Math Packet, week 1, optional (but important) work

Parents:	Padres:	Students:
Thank you for supporting your student's learning - we appreciate you. Encourage your student to do as much of this work as they can. Reassure them that it can be normal to get stuck on a math problem and to keep trying; that is how we learn. While this work is optional and not graded you may decide that it is mandatory in your house. If you want to check that they did the work, here is a teacher tip. **Don't just ask to see the paperwork completed. Choose two or three problems and ask them to teach you how to do it.** Not only will this help you check if they understand, but explaining it to you also helps them learn it better.	(lo siento, esto es del traductor de google) Gracias por apoyar el aprendizaje de su hijo. Le agradecemos. Anime a su estudiante a hacer todo el trabajo que pueda. Asegúreles que puede ser normal quedarse atrapado en un problema matemático y seguir intentándolo; Así es como aprendemos. Si bien este trabajo es opcional y no está calificado, puede decidir que es obligatorio en su casa. Si desea verificar que hicieron el trabajo, aquí hay un consejo para el maestro. **No solo pida ver la documentación completa. Elija dos o tres problemas y pídales que le enseñen cómo hacerlo.** Esto no solo lo ayudará a verificar si entienden, sino que si se lo explica, también les ayudará a aprenderlo mejor.	First, we miss you. We know that time off of school may seem pretty awesome at first, but keeping your brain learning is important. Think of this math as exercise for your brain. Math is in the news everywhere lately and it is important to learn these skills so that you are an informed citizen and math will open opportunities for your future educational and career goals. Try your best. The good news is that grading pressure is off; this is all about learning and understanding the math. Remember, if your parents are making you do this it is because they care about your education.

- Key search terms are included in many of the directions so that if you have internet access you can search for videos to help provide examples.
- Answer keys for this work will be provided in next week's packet

We are here for you. Email us if you need any support

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Online Math Resources

Source	Notes
Sudoku (www.sudoku.com)	Japanese puzzle game
Khan Academy (www.khanacademy.org)	Videos, notes, and practice
Desmos (www.desmos.com)	Simple and graphing calculator
Jefferson Lab (https://education.jlab.org/indexpages/elementgames.html)	Science & maths games
Mangahigh (https://www.mangahigh.com/en-gb/games)	Games
MathHelp (https://member.mathhelp.com/courses/middle_and_high_school/12?showCoursesList=true)	Videos, Practice, Test
That Quiz (https://www.thatquiz.org)	Simple Quiz
Quizlet (https://quizlet.com/topic/math/)	Flashcards, diagrams, study guides, and practice tests
PBS Math Club (https://www.pbslearningmedia.org/subjects/mathematics/high-school-algebra/)	Real-world connections and resources via video
YouTube	Lots of math-oriented videos: Veritasium (https://www.youtube.com/user/1veritasium/videos), Mark Rober (https://www.youtube.com/user/onemeeeliondollars, Smarter Every Day (https://www.youtube.com/user/destinws2), Numberphile (https://www.youtube.com/user/numberphile) are all great channels Don't forget threemathguys if you want to hear Mr. Dack and Mr. Vue's voice: https://www.youtube.com/watch?v=E5h_zcoNEy8 Or you can watch some of Mr. Dull's videos: https://www.youtube.com/user/enixis85/videos

The New York Times https://nyti.ms/3aRzTnO

The Exponential Power of Now

The explosive spread of coronavirus can be turned to our advantage, two infectious disease experts argue: "But only if we intervene early. That means now."

By Siobhan Roberts

March 13, 2020

In early December, Britta Jewell, an infectious disease epidemiologist at the MRC Centre for Global Infectious Disease Analysis, Imperial College London, began researching some of the novel respiratory viruses that were then circulating.

Before long, she and her father, Nick Jewell — also an infectious disease epidemiological statistician, at the London School of Hygiene and Tropical Medicine — were in constant conversation about Covid-19. He was in bed, recovering from something like a severe flu. (He had tested flu-negative, which was unusual — and what motivated her research.) They talked over email and WhatsApp and the phone about the grim situation evolving in Wuhan, China, where the virus originated.

"In mid- to late January we started developing a plan for our family in case one of us became infected, and preparing supplies for two weeks of isolation," she said. They also started calculating the numbers and sharing frustrations over their inability to convey to people the seriousness of the coronavirus's exponential spread.

"We were listening to people, such as President Trump, saying, 'What's the fuss, it's just like the flu,' and 'There are only 15 cases, and only one death in the U.S., much fewer than everywhere else, we're doing great,'" Dr. Nick Jewell said. "But every epidemiologist knew what was coming inexorably toward us."

On Tuesday, they noticed a tweet by Mike Baker of The New York Times, in which he noted the cumulative number of coronavirus cases in the U.S. by date:

Jan. 14 — 0

Jan. 21 — 1

Jan. 28 — 5

Feb. 4 — 11

Feb. 11 — 14

Feb. 18 — 25

Feb. 25 — 59

Mar. 3 — 125

Mar. 10 — 1,004

"That is exponential growth," Dr. Nick Jewell said. (He noted that the latest increase was also likely a reflection of increased testing.)

