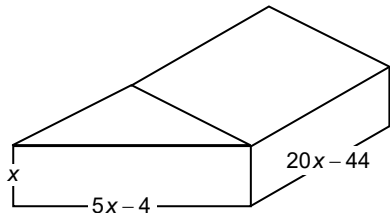Algebra 2H
WS 07.X- Greenhouse and Box

The "lower portion" of the greenhouse shown has a volume of 528 cubic yards. It has a height of x yards, a width of $5x-4$ yards, and a length of $20x-44$ yards.

1. Write an equation, set equal to zero, that will allow you to solve for x.
2. Solve the equation for x.
3. What are the dimensions of the greenhouse?
4. Suppose the "lower portion" of your greenhouse has a volume of 609 cubic yards, and dimensions of x yards high, $12x-29$ yards wide, and a length of $12x-7$ yards long. What would its dimensions be?

You are designing an open-topped box to be made from a piece of cardboard that is 8 inches by 12 inches. The box will be formed by cutting a square from each corner and folding up the flaps. You want the box to have the greatest volume possible.

5. Write an equation representing the dimensions of the box.
6. What should the length the side of the square cut from each corner?
7. What volume does that produce?
8. What are the dimensions of the box?


Algebra 2H
WS 07.X- Aquarium

The Tennessee Aquarium in Chattanooga, Tennessee, is the largest freshwater aquarium in the world with 450,000 gallons of water in 24 exhibits. The 130,000 square feet of the aquarium are home to more than 9000 creatures. An interesting fact is that over half a million crickets, about 400,000 worms, and 15,000 pounds of seafood are devoured by the aquarium's wildlife each year.

1. How many gallons of water, on average, does each exhibit in the aquarium have?

Suppose the Tennessee Aquarium is opening a new saltwater exhibit that will have tropical fish from around the world. Some of the rectangular aquariums being ordered are described below.

2. Aquarium 1 (180-Gallon Tank): The aquarium has a length of x inches, a height and width that are both 48 inches less than the length, and a volume of 41,472 cubic inches. Write a polynomial to describe the volume of the aquarium. Then find its dimensions.
3. Aquarium 2 (300-Gallon Tank): The aquarium has dimensions of x feet long, x - 6 feet wide, and x - 5.5 feet high. The volume of the aquarium is 40 cubic feet. Write a polynomial to describe the volume of the aquarium. Then find its dimensions.

Algebra 2H
WS 7.7-7.8- Factored Form and Rational Root Theorem

1. Refer to the following graphs:
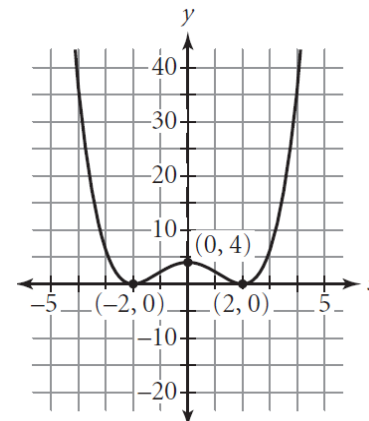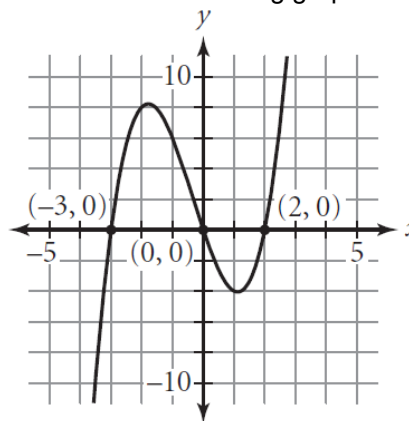
a. Identify the zeros of each graph.
b. Identify the y-intercept of each graph.
c. Identify the lowest possible degree of each graph.
d. Write the factored form of each graph.

