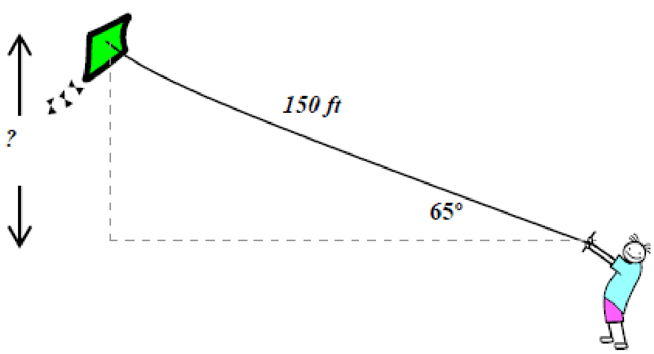
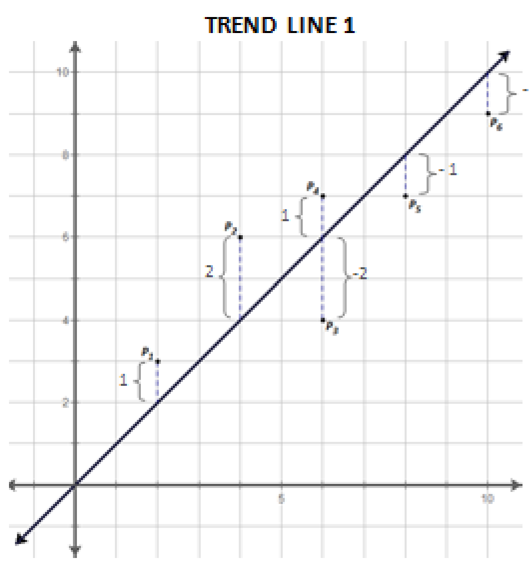
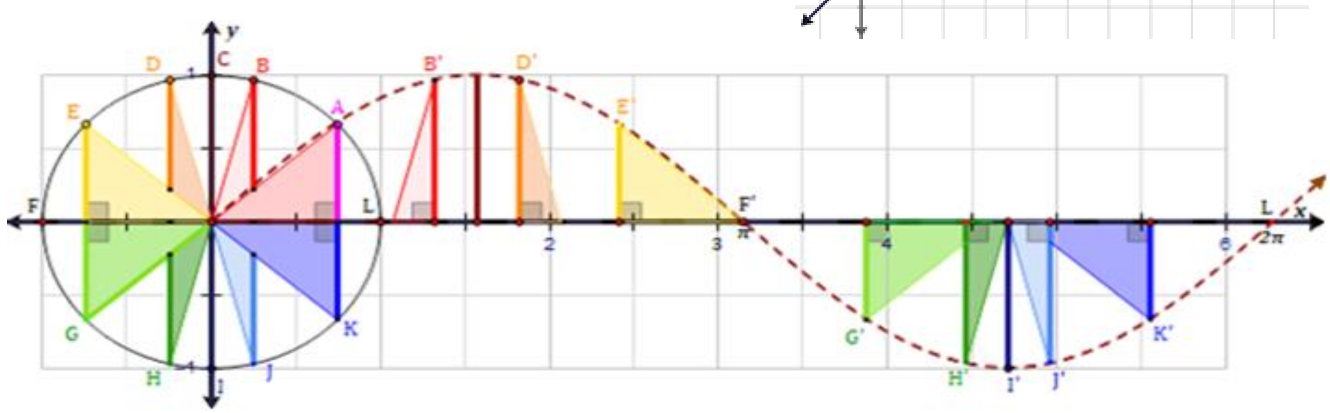
Adv. Math Decision Making

Unit 5: Trigonometry & Regression Models







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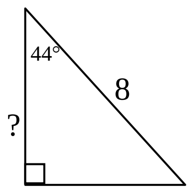
Sec 7.1 – Recursion Models
Right Triangle Trigonometry

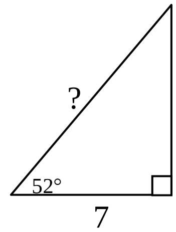
Name:

1. Find the requested unknown side of the following triangles.

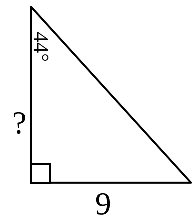
a.



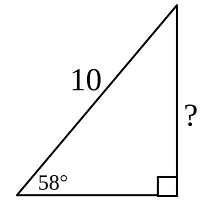
b.



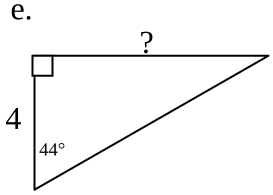
c.



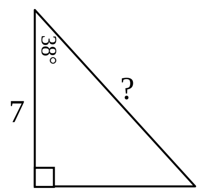
d.



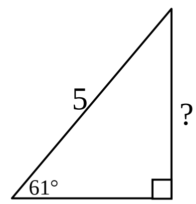
e.



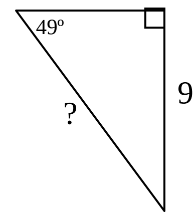
f.



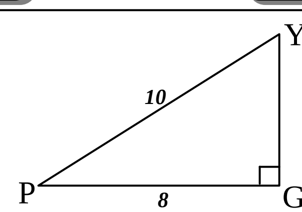
g.



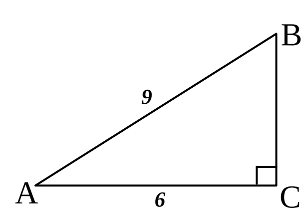
h.



2. Find the value of sin P.



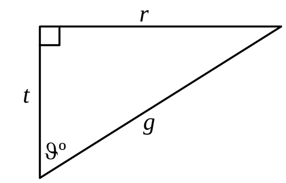
3. Find the EXACT value of tan B.



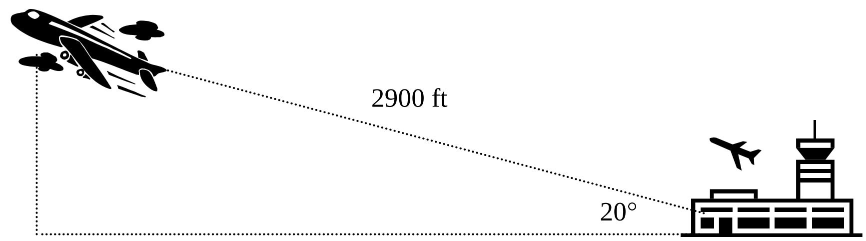
4. **Which expression represents cos (ϑ) for the triangle shown?**

A. $\dfrac{g}{r}$ **B.** $\dfrac{r}{g}$

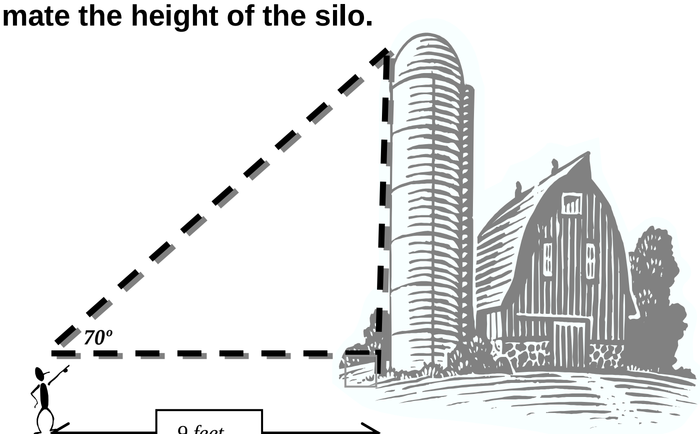
C. $\dfrac{g}{t}$ **D.** $\dfrac{t}{g}$



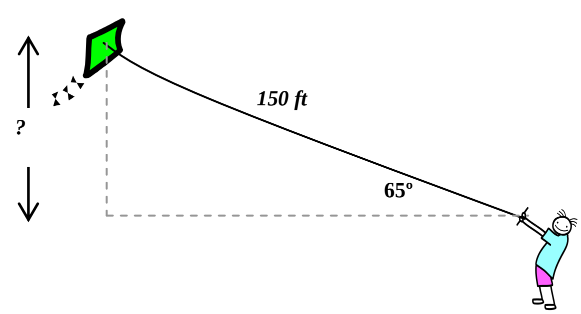
5. **As a plane takes off it ascends at a 20° angle of elevation. If the plane has been traveling at an average rate of 290 ft/s and continues to ascend at the same angle, then how high is the plane after 10 seconds (the plane has traveled 2900 ft).**



6. **A person noted that the angle of elevation to the top of a silo was 65º at a distance of 9 feet from the silo. Using the diagram approximate the height of the silo.**

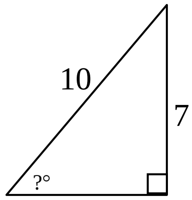


7. **A kid is flying a kite and has reeled out his entire line of 150 ft of string. If the angle of elevation of the string is 65º then which expression gives the vertical height of the kite?**

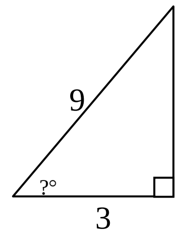


2. Find the requested unknown angles of the following triangles using a calculator.

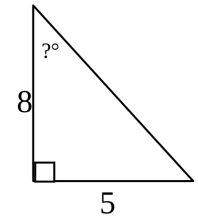
a.



b.



c.

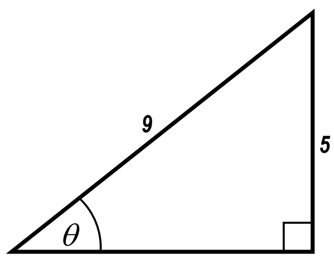


2. Find the approximate unknown angle, θ, using <u>INVERSE trigonometric ratios</u> ($\sin^{-1}$, $\cos^{-1}$, or $\tan^{-1}$).

a. $\cos\theta = 0.823$

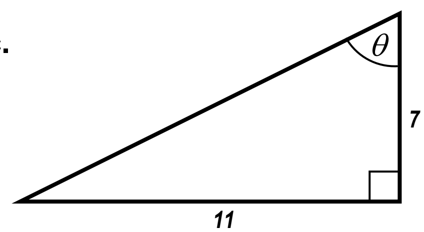
$\theta =$

b.



$\theta =$

c.