"We started discussing what actions to take in the face of exponential growth," he said. "Obviously, we need to slow the rate of growth (flatten the curve) through government and individual responses — effectively based on increased testing and heightened social distancing. But in order to accomplish that, we first need to convince people to take this outbreak seriously, which is no small task. It's as if humans can only think linearly. But for epidemic modelers, exponential growth is the very nature of the beast."

Dr. Britta Jewell wondered whether the power of exponential growth could be turned to a collective advantage. "The answer was yes, but only if we intervene early," she said. "That means now."

The exponential effect was now on other minds as well. Yaneer Bar-Yam, a physicist and systems scientist and the founding president of the New England Complex Systems Institute, convened a YouTube chat with Nassim Nicholas Taleb, a probability flâneur and risk analyst, to discuss "Why It's Better to Panic Early," following up on a paper they put out in late January. And on Tuesday, Tomas Pueyo, a Silicon Valley entrepreneur, posted what amounted to a lengthy white paper on Medium titled, "Coronavirus: Why You Must Act Now," which has been viewed 18 million times already.

"The graph that really grabbed my attention was the one showing a model of daily new cases of Covid-19 with social-distancing measures starting just one day apart," Dr. Britta Jewell said. "It only takes a one-day difference in action to see a 40 percent reduction in cases — that's enormous. It really conveys the urgency of the situation."

Working in Excel, she composed a graph showing the power of one case averted now, today — versus one case averted a week from now — in an effort to convey to people what she called "the positive side of exponential growth."

Britta Jewell, an infectious disease epidemiologist at the Imperial College, London, at home. Jane Stockdale for The New York Times

Using the current case counts from the U.S. as of Friday morning, she calculated what the epidemic would look like if cases grew by 30 percent every day for a month — they have been growing by 30 to 40 percent every day for a week — then looked at what would happen if just one of those infections were prevented tomorrow instead of a week from now.

The following is an edited version of my phone and email conversations with Dr. Britta Jewell, in London, and Dr. Nick Jewell, who for the moment is staying put in Berkeley, Calif.

What is happening in this graph?

BJ The graph illustrates the results of a thought experiment. It assumes constant 30 percent growth throughout the next month in an epidemic like the one in the U.S. right now, and compares the results of stopping one infection today — by actions such as shifting to online classes, canceling of large events and imposing travel restrictions — versus taking the same action one week from today

The difference is stark. If you act today, you will have averted four times as many infections in the next month: roughly 2,400 averted infections, versus just 600 if you wait one week. That's the power of averting just one infection, and obviously we would like to avert more than one.

The principle is that, with the exponential growth phase of an epidemic, individual and institutional actions such as social distancing taken early on can have a much greater impact than if the same actions are taken even a week later.

NJ The magnitude of the outbreak creeps up on you; it doesn't look like things are growing very much, and then suddenly they are. Today, the U.S. is up to at least 1,714 known cases and we're only a couple of days on from when it was 1,004. It's going to be 4,000 by Monday, and then it's going to be 8,000 by next Wednesday, and then it's.... Exponential growth is staggering when it takes over.

In a nutshell, what is exponential growth?

BJ Exponential growth is a classic pattern in which numbers stay small initially, but then you end up with very large numbers very quickly. If you start with a certain number, and then multiply that number by a growth factor every day, depending on what that growth rate is, you'll see the cumulative number doubling over a certain time period.

What really matters is how high that growth rate is. In the U.S. right now, according to Our World in Data, confirmed Covid-19 cases are increasing by about 30 to 40 percent per day and the total number is doubling about every two days.

NJ Think about your family tree and how the number of your ancestors (or descendants) grows with every generation. Or there's the story about the rabbits breeding. Two rabbits breed four rabbits and four rabbits breed eight rabbits and eight rabbits breed 16 rabbits, and if they're breeding every six or seven days, very soon you have a lot of rabbits.

BJ If you start with two rabbits and the number doubles every week, you've got about 1,000 rabbits after 10 weeks. That doesn't seem so bad. But another 10 weeks later? You've got a million. It's intuitively very hard to grasp how quickly these numbers go up beyond a certain point — people tend to anchor on the low numbers at the beginning, when the curve is relatively flat.

But the same exponential effect is equally powerful with mitigation efforts — staying home now, for example. How do the "exponential now" decisions play out later down the line?

BJ Part of the advantage of an individual action removing a single infection is not necessarily that the person I don't infect tomorrow will never be infected, but that the infection will happen later than tomorrow, maybe in a few weeks or so.

And at some point at least some of the newly infected people will be surrounded by more immune (recovered) individuals among their contacts, so the newly infected will in turn infect fewer people, and so on.

Effectively, each of us can choose to reduce our personal R0 — the number of people each one of us would go on to infect if we developed Covid-19 — and this will help flatten the curve. If you can drive the effective R0 below 1, you can slow down and stop the spread.