2. Write a polynomial function which has a double root at $x=3$, a root at $x=-4$, and has a y-intercept of $(0,-54)$.

3. Write a polynomial function with a solution of $x=-3i$ and $x=6$ that passes through the point $(1,-125)$.

4. Factor each polynomial without the use of your calculator
a. $y=x^3-6x^2+5x+12$
b. $y=6x^3+17x^2+6x-8$
c. $y=x^3-3x^2-9x-5$

CRYPTIC QUIZ

1. What do you call a skydiver with the flu?

$$\underline{}_{3} \ \underline{}_{12} \ \underline{}_{7} \ \underline{}_{10} \ \underline{}_{12} \ \underline{}_{6} \ \underline{}_{11} \ \underline{}_{9} \ \underline{}_{2} \ \underline{}_{10} \ \underline{}_{8}$$

2. How do you crash a houseboat party?

$$\underline{}_{7} \ \underline{}_{10} \ \underline{}_{12} \ \underline{}_{8} \ \underline{}_{11} \ \underline{}_{3} \ \underline{}_{1} \ \underline{}_{14} \ \underline{}_{13} \ \underline{}_{5} \ \underline{}_{8} \ \underline{}_{5} \ \underline{}_{6} \ \underline{}_{4} \ \underline{}_{1}$$

Simplify each expression below. Find your answer in the answer column and notice the letter next to it. Each time the exercise number appears in the code, write this letter above it.

Answer column (top group):

$$\text{(F)} \quad -(c + 2d)$$
$$\text{(C)} \quad c - d$$
$$\text{(M)} \quad c - 2d$$
$$\text{(K)} \quad \frac{c - 3}{c + 8}$$
$$\text{(B)} \quad \frac{3c}{3c - d}$$
$$\text{(S)} \quad \frac{c + d}{5}$$
$$\text{(T)} \quad \frac{c + 6}{7(c + 1)}$$
$$\text{(G)} \quad \frac{cd}{c - 4d}$$
$$\text{(U)} \quad \frac{5c^2}{c + 7}$$

Exercises (top group):

$$\text{(8)} \quad \frac{6 - 5c - c^2}{7c^2 - 7}$$
$$\text{(9)} \quad \frac{-c^2 + 6c - 9}{c^2 + 5c - 24}$$
$$\text{(10)} \quad \frac{-10c^3 - 5c^2}{2c^2 + 15c + 7}$$
$$\text{(11)} \quad \frac{c^2 - d^2}{c + d}$$
$$\text{(12)} \quad \frac{-c^2 + 2cd + 3d^2}{5c - 15d}$$
$$\text{(13)} \quad \frac{c^2d + 4cd^2}{-c^2 + 16d^2}$$
$$\text{(14)} \quad \frac{-3c^2 + 6cd}{-3c^2 + 7cd - 2d^2}$$

Answer column (bottom group):

$$\text{(N)} \quad -(x - 6)$$
$$\text{(H)} \quad -(x + 7)$$
$$\text{(A)} \quad -5$$
$$\text{(O)} \quad \frac{x + 5}{x - 2}$$
$$\text{(J)} \quad \frac{x - 2}{x - 5}$$
$$\text{(R)} \quad \frac{1}{x - 3}$$
$$\text{(L)} \quad \frac{x - 4}{6x}$$
$$\text{(E)} \quad \frac{x + 3}{2}$$
$$\text{(I)} \quad \frac{x - 4}{3x}$$

Exercises (bottom group):

$$\text{(1)} \quad \frac{x + 3}{9 - x^2}$$
$$\text{(2)} \quad \frac{49 - x^2}{x - 7}$$
$$\text{(3)} \quad \frac{5x - 20}{4 - x}$$
$$\text{(4)} \quad \frac{-x^2 + 8x - 12}{x - 2}$$
$$\text{(5)} \quad \frac{x^2 - 2x - 15}{10 - 2x}$$
$$\text{(6)} \quad \frac{-x^2 + 8x - 16}{3x^2 - 12x}$$
$$\text{(7)} \quad \frac{-x^2 - 3x + 10}{25 - x^2}$$

© 1989 Creative Publications   OBJECTIVE 5–b: To simplify algebraic fractions (numerator and/or denominator not written in descending order of exponents with first coefficient positive).

What Happened to the Peanut Who Went Walking Late at Night?

Express each quotient below in simplest form. Find your answer in the answer column and notice the letter next to it. Write this letter in each box containing the number of that exercise.