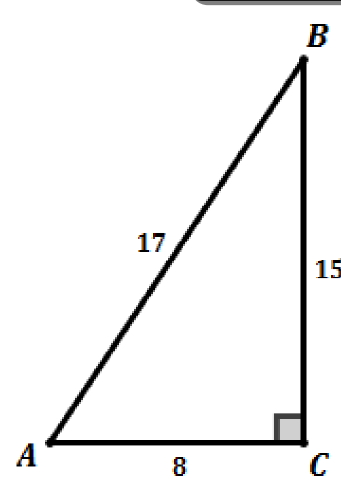
$\theta =$

3. Indentify each of the following requested Trig Ratios.

A. sin A =

B. cos B =

C. Measure of angle B =

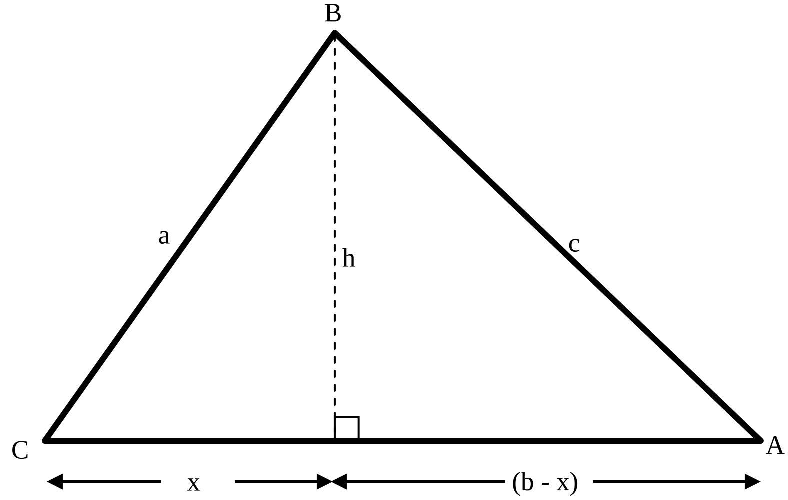


Sec 5.2 –Trigonometry
Law of Sines

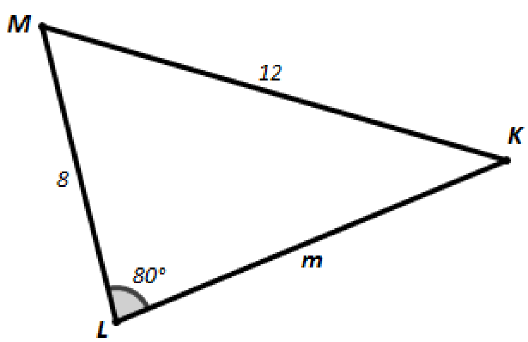
Name:

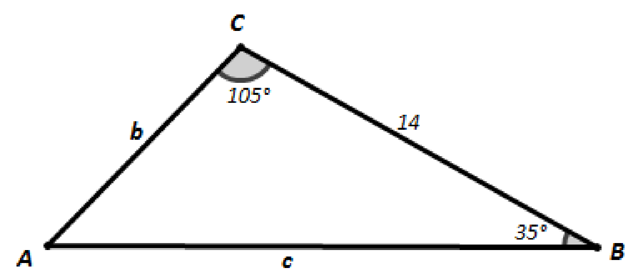
Law of Sines: Start with *sin (A)* and *sin(C)*.

PROOF :



1. Find the unknown sides and angles of each triangle using the **Law of Sines.**

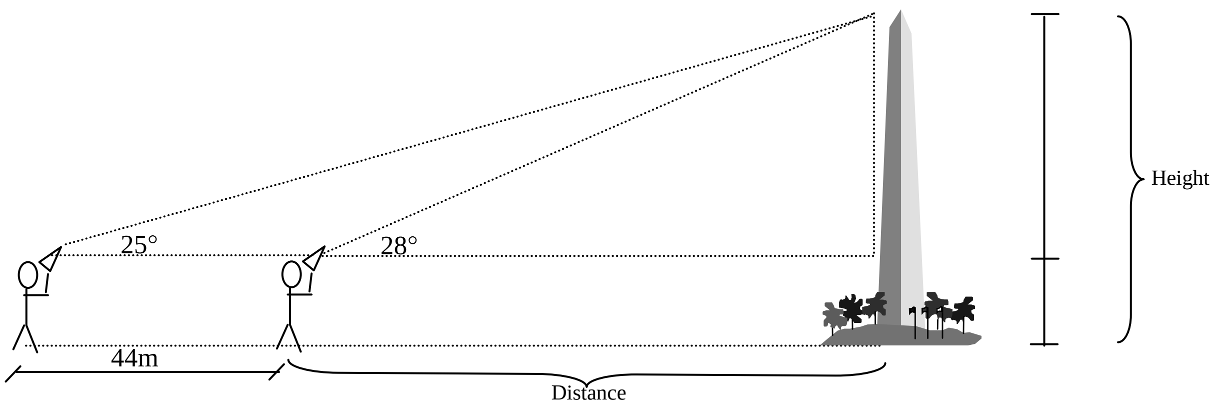




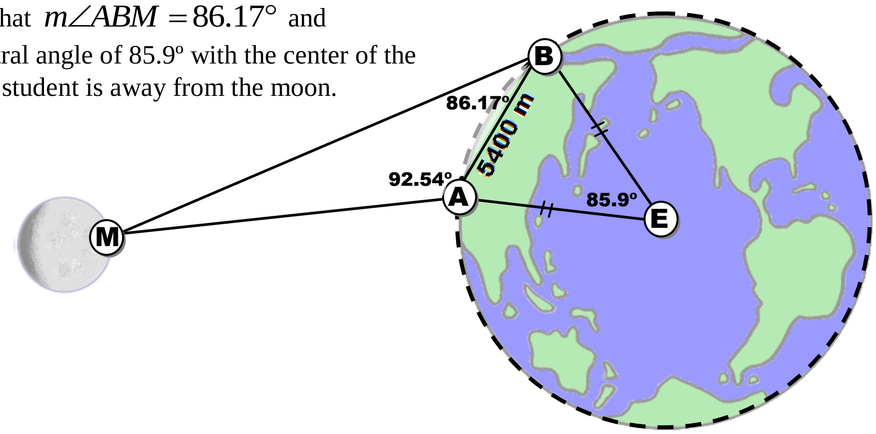
m	
m∠**M**	
m∠**K**	

c	
b	
m∠**A**	

2. A student was trying to determine the height of the Washington monument from a distance. So, he measured two angles of elevation 44 meters apart. The angle of elevation the furthest away from the monument measured to be 25° and the closest angle of elevation measured 28°. The student determining the angles is 1.6 Meters tall from his feet to his eyeballs. Find the Height = [ ] Distance away = [ ]



8. Two students that are on the same longitudinal line are approximately 5400 miles apart. The used an inclinometer, a little geometry, and a tangent line to determine the that $m\angle ABM = 86.17°$ and $m\angle BAM = 92.54°$. The two students form a central angle of 85.9º with the center of the earth. Given this information determine how far each student is away from the moon.

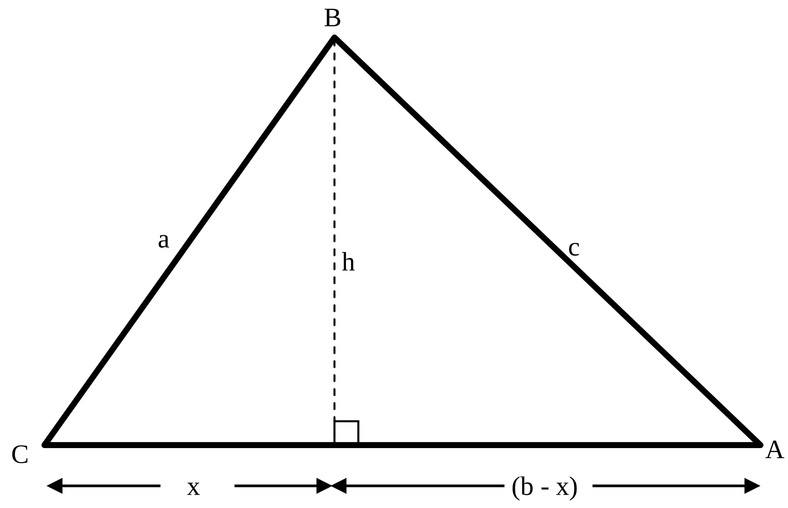


Use this information to find the radius of the Earth and then the circumference ($C = 2\pi r$).

Sec 5.3 –Trigonometry
Law of Cosines

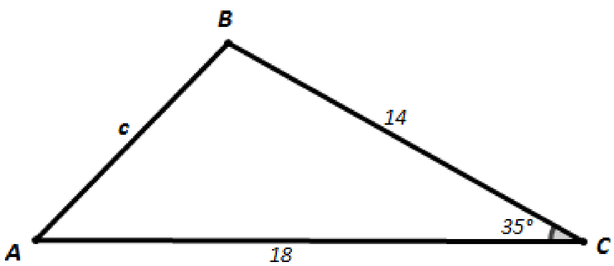
Name:

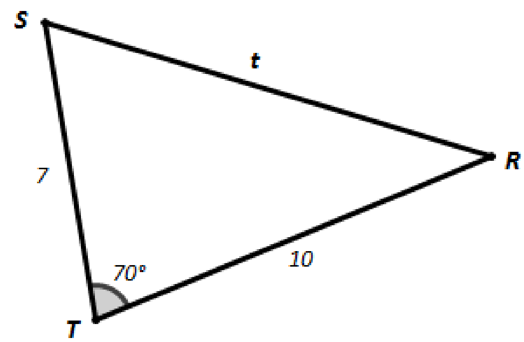
Law of Cosines: Start with cos (C) and the Pythagorean theorem for both of the right triangles.



<u>PROOF :</u>

1. Find the unknown sides and angles of each triangle using the **Law of Cosines.**

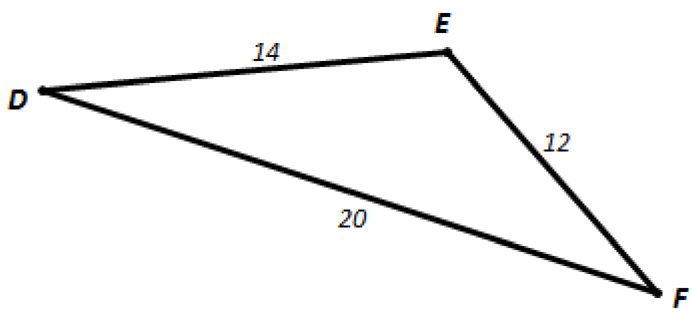




f	
d	
m∠**D**	

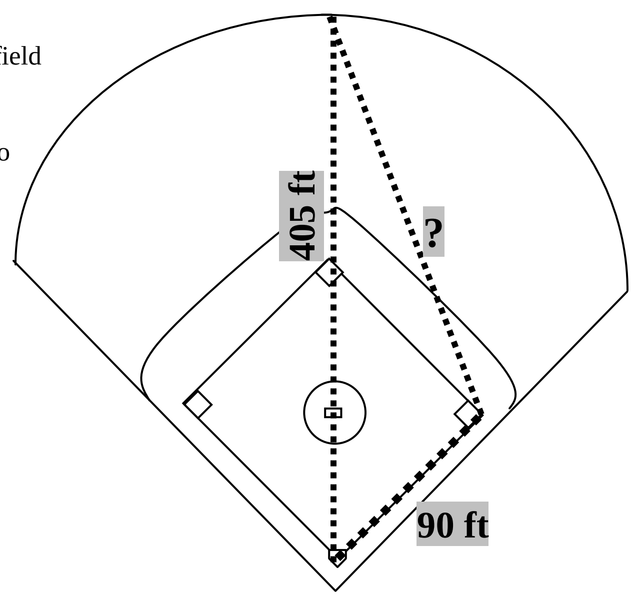
t	
m∠**S**	
m∠**R**	

2. Find the unknown sides and angles of each triangle using the **Law of Sines.**

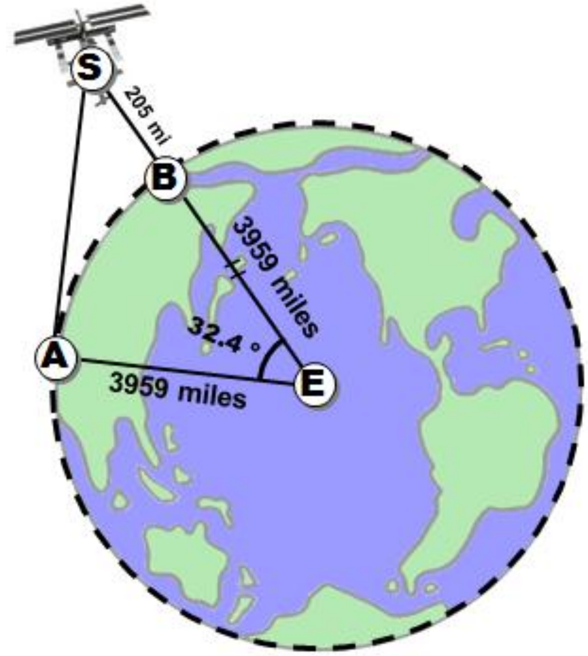


m∠**D**	
m∠**E**	
m∠**F**	

3. A centerfield baseball player caught a ball right at the deepest part of center field against the wall. From home plate to where the player caught the ball is 405 feet. The outfielder is trying to complete a double play by throwing the ball to first base. Using the diagram, how far did the outfielder need to throw the ball. *(The bases are all laid out in a perfect square with each base 90 feet away from the next. Since it is a square you should be able to determine the angle created by 1st base – home plate – 2nd base)*



4. On one night, a scientist needs to determine the distance she is away from the International Space Station. At the specific time she is determining this the space station distance they are both on the same line of longitude 77˚ E. Furthermore, she is on a latitude of 29˚ N and the space station is orbiting just above a latitude of 61.4˚ N. In short, the central angle between the two is 32.4˚. If the Earth's radius is 3959 miles and the space station orbits 205 miles above the surface of the Earth, then how far is the scientist away from the space station?