According to analysis from the London School of Hygiene and Tropical Medicine's center for mathematical modeling, it looks like Hong Kong was able to do that in February, and their epidemic trajectory looks quite different as a result. The effective reproduction number isn't set in stone — it's vulnerable to interventions.

What is your top research priority as you look forward?

NJ We're trying to model and project health care demands over the immediate future, looking three weeks ahead: given our best guess of where we might be with cases in three weeks, and the likely age groups, how many hospital beds will be needed, how many I.C.U. beds, how many respirators. Health care providers are feverishly trying to plan how much they need to ramp up their capacity to meet the anticipated demand as best they can, to avoid being swamped.

BJ Not overwhelming the health care system is certainly the most pressing issue right now, and hopefully we can achieve this if we flatten the curve. But long term, I'm concerned about keeping social distancing sustainable. It's a fine line to walk, because if you actually do slow down the epidemic substantially, it will look like everyone overreacted. It may be hard to convince people that at least some social distancing measures need to stay in place — like not shaking hands, or avoiding large crowds if you're vulnerable — after the initial peak of the epidemic.

A lot of people seem to be asking: Is it really likely to get as bad in the United States and Canada as it is in Italy?

NJ Yes. Tell me one reason it shouldn't. I see no reason. The United States are maybe two weeks behind Italy. I think everyone got a shock this week, and there was the sense of a shift, with the N.B.A. canceling and the president speaking from the Oval Office with the travel ban, and then Tom Hanks and Rita Wilson — bang, bang, bang.

I think next week we are going to get an even bigger shock. Because we are going to have, as I said, 5,000 to 10,000 cases. People are going to realize it is everywhere. I can't go to the store, I can't take public transportation, I'm surrounded by infected people. We're not far away from that. Unless we do something — and the sooner we do it the better.

That is scary.

NJ It is very scary.

Look at the final-size equations that people are throwing around. The final size — the total number of people who get infected — is related to the rate of the exponential growth, the reproductive number. Flattening the curve is an attempt to get that reproductive number down. It makes for a longer epidemic, but less intense.

If you have an R0 of 2 — two more cases on average for every person infected — the math tells you that if it is not impeded in any way, that fire burns through the forest, and in the end it will have burned half of the forest — half of the world population or half of the U.S. population will be infected. Angela Merkel said that, worst-case or eventually, she anticipates that 70 percent of Germans will be infected.

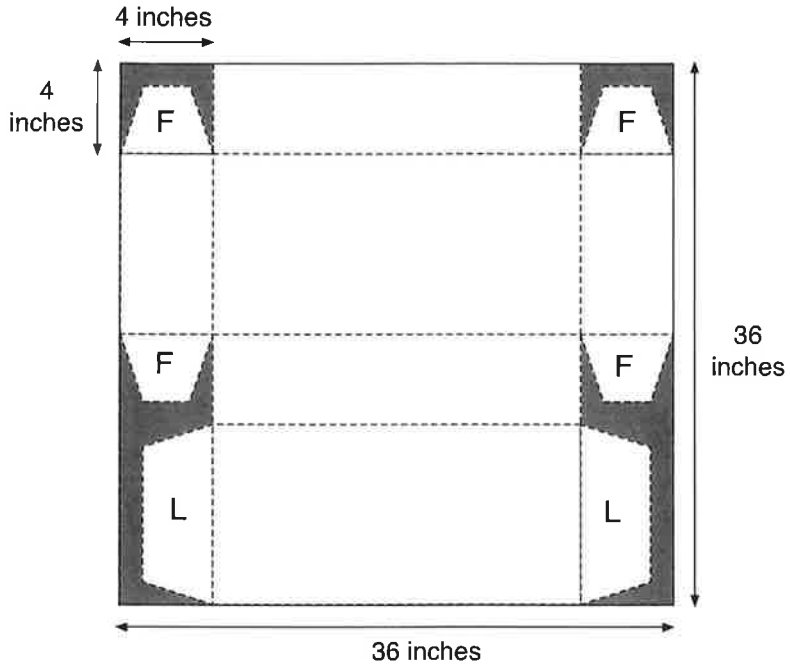
Then it will die out, if we have lasting immunity as a herd. The virus can't find new, susceptible hosts very easily and it dies out. This is just mathematics. The only hope we have is to lower the reproduction number. And the only way we know how to do that, absent a vaccine, is to contact trace with testing, find infected cases and isolate them. And social distancing — that's where you reduce the contact rate between infected and susceptible people, you make it harder for an infected to bump into a susceptible. That's our only hope at the moment. And I don't know that that message has really gotten out. I think we're getting there, but I'm not sure.

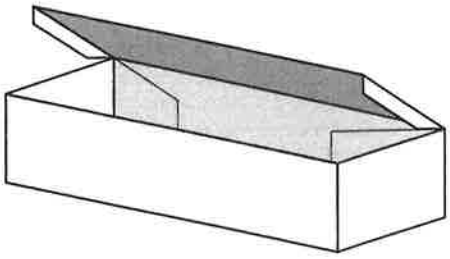
BJ A big question now is how long we can maintain these measures, if we choose to take them either as individuals or governments.