Answer column:

$$\text{(H)} \quad 7m(m - n)$$
$$\text{(N)} \quad -3n^4(n - 3)$$
$$\text{(T)} \quad m(m + 3)$$
$$\text{(D)} \quad -\frac{3}{2n^4}$$
$$\text{(U)} \quad \frac{4n^4(m - 5)}{m}$$
$$\text{(R)} \quad \frac{1}{2m^4n(m - 7)}$$
$$\text{(S)} \quad \frac{n(2n - 9)(n + 3)}{3(2n - 3)(n - 6)}$$
$$\text{(I)} \quad -\frac{6}{m - 4}$$
$$\text{(A)} \quad \frac{n(2n - 5)}{5(3n - 1)(n - 5)}$$
$$\text{(W)} \quad \frac{7m}{n(m + n)}$$
$$\text{(L)} \quad \frac{1}{2m^6n(m - 5)}$$
$$\text{(E)} \quad \frac{n - 5}{3m^6}$$

Exercises:

$$\text{(1)} \quad \frac{12m^2n^5}{m + 5} \div \frac{3m^3n}{m^2 - 25}$$

$$\text{(2)} \quad \frac{n^2 - 9n + 20}{6m^7n^2} \div \frac{5n - 20}{10mn^2}$$

$$\text{(3)} \quad \frac{m^2}{m^2 - 7m} \div \frac{1}{m^2 - 4m - 21}$$

$$\text{(4)} \quad \frac{16 - 2m}{m^2 + 2m - 24} \div \frac{m - 8}{3m + 18}$$

$$\text{(5)} \quad \frac{12n - 36}{9 - n^2} \div \frac{8n^5}{n^2 + 3n}$$

$$\text{(6)} \quad \frac{m^2 - n^2}{m^2 + 2mn + n^2} \div \frac{m^2n - mn^2}{7m^2}$$

$$\text{(7)} \quad \frac{n^2 - n - 12}{2n^2 - 15n + 18} \div \frac{3n^2 - 12n}{2n^3 - 9n^2}$$

$$\text{(8)} \quad \frac{17mn^3}{m^2 + 2m - 35} \div \frac{34m^8n^4}{m^2 + 7m}$$

$$\text{(9)} \quad \frac{4n^3 - 25n}{3n^2 - 16n + 5} \div (10n + 25)$$

4	3	6	9	7	9	7	7	9	1	8	3	2	5

OBJECTIVE 5–g: To divide algebraic fractions.   © 1989 Creative Publications

What Game Do Cannibals Play at Parties?

Express each difference below in simplest form. Find your answer and notice the letter next to it. Write this letter in each box containing the number of that exercise.

① $\dfrac{8}{x^2-4} - \dfrac{3}{x-2}$

② $\dfrac{9}{x^2-2x-15} - \dfrac{2}{x+3}$

③ $\dfrac{7x}{x^2-9x+14} - \dfrac{4}{x-7}$

④ $\dfrac{3}{x-4} - \dfrac{x-9}{x^2-16}$

⑤ $\dfrac{5}{x+5} - \dfrac{2x+5}{x^2+9x+20}$

⑥ $\dfrac{3}{d-7} - \dfrac{2}{3d+1}$

⑦ $\dfrac{8}{5d+4} - \dfrac{1}{2d-3}$

⑧ $\dfrac{d+2}{4d-1} - \dfrac{7}{d+5}$

⑨ $\dfrac{d^2+3}{d^2-2d} - \dfrac{d-4}{d}$

⑩ $\dfrac{d^2-11}{d^2-7d+12} - \dfrac{d+1}{d-4}$

Answers:

Ⓜ $\dfrac{3x}{x+5}$

Ⓐ $\dfrac{-2x+19}{(x+3)(x-5)}$

Ⓝ $\dfrac{3d+8}{d(d-2)}$

Ⓒ $\dfrac{8d-15}{(5d+4)(2d-3)}$

Ⓔ $\dfrac{3}{x+4}$

Ⓥ $\dfrac{2x+3}{(x-2)(x-7)}$

Ⓛ $\dfrac{2}{d-3}$

Ⓢ $\dfrac{7d+17}{(d-7)(3d+1)}$

Ⓗ $\dfrac{-3x+2}{(x+2)(x-2)}$

Ⓞ $\dfrac{2x+21}{(x+4)(x-4)}$

Ⓓ $\dfrac{d^2-21d+17}{(4d-1)(d+5)}$

Ⓟ $\dfrac{d^2-18d+4}{(4d-1)(d+5)}$

Ⓡ $\dfrac{3x+8}{(x-2)(x-7)}$

Ⓤ $\dfrac{7x+11}{(x+3)(x-5)}$

Ⓦ $\dfrac{6d-5}{d(d-2)}$

Ⓣ $\dfrac{11d-28}{(5d+4)(2d-3)}$

6	9	2	10	10	4	9	7	1	5	10	5	2	8	5	3

What Sound Did the Sheep Hear When Her Sister Exploded?

Solve each equation and find your answer in the rectangle below. Cross out the box that contains your answer. When you finish, write the letters from the remaining boxes in the spaces at the bottom of the page.

① $\dfrac{2}{x+3} + \dfrac{3}{x+4} = \dfrac{7}{x^2+7x+12}$

② $\dfrac{4}{x-5} + \dfrac{1}{x+2} = \dfrac{2x+7}{x^2-3x-10}$

③ $\dfrac{a-30}{a^2+4a-21} = \dfrac{5}{a+7} - \dfrac{2}{a-3}$

④ $\dfrac{x}{x+4} = \dfrac{3}{x-1}$

⑤ $\dfrac{6}{y+2} + \dfrac{1}{y-2} = 1$

⑥ $\dfrac{3}{n} + \dfrac{2}{n-1} = 2$

⑦ $2 = \dfrac{x}{x+3} - \dfrac{3}{x-5}$

⑧ $\dfrac{1}{d-7} + \dfrac{d}{d-2} = \dfrac{5}{d^2-9d+14}$

⑨ $\dfrac{x-1}{x+1} - \dfrac{6}{x-3} = 3$

ER	AH	UP	IG	MB	KO	FR	OO	SH	AM	SB	CK	SI	YE
6, -2	$-\dfrac{5}{3}$	$\dfrac{4}{3}$	$-\dfrac{1}{2}$, 3	$-\dfrac{1}{4}$	-2	-7, 3	2, 8	$-\dfrac{1}{2}$	-3, 1	-9	-1	-5, 2	6, 1

Part B- Homework

1) An old copying machine can produce 90 copies of a report in 120 minutes. A new machine can do the same job in 80 minutes. If both machines are used, how long would it take to do the job?

2) A pump was used to empty a flooded basement. After 3 hours, a second pump was added and the basement was emptied in 8 more hours. The first pump could have done the job alone in 20 hours. How long would it take the second pump to do the job alone?

3) Two numbers are in the ratio of 5 to 8. If the first number is decreased by 10 and the second number is increased by 4, the resulting numbers are in the ratio of 1 to 2. Find the original numbers.

4) A barge traveled 7 mph in still water. It travels 6 miles downstream in the same time it travels 2 miles upstream. Find the rate of the current.

5) Twelve fluid ounces of cola contain 145 calories. How many calories are in 16 ounces of cola?

6) The heat loss per hour through a window varies inversely with the thickness of the window. A window with a thickness of 0.3 cm loses 2400 calories per hour. How many calories are lost per hour through a window with a thickness of 0.8 cm.

7) There is a linear relationship between the number of standard bricks required for a wall and the thickness of the mortar joints.

Thickness of Mortar Joints (in)	0.25	0.375	0.5
Number of Bricks per ft^2	7	6.6	6.2

Write an equation to describe the relationship. Use the equation to find the number of bricks per square foot if the mortar thickness is 0.5625 inches.

8) The diameter in inches (D) of a car cylinder can be approximated using the formula $D = \sqrt{\dfrac{2.5h}{n}}$ where h is the horsepower of the engine and n is number of cylinders. Find D if $h = 35$ and $n = 6$.

Part D- Homework

1) **RACQUETBALL** You've paid $120 for a membership to a Racquetball Club. Court time is $5 per hour.

   a) Write a model that represents your average cost per hour of court time as a function of the number of hours played. Graph the model. What is an equation of the horizontal asymptote and what does it represent?

   b) Suppose you can play racquetball at the YMCA for $9 per hour without being a member. How many hours would you have to play at the Racquetball Club before the average cost is below $9 per hour?