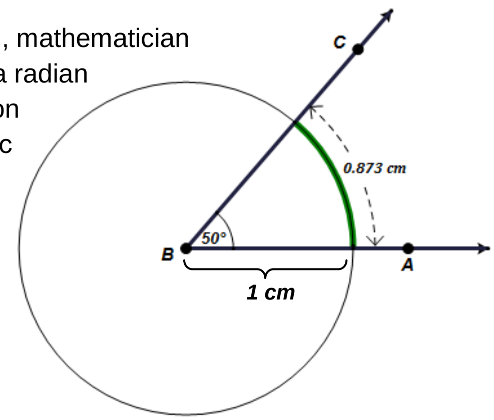


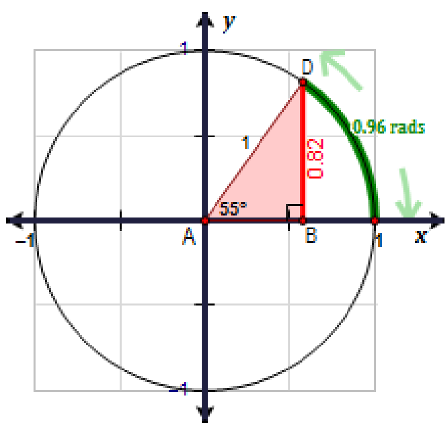
Sec 5.4a –Trigonometry
Sine Wave Origin

Name:

1. The Babylonian Degree method of measuring angles. Around 1500 B.C. the Babylonians are credited with first dividing the circle up in to 360̊. They used a base 60 (sexagesimal) system to count (i.e. they had 60 symbols to represent their numbers where as we only have 10 (a centesimal system of 0 through 9)). So, the number 360 was convenient as a multiple of 60. Additionally, according to Otto Neugebauer, an expert on ancient mathematics, there is evidence to support that the division of the circle in to 360 parts may have originated from astronomical events such as the division of the days of a year. So, that the earth moved approximately a degree a day around the sun. However, this would cause problems as years passed to keep the seasons accurately aligned in the calendar as there are 365.242 actual days in a year. Some ancient Persian calendars did actually use 360 days in their year further supporting this idea.

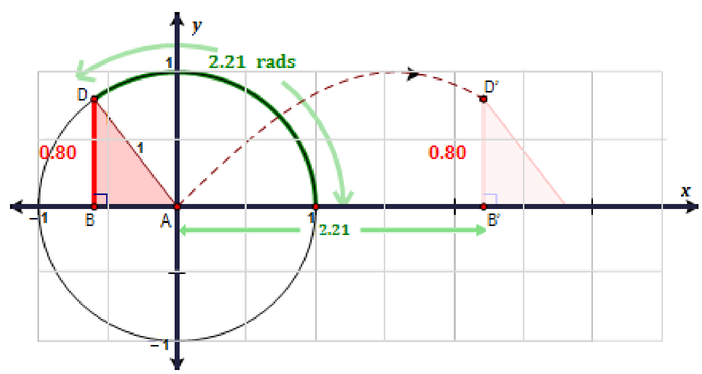
2. The transition to Radian measure of angle: Around 1700 in the United Kingdom, mathematician Roger Cotes saw some advantages in some situations to measuring angles using a radian system. A radian system simply put, drops a unit circle (a circle with a radius of 1) on to an angle such that the center is at the vertex and the length of the intercepted arc is the radian measure. So, a full circle of 360̊ is equivallent to 2π·(1) radians. In the example at the right, an angle of 50̊ is shown. Then, a circle that has a radius of 1 cm is drawn with its center at the vertex. Finally, the intercepted arc length is determined to be approximately 0.873 or more precisely $\frac{5\pi}{18}$ radians.





3. How Right Triangles create a WAVE: First consider a right triangle drawn inside of a unit circle like the one shown at the right. Determine the value of $sin(A)$. Try the example at the right find $sin(55°)$ which is approximately the same as finding $sin(0.96\ rads)$.

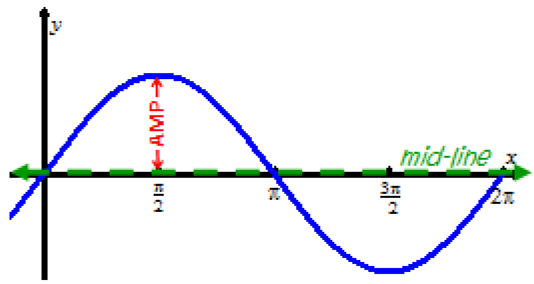
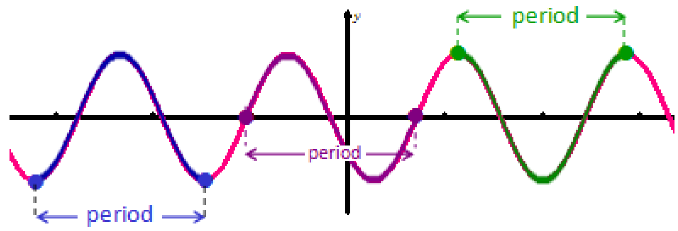
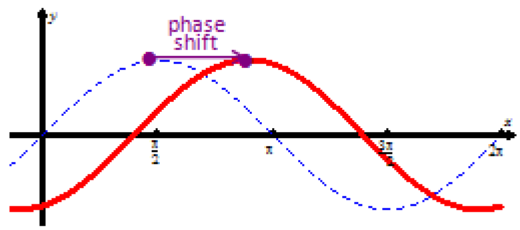
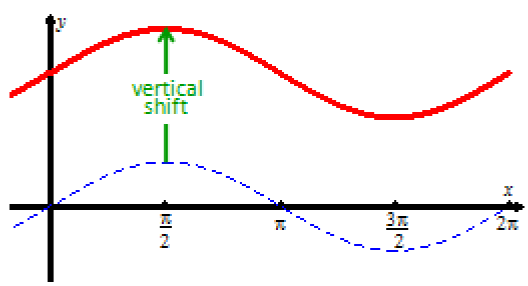
Then, if we plot each of point where x is the measure of the angle of the unit circle in radians and y is value of $sin(A)$ which is essentially the height of the right triangle for the given angle. The resulting locus of points generates a Sine Wave. Below shows several right triangles mapping out a s sine wave.



Sec 5.4b–Trigonometry
Sine Wave Origin

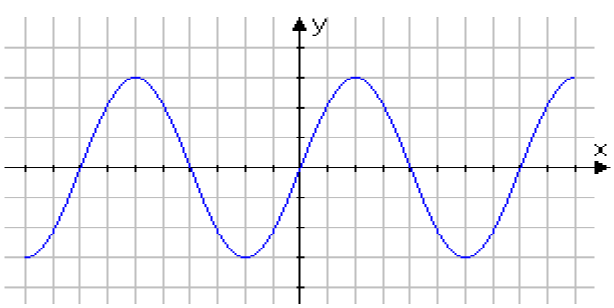
Name:

A Sine Wave is commonly described by 4 components.

Parts of a Sine Wave	Visual
Amplitude: The amplitude of a wave is the distance from the midline to highest point of the wave. (half of the vertical displacement. $\textit{Amplitude} = \frac{(\textit{Highest } Y \ - \textit{Lowest } Y)}{2}$	
Period: The period of the wave is the horizontal distance of one complete cycle. $\textit{Period} = (\textit{Crest } X) - (\textit{Previous Crest } X)$ $\textit{Period} = (\textit{Trough } X) - (\textit{Previous Trough } X)$	
Phase Shift: The amount the wave is shifted right or left $\textit{Phase Shift} = \frac{(\textit{Crest } X) + (\textit{Previous Trough } X)}{2}$	
Vertical Shift: The amount the wave is shifted up or down $\textit{Vertical Shift} = \frac{(\textit{Highest } Y + \textit{Lowest } Y)}{2}$	

1. Find a possible equation of the following graphs.

a.



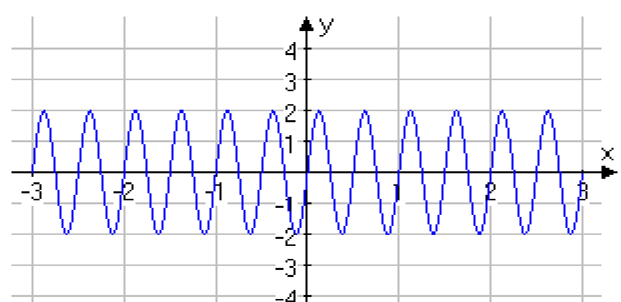
Amplitude =

Period =

Phase Shift =

Vertical Shift =

b.



Amplitude =

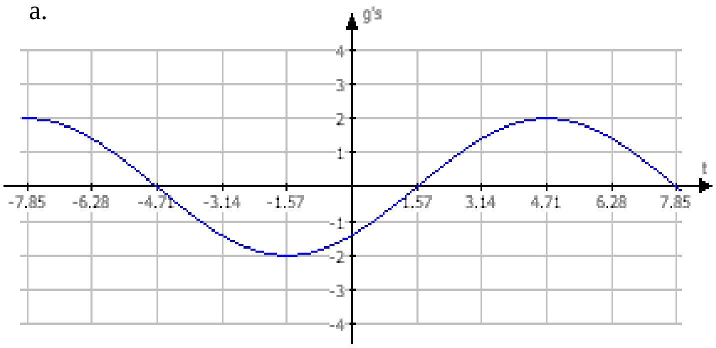
Period =

Phase Shift =

Vertical Shift =

2. Find a possible equation of the following graphs.

a.



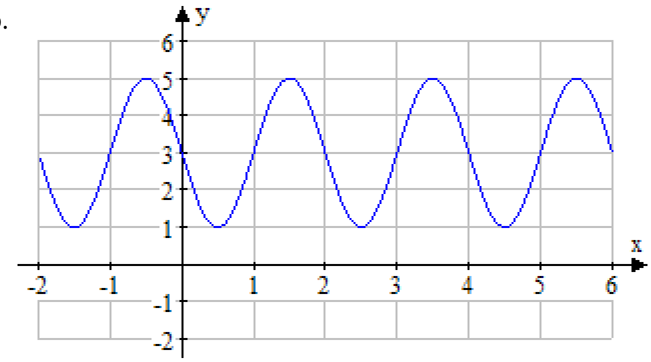
Amplitude =

Period =

Phase Shift =

Vertical Shift =

b.



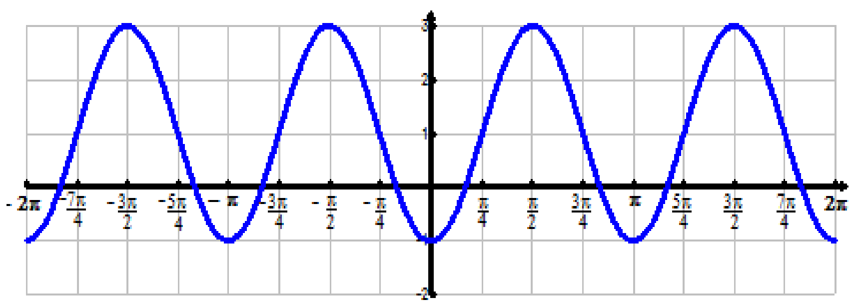
Amplitude =

Period =

Phase Shift =

Vertical Shift =

c.