If we're not expecting a vaccine for 12 to 18 months, we also need to find a way — at least after the initial first peak of the epidemic — to make sustainable changes. If social distancing measures keep a large proportion of the population susceptible now, that means those individuals may still be infected in a second, or third, wave of the epidemic if life goes back to normal.

Fruit Boxes

A grocer wants to sell fruit in boxes.
He wants to make the boxes from square card 36 inches long and 36 inches wide as shown.





(Diagrams not drawn to scale.)

The shaded areas are cut away and the rest is folded along the dashed lines.
The sides are folded up and stuck together using the four flaps marked F.
The lid has two flaps, marked L, which are not glued.

1. Calculate the volume of the finished box. Show your work.

Please continue your work on the page opposite

Fruit Boxes (continued)

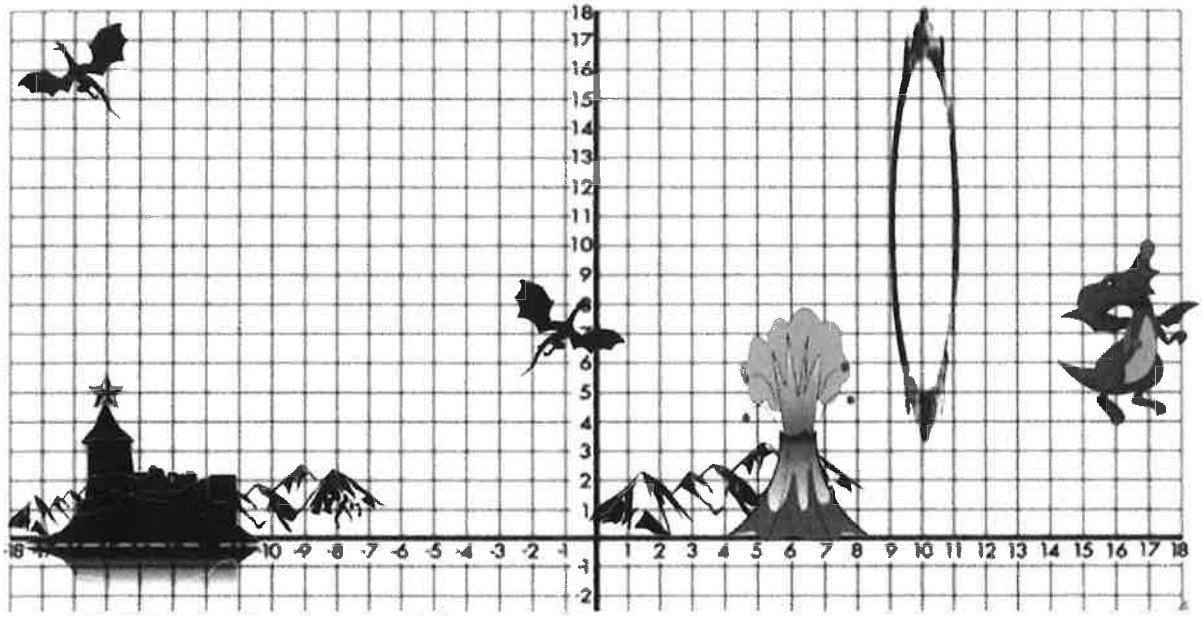
2. Suppose he starts with the same square of card, but changes the 4 inches to a different measurement. What is the largest volume he can make the box? Show your calculations.

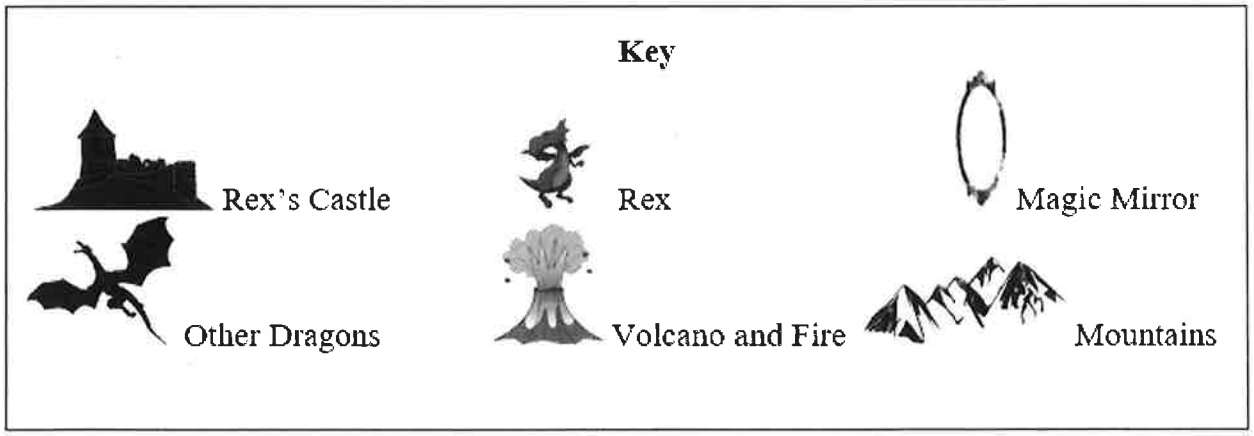
Video Game Designer

Name: _____ **Date:** _____

You are part of a video game design team, earning a yearly salary of $72,000. You are developing a new fantasy dragon game featuring Rex. You are working with Alejandro and Isabel. Figure 1 is an image of the opening screen of the game.

