705 of first 2,500 cases range in age from 20 to 44.

By Michelle Fay Cortez, Angelica LaVito, and Robert Langreth
Bloomberg March 18, 2020, 7:09 PM

Prognosis

New evidence from Europe and the U.S. suggests that younger adults aren't as impervious to the novel coronavirus that's circulating worldwide as originally thought.

Despite initial data from China that showed elderly people and those with other health conditions were most vulnerable, young people — from twenty-somethings to those in their early forties — are falling seriously ill. Many require intensive care, according to reports from Italy and France. The risk is particularly dire for those with ailments that haven't yet been diagnosed.

"It may have been that the millennial generation, our largest generation, our future generation that will carry us through for the next multiple decades, here may be a disproportional number of infections among that group," Deborah Birx, the White House coronavirus response coordinator, said in a press conference on Wednesday, citing the reports.

The data bears out that concern. In Italy, the hardest hit country in Europe, almost a quarter of the nearly 28,000 coronavirus patients are between the ages of 19 and 50, according to data website Statista.

Similar trends have been seen in the U.S. Among nearly 2,500 of the first coronavirus cases in the U.S., 705 were aged 20 to 44, according to the Centers for Disease Control and Prevention. Between 15% and 20% eventually ended up in the hospital, including as many as 4% who needed intensive care. Few died.

One of those younger adults is Clement Chow, an assistant professor of genetics at the University of Utah. "I'm young and not high risk, yet I am in the ICU with a very severe case," Chow said in a March 15 tweet. "We really don't know much about this virus."

According to his Twitter posts, Chow had a low-grade fever for a few days and then a bad cough that led to respiratory failure. It turned out to be the coronavirus. He ended up on high flow oxygen in the ICU. When he arrived last Thursday, he was the first patient there. "Now there are many more," he tweeted.

Chow didn't give his age in the tweets, but his laboratory website indicates he graduated from college in 2003 and has two unruly children. He didn't respond to an email and Bloomberg was unable to independently confirm his status as a patient.

It's true that risk of death climbs precipitously with age. While there were only 144 patients over age 85, as many as 70% were hospitalized and 29% needed intensive care, according to the CDC report. One in four died, the agency said in the Morbidity and Mortality Weekly Report.

Yet emerging evidence suggests that infants and toddlers may also be at risk of severe complications. In a study of more than 2,000 young children with Covid-19 from China, published this week in Pediatrics, Chinese doctors found that about 11% of cases in infants were judged to be severe or critical, as were 7% of those in toddlers and preschoolers. While still a lower rate of severe disease than adults, it's hardly insignificant.

In the White House press conference Wednesday, President Donald Trump implored younger people to stop reckless behavior, such as partying, going to the beach and hanging out at bars. Yet, as college campuses across the country close down and require students to leave, even the most conscientious young adults face a difficult choice. Finding their academic years abbreviated and graduation plans shattered, many are driving or flying home, where they risk exposing their parents and grandparents to Covid-19.

The same concerns apply to young people starting out in big cities who suddenly find themselves under pressure to head back to their hometowns. Livia Calari's father has been begging her to come home for weeks. The 25-year-old and her boyfriend live in Brooklyn, New York, and have been nervously watching the warnings from officials intensify and the city they live in shut down. But they're staying put, for now at least.

The couple has two cats they'd have to move. If they did hunker down with Calari's father in Washington, D.C., they would be asked to self-quarantine on a separate floor for two weeks. Plus, the thought of accidentally bringing the virus worries them.

“I have a lot of anxiety, maybe irrationally, about bringing it to him,” Calari said of her father, who's 65. “I would feel awful.”

After days of thinking over their options, they decided to stay in New York and re-evaluate if a lockdown gets to the point where they can’t even leave their apartment to take walks.

Stay Home

Infection-fighting officials are willing to go to unusual lengths to get the word out to young people where they congregate, including on the Pardon My Take podcast from Barstool Sports – one of the most popular sports shows with younger listeners.

Anthony Fauci, the head of the National Institute on Allergy and Infectious Diseases, told the hosts how stressful the outbreak has been.

“You cannot imagine,’’ he said. “You see what happened in China, you see what’s happening in Italy. We have the virus in the United States, and we want to make sure by our efforts that we don’t have that degree of disease and suffering that we are seeing in other countries.’’

And he called on young people to embrace the effort to protect themselves and the broader population.

“No one is invulnerable, but even if you are doing very well, you have to be a very important part of our national effort to contain the outbreak,’’ Fauci said. “You are not a passive person in this. You are an important part of the active plan to contain this epidemic. We really do need you. This isn’t something that can be successful without you.”

Digging Deep- answers may be in phrases

1. What does this author want you to know about young people and COVID-19?

   _____

   _____

   _____

   _____

2. Using evidence from this text, should you be concerned about COVID-19? Explain you answer:

   _____

   _____

   _____

   _____

3. What should you be doing to protect yourself and your family from COVID-19?

   _____

   _____

   _____

   _____

4. Choose a word/line/passage form the article and respond to it.

   _____

   _____

Analyzing Author's Craft

Re-read the article a final time looking specifically for writer's craft.

Make notes about the kinds of ideas covered in the text, the type of evidence the writer uses to support his ideas, how the piece is organized and presented, and how the writer uses language/words to add layers of meaning.

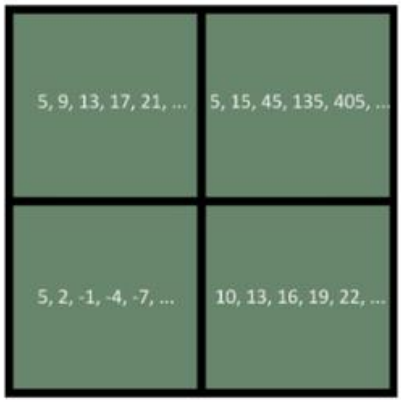
After you identify some of the techniques choose one of focus.

- Quote the example from the text.
- Identify where in the text the author uses the technique.
- How does the use of this technique support the main idea and impact the reader?
- Explain in 1- 2 paragraphs.

IM4 – Week of May 18th

Infinite Series

Which One Doesn't Belong? Why?



Concept Summary: Infinite Geometric Series

A. How can you evaluate an infinite geometric series?

A geometric series is the sum of the elements of a geometric sequence. Just like some sequences are infinite since they go on forever, a series can be infinite too.

	Finite	Infinite
Sequence	a_1, a_2, a_3, a_4, a_5	$a_1, a_2, a_3, a_4, a_5, \ldots$
Series	$a_1 + a_2 + a_3 + a_4 + a_5$	$a_1 + a_2 + a_3 + a_4 + a_5 + \ldots$

Even though an infinite series is the sum of an infinite number of terms, some infinite series actually have a *finite* sum. To see how this can happen, consider adding each term of the series one by one.

$$S_1 = a_1$$
$$S_2 = a_1 + a_2$$
$$S_3 = a_1 + a_2 + a_3$$
$$\vdots$$
$$S_n = a_1 + a_2 + a_3 + a_4 + a_5 + \ldots + a_n$$

These sums form a sequence. When the sequence converges to a real number, the infinite series has a finite sum equal to that number.