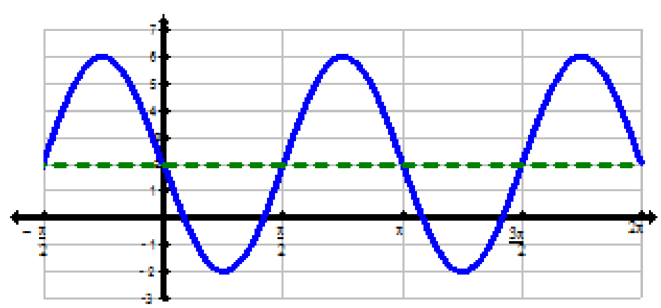
Amplitude =

Period =

Phase Shift =

Vertical Shift =

d.



Amplitude =

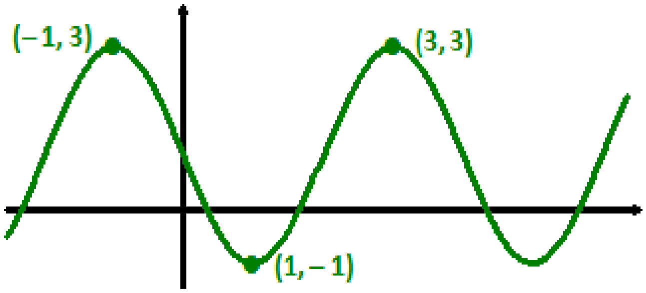
Period =

Phase Shift =

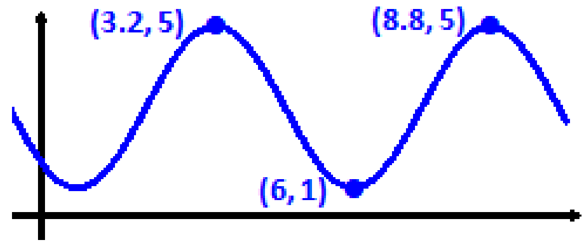
Vertical Shift =

3. Find a possible equation of the following graphs.

a.



b.



Amplitude =

Period =

Phase Shift =

Vertical Shift =

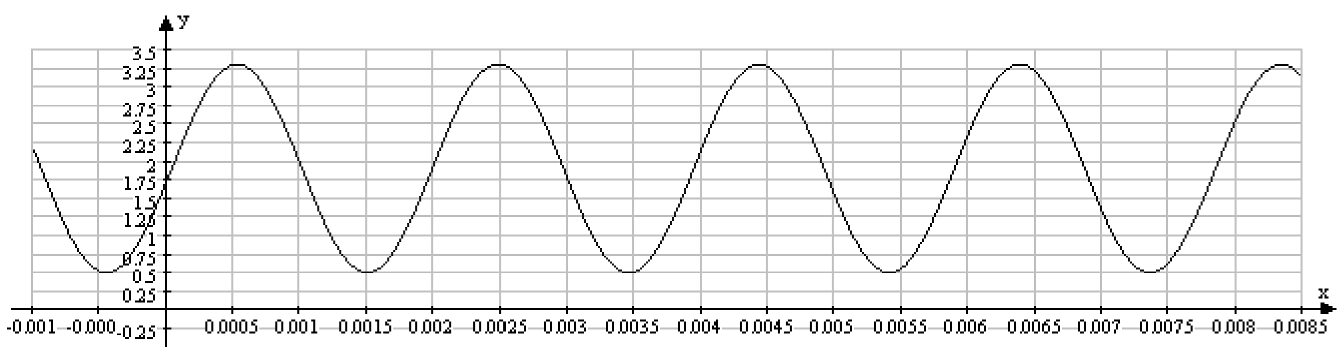
Amplitude =

Period =

Phase Shift =

Vertical Shift =

4. The following is a graph of a tuning fork held up to a CBL microphone.



a. What is the amplitude?

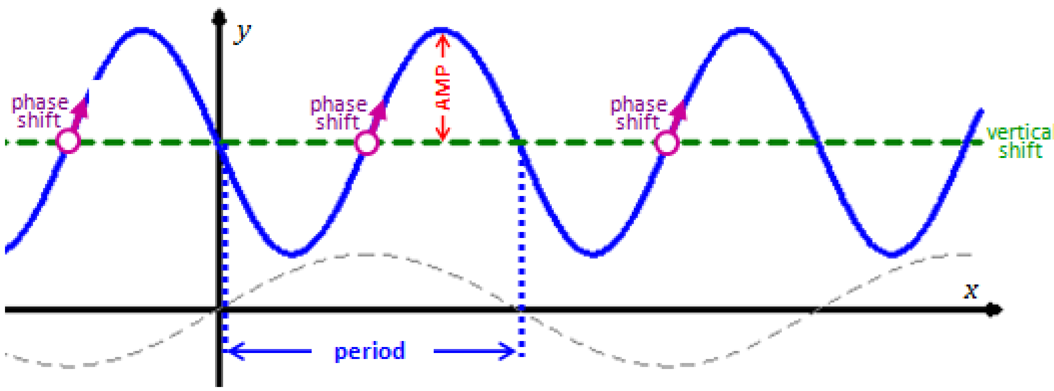
b. What is the Vertical Shift?

c. What is the Period?

d. What is a possible Phase Shift?

Sec 5.4a –Trigonometry
Sine Wave Origin

Name:



$$y = a \cdot \sin(b(x - c)) + d$$

a = Amplitude

$\frac{2\pi}{b}$ = Period

c = Phase Shift

d = Vertical Shift

1. Determine the following parts of the graph described by following equation.

$$\boxed{y = 4\sin(\pi(x-3)) + 5}$$

2. Determine the following parts of the graph described by following equation.

$$\boxed{y = 3\sin\left(\frac{1}{2}\left(x - \frac{3\pi}{2}\right)\right) + 4}$$

Amplitude =

Period =

Phase Shift =

Vertical Shift =

Amplitude =

Period =

Phase Shift =

Vertical Shift =

3. Determine the following parts of the graph described by following equation.

$$y = -5\sin(2x+6)-1$$

Amplitude =

Period =

Phase Shift =

Vertical Shift =

4. Determine the following parts of the graph described by following equation.

$$y = 4\sin(\pi x - 2)+6$$

Amplitude =

Period =

Phase Shift =

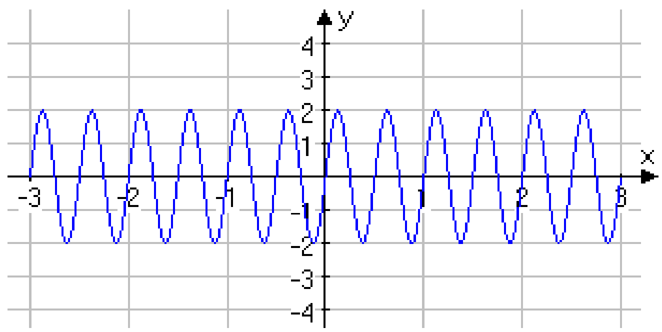
Vertical Shift =

Sec 5.6 –Trigonometry
Sine Wave Graphing

Name:

1. Find a possible equation of the following graphs.

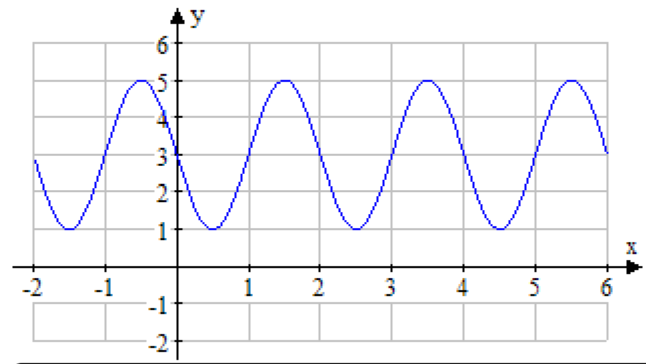
a.



Amp = Per = Phase shift = Vert. Shift =

Equation as a Sine Wave:

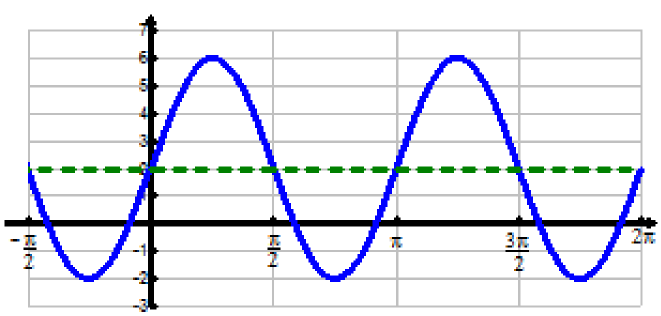
b.



Amp = Per = Phase shift = Vert. Shift =

Equation as a Sine Wave:

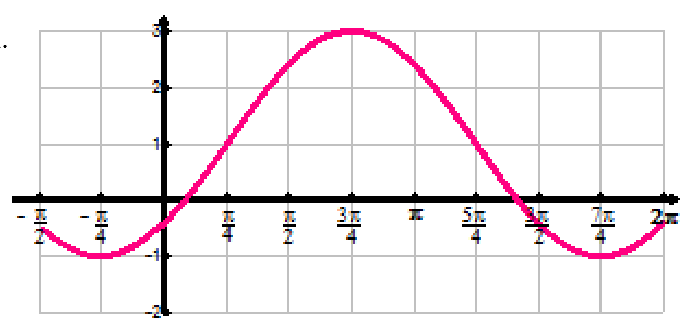
c.



Amp = Per = Phase shift = Vert. Shift =

Equation as a Sine Wave:

d.