Figure 1: Opening Screen





Your task is to return Rex to his castle by following the rules listed on the next page.

Game Rules

- Rex must not touch the volcano or its fire.
- The Magic Mirror is a line of reflection.
- Rex must not touch any other dragon.
- Rex must touch the tip of his horn to the star on the castle tower in order to enter it.

1. The tip of Rex's horn is currently located at the coordinate point (17,10). If Rex is moved so that his horn is now located 3 units to the left and 5 units down, what are the new coordinates?

_____

2. Alejandro claims that if Rex is translated from his original position by the translation rule $(x, y) \rightarrow (x, y + 3)$ his horn will now be at the point $(20, 13)$. Do you agree or disagree with Alejandro's claim? Justify your decision.

_____

_____

_____

_____

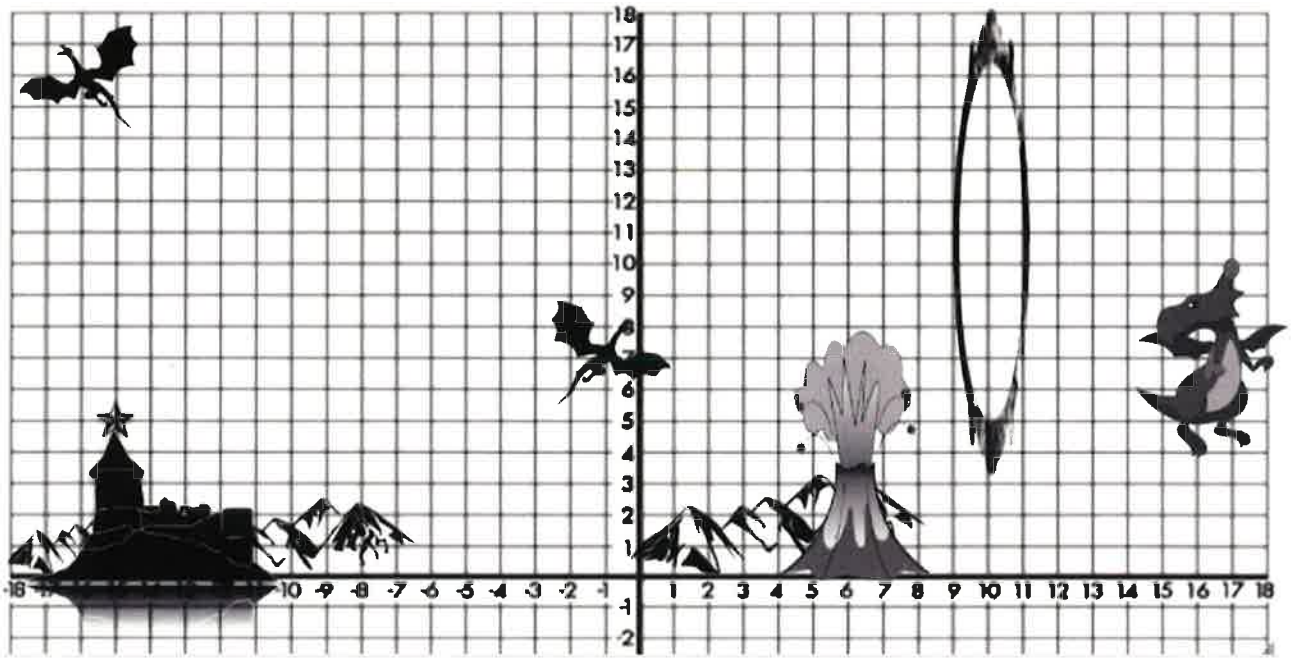
_____

3. Rex can only return to his castle by entirely **reflecting** through the Magic Mirror. What is the equation for the line of reflection that allows Rex to move through the mirror based on his location determined in **Question 2**?