Infinite/Geometric Sequence Worksheet 1

For Items 1–9, match the recursive definition in Column A with the explicit definition in Column B. An example has been given.

Column A	Column B
Ex. $a_n = \begin{cases} 3, \text{ if } n = 1 \\ a_{n-1}(6), \text{ if } n > 1 \end{cases}$	a. $a_n = a_1 r^{n-1}$
1. $a_n = \begin{cases} a_1, \text{ if } n = 1 \\ a_{n-1}(r), \text{ if } n > 1 \end{cases}$	b. $a_n = x(y)^{n-1}$
2. $a_n = \begin{cases} 25, \text{ if } n = 1 \\ a_{n-1}\left(\frac{1}{5}\right), \text{ if } n > 1 \end{cases}$	c. $a_n = 2(2.6)^{n-1}$
3. $a_n = \begin{cases} 2, \text{ if } n = 1 \\ a_{n-1}(4), \text{ if } n > 1 \end{cases}$	d. $a_n = 25\left(\frac{1}{5}\right)^{n-1}$
4. $a_n = \begin{cases} 4, \text{ if } n = 1 \\ a_{n-1}(2), \text{ if } n > 1 \end{cases}$	e. $a_n = 2(4)^{n-1}$
5. $a_n = \begin{cases} 2.6, \text{ if } n = 1 \\ a_{n-1}(2), \text{ if } n > 1 \end{cases}$	f. $a_n = 3(6)^{n-1}$
6. $a_n = \begin{cases} x, \text{ if } n = 1 \\ a_{n-1}(y), \text{ if } n > 1 \end{cases}$	g. $a_n = \frac{1}{5}(25)^{n-1}$
7. $a_n = \begin{cases} 2, \text{ if } n = 1 \\ a_{n-1}(2.6), \text{ if } n > 1 \end{cases}$	h. $a_n = 4(2)^{n-1}$
8. $a_n = \begin{cases} y, \text{ if } n = 1 \\ a_{n-1}(x), \text{ if } n > 1 \end{cases}$	i. $a_n = 2.6(2)^{n-1}$
9. $a_n = \begin{cases} \frac{1}{5}, \text{ if } n = 1 \\ a_{n-1}(25), \text{ if } n > 1 \end{cases}$	j. $a_n = y(x)^{n-1}$

Infinite/Geometric Sequence Worksheet 2

1. Is the sequence 1.7, 5.1, 15.3, 45.9, 137.7, ... a geometric sequence? If so, write a recursive definition for the sequence.

2. The recursive definition for a sequence is $a_n = \begin{cases} 32, \text{ if } n = 1 \\ \frac{1}{4}a_{n-1}, \text{ if } n > 1 \end{cases}$. What is the explicit definition of the sequence?

   Ⓐ $a_n = 16\left(\frac{1}{2}\right)^n$

   Ⓑ $32, 8, 2, \frac{1}{2}, \frac{1}{8}, \ldots$

   Ⓒ $a_n = 32\left(\frac{1}{2}\right)^n$

   Ⓓ $a_n = 32\left(\frac{1}{4}\right)^{n-1}$

3. What is the expanded form of the series $\sum_{n=1}^{6} 3(2)^{n-1}$?

   _____

   What is the sum? _____

4. How many terms are in the geometric series $2.1 + 10.5 + \ldots + 820{,}312.5$?

   Ⓐ 3

   Ⓑ 7

   Ⓒ 9

   Ⓓ 180

5. What is the monthly payment rate for a $20,000 loan for 4 years with an annual interest rate of 4.8%?

CC Standard Practice Week 7

Selected Response

1. What is the sum of the finite geometric series?

$1{,}215 + 405 + 135 + \ldots\ldots + \frac{5}{9}$

Ⓐ $1{,}821\frac{2}{3}$

Ⓑ $1{,}822\frac{2}{9}$

Ⓒ $1{,}822\frac{11}{27}$

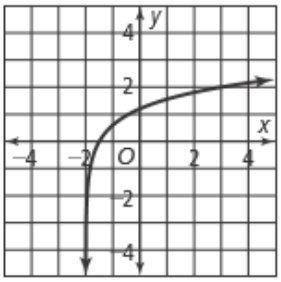
Ⓓ $2{,}429\frac{17}{27}$

Constructed Response

2. What is the solution of $16^{3x} = 2$?

Extended Response

3. The graph of the equation $y = 2\log(2x + 4)$ is shown at the right.



a. Explain how you can use the graph to solve the equation $2\log(2x + 4) = 2$.

b. Show the solution on the graph.

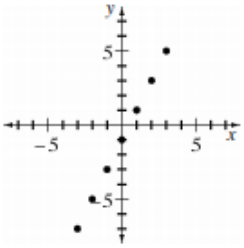
To recognize if a function is linear, exponential, or neither, look at the differences of the y-values between consecutive integer x-values. If the difference is constant, the graph is linear. If the difference is not constant, look at the pattern in the y-values. If a constant multiplier can be used to move from one y-value to the next, then the function is exponential. (Note that the same multiplier can be used to move from the difference to difference in an exponential function.)

Examples

Based on each table, identify the shape of the graph.

Example 1

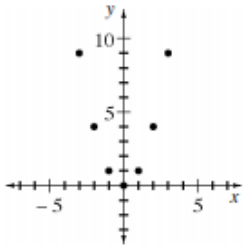
x	–3	–2	–1	0	1	2	3
y	–7	–5	–3	–1	1	3	5
		2	2	2	2	2	2



The difference in y-values is always two, a constant.
The function is linear; the graph at right confirms this.

Example 2

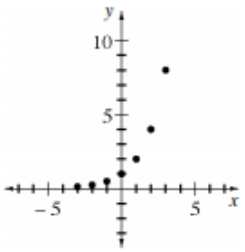
x	–3	–2	–1	0	1	2	3
y	9	4	1	0	1	4	9
		–5	–3	–1	1	3	5



The first difference in y-values is not constant, and there is not a constant multiplier in moving from one y-value to the next. The function is neither linear nor exponential; the graph at right confirms this.

Example 3

x	–3	–2	–1	0	1	2	3
y	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8
		$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4



The y-values have a constant multiplier of 2. (Also the differences in y-values have a constant multiplier of 2.)
The function is exponential; the graph at right confirms this.

Problems

Based on the growth (the difference in y-values) shown in the tables, identify the corresponding graph as linear, exponential, or neither.