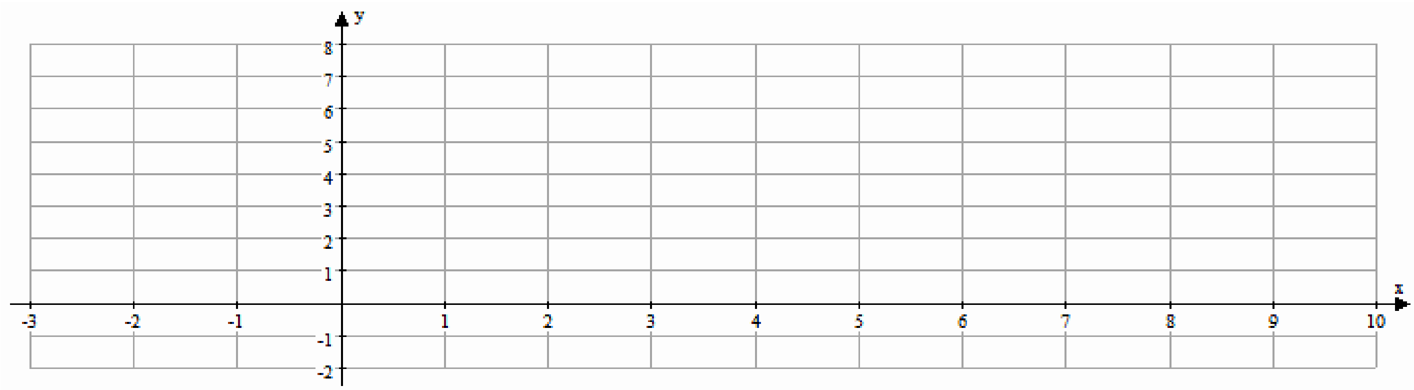


Amp = Per = Phase shift = Vert. Shift =

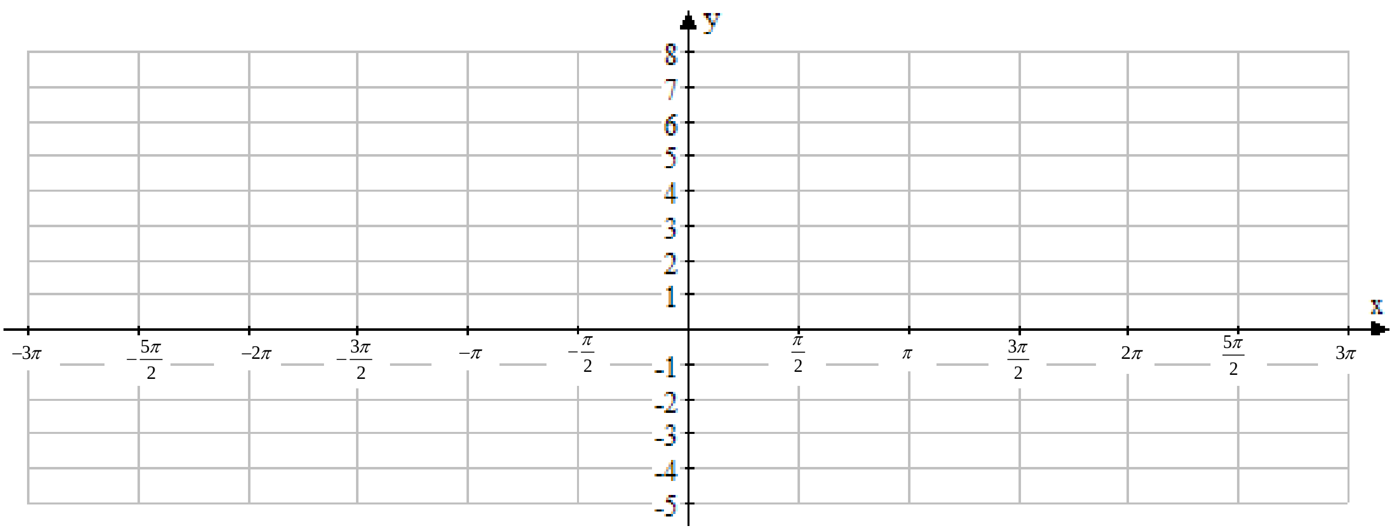
Equation as a Sine Wave:

2. Graph the following equation.

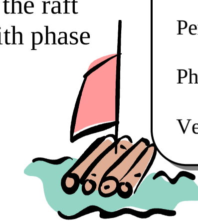
a.
$$y = 2\sin\left(\frac{\pi}{2}(x-3)\right)+5$$



b.
$$y = 3\sin\left(\frac{1}{2}\left(x-\frac{3\pi}{2}\right)\right)+4$$



3. The Coast Guard observes a raft floating on the water bobbing up and down a total of 8 feet. Beginning at the top of the wave, the raft completes a full cycle every 5 seconds. Write an equation with phase shift 0 to represent the height of the raft after t seconds.



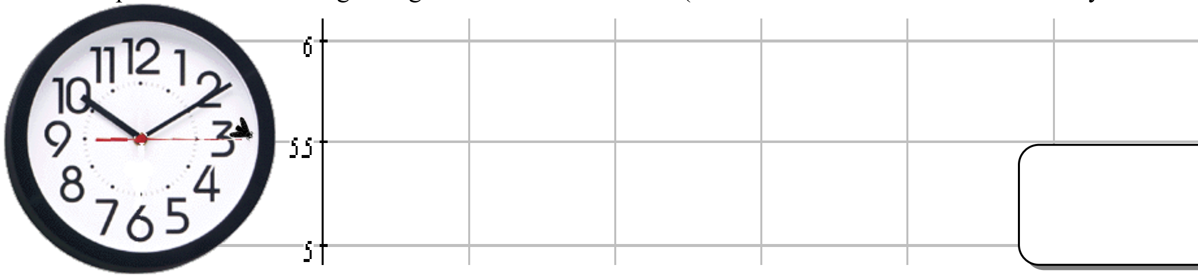
Amplitude =

Period =

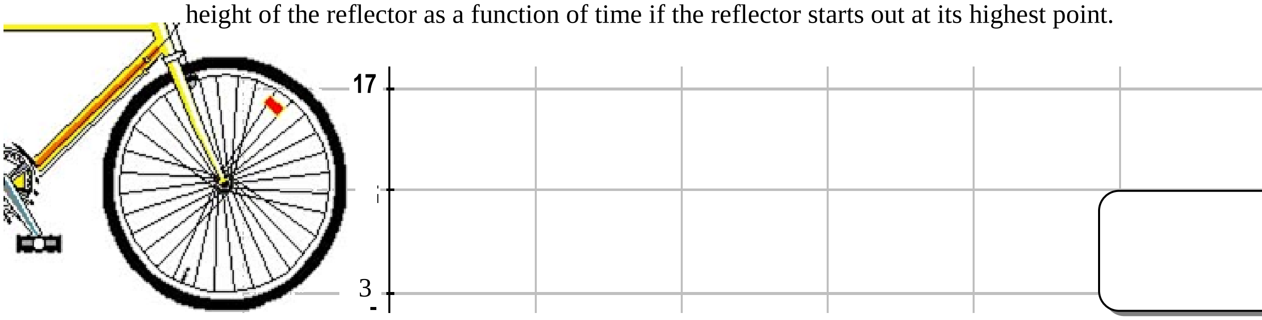
Phase Shift =

Vertical Shift =

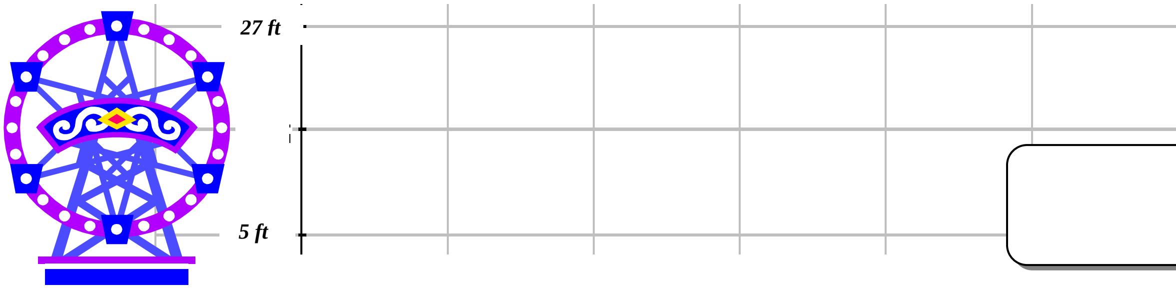
4. An insect is stuck on the very tip of a second hand of a wall clock for a couple of minutes. The tip of the second hand is 5 feet above the floor at its lowest point and 6 feet above the floor at its highest. The bug landed on the second hand at exactly 15 seconds after 10:10 pm. Describe the bug's height as a function of time. (remember a second hand takes exactly 60 seconds to complete a full cycle)



5. A reflector on a bicycle tire is going around with a bike tire one complete revolution every 0.4 seconds. At its highest point the reflector is 17 inches off the ground. At its lowest point it 3 inches of the ground. Write an equation that describes the height of the reflector as a function of time if the reflector starts out at its highest point.

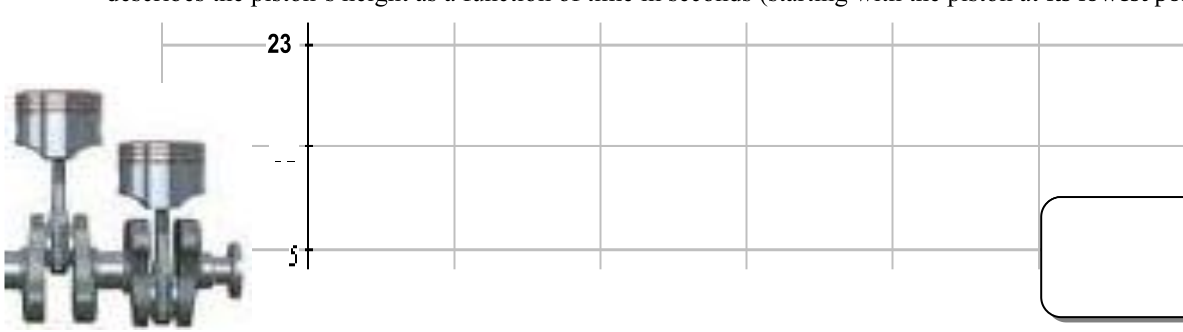


6. A person gets on a Ferris wheel that starts off 5 ft above ground and at its highest is 27 ft above ground. If the Ferris wheel completes a full rotation in 40 seconds. The person <u>starts</u> at the bottom. Write an equation that describes the height of the rider as a function of time.



7. A sewing machine needle is bouncing up and down between 3 and 2 inches off the table. If the needle completes a full cycle every 1 second and begins at the top of a cycle then write an equation that describes the height of the needle as a function of time in seconds.

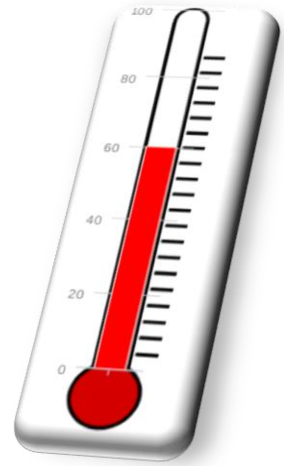
8. A piston inside of an engine turns a crank shaft at 2000 times a second or once every .0005 seconds. The top of the piston is 20 inches above the ground at its lowest point and 23 inches above ground at its highest point. Create a function that describes the piston's height as a function of time in seconds (starting with the piston at its lowest point)



9. The average high temperature of a day in Atlanta can be modeled by the equation:

$$T = 20sin\big(0.017(d + 1.816)\big) + 69$$

'***T***'represents the temperature in Fahrenheit and '***d'*** is day number of the year (e.g. Feburary 2nd would be day 33)

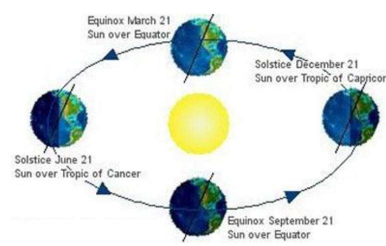


a. Using the model what is the average high temperature on February 28th?

b. Using the model what is the lowest high temperature of the year?

c. Using the model what is the highest high temperature of the year?

10. The number of minutes of sun each day in Louisiana can modeled by the equation:



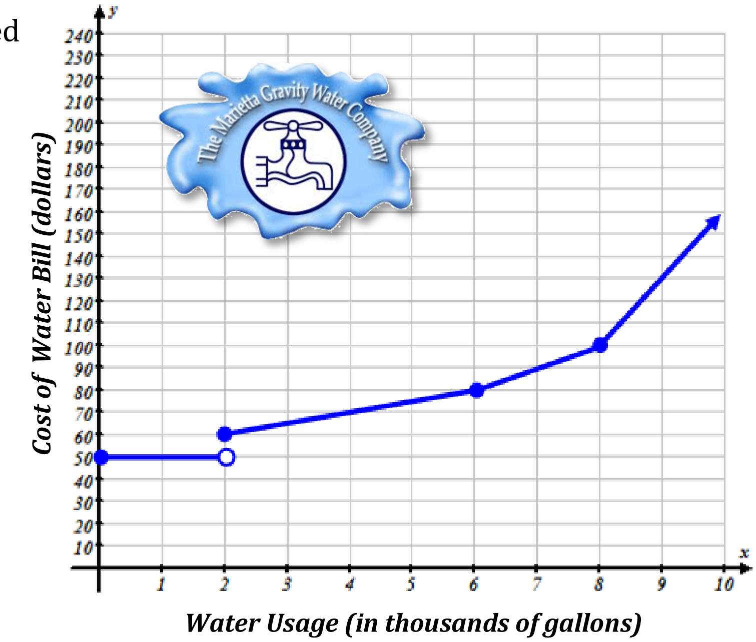
$$M = 113.3sin\big(0.017(d + 1.319)\big) + 727$$

'***M'*** represents the number of minutes of sunshine each day and '***d'*** is day number of the year (e.g. Feburary 2nd would be day 33)

a. Using the model how many minutes of sunshine should there be on February 28th?

b. Using the model how many minutes of sunshine are there on the longest day?