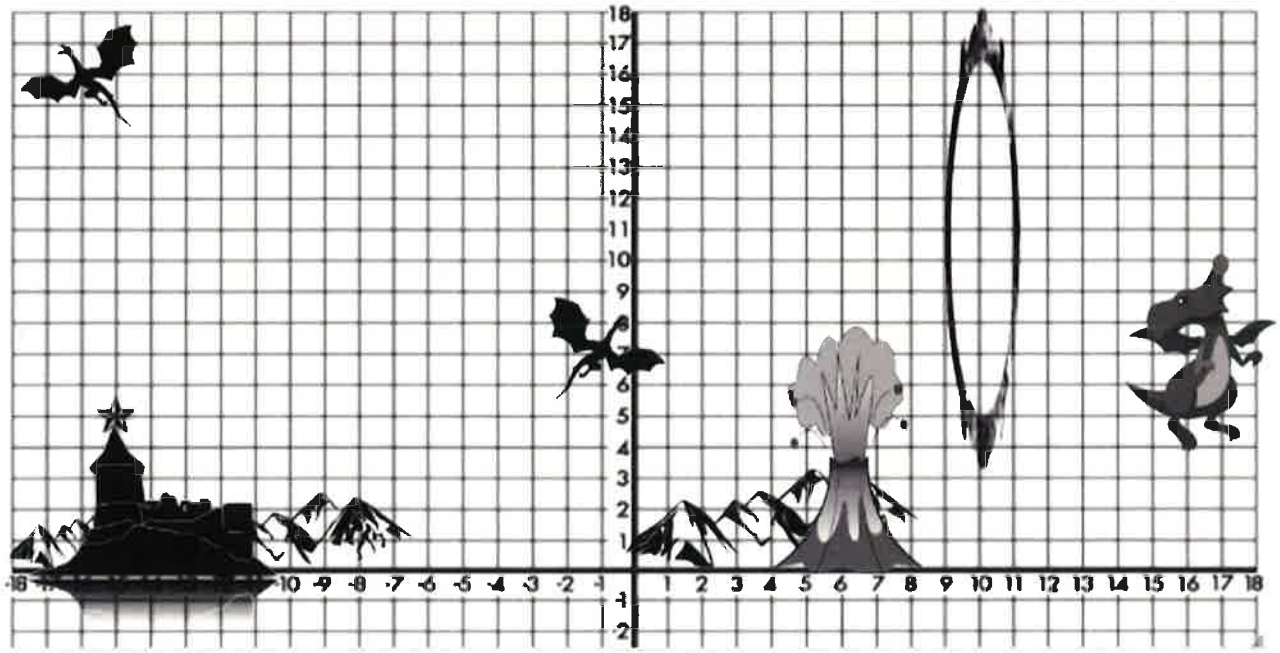
_____

_____

4. Alejandro claims that Rex's movements in **Questions 2 and 3** will result in Rex touching the volcano fire. Do you agree or disagree with Alejandro's claim? Justify your decision.



5. Recommend a series of transformations that will take Rex from his original starting position to the castle following the game rules.



Justify that your series meets all of the game rules and takes Rex home to his castle.

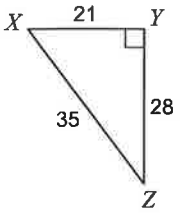
Geometry Name_____ ID: 1

Week 1 Optional Work

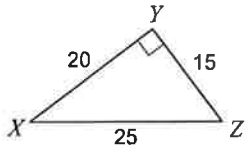
Date_____ Period____

Find the value of each trigonometric ratio to the nearest ten-thousandth. Key search terms: trigonometry, sine, cosine, tangent, ratio.

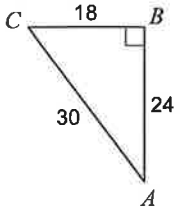
1) tan Z



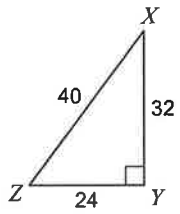
2) tan X



3) sin C

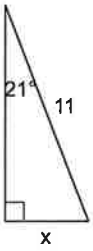


4) cos Z



Find the missing side. Round to the nearest tenth. Key search terms: trigonometry, sine, cosine, tangent.

5)



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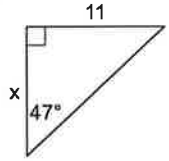

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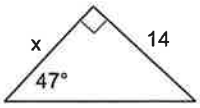

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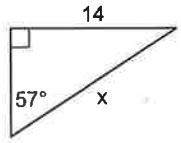
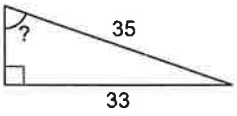


Find the measure of the indicated angle to the nearest degree. Key search terms: trigonometry, arcsine, arccosine, arctangent.

9)



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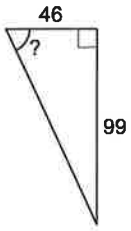

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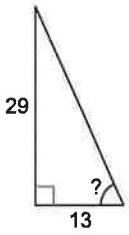

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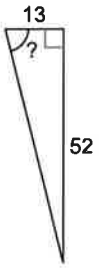
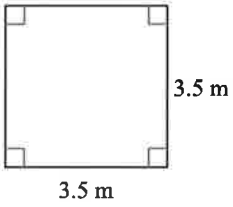


Find the area of each. Key search terms: area of quadrilaterals/triangles.