2) **LIGHTNING** Air temperature affects how long it takes sound to travel a given distance. The time it takes for sound to travel one kilometer can be modeled by: $t = \dfrac{1000}{0.6T + 331}$, where t is the time (in seconds) and T is the temperature (in degrees Celsius). You are 1 km from the lightning strike and it takes exactly 3 seconds to hear the thunder. Use a graph to find the approximate air temperature.

3) **ENERGY EXPENDITURE** The total energy expenditure E (in joules per gram mass per kilometer) of a typical budgerigar parakeet can be modeled by

$E = \dfrac{0.31v^2 - 21.7v + 471.75}{v}$, where v is the speed of the bird (in kilometers per hour). Graph the model. What speed minimizes a budgerigar's energy expenditure?

4) **OCEANOGRAPHY** The mean temperature T (in degrees Celsius) of the Atlantic Ocean between latitudes 40°N and 40°S can be modeled by: $T = \dfrac{17,800d + 20,000}{3d^2 + 740d + 1000}$, where d is the depth (in meters). Graph the model. Use the graph to estimate the depth at which the mean temperature is 4°C.

5) **HOSPITAL COSTS** For 1985 to 1995, the average daily cost per patient C (in dollars) at community hospitals in the United States can be modeled by: $C = \dfrac{-22,407x + 462,048}{5x^2 - 122x + 1000}$, where x is the numbers of years since 1985. Graph the model. Would you use this model to predict patient costs in 2005? Explain.

6) **DELIVERY CHARGES** You and your friends order pizza and have it delivered to your house. The restaurant charges $8 per pizza plus a $2 delivery fee. Write a model that gives the average cost per pizza as a function of the number of pizzas ordered. Graph the model. Describe what happens to the average cost as the number of pizzas ordered increases.

7) **COLLEGE GRADUATES** From the 1984-85 school through the 1993-94 school year, the number of female college graduates F and the total number of college graduates G in the United States can be modeled by:

$$F = \dfrac{-19,600t + 493,000}{-0.0580t + 1} \quad \text{and} \quad G = \dfrac{7560t^2 + 978,000}{0.00418t^2 + 1}$$

where t is the number of school years since the 1984-85 school year. Write a model for the number of male college students.

8) **DRUG ABSORPTION** The amount A (in milligrams) of an oral drug, such as aspirin, in a person's bloodstream can be modeled by: $A = \dfrac{391t^2 + 0.112}{0.218t^4 + 0.991t^2 + 1}$, where t is the time (in hours) after one dose is taken.

   a) Graph the equation on your graphing calculator.

   b) A second dose of the drug is taken one hour after the first dose. Write an equation to model the amount of the second dose in the bloodstream.

   c) Write and graph a model for the total amount of the drug in the bloodstream after the second dose is taken.

   d) About how long after the second dose has been taken is the greatest amount of the drug in the bloodstream?

9) **BASKETBALL STATISTICS** So far in the basketball season you have made 12 free throws out of the 20 free throws you have attempted, for a free throw shooting percentage of 60%. How many consecutive free-throw shots would you have to make to raise your free-throw shooting percentage to 80%?

10) **FOOTBALL STATISTICS** At the end of the 1998 season, the NFL's all-time leading passer during regular season play was Dan Marino with 4763 completed passes out of 7989 attempts. In his debut 1998 season, Peyton Manning made 326 completed passes out of 575 attempts. How many consecutive completed passes would Manning have to make to equal Marino's pass completion percentage?

11) **PHONE CARDS** A telephone company offers you an opportunity to sell prepaid, 30 minute long-distance phone cards. You will have to pay the company a one-time setup fee of $200. Each phone card will cost you $5.70. How many cards would you have to sell before your average total cost per card falls to $8?

Show all work with numerical substitutions on a separate sheet of paper.