1. A city water company charges homeowners based on how much water they use in thousands of gallons. The company progressively charges at a higher rate the more water that is used.



   a. Based on the graph at the right how much does the city charged when a home owner uses the following number of gallons of water:

      1700 gallons of water costs ________________.

      2000 gallons of water costs________________.

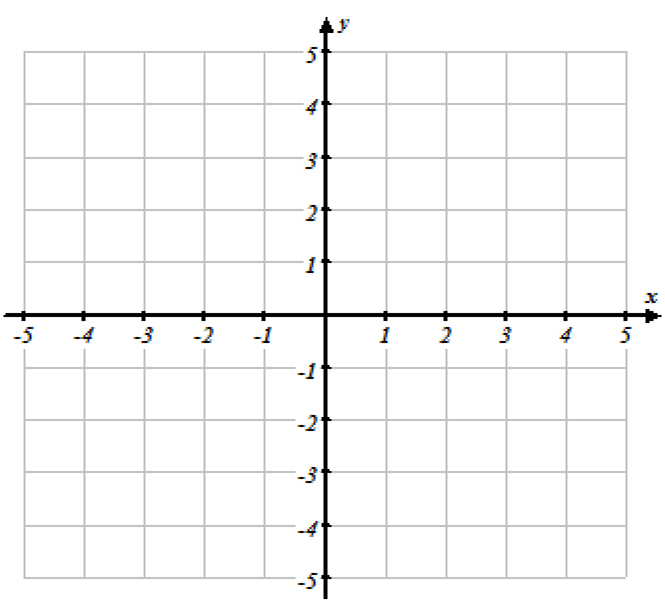
      7000 gallons of water costs________________.

   b. Finish filling in the following piece-wise equation below that describes the chart based on the graph:

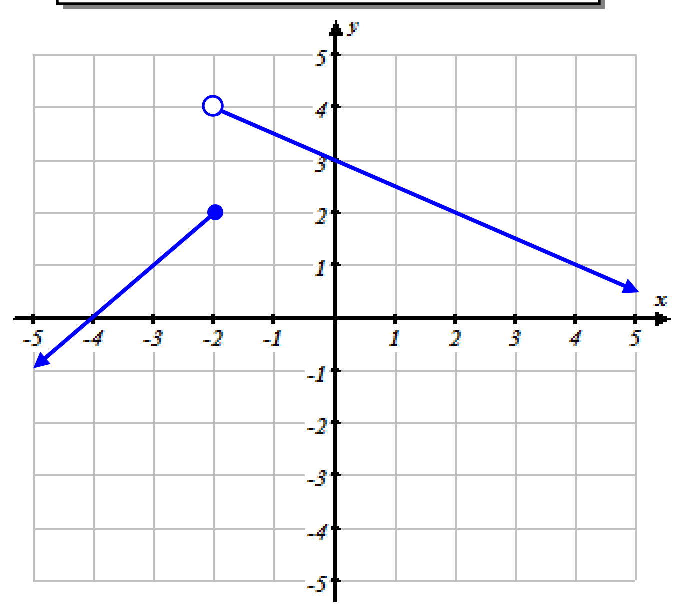
$$y = \begin{cases} 50 & if\;\; 0 \le x < 2 \\ 5x + 50 & \boxed{\phantom{if\;\; 0 \le x < 2}} \\ \boxed{} & if\;\; 6 \le x < 8 \\ 30x - 140 & \boxed{\phantom{if\;\; 0 \le x < 2}} \end{cases}$$

2. Graph the following piece-wise graph

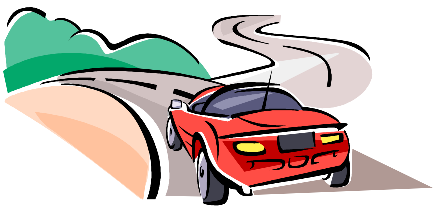
$$y = \begin{cases} -x + 1, & x \le 1 \\ 2x - 3. & x > 1 \end{cases}$$

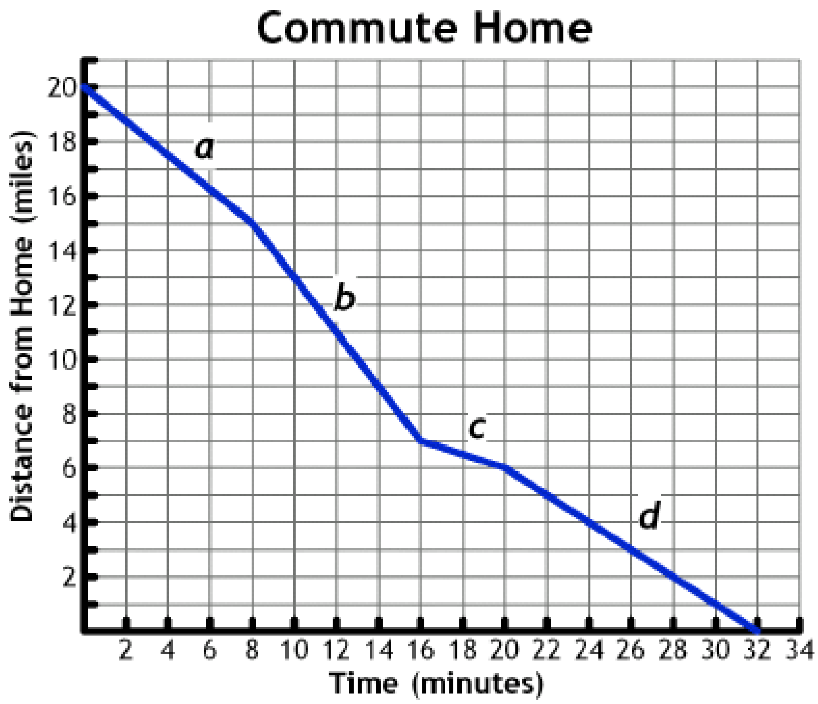


3. Determine the equation for the following piece-wise graph.



Mrs. Washington lives 20 miles from her office and drives her car to and from work every day. The graph below shows her distance from home over time as she drove home from work one day.





4. Write a dependency statement expressing the relationship between the two variables, distance and time.

Segment	Slope	Equation of Line	Domain	Range
a				
b				
c				
d				

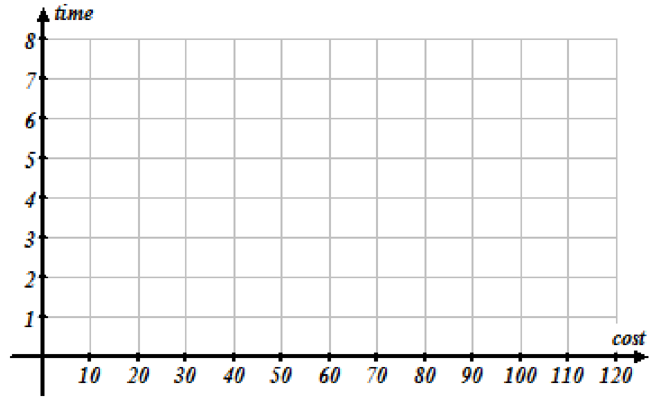
5. What does the slope of a line segment represent in the context of this situation?

Sec 5.8 – Trigonometry & Regression
Linear Regression Models

Name:

1. Create a scatter plot and approximate a trend line of best fit based on the data below

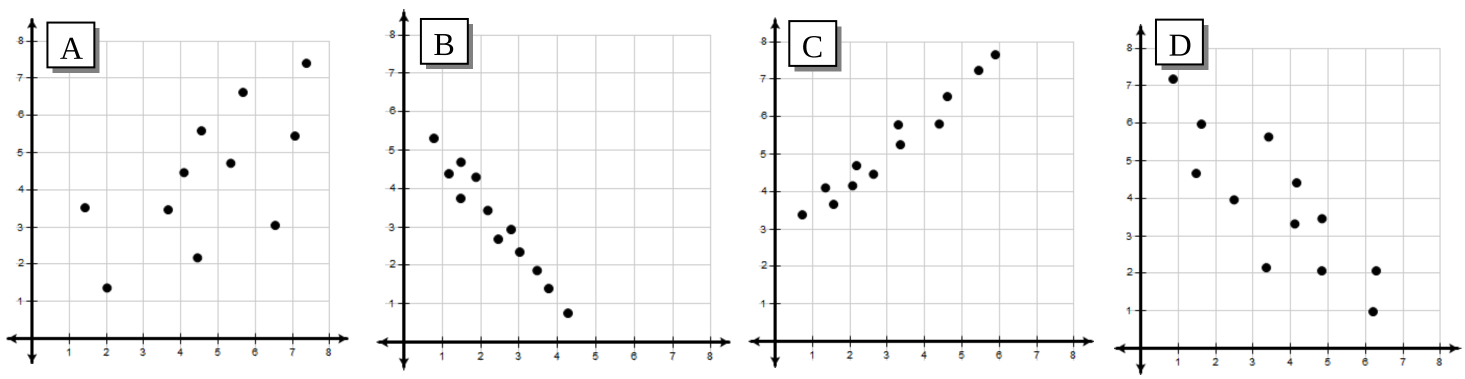
Model	Cost of Car	0-60 mph acceleration
Scion xB	\$16 K	7.8 sec
Mitsubishi Eclipse	\$24 K	6.1 sec
Chev. Corvette	\$106 K	3.4 sec
Nissan GT-R	\$76 K	3.5 sec
SSC Ultimate Aero	\$42 K	4.8 sec
Lotus Elise	\$60 K	4.4 sec
Honda Civic Si	\$22 K	6.7 sec



Using your trend line, predict the 0-60 time for a car that costs \$120 K?

2. Consider the following scatter plots:

______strong positive correlation ______weak positive correlation _______strong negative correlation ______weak negative correlation



3. Consider the following situations. Determine whether you think they have a **positive** or **negative** correlation.

________________a. Usually as a car increases in age, its value decreases.

________________b. Usually the more hours that a person works the larger their paycheck.

________________c. Usually the younger a child is, the smaller their height.

________________d. Usually the longer you use a smart phone, the amount of battery life decreases.

4. Consider the following situations and answer the following **True** or **False** Questions.

A researcher noticed a relatively strong positive correlation between a student's score on the SAT and their GPA at the high school they attend.

________________a. If one student has one of the lower SAT scored at one high school then they probably have one of the higher GPA's at their school.

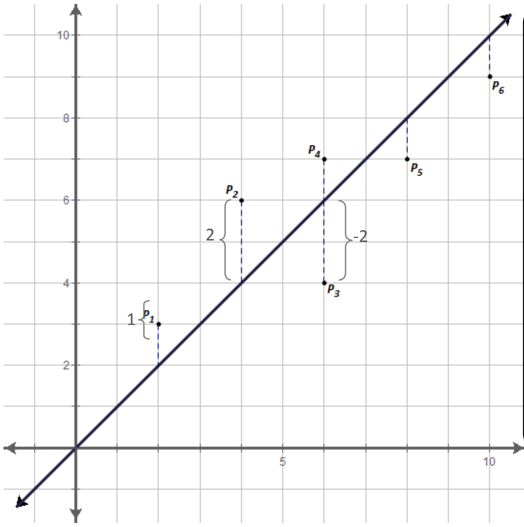
________________b. If one student has the highest SAT score at one high school then they must have the highest GPA at their high school too.

________________c. If one student has one of the higher SAT scores at one high school then they probably have one of the higher GPA's at their school.