13)



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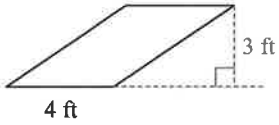

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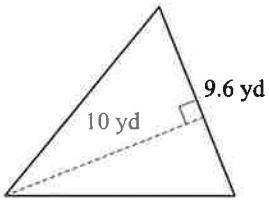

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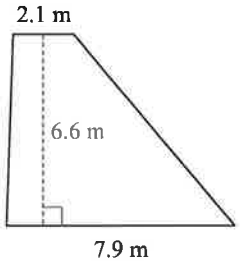

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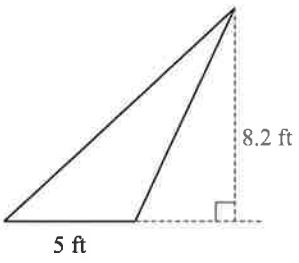
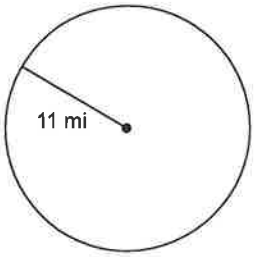


Find the area of each. Use your calculator's value of π. Round your answer to the nearest tenth. Key search terms: area of circles

18)



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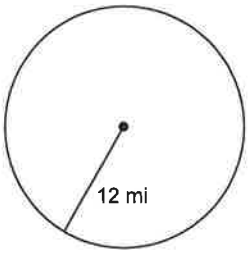

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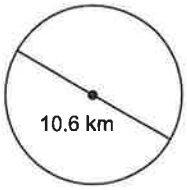
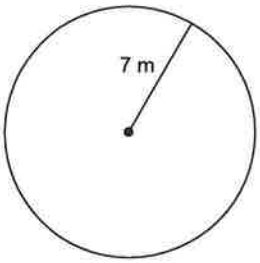
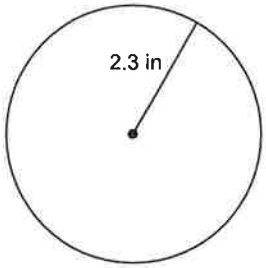


Find the circumference of each circle. Use your calculator's value of π. Round your answer to the nearest tenth. Key search terms: circumference of circles

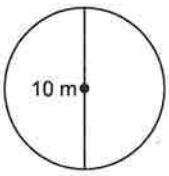
22)



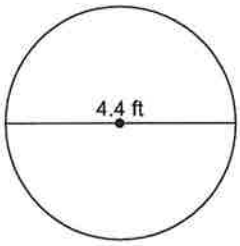
23)



24)

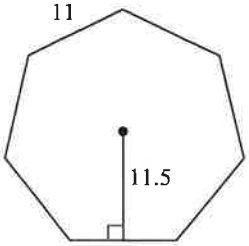


25)

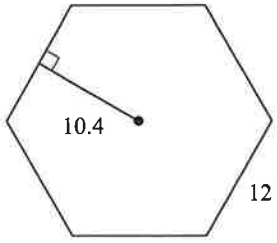


Find the area of each regular polygon. Round your answer to the nearest tenth if necessary. Key search terms: area of regular polygons, apothem, special right triangles.

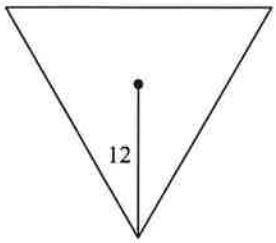
26)



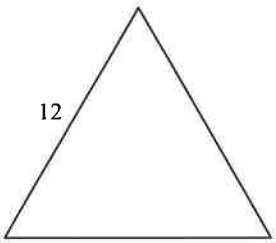
27)



28)

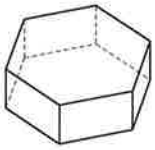


29)

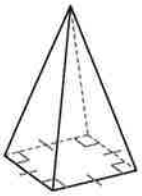


Name each figure. Key search terms: How to name a solid.

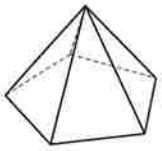
30)



31)



32)



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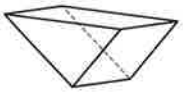
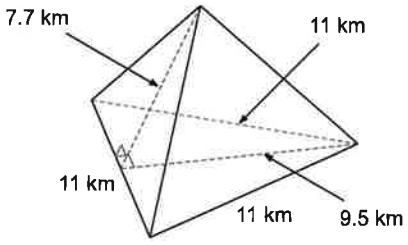


34)

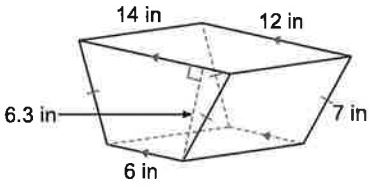
35)

Find the surface area of each figure. Round your answers to the nearest hundredth, if necessary. Key search terms: surface area, prisms, pyramids, cones, spheres

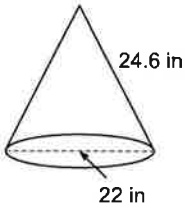
36)



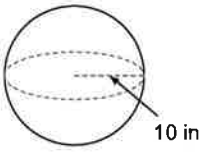
37)



38)



39)