$\overline{14}\ \overline{16}\ \overline{18}\ \overline{09}\ \overline{18}\ \overline{12}\ \overline{13}\ \overline{17}\ \overline{11}\overline{09}\ \overline{18}\ \overline{10}\ \overline{14}\ \overline{16}\ \overline{05}\ \overline{18}\ \overline{17}\ \overline{17}\ \overline{15}\ \overline{14}\ \overline{16}$

$\overset{\text{'}}{\overline{04}}\ \overline{14}\ \overline{07}\ \overline{13}\ \overline{18}\ \overline{15}\ \overline{16}\ \overline{12}\ \overline{03}\ \overline{18}\ \overline{08}\ \overline{13}\ \overline{18}\ \overline{17}\ \overline{17}\ \overline{15}\ \overline{14}\ \overline{16}\ \overline{01}\overline{09}\ \overline{18}\ \overline{16}$

$\overset{\text{'}}{\overline{11}}\overline{18}\ \overline{13}\ \overline{06}\ \overline{17}\ \overline{15}\ \overline{16}\ \overline{17}\ \overline{07}\ \overline{10}\ \overline{10}\ \overline{18}\ \overline{17}\ \overline{17}\ \overline{15}\ \overline{14}\ \overline{16}\ \overline{12}\ \overline{13}\ \overline{18}\ \overline{16}\ \overline{11}$

$\overset{\text{!}}{\overline{15}}\ \overline{16}\ \overline{12}\ \overline{13}\ \overline{15}\ \overline{11}\overline{09}\ \overline{06}\ \overline{18}\ \overline{11}\overline{15}\ \overline{10}\ \overline{08}\ \overline{13}\ \overline{14}\ \overline{02}\ \overline{13}\ \overline{18}\ \overline{17}\ \overline{17}\ \overline{15}\ \overline{14}\ \overline{16}$

Fill in the blanks above and to the right with the letter that represents the correct answer.

A = 3

B = 40

C = 2

D = -38

E = -59

F = 20,100

G = 2.5

H = 7

I = 9000

J = 3200

K = 52

L = 203

M = 2250

N = 1

O = 18,500

P = -25

Q = 4

R = 31

S = -4

T = 18

U = -57

V = -3

W = -203

X = 400

Y = -67

Z = -211

___ 1. In $5, -3, -11, \ldots$, find a_{27}.

___ 2. In $-\dfrac{7}{2}, -3, -\dfrac{5}{2}, \ldots$, find a_{13}.

___ 3. In $2, 0, -2, \ldots$, find a_{21}.

___ 4. In $5, \dfrac{1}{5}, -4\dfrac{3}{5}, \ldots$, find a_{16}.

___ 5. In $1, 2, 3, 4, 5, \ldots$, find S_{200}.

___ 6. In $-4, -2, 0, \ldots$, find S_{50}.

___ 7. $a_1 = 3, \quad d = -2$, find a_{31}.

___ 8. $a_1 = 8, \quad a_5 = -4$, find a_{12}.

___ 9. $a_7 = 31, \quad d = 4$, find a_1.

___ 10. $a_{10} = 21, \quad S_{10} = 120$, find d.

___ 11. Find the arithmetic mean of 70 and -34.

___ 12. If six arithmetic means are inserted between -4 and 45, what is the value of the first one inserted?

___ 13. If seven arithmetic means are inserted between -18 and 38, what is the value of the 7th one inserted?

___ 14. The first year a politician is in office she saves $500. Each succeeding year, she saves $300 more than the year before. How much has she saved (in total) after her 10th year in office?

___ 15. A secretary is employed at a starting salary of $6000 and promised annual raises of $600. What will his annual salary be for the 6th year of employment?

___ 16. Find the arithmetic mean of -38 and 40.

___ 17. $a_5 = 16, \quad a_8 = 31$, find a_1.

___ 18. $a_4 = -1, \quad a_{12} = -17$, find a_{33}.

21

3.   . 10   8
   . 25   19
1/5.   14.   27
       2
-43.   -63
   5.
         -3√6
30.
 . 26   1/4
           12
16 •   7•
   18   17

24 . 13   •15
   .128   • -4/3
 4   20 7/27 •
           • 22
      425.1
   20   6   •23
29 •   11   9   1   •28

           • -4

Connect each problem with its answer. Show all work, including formulas with substitutions, neatly on a separate sheet of paper.

1) In $896, 448, 224, \ldots$ find a_6.