1.

x	−3	−2	−1	0	1	2	3
y	14	10	6	2	−2	−6	−10

2.

x	−3	−2	−1	0	1	2	3
y	$\frac{1}{2}$	1	2	4	8	16	32

3.

x	−3	−2	−1	0	1	2	3
y	21	12	5	0	−3	−4	−3

4.

x	−3	−2	−1	0	1	2	3
y	−16	−13	−10	−7	−4	−1	2

5.

x	−3	−2	−1	0	1	2	3
y	−14	−9	−4	1	6	11	16

6.

x	−3	−2	−1	0	1	2	3
y	−18	−6	−2	0	2	6	18

7.

x	−3	−2	−1	0	1	2	3
y	4	8	16	32	64	128	256

8.

x	−3	−2	−1	0	1	2	3
y	$\frac{1}{27}$	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9	27

9.

x	−3	−2	−1	0	1	2	3
y	30	20	12	6	2	0	0

10.

x	−3	−2	−1	0	1	2	3
y	11	9	7	5	3	1	−1

11.

x	−3	−2	−1	0	1	2	3
y	$\frac{1}{9}$	$\frac{1}{3}$	1	3	9	27	81

12.

x	−3	−2	−1	0	1	2	3
y	−27	−9	−3	0	3	9	27

13.

x	−3	−2	−1	0	1	2	3
y	0	5	8	9	8	5	0

14.

x	−3	−2	−1	0	1	2	3
y	3	0	−1	0	3	8	15

15.

x	−3	−2	−1	0	1	2	3
y	1	0	−1	−2	−1	0	1

16.

x	−3	−2	−1	0	1	2	3
y	$\frac{9}{8}$	$\frac{9}{4}$	$\frac{9}{2}$	9	18	36	72

Law of Sines/Cosines Anticipatory Activity

Before Reading Agree/Disagree	Statement	Facts/Evidence From the Book (Include page number.)	After Reading Agree/Disagree
	An oblique triangle is any triangle that does not have a right angle.		
	SohCahToa is an acronym that can be used for finding missing sides of a triangle.		
	It is impossible to find the area of a triangle without knowing its base and height.		
	The Law of Cosines can only be used to solve triangles in which we know either two sides and any angle, or all three sides.		
	The Law of Sines can be used to solve any oblique triangle.		
	Heron's Formula is useful for calculating information about bird flights.		
	The ambiguous case is when you cannot quickly solve a triangle. It involves information which could create infinitely many triangles.		

6.1 Introduction

In this section let us solve **oblique triangles**—triangles that have no right angles. As standard notation, the angles of a triangle are labeled

A, B and C

and their opposite sides are labeled

a, b, c

as shown in Figure 6.1.

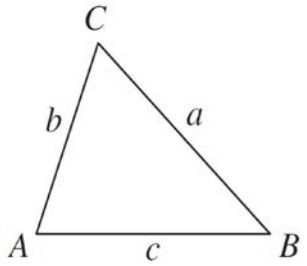


Figure 6.1

6.1 Introduction

To solve an oblique triangle, you need to know the measure of at least one side and the measures of any two other parts of the triangle—two sides, two angles, or one angle and one side.

This breaks down into the following four cases.

1. Two angles and any side (AAS or ASA)
2. Two sides and an angle opposite one of them (SSA)
3. Three sides (SSS)
4. Two sides and their included angle (SAS)

6.1 Introduction

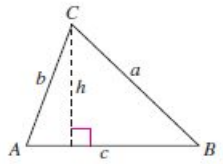
The first two cases can be solved using the **Law of Sines,** whereas the last two cases can be solved using the Law of Cosines.

Law of Sines

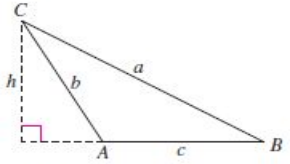
If ABC is a triangle with sides a, b, and c, then

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Oblique Triangles



A is acute.



A is obtuse.

Figure 6.2

6.1 Introduction

The Law of Sines can also be written in the reciprocal form

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

6.1 Example 1 – *Given Two Angles and One Side—AAS*

For the triangle in Figure 6.3, $C = 102.3°$, $B = 28.7°$ and $b = 27.4$ feet. Find the remaining angle and sides.

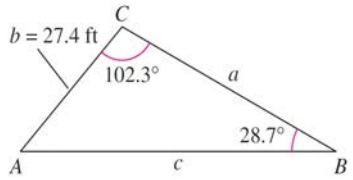


Figure 6.3

Solution:

The third angle of the triangle is

$$A = 180° - B - C$$
$$= 180° - 28.7° - 102.3°$$
$$= 49.0°$$

6.1 Example 1 – *Solution* cont'd

By the Law of Sines, you have

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}.$$

Using $b = 27.4$ produces

$$a = \frac{b}{\sin B}(\sin A) = \frac{27.4}{\sin 28.7°}(\sin 49.0°) \approx 43.06 \text{ feet}$$

and

$$c = \frac{b}{\sin B}(\sin C) = \frac{27.4}{\sin 28.7}(\sin 102.3°) \approx 55.75 \text{ feet}.$$

6.1 The Ambiguous Case (SSA)

In Example 1, you saw that two angles and one side determine a unique triangle.

However, if two sides and one opposite angle are given, then three possible situations can occur:

(1) no such triangle exists,

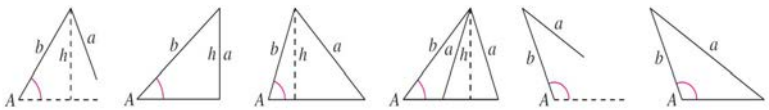
(2) one such triangle exists, or

(3) two distinct triangles satisfy the conditions.

6.1 The Ambiguous Case (SSA)

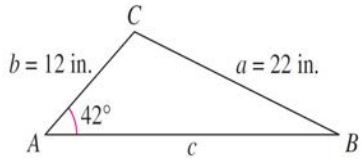
The Ambiguous Case (SSA)

Consider a triangle in which you are given a, b, and A. (Notice that $h = b \sin A$.)

	A is acute.	A is acute.	A is acute.	A is acute.	A is obtuse.	A is obtuse.
Sketch						
Necessary condition	$a < h$	$a = h$	$a \geq b$	$h < a < b$	$a \leq b$	$a > b$
Possible triangles	None	One	One	Two	None	One

6.1 Example 3 – *Single-Solution Case—SSA*

For the triangle in Figure 6.5, a = 22 inches, b = 12 inches, and A = 42°. Find the remaining side and angles.



One solution: a ≥ b

Figure 6.5

Solution:

By the Law of Sines, you have

$$\frac{\sin B}{b} = \frac{\sin A}{a}$$ Reciprocal form

6.1 Example 3 – *Solution* cont'd

$$\sin B = b\left(\frac{\sin A}{a}\right)$$ Multiply each side by b

$$\sin B = 12\left(\frac{\sin 42°}{22}\right)$$ Substitute for A, a, and b.

$$B \approx 21.41°.$$ B is acute.