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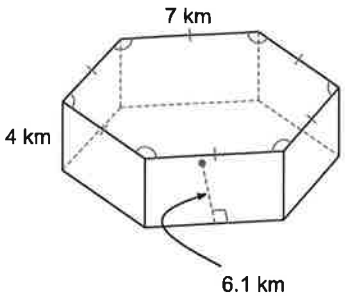
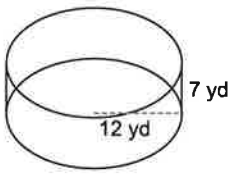
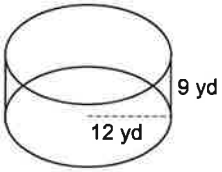


41)

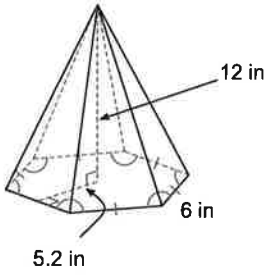


Find the volume of each figure. Round your answers to the nearest hundredth, if necessary. Key search terms: volume of prisms, pyramids, cones, cylinders, spheres.

42)



43)



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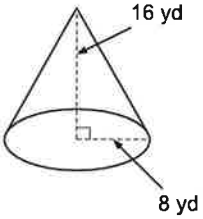

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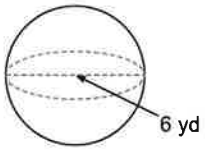

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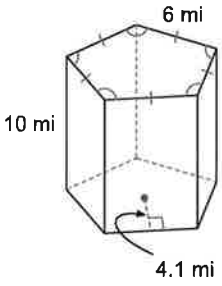
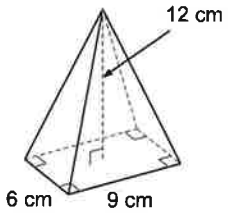


47)



Help! Negative numbers and fractions still mess me up. ID: 1

For some of you this time away is the perfect chance to improve these skills.

Evaluate each expression. Practice a few of these each day to improve. Check the answers as you go. Key search terms: integer operations, fraction operations, mixed numbers.

1) $-9 \div (-1 - -1 + 3)$

2) $6 - (5 + 3)(-4)$

3) $-4 + 3 + -4 - -2$

4) $1 + (-4 - -6)^2$

5) $2 + 4 + -1 - -5$

6) $(-1 - -2)^2 - 4$

7) $4 - -3 - (5)(2)$

8) $3 - -3 \div (1 - -2)$

9) $-6 - 1 - \left(-5 - \frac{6}{-6}\right) - 6$

10) $\frac{12 - 4}{(6 - 4)^3 - 6}$

11) $\left(-1 - \frac{3^2 - 6}{-1}\right)(-4)$

12) $\frac{9 - 6 - 5}{(2)(3 - 2)}$

13) $\frac{12 + 5 - 4 - 3}{6 - 1}$

14) $-\frac{9}{(2)(-4) - (-1 - 2 - 2)}$

15) $-6 + (4)((-2)(4) + -2 - 1)$

16) $-1 + \frac{18 - 3}{-1 - (1 - 5)}$

17) $\left(3\frac{2}{5}\right)(2) + 2\frac{1}{2}$

18) $\frac{-\frac{5}{4}}{-1 - 2}$

19) $-3\frac{1}{5} + (-1)^2$

20) $\left(-\frac{2}{3} + 6\right)(-1)$

21) $-2\frac{1}{2} + 5 - -\frac{1}{6}$

22) $-\frac{3\frac{2}{5}}{\frac{5}{3}} + 2\frac{1}{4}$

23) $2\frac{4}{5} - 1\frac{1}{2} + 3\frac{2}{3}$

24) $\frac{\frac{7}{5}}{-1\frac{1}{2} - -\frac{5}{6}}$

Answers to For some of you this time away is the perfect chance to improve these skills. (

1) -3
2) 38
3) -3
4) 5
5) 10
6) -3
7) -3
8) 4
9) -9
10) 4
11) -8
12) -1
13) 2
14) 3
15) -50
16) 4
17) $\frac{93}{10}$
18) $\frac{5}{12}$
19) $-\frac{11}{5}$
20) $-\frac{16}{3}$
21) $\frac{8}{3}$
22) $\frac{21}{100}$
23) $\frac{149}{30}$
24) $-\frac{21}{10}$

A Golden Crown ?

The King asks Archimedes if his crown is made from pure gold.

He knows that the crown is either pure gold or it may have some silver in it.

Archimedes figures out that the volume of the crown is 125 cm^3 and that its mass is 1.8 kilograms.

He also knows that 1 kilogram of gold has a volume of about 50 cm^3 and 1 kilogram of silver has a volume of about 100 cm^3.

1. Is the crown pure gold? Explain how you know.

2. If the crown is not pure gold, then how much silver is in it?
   Show all your work.

Leaky Faucet

Jan estimates that the faucet in her kitchen drips at a rate of 1 drop every 2 seconds.

1. Estimate how many times the faucet drips in a **week**.
   Show your calculations.

_____

Jan estimates that approximately 575 drops fill a 100 milliliter bottle.

2. Estimate how much water her leaky faucet wastes in a **year**.
   Show how you figured it out.

_____