2) In $\dfrac{4}{81}, \dfrac{4}{27}, \dfrac{4}{9}, \ldots$ find a_6.

3) In $\dfrac{13}{16}, \dfrac{13}{8}, \dfrac{13}{4}, \ldots$ find a_6.

4) In $29, -29, 29, \ldots$ find a_{13}.

5) In $5^{-7}, 5^{-6}, 5^{-5}, \ldots$ find a_{10}.

6) In $208, -104, 52, \ldots$ find a_5.

7) In $23^{-10}, 23^{-9}, 23^{-8}, \ldots$ find a_{12}.

8) In $3, -6, 12, \ldots$ find S_6.

9) In $\dfrac{1}{27}, -\dfrac{1}{9}, \dfrac{1}{3}, \ldots$ find S_7.

10) $a_1 = -81, \quad r = -\dfrac{1}{3}$, find a_4.

11) $a_1 = -\dfrac{1}{16}, \quad a_6 = -64$, find a_4.

12) $a_3 = -12, \quad a_6 = -324$, find a_1.

13) $a_5 = \dfrac{10}{27}, \quad r = \dfrac{1}{3}$, find a_1.

14) $S_4 = 40, \quad r = 3$, find a_4.

15) Find the negative geometric mean between 2 and 27.

16) Find the positive geometric between 2 and 288.

17) If 3 geometric means are inserted between $\dfrac{1}{64}$ and 4, what is the value of the middle one inserted.

18) $a_1 = 1500, \quad a_5 = \dfrac{12}{5}, \quad$ and $r > 0$, find r.

19) $a_1 = 63, \quad a_5 = \dfrac{7}{9}, \quad$ and $r > 0$, find a_2.

20) $a_1 = 300, \quad r = 0.3,$, find S_4.

For problems 21-25, supply the next term.

21) $-25, 5, -1,$ _____

22) $\dfrac{4}{81}, -\dfrac{4}{27}, \dfrac{4}{9},$ _____

23) $32, -16, 8,$ _____

24) $-10240, 1280, -160,$ _____

25) $-\dfrac{1}{64}, \dfrac{1}{8}, -1,$ _____

26) You deposit 1 cent in an antique bank on March 3rd. Every day thereafter you double the amount deposited. How many cents are deposited on March 10th?

27) Referring to problem 26, how does the March 10th deposit compare to the March 12th deposit?

28) You have $480 hidden under the mattress. On June 13th you spend half the amount and decide to spend half the remaining amount each day thereafter. How many dollars do you spend on June 17th?

29) Referring to problem 28, take your June 19th "mattress allotment" and add it to the $5.25 already in your wallet. Your wallet now contains how many dollars?

30) What is a_{204} in $-43, -43, -43, \ldots$

Do problems neatly on a separate sheet of paper. For each problem:
- Define the variables you use.
- Write a system of inequalities.
- Draw an accurate graph.
- Lightly shade the solution area (feasible region).
- Find and label the vertices of the feasible region
- Write the function you want to maximize/minimize.
- Indicate whether it is a maximum or a minimum.
- Make a table showing the function values at the vertices.
- State and explain the meaning of your solution.

A shoe manufacturer makes indoor and outdoor soccer shoes. There is a two-step process for both kinds of shoes. Each pair of outdoor shoes requires 2 hours in Step A and 1 hour in Step B, and produces a profit of $20. Each pair of indoor shoes requires 1 hour in Step A and 3 hours in Step B, and produces a profit of $15. The company has 40 hours of labor available per day in Step A and 60 hours of labor available per day in Step B. How many pairs of each type should be made to maximize the profit?

A farmer can plant up to 8 acres of land with wheat and barley. He can earn $5,000 for every acre he plants with wheat and $3,000 for every acre he plants with barley. His use of a necessary pesticide is limited by federal regulations to 10 gallons for his entire 8 acres. Wheat requires 2 gallons of pesticide for every acre planted and barley requires just 1 gallon per acre. How many acres of wheat and how many acres of barley should the farmer plant to maximize his profit?

A painter has exactly 32 units of yellow dye and 54 units of green dye. He plans to mix as many gallons as possible of color A and color B. Each gallon of color A requires 4 units of yellow dye and 1 unit of green dye. Each gallon of color B requires 1 unit of yellow dye and 6 units of green dye. Find the maximum number of gallons he can mix.