Now you can determine that

$C \approx 180° - 42° - 21.41°$

$= 116.59°$

6.1 Example 3 – *Solution* cont'd

Then the remaining side is given by

$$\frac{c}{\sin C} = \frac{a}{\sin A}$$ Law of Sines

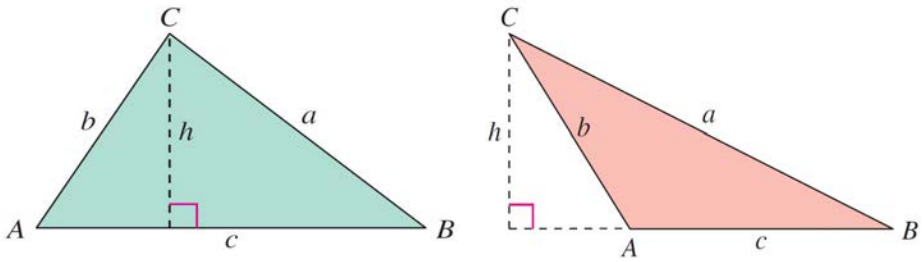
$$c = \frac{a}{\sin A}(\sin C)$$ Multiply each side by sin C.

$$c = \frac{22}{\sin 42°}(\sin 116.59°)$$ Substitute for a, A, and C.

$$c \approx 29.40 \text{ inches.}$$ Simplify.

6.1 Area of an Oblique Triangle

The procedure used to prove the Law of Sines leads to a simple formula for the area of an oblique triangle. Referring to Figure 6.8, note that each triangle has a height of $h = b \sin A$.



A is acute. A is obtuse.

Figure 6.8

6.1 Area of an Oblique Triangle

To see this when A is obtuse, substitute the reference angle $180° - A$ for A. Now the height of the triangle is given by

$$h = b \sin (180° - A)$$

Using the difference formula for sine, the height is given by

$$h = b(\sin 180° \cos A - \cos 180° \sin A)$$

$\sin(u - v) = \sin u \cos v - \cos u \sin v$

$$= b[0 \bullet \cos A - (-1) \bullet \sin A]$$

$$= b \sin A.$$

6.1 Area of an Oblique Triangle

Consequently, the area of each triangle is given by

$$\text{Area} = \tfrac{1}{2}(\text{base})(\text{height})$$

$$= \tfrac{1}{2}(c)(b \sin A)$$

$$= \tfrac{1}{2} bc \sin A.$$

By similar arguments, you can develop the formulas

$$\text{Area} = \tfrac{1}{2} ab \sin C$$

$$= \tfrac{1}{2} ac \sin B.$$

6.1 Area of an Oblique Triangle

Area of an Oblique Triangle

The area of any triangle is one-half the product of the lengths of two sides times the sine of their included angle. That is,

$$\text{Area} = \frac{1}{2}bc \sin A = \frac{1}{2}ab \sin C = \frac{1}{2}ac \sin B.$$

6.1 Example 6 – *Finding the Area of an Oblique Triangle*

Find the area of a triangular lot having two sides of lengths 90 meters and 52 meters and an included angle of 102°.

Solution:

Consider $a = 90$ meters, $b = 52$ meters, and $C = 102°$, as shown in Figure 6.9.

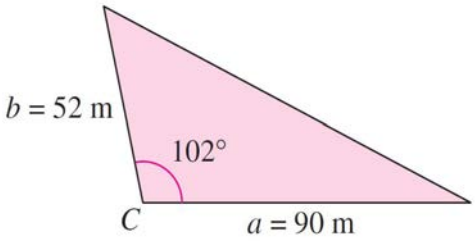


Figure 6.9

6.1 Example 6 – *Solution* cont'd

Then the area of the triangle is

$$\text{Area} = \tfrac{1}{2}ab \sin C \qquad \text{Formula for area}$$

$$= \tfrac{1}{2}(90)(52)(\sin 102°) \qquad \text{Substitute for } a, b, \text{ and } C.$$

$$\approx 2288.87 \text{ square meters.} \qquad \text{Simplify.}$$

6.1 The Remaining Cases

Two cases remain in the list of conditions needed to solve an oblique triangle—SSS and SAS.

To use the Law of Sines, you must know at least one side and its opposite angle.

When you are given three sides (SSS), or two sides and their included angle (SAS), none of the ratios in the Law of Sines would be complete. In such cases you can use the **Law of Cosines**.

6.2 Law of Cosines

Law of Cosines

Standard Form	*Alternative Form*
$a^2 = b^2 + c^2 - 2bc \cos A$	$\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$
$b^2 = a^2 + c^2 - 2ac \cos B$	$\cos B = \dfrac{a^2 + c^2 - b^2}{2ac}$
$c^2 = a^2 + b^2 - 2ab \cos C$	$\cos C = \dfrac{a^2 + b^2 - c^2}{2ab}$

6.2 Example 1 – *Three Sides of a Triangle—SSS*

Find the three angles of the triangle shown in Figure 6.12.

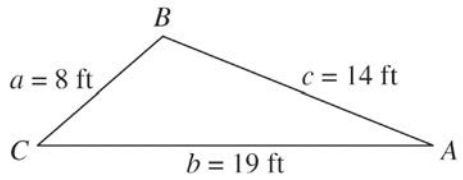


Figure 6.12

Solution:

It is a good idea first to find the angle opposite the longest side—side b in this case. Using the alternative form of the Law of Cosines, you find that

$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$ Alternative form

6.2 Example 1 – *Solution* cont'd

$$= \frac{8^2 + 14^2 - 19^2}{2(8)(14)}$$ Substitute for a, b, and c.

$$\approx -0.45089.$$ Simplify.

Because cos B is negative, you know that B is an obtuse angle given by $B \approx 116.80°$.

6.2 Example 1 – *Solution* cont'd

At this point it is simpler to use the Law of Sines to determine A.

$$\sin A = a\left(\frac{\sin B}{b}\right) \approx 8\left(\frac{\sin 116.80°}{19}\right) \approx 0.37583$$

You know that A must be acute, because B is obtuse, and a triangle can have, at most, one obtuse angle.
So, $A \approx 22.08°$ and

$$C \approx 180° - 22.08° - 116.80° = 41.12°$$

6.2 Heron's Area Formula

The Law of Cosines can be used to establish the following formula for the area of a triangle. This formula is called **Heron's Area Formula** after the Greek mathematician Heron (ca. 100 B.C.).

Heron's Area Formula

Given any triangle with sides of lengths a, b, and c, the area of the triangle is given by

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

where $s = \frac{a+b+c}{2}$.

6.2 Example 5 – *Using Heron's Area Formula*

Find the area of the triangle shown in Figure 6.16.

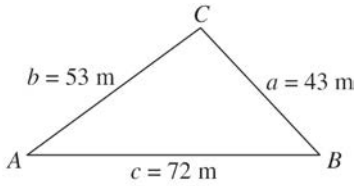


Figure 6.16

Solution:

Because

$$s = \frac{a + b + c}{2} = \frac{168}{2} = 84$$

6.2 Example 5 – *Solution* cont'd

Heron's Area Formula yields

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{84(84-43)(84-53)(84-72)}$$

$$= \sqrt{84(41)(31)(12)}$$

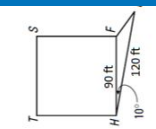
$$\approx 1131.89 \text{ square meters.}$$

6.2 Heron's Area Formula

Formulas for Area of a Triangle

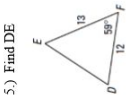
1. Standard Formula: $\text{Area} = \frac{1}{2}bh$
2. Oblique Triangle: $\text{Area} = \frac{1}{2}bc \sin A = \frac{1}{2}ab \sin C = \frac{1}{2}ac \sin B$
3. Heron's Area Formula: $\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$

Law of Sines/Cosines Worksheet 1

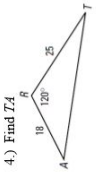


1.) A baseball infield is determined by a square with sides 90 ft long. In the diagram, home plate is H and first base is F. Suppose the first baseman ran in a straight line from F to catch a pop-up at B, 120 ft from home plate. If the measure of $\angle FHB$ is 10°, how far did the first baseman run?