5. Most trend lines that are considered to be a "good fit" will be balanced such that the total **RESIDUAL** above and below the trend line is equal. **RESIDUAL** can be defined as the difference between the actual value (y) and expected value $(\hat{y})$. A more succinct definition, **RESIDUAL** can be described as the vertical distance each data point is away from the trend line (with signed difference for above and below the trend line).

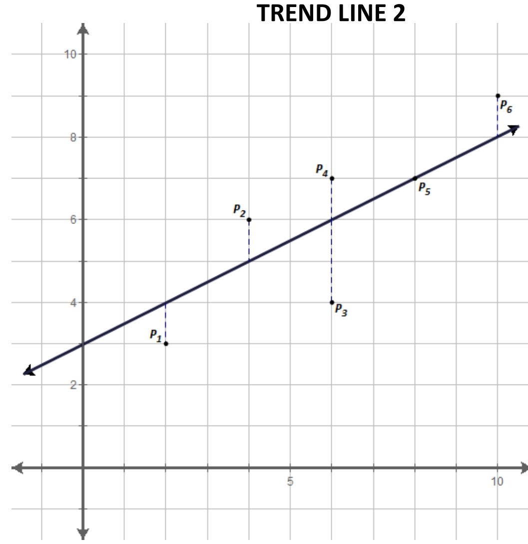
Find the **RESIDUAL**s for each of the TREND LINES below (the SCATTER PLOT is the **same** in each graph).

TREND LINE 1



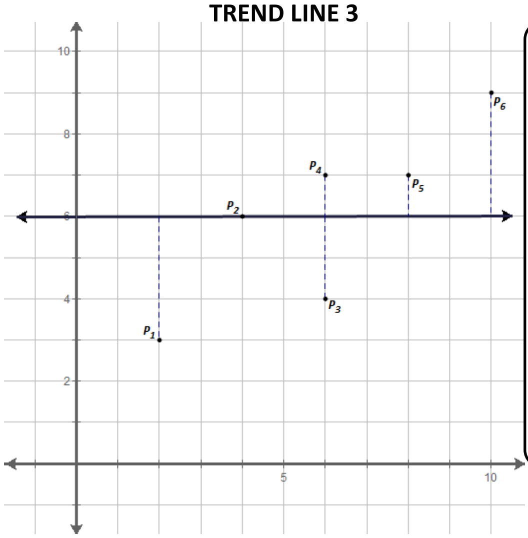
Data Point	*Residual*
P_1	1
P_2	2
P_3	−2
P_4	
P_5	
P_6	
Sum of Residuals	

TREND LINE 2



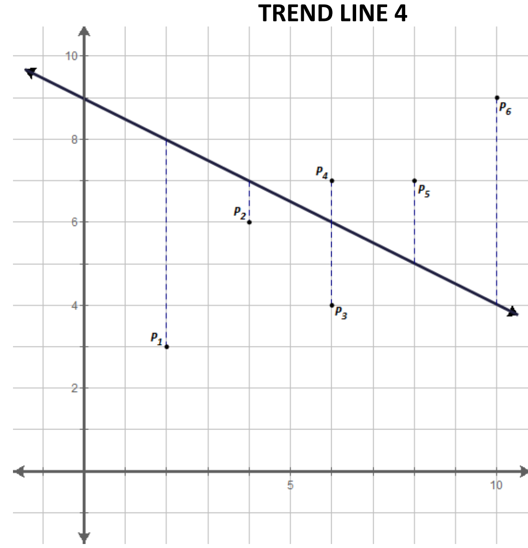
Data Point	*Residual*
P_1	
P_2	
P_3	
P_4	
P_5	
P_6	
Sum of Residuals	

TREND LINE 3



Data Point	*Residual*
P_1	
P_2	
P_3	
P_4	
P_5	
P_6	
Sum of Residuals	

TREND LINE 4



Data Point	*Residual*
P_1	
P_2	
P_3	
P_4	
P_5	
P_6	
Sum of Residuals	

6. What do all 4 trend lies above have in common? *(optional: what is the approximate residual of your trend line from earlier)*

7. To better analyze which trend line is best, it is common to consider comparing the sum of the squares of the residuals. Which trend line do you think is the best based on this new information? Is it the one you expected?

TREND LINE 1

Data Point	*Residual*	*Residual Squared*
P_1	1	1
P_2	2	4
P_3	−2	4
P_4		
P_5		
P_6		
Sum		

TREND LINE 2

Data Point	*Residual*	*Residual Squared*
P_1		
P_2		
P_3		
P_4		
P_5		
P_6		
Sum		

TREND LINE 3

Data Point	*Residual*	*Residual Squared*
P_1		
P_2		
P_3		
P_4		
P_5		
P_6		
Sum		

TREND LINE 4

Data Point	*Residual*	*Residual Squared*
P_1		
P_2		
P_3		
P_4		
P_5		
P_6		
Sum		

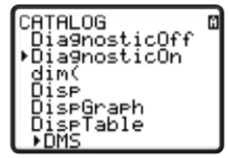
8. The line that minimizes the squares is called the LEAST SQUARES REGRESSION LINE. Most scientific calculators are capable of determining the equation of this trend line. Consider again the data about the cars. **The following are the directions for the TI-83/84:**

Model	**Cost of Car**	**0-60 mph acceleration**
Scion xB	\$16 K	7.8 sec
Mitsubishi Eclipse	\$24 K	6.1 sec
Chev. Corvette	\$106 K	3.4 sec
Nissan GT-R	\$76 K	3.5 sec
SSC Ultimate Aero	\$42 K	4.8 sec
Lotus Elise	\$60 K	4.4 sec
Honda Civic Si	\$22 K	6.7 sec

1) First, it will be helpful to turn on additional diagnostic information in your calculator.

CATALOG — SCROLL DOWN TO DianosticOn

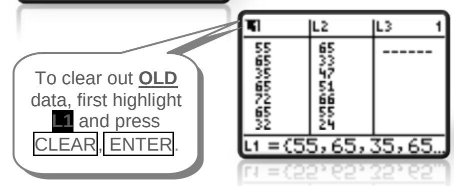
2nd 0 ⌄ ⌄ .... ⌄ ⌄ ENTER ENTER



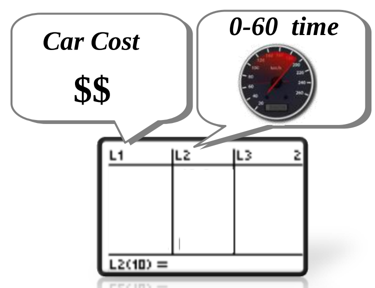
2) Under the Stat menu, press STAT 5 ENTER.
(This just resets the list menus)

3) Next, press STAT ENTER

4) If there is OLD data already in the lists that needs to be cleared press the up arrow, ⌃, to highlight L1 and then press CLEAR ENTER to clear out the old data. Do the same for L2 if it has OLD data that needs to be cleared.



5) Next, enter the Cost of the Car in L1 and the 0-60 mph time in L2.



6) Return to the home screen by pressing 2nd MODE and then to calculate the linear regression press STAT 〉 4 ENTER.

7) This represents the an equation of a line that minimizes the total residuals squared.

Fill in the blanks to complete the LEAST SQUARES REGRESSION LINE equation.

y = ______________ ·**x** + __________________
a b

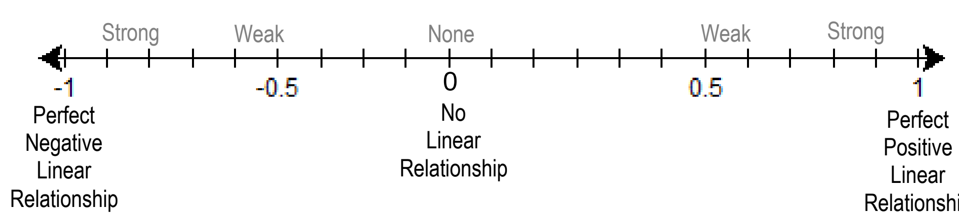
Use this equation to reattempt your prediction of how fast a car can go from 0-60mph that costs \$120 K

y = ______________ ·**(120)** + ______________ =
a b

9. When a prediction is made between two given data points the prediction is called an **INTERPOLATION**. When a prediction is made outside the range of given data points the prediction is an **EXTRAPOLATION**. Which type of prediction was used when you predicted the 0 – 60 mph time of a car that cost \$120 K?

10. A calculation called the **correlation coefficient (r)** is used to measure the extent to which the data for the two variables show a linear relationship. The closer the value is to 1 or –1 the stronger the linear relationship. Describe the relationship of the car data.

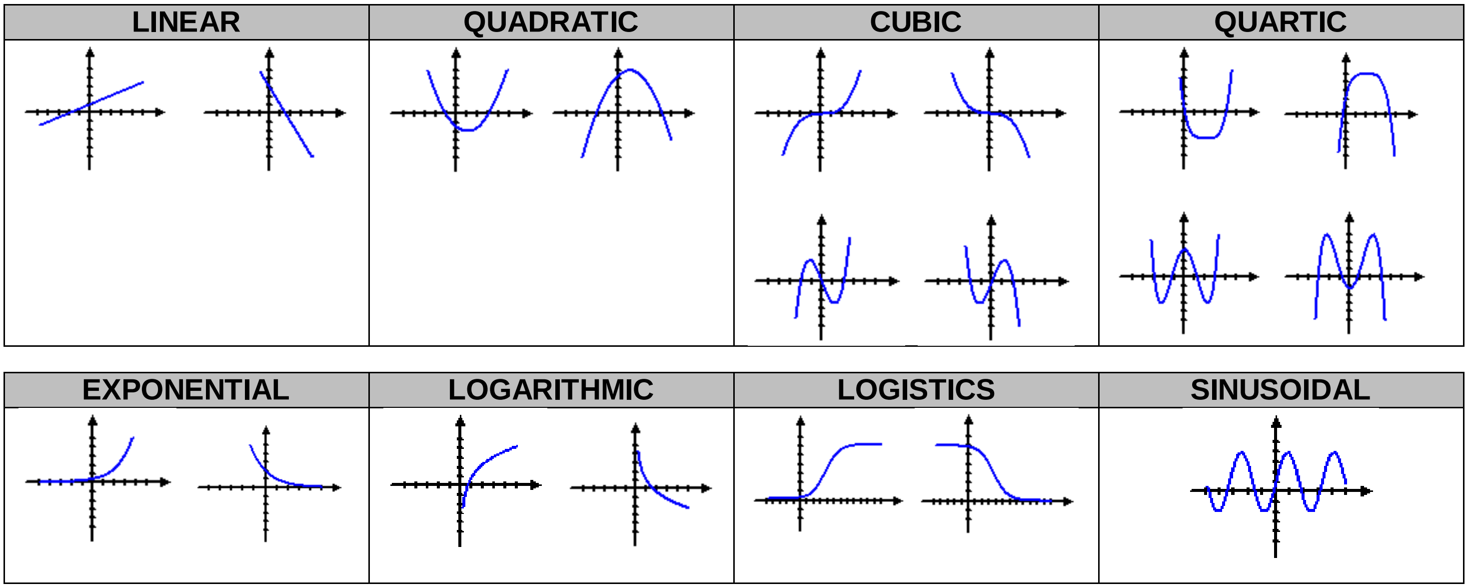
r:



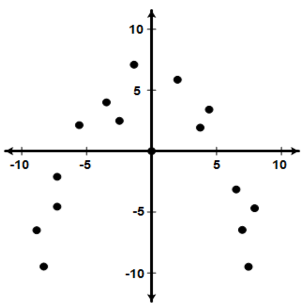
Sec 5.9 – Trigonometry & Regression
Other Regression Models

Name:

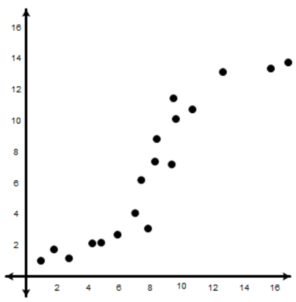
Common Function Models:



1. Which model do you think is the most appropriate for the following data sets?

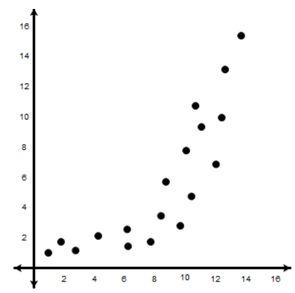


Model:

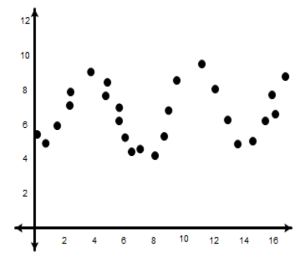


Model:

Model:



Model:



Model:

2. Determine which model would be best for each of the following data sets and then determine an equation.

x	1	2	3	4	5	6	7	8	9	10
y	1	1.5	2	3	7	12	15	16	16.5	16.6

Model:

Equation:

x	1	2	3	4	5	6	7	8	9	10
y	- 9	- 2	3	5	6	6.1	5.5	2	- 1	-7

Model:

Equation:

Make a graph of the data on your calculator and on the grid.

i. Press STAT ENTER

ii. If there is OLD data already in the lists that needs to be cleared press the up arrow, ⌃, to highlight L1 and then press CLEAR ENTER to clear out the old data. Do the same for L2 if it has OLD data that needs to be cleared.