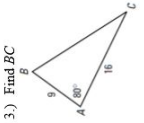
2.) Two airplanes leave Berlin, one heading straight for London and the other straight for Paris. The angle formed is 18 degrees. Use the Law of Cosines to estimate the distance from London to Paris.



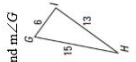
5.) Find DE



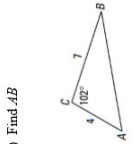
4.) Find TA



3.) Find BC



7.) Find $m\angle G$



6.) Find AB

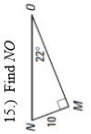
Law of Sines/Cosines Worksheet 1

8.) Some students in Geometry are assigned the task of measuring the distance between two trees separated by a swamp. The students determine that the angle formed by tree A, a dry point C, and tree B is 27°. They also know that $m\angle ABC$ is 85°. If AC is 150 ft, how far apart are the trees?

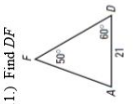
9.) Two lookout towers, L and M, are 50 kilometers apart. The ranger in Tower L sees a fire at point C such that $m\angle CLM = 40°$. The ranger in Tower M sees the same fire such that $m\angle CML = 65°$. How far is the fire from Tower L?

12.) Find PA

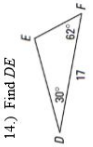
15.) Find NO



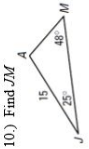
11.) Find DF



14.) Find DE



10.) Find JM



13.) Find BC

Law of Sines/Cosines Worksheet 2

1. A farmer has a triangular field with sides 120 yards, 170 yards, and 220 yards. Find the area of the field in square yards.

2. Two surveyors are determining the distance to a tower located between them but across the river. The first one determines that the line of sight to the tower makes an angle of 89° with the bank of the river. 495 m downstream another surveyor determines his line of sight to the tower is 55° to the tower with the river. How far is each surveyor to the tower?

3. To determine the length of an airplane, a person walks 300 ft from point A, the nose of the aircraft to point B, the end of the wing and then turns 80° and walks 250 ft to the tail of the airplane. Find the length of the airplane.

4. An kite flyer lying on the ground is looking at her kite in the sky with an angle of elevation of 71° . If there is 1500 ft of kite string and it is taut, what is the height of the kite?

5. Two points M and N are separated by a swamp. A base line MK is established on one side of the swamp. MK is 180 m in length. The measure of angle K is 62° and angle N is 74°. Find the distance between M and N.

Law of Sines/Cosines Worksheet 2

6. The baseball player in center field is playing approximately 330 feet from the television camera that is behind home plate. A batter hits a ball that goes to the wall 420 feet from the camera. Approximate the number of feet that the center fielder has to run to make the catch if the camera turns 8° to follow the play.

7. Two angles of a triangle are 30° and 55° and the longest side is 34 m. Find the length of the shortest side.

8. The science club just launched a rocket straight up in the air. At the instant that the rocket is 90 meters high, what is the angle of elevation from an observer that is 40 meters from the launch pad?

9. Two sides and a diagonal of a parallelogram are 7, 9, and 15 in respectively. Find the measures of the angles of the parallelogram.

A downhill rolling race

By Ben Finio, Scientific American on 01.09.20
Word Count **978**
Level **MAX**

Everyday items like aluminum cans can teach us about physics. A filled can has more mass. It will roll differently than a can that is empty.
Photo by: ziodanilo/Pixabay

Imagine rolling two identical cans down a slope, but one is empty and the other is full. Which one will reach the bottom first? You might have learned that when dropped straight down, all objects fall at the same rate regardless of how heavy they are (neglecting air resistance). Is the same true for objects rolling down a hill? Try this activity to find out.

Background

When you lift an object up off the ground, it has potential energy due to gravity. The amount of potential energy depends on the object's mass, the strength of gravity and how high it is off the ground. When you drop the object, this potential energy is converted into kinetic energy, or the energy of motion. Kinetic energy depends on an object's mass and its speed. Ignoring frictional losses, the total amount of energy is conserved.

For a rolling object, kinetic energy is split into two types: translational (motion in a straight line) and rotational (spinning). So when you roll a ball down a ramp, it has the most potential energy when it is at the top, and this potential energy is converted to both translational and rotational

kinetic energy as it rolls down. This leads to the question: Will all rolling objects accelerate down the ramp at the same rate, regardless of their mass or diameter?

The answer depends on the objects' moment of inertia, or a measure of how spread out its mass is. If two cylinders have the same mass but different diameters, the one with a bigger diameter will have a bigger moment of inertia, because its mass is more spread out. Similarly, if two cylinders have the same mass and diameter, but one is hollow (so all its mass is concentrated around the outer edge), the hollow one will have a bigger moment of inertia. Does moment of inertia affect how fast an object will roll down a ramp? Give this activity a whirl to discover the surprising result!

Materials

Two soup or bean or soda cans (You will be testing one empty and one full.)

A hollow sphere, such as an inflatable ball

A solid sphere, such as a marble (It does not need to be the same size as the hollow sphere.)

Cardboard box or stack of textbooks

Flat, rigid material to use as a ramp, such as a piece of foam-core poster board or wooden board. The longer the ramp, the easier it will be to see the results.

Preparation

Empty, wash and dry one of the cans. (Don't waste food — store it in another container!) Prop up one end of your ramp on a box or stack of books so it forms about a 10- to 20-degree angle with the floor.

Procedure

Hold both cans next to each other at the top of the ramp. Which one do you think will get to the bottom first?

Let go of both cans at the same time. Watch the cans closely. Which one reaches the bottom first? Repeat the race a few more times. Does the same can win each time?

Now try the race with your solid and hollow spheres. Which one do you predict will get to the bottom first? What happens when you race them?

Extra: Find more round objects (spheres or cylinders) that you can roll down the ramp. For example, rolls of tape, markers, plastic bottles, different types of balls, etcetera. Try racing different types objects against each other. What seems to be the best predictor of which object will make it to the bottom of the ramp first?

Extra: Try the activity with cans of different diameters. What happens if you compare two full (or two empty) cans with different diameters? What about an empty small can versus a full large can or vice versa?

Extra: Try racing different combinations of cylinders and spheres against each other (hollow cylinder versus solid sphere, etcetera). Can you make an accurate prediction of which object will

reach the bottom first?

Observations And Results

You should find that a solid object will always roll down the ramp faster than a hollow object of the same shape (sphere or cylinder) — regardless of their exact mass or diameter. This might come as a surprising or counterintuitive result! A classic physics textbook version of this problem asks what will happen if you roll two cylinders of the same mass and diameter — one solid and one hollow — down a ramp. The answer is that the solid one will reach the bottom first. In that specific case, it is true the solid cylinder has a lower moment of inertia than the hollow one does. Although they have the same mass, all the hollow cylinder's mass is concentrated around its outer edge so its moment of inertia is higher.