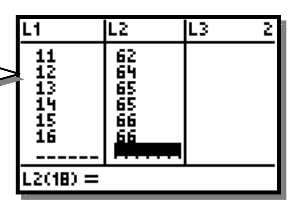
iii. Next, enter all of the data in L1 and L2.

iv. After entering the data, press 2nd Y= ENTER and select all of the options shown in the screen at the right. To do this move the cursor to the appropriate option (On , ▪▪▪ , ▫)and press ENTER. To change the Xlist to L_1 if needed move the cursor to Xlist and press 2nd 1 and to the Ylist and press 2nd 2 .

v. Finally, press ZOOM 9. To make further adjustments to the graph window press WINDOW .

vi. Additionally, you can type the equation you calculated earlier in the Y= to see the scatter plot and regression equation

Enter the data from the chart into L1 and L2

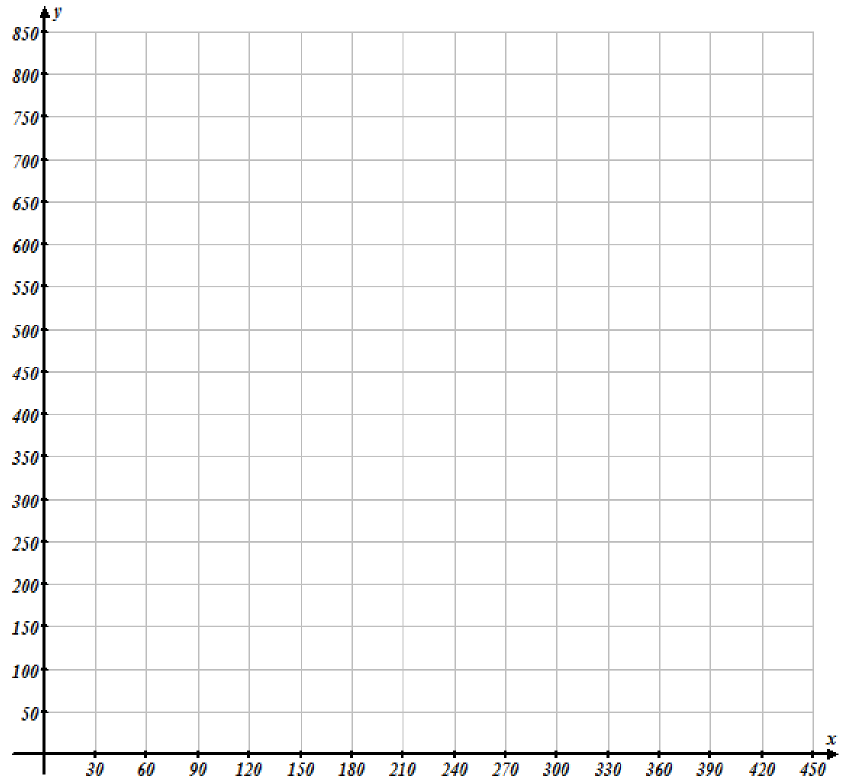


Select each of the following options by moving your cursor to each and Pressing ENTER.

3. Make a scatter plot of the length of daylight by day number for Houston on the blank grid.

(Length of Daylight for Cities). To make the graph easier, make January 1 = Day 1 and December 31 = Day 365. In addition, graph the length of daylight in terms of minutes.

Date	Day Number	Houston	
		HH:MM	Min.
Jan. 1	1	10:17	617
Feb. 1	32	10:48	648
March 1	60	11:34	694
Apr. 1	91	12:29	749
May 1	121	13:20	800
June 1	152	13:57	837
July 1	182	14:01	841
Aug. 1	213	13:33	813
Sept. 1	244	12:45	765
Oct. 1	274	11:52	712
Nov. 1	305	11:00	660
Dec. 1	335	10:23	623



a. Continue plotting data points for the second year as they would repeat beginning with the first day of the second year of 366 would again have the length of a day of 617 minutes (Day 397, 648 min)

b. Which mathematical model would be most appropriate?

c. Enter the data into the stat lists of your graphing calculator. Use the calculator to make a scatter plot of the length of daylight by day number for Houston.

vii. Under the Stat menu, press [STAT] [5] [ENTER]. *(This just resets the stat menu.)*

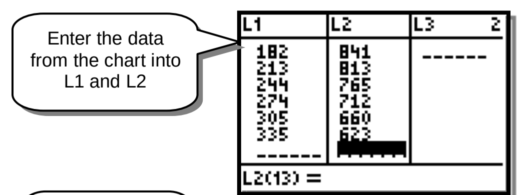
viii. Press [STAT] [ENTER]

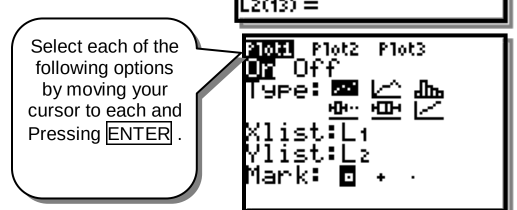
ix. If there is OLD data already in the lists that needs to be cleared press the up arrow, [▲], to highlight L1 and then press [CLEAR] [ENTER] to clear out the old data. Do the same for L2 if it has OLD data that needs to be cleared.

x. Next, enter all of the day numbers in L1 and the day lengths in L2.

xi. After entering the data, press [2nd] [Y=] [ENTER] and select all of the options shown in the screen at the right. To do this move the cursor to the appropriate option (On, scatter, □)and press [ENTER]. To change the Xlist to L_1 if needed move the cursor to Xlist and press [2nd] [1] and to the Ylist and press [2nd] [2] .

xii. Finally, press [ZOOM] [9]. To make further adjustments to the graph window press [WINDOW] .

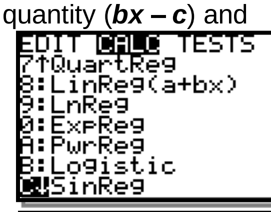


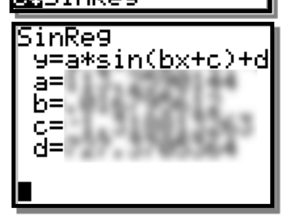


d. Use your calculator to generate a sinusoidal regression model. Record the equation (round values to the nearest hundredth) in the Summary Table at the end of this activity sheet. Factor the value of ***b*** from the quantity (***bx*** – ***c***) and include that form of the equation as well.

Return to the home screen by pressing [2nd] [MODE] and then to calculate the **Sinusoidal** regression press [STAT] [▶] [▼] [▼] [▼] [▼] [▼] [▼] [▼] [▼] [▼] [▼] [▼] [ENTER] [ENTER].

Scroll down to choice "C:SinReg"





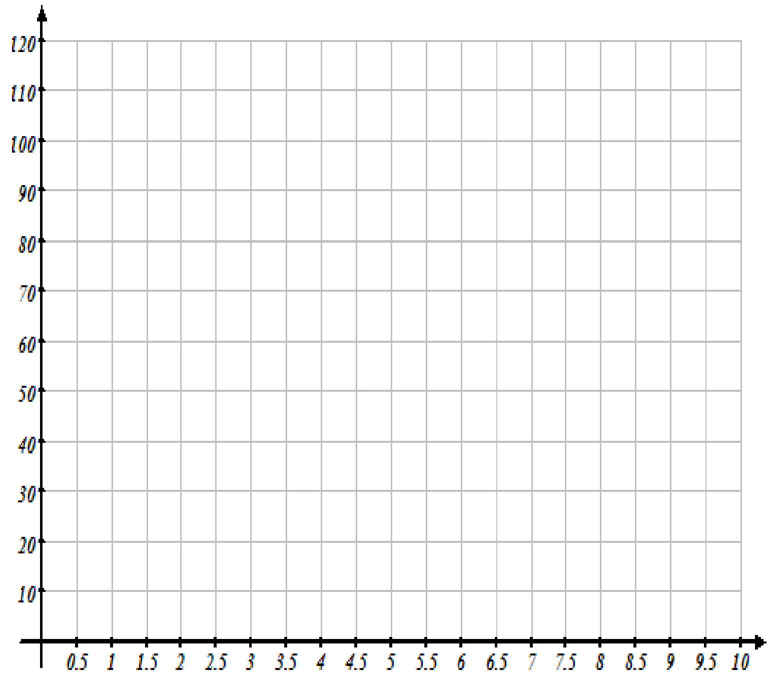
$$y = \underset{a}{\underline{\qquad}}\,\sin(\underset{b}{\underline{\qquad}}\,x + \underset{c}{\underline{\qquad}}) + \underset{d}{\underline{\qquad}}$$

e. Based on the model predict the length of day 185 (The 4th of July).

4. A company in California is test marketing a new line of lipsticks. The lipstick only costs the company \$0.90 to make due to the volume production. The company located several different cities with approximately the same demographics and sold the exact same lipstick at different prices. They wanted to know which price would yield the largest profit. The following table shows the prices at which they were sold and the number sold at that price over a period of 3 months.

Cost	\$3.00	\$4.00	\$5.50	\$7.00	\$8.50	\$10.00
Number Sold	19	59	91	117	101	48

a. Make a Scatter Plot.



b. Draw a trend line or curve if more appropriate.

c. What type of association does the data show? (Is it linear?)

d. Explain why you think the data looks the way it does.

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e. The TI-83/84 is capable of calculating quadratic, cubic, and quartic regression equations. Determine an appropriate regression model using the data.

f. According to your model, what might be the suggested number sold if the store charges \$9?

g. According to your model, what might be the suggested number sold if the store charges \$12?

h. What constraints should be put on your model?

5. A rancher has decided to dedicate a 400-square-mile portion of his ranch as a black bear habitat. Working with his state, he plans to bring 10 young black bears to the habitat in an effort to grow the population. His research shows that the annual growth rate of black bears is about 0.8. Black bears thrive when the population density is no more than about 1.5 black bears per square mile.

After bringing the initial 10 bears. The researcher noticed the following population growth:

Year	1995	1996	1997	2000	2002	2003	2004	2005	2007	2008	2010	2011	2012
Years after 1995	0	1	2	5	7	8	9	10	12	13	15	16	17
Number of Bears	10	18	30	148	302	391	465	515	575	580	595	597	598

a. Which model would be best?

b. Determine a regression model using the calculator.

c. What appears to be the maximum population of bears? (Hint: just predict the number of bears far off in to the future and see if it levels out. You could predict the number of bears in 2055 where x = 60)