But it is incorrect to say, "The object with a lower moment of inertia will always roll down the ramp faster." It takes a bit of algebra to prove, but it turns out that the absolute mass and diameter of the cylinder do not matter when calculating how fast it will move down the ramp — only whether it is hollow or solid. So, in this activity you will find that a full can of beans rolls down the ramp faster than an empty can — even though it has a higher moment of inertia. It has the same diameter, but is much heavier than an empty aluminum can. Applying the same concept shows two cans of different diameters should roll down the ramp at the same speed, as long as they are both either empty or full. The same principles apply to spheres as well — a solid sphere, such as a marble, should roll faster than a hollow sphere, such as an air-filled ball, regardless of their respective diameters.

The problem with superman, and other physics conundrums

By Rhett Allain, Science Friday on 02.19.20
Word Count **1,266**
Level **MAX**

Superheroes such as Superman use all sorts of unnatural powers to save the world. The physics behind their skills is often impossible, but it can help us understand how physics works in the real world. Graphic: Chin Leong Teoh/EyeEm/Getty Images

Editor's Note: This article was originally published by Science Friday in 2015. Before publication, readers submitted pop culture physics questions. Rhett Allain, a physics professor and author of the book "Geek Physics," answered their questions below.

First, let me say that these are all great questions. Really, in some way, just asking the question is as much fun as answering it. But what do these outlandish queries have to do with real science? For me, thinking about fake things (like superheroes or video games) is very similar to looking at things in the real world. Let me offer an analogy.

Have you ever been rock climbing, either on real rocks or on a manmade climbing wall? In both situations, a human goes through similar motions. But some people really like the fake climbing walls because it gives them a chance to practice, and the facades are usually easier to get to than real mountains. The same is true for analyzing fake things — it's good practice for scientific inquiry into real phenomena.

Now, on to your questions. I just realized that most of them deal with superheroes. I hope that doesn't disappoint you.

Question: Can Superman really fly? Or does the different gravity of Earth's sun just allow him to jump really far?

Answer: I'm certain that Superman has been the topic of many scientific discussions. My answer to this question might not be unique, but it's still fun. Originally, the idea was that Superman was so strong that he was "able to leap a tall building in a single bound." Could jumping work as a form of flying?

Remember that there's another superhero who likes to jump — the Hulk. The problem with both the Hulk and Superman jumping is that it requires pushing on the ground. When a normal human jumps, the feet push on the ground with a force, and the human moves up in the air. In order to shoot off the ground at an even greater speed, you would need to push harder. In "The Avengers" movie, the Hulk jumps about 120 meters high—which would require a force of around 400,000 Newtons (remember that Hulk has a larger mass than a normal human). But this force is big enough that it would actually destroy the surface that the Hulk jumped from. The same would be true for a jumping Superman. As he applied the force necessary to jump to great heights, he would sink into the very ground he was trying to jump from. Just think about jumping in soft mud, that's what this would be like.

If Superman doesn't jump, then, how does he fly? Some people suggest that he has some sort of telekinetic power that allows him to push off the ground without touching it. However, that's like saying he flies by magic. I think we can do better than that. There are a couple of ways that real objects fly. First, there's a rocket, which stays off the ground by shooting gases out the bottom thruster. Could this work for Superman? Perhaps he could emit particles out of one side of his body, and this would work, except that he would either need a large number of particles (think of the massive fuel in a rocket), or those particles would have to travel at super speeds.

The second kind of flying object is an airplane, which stays off the ground by ramming into air and deflecting it downward (yes, that's a very simplistic explanation of flying). But in order to crash into the air, the object must be moving forward—and now we're back to the same problem: How does Superman move forward? I'm going to go out on a limb and say that he shoots particles out the bottom of his feet.

Question: Why don't the people The Flash rescues get whiplash from the sudden acceleration?

Answer: The short answer is that these humans actually would be injured. In the movie "X-Men: Days of Future Past," Quicksilver (the Marvel version of a fast-running superhero) holds on to someone's head in order to prevent whiplash, but whiplash is only a small part of the problem. The real problem is damage to internal organs.

When superheroes like The Flash or Quicksilver rescue someone, they must accelerate that person. And to accelerate someone, they must push on him in some way. If The Flash pushes on the back of a human, this will accelerate the human's back. The back then pushes on the lungs, and the lungs push on the front chest. All this pushing is bad — it can cause all sorts of physical damage. A human might be able to survive acceleration up to 40 g's for a very short time, but this is less than the acceleration for many superheroes.

So, how do they do it? In sum, I don't know.

Q: How was the Bionic Man able to lift so many heavy things without his spine or pelvis buckling?

A: This is a great point. Just because Steve Austin (his friends just call him Steve) has a bionic arm, this doesn't mean he can do anything. If his arms lifted up some heavy mass, his back and legs would also have to support it.

This oversight didn't just occur in "The Six Million Dollar Man." In the movie "Avengers: Age of Ultron," Tony Stark (as Iron Man) attempts to lift Thor's hammer by using just the glove of the Iron Man suit.

No matter how hard the glove pulls on the hammer, Tony (the mere human) would have to pull on the glove. It's just a bad idea for the rest of his body. But maybe Tony never intended to really lift the hammer.

Question: How realistic is it to dream about antimatter as a plausible power source in the next century?

Answer: Ah ha! A non-superhero question. First, what is antimatter? In short, antimatter is just like normal matter, but with the opposite charge (that's not the full story, but it's good enough). If you have a positively charged proton, for instance, there is an antimatter proton (called the antiproton) with the same mass but a negative charge, and there is also an anti-electron (also called the positron) that is just like an electron, but with a positive electrical charge.

What happens when you get a positron and an electron near each other? Since they are opposite charges, they attract, and there is nothing to keep these particles apart, so they just annihilate each other—and in the process, they create energy. How much energy? Well, you've probably seen the famous equation E = mc2. That can tell you how much energy you'd need for a given amount of mass (m). And guess what? In this case, it's a lot. If you had just 1 kg of matter and 1 kg of antimatter, this would create 1.8 x 10^19 Joules. That's close to the amount of energy used in the entire U.S. in one year.

This all said—and I hate to burst your bubble—antimatter won't be a source of energy. Why not? Well, to use this as an energy source, you must *have* antimatter. It turns out that our universe has much more matter than antimatter (at least as far as we know). So, you can't really use antimatter to make energy unless you either find a bunch of it or create it yourself—but it takes a lot of energy to make antimatter. So, you see the problem.

OK, that's it. I hope you enjoyed the answers. I sure enjoyed answering them.

The Dust Bowl

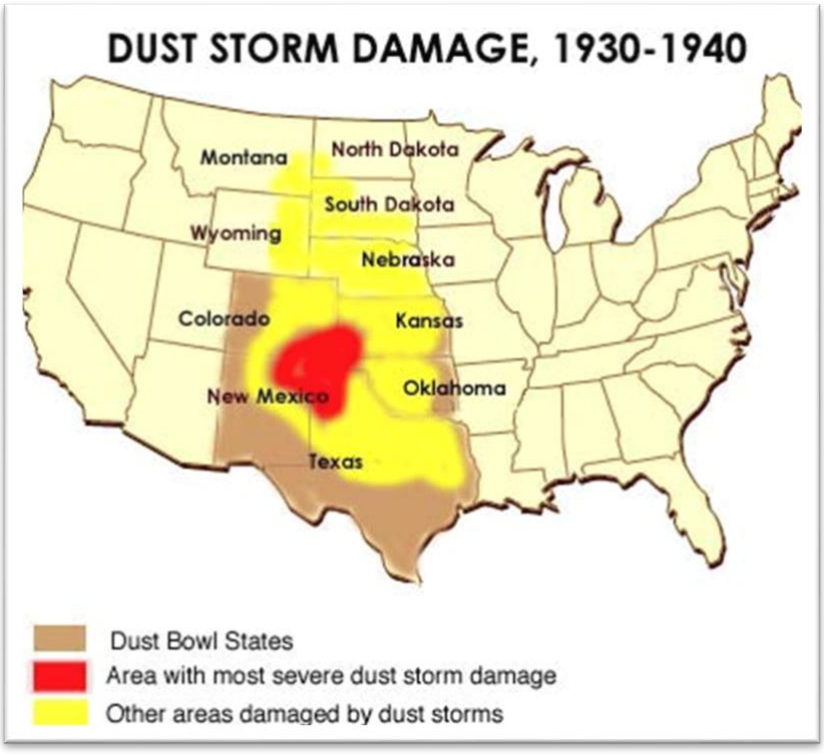
Benchmark Standard	History 3a: Students will compare competing historical narratives, by contrasting different historians' choice of questions, use and choice of sources, perspectives, beliefs, and points of view, in order to demonstrate how these factors contribute to different interpretations.
Grade Band	11-12
Vocabulary	In the documents

~This is a Stanford History Education Group (SHEG) lesson, modified by CSD for use at home~

ACTIVITY 1: Look at the photograph below and answer the questions that follow it.

1. Describe what you see in this picture.
2. When and where do you think this picture was taken? Explain your answer.

ACTIVITY 2: Observe the pictures and read the Dust Bowl information.



• The Dust Bowl refers to a period of severe dust storms and soil erosion in the Great Plains during the 1930s.
• This region included parts of Oklahoma, Texas, Kansas, Colorado, and smaller parts of New Mexico and Nebraska.

There were more than 300 dust storms, also known as "Black Blizzards," between 1933 and 1938. These storms often featured fast moving clouds of dust several miles wide that covered farms and homes, destroyed crops, and made people sick. One of the hardest hit areas was the Oklahoma Panhandle.

Migrant family in San Francisco, 1935

Farmer leveling dust hills in Texas, 1938

- Many people left the Dust Bowl region, abandoning their homes and to look for work in Western states, such as California. However, many stayed behind.
- Since the 1930s people have debated what caused the Dust Bowl. Historians continue to address this question: Was the Dust Bowl a natural disaster or was it caused by people's actions?
- Today we are going to analyze and compare a set of primary and secondary sources to better understand ***what caused the Dust Bowl.***
- You will now read and compare accounts of the Dust Bowl from two people who lived through it. The purpose and directions for reading the documents are:
    - to think about what life was like during the Dust Bowl
    - to compare the similarities and differences of these documents
    - to consider how the documents help you answer the Central Historical Question: What caused the Dust Bowl?

ACTIVITY 3: Read documents A & B. Answer the guiding questions for Documents A & B on a separate sheet of paper. Fill out the graphic organizer for Documents A & B.

ACTIVITY 4: Read document C. Answer the Guiding Questions for Document C. Fill out the Graphic Organizer for Document C.

ACTIVITY 5: Read Documents D & E. Answer the Guiding Questions for Documents D & E. Fill out the Graphic Organizer for Documents D & E.

ACTIVITY 6: Complete the final hypothesis on the Graphic Organizer, what caused the Dust Bowl?

Document A: Henderson Letter (Modified)

Caroline Henderson started homesteading in the Oklahoma Panhandle in 1907. She was a published writer who wrote for various magazines. The passage below is an excerpt of a letter she wrote to Secretary of Agriculture Henry Wallace in 1935 at the age of 58. Wallace would later credit her with helping America understand farmers' problems and the courage they exhibited.

For twenty-seven years this little spot on the vast expanses of the Great Plains has been the center of all our thought and hope and effort. And marvelous are the changes that we have seen . . . The almost unbroken buffalo grass sod has given way to cultivated fields. The old trails have become wide graded highways. Little towns have sprung up with attractive homes, trees, flowers, schools, churches, and hospitals. Automobiles and trucks, tractors and combines have revolutionized methods of farm work and manner of living. The wonderful crop of 1926 when our country alone produced 10,000,000 bushels of wheat – more it was said than any other equal area in the world – revealed the possibilities of our productive soil under modern methods of farming. It seemed as if at last our dreams were coming true. . . .

Yet now our daily physical torture, confusion of mind, and gradual wearing down of courage, seem to make that long continued hope look like a vanishing dream. For we are in the worst of the dust storm area where "dust to eat" is not merely a figure of speech, but the phrasing of a bitter reality. . . .

In this time of severe stress, credit must be given to the various activities of the federal government. Without such aid as has been furnished, it seems certain that large sections must have been virtually abandoned. Yet common sense suggests that the regions which are no longer entirely self-supporting cannot rely indefinitely upon government aid. So the problem remains and the one satisfactory solution is beyond all human control. Some of our neighbors with small children, fearing the effects upon their health, have left temporarily "until it rains." Others have left permanently, thinking doubtless that nothing could be worse.

Source: Caroline Henderson's letter to Henry A. Wallace, sent July 26, 1935

Document B: Svobida Account (Modified)

Lawrence Svobida was a young farmer who came to Oklahoma in 1929 and farmed there until 1939. He suffered seven crop failures in eight years. When he left, he wrote an account of his struggles. He wanted to share the story of the "average farmer without sugar coating it," as he claimed others had. Below are two excerpts from his account.

Excerpt 1: The **gales** chopped off the plants even with the ground, then proceeded to take the roots out. They did not stop there. They blew away the rich topsoil, leaving the subsoil exposed: and then kept sweeping away the "hard-pan," which is almost as hard as the concrete.

This was something new and different from anything I had ever experienced before – a destroying force beyond my wildest imaginings. When some of my own fields started blowing, I was utterly **bewildered**. . . .

According to [my neighbors'] information, there was little hope of saving a crop once the wind had started blowing; and the only known method of checking the movement of the soil was the practice of strip listing. This meant running deep parallel **furrows** twenty or thirty feet apart, in an east and west direction, across the path of the prevailing winds. This tends to check the force of the wind along the ground and allows the fine silt-like dust to fall into the open furrows.

Excerpt 2: There had been **overgrazing** before the coming of the settlers and the invasion of barbed wire, but the **death knell** of the Plains was sounded and the birth of the Great American Desert was **inaugurated** with the introduction and rapid improvement of power farming. Tractors and **combines** made the Great Plains regions a new wheat empire, but in doing so they disturbed nature's balance, and nature is taking its revenge.

Source: Lawrence Svobida, Farming the Dust Bowl: A First-Hand Account from Kansas, first published in 1940.

VOCABULARY:	
Gales: strong winds, windstorms	Death knell: bell or signal announcing death
Bewildered: confused	Inaugurated: begun
Overgrazing: too much grass eaten by cattle	Combines: a machine that harvests crops

Document C: Government Report

The passage below is an excerpt from the Report on the Great Plains Drought Area Committee. This report was created by was a government committee set up to analyze the causes of the Dust Bowl. Morris Cooke, Administrator of the Rural Electrification Administration, chaired the committee, but the leaders of eight federal agencies, including the Department of Agriculture and Soil Conservation Service, signed it.

Personal and Confidential from Morris Cooke.

August 27, 1936

Dear Mr. President,

The Committee has made a **preliminary** study of drought conditions in the Great Plains area with the hope of outlining a long-term program which would **render** future droughts less disastrous. . .

The agricultural economy of the Great Plains will become increasingly unstable and unsafe, in view of the impossibility of permanent increase in the amount of rainfall, unless **overcropping**, overgrazing and improper farm methods are prevented. There is no reason to believe that the primary factors of climate temperature, precipitation and winds in the Great Plains region have undergone any fundamental change. The future of the region must depend, therefore, on the degree to which farming practices conform to natural conditions. Because the situation has now passed out of the individual farmer's control, the reorganization of farming practices demands the cooperation of many agencies, including the local, State, and Federal governments.

Mistaken public policies have been largely responsible for the situation now existing. The Federal Government must do its full share in **remedying** the damage caused by a mistaken homesteading policy, by the stimulation of war time demands which led to overcropping and overgrazing, and by encouragement of a system of agriculture which could not be both permanent and **prosperous**.

Source: Excerpt from the Report of the Great Plains Drought Area Committee, sent to President Roosevelt on August 27, 1936.

VOCABULARY:	
preliminary: first, introductory	overcropping: depleting soil by continually planting crops on it
render: to make	remedying: making right render: to make prosperous: financially successful

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Document D: Historian, Professor Donald Worster

Professor Donald Worster is a leader in the field of environmental history. He is a professor at the University of Kansas and has written several books on environmental topics. The excerpt below is from his book Dust Bowl: The Southern Plains in the 1930s.

The Dust Bowl took only 50 years to accomplish. . . . It came about because the culture was operating in precisely the way it was supposed to. Americans blazed their way across a richly endowed continent with a ruthless, devastating efficiency unmatched by any people anywhere. Some environmental catastrophes are nature's work, others are the slowly accumulating effects of ignorance or poverty. The Dust Bowl, in contrast, was the inevitable outcome of a culture that deliberately, self-consciously, set itself that task of dominating and exploiting the land for all it was worth.

The Dust Bowl . . . came about because the expansionary energy of the U.S. had finally encountered a volatile, marginal land, destroying the delicate ecological balance that had evolved there. We speak of farmers and plows on the plains and the damage they did, but the language is inadequate. What brought them to the region was a social system, a set of values, an economic order. . . . Capitalism, it is my contention, had been the decisive factor in this nation's use of nature.

Source: Excerpt from Professor Donald Worster's book titled, Dust Bowl: The Southern Plains in the 1930s, published in 1979.

VOCABULARY:	
endowed: gifted, resourced	inevitable: unavoidable, necessary
ruthless: cruel	expansionary: spreading out
efficiency: effectiveness	volatile: unstable, unpredictable
catastrophes: disasters, tragedies	marginal: of secondary importance

Document E: Historian, Professor R. Douglas Hurt

Professor R. Douglas Hurt is the head of the History Department at Purdue University. He has written numerous books on agricultural history. The excerpt below comes from his book The Dust Bowl: An Agricultural and Social History.

Dust storms in the southern Great Plains, and indeed, in the Plains as a whole, were not unique to the 1930s . . . Many factors contributed to the creation of the Dust Bowl – soils subject to wind erosion, drought which killed the soil-holding vegetation, the **incessant** wind, and technological improvements which facilitated the rapid breaking of the native sod. The nature of southern Plains soils and periodic influence of drought could not be changed, but the technological abuse of the land could have been stopped. This is not to say that mechanized agriculture **irreparably** damaged the land – it did not. New and improved **implements** such as tractors, one-way disk plows, grain drills, and combines reduced plowing, planting, and harvesting costs and increased agricultural productivity. Increased productivity caused prices to fall, and farmers **compensated** by breaking more sod for wheat. At the same time, farmers gave little thought to using their new technology in ways that would **conserve** the soil.

Source: Excerpt from Professor R. Douglas Hurt's book titled, The Dust Bowl: An Agricultural and Social History, published in 1981.

VOCABULARY:	implements: equipment, tools
incessant: nonstop, constant	compensated: adjusted, made do
irreparably: permanently	conserve: protect from harm or destruction

GUIDING QUESTIONS:

Document A: Henderson

1) What type of document is this? When was it written? Why was it written?
2) According to Henderson, what are three changes that happened in Oklahoma during the 1910s and 1920s? What is her attitude about these changes?
3) How does the author describe life in Oklahoma in 1935? What are two examples of how people experienced the Dust Bowl?
4) How does this document help you address the question: What caused the Dust Bowl?

Document B: Svobida

1) Who wrote this document? When was it written? Why was it written?
2) According to Svobida, how did the dust and wind affect crops?
3) What exactly does Svobida mean by the phrase "power farming"? What would be the difference between traditional farming and "power farming"?
4) What, according to this Svobida, were two causes of the Dust Bowl?
5) How is Svobida's account similar to and different from Henderson's letter?

Document C: Government Report

1) What kind of document is this? When was it written? Why was it written?
2) What problem is this report addressing?
3) What, according to this report, were three causes of the Dust Bowl?
4) Is this a reliable account? Why or why not?

Documents D and E: Professors Worster and Hurt

1) What kind of documents are these? When were they written? Why were they written?
2) What does Professor Worster identify as the primary cause of the Dust Bowl?
3) Do the other documents support this conclusion? Why or why not?
4) What are 4 causes of the Dust Bowl that Professor Hurt identifies?
5) In what ways are Worster and Hurt's accounts different?

Graphic Organizer

Initial hypothesis: What caused the Dust Bowl?

Round One:

Document	Reasons suggested by this document	Evidence from document to support these reasons
Henderson Letter		
Svobida Account		

Second hypothesis: What caused the Dust Bowl?

Round Two:

Document	Reasons Suggested by this Document	Evidence from document to support these reasons
Government Report		

Third hypothesis: What caused the Dust Bowl?

Round Three

Document	Reasons Suggested by this Document	Evidence from document to support these reasons
Worster Excerpt		
Hurt Excerpt		

Final Hypothesis: What caused the Dust Bowl? Explain and support your answer with evidence from the docs.