Arnetta makes and sells teddy bears to gift shops. For her next shipment, she plans to make at least 90 bears. It costs her $5 to make a large bear and $2 to make a small bear. She plans to spend no more than $450 on materials. She plans to make at least twice as many small bears as large bears. If she makes a profit of $10 on each large bear and $5 on each small bear, how many of each type of bear must she sell to maximize her profit? What is her maximum profit?

Do problems neatly on a separate sheet of paper. For each problem:
- Define the variables you use.
- Write a system of inequalities.
- Draw an accurate graph.
- Lightly shade the solution area (feasible region).
- Find and label the vertices of the feasible region
- Write the function you want to maximize/minimize.
- Indicate whether it is a maximum or a minimum.
- Make a table showing the function values at the vertices.
- State and explain the meaning of your solution.

1. The junior class has $300 to invest in a candy sale. They can sell no more than 9 cases of suckers and they must sell at least 18 cases of M & M's. Suckers cost $4 a case and M & M's cost $12 a case. If the profit on a case of suckers is $10 and the profit on a case of M & M's is $20, how many each should they buy to maximize their profit?

2. Hi-Fidelity, a small electronics firm, makes CD players and stereo receivers. The plant can make at most 30 CD players and 20 receivers in a week. It takes 2 worker hours to make a CD player and 4 worker hours to make a receiver. If there are 100 worker hours available per week and if the company makes a $150 profit on a receiver and a $50 profit on a CD player, how many of each should it make to maximize its profit?

3. A company makes both regular and deluxe tote bags. A regular tote bag requires 4 yards of canvas and 1 yard of leather. A deluxe tote bag requires 2 yards of canvas and 3 yards of leather. The company has 104 yards of canvas and 56 yards of leather available to make the tote bags. If each regular tote bag has a $20 profit and each deluxe tote bag has a $35 profit, how many of each style of tote bag should the company make to maximize its profit on the tote bags? What is the maximum profit?

4. A skateboard company manufactures both Pro Boards and Specialty Boards. Pro Boards require 1.5 hours of production time and 1 hour of deck finishing/quality control time. Specialty Boards require 2 hours of production time and 0.5 hours of deck finishing/quality control time. The company has 88 worker hours available each day for production and 42 worker hours available each day for deck finishing/quality control. If the profit on a Pro Board is $50 and the profit on a Specialty Board is $85, determine the number of each type of skateboard the company needs to make in order to maximize its profit. What is the maximum profit?

Ans:
1) 9 Suckers, 22 M & M's, $530   2) 10 CD, 20 Receivers, $3500
3) 20 Regular, 12 Deluxe, $820   4) 0 Pro, 44 Specialty, $3740

▶DAFFYNITION DECODER●

EUROPE:

30°	42°	21°	24°	74°	2°	21°	24°	37°	49°	2°	42°	17°	32°	5°	2°

UNDERGROUND GARAGE:

46°	5°	9°	9°	28°	2°	42°	7°	46°	5°	9°	9°	7°	51°	5°	24°	68°	34°	2°

TO DECODE THE TWO DAFFYNITIONS ABOVE: For the first nine exercises, find the measure of the angle indicated. For the remaining exercises, find the angle measure needed to solve the problem. Round to the nearest degree. Each time the answer appears in the code, write the letter of the exercise below it.

Ⓝ 5, 3

Ⓤ 11, 4

Ⓒ 8, 5

Ⓞ 9, 10

Ⓨ 15, 13

Ⓟ 50, 20

Ⓦ 30, 21

Ⓘ 45, 25

Ⓐ 12, 1

Ⓛ A driveway is built on an incline so that it rises 3 m over a distance of 20 m. What is the angle of elevation of the driveway?

20, 3

Ⓡ Each step of a stairway rises 16 cm for a tread width of 36 cm. What angle does the stairway make with the floor?

36, 16

Ⓑ A roof is constructed as shown in the diagram. Find the pitch (angle of elevation) of the roof.

10′, 16′

Ⓣ A train decreases its altitude by 8 m when traveling along 200 m of track. Find the angle of depression of the track.

8, 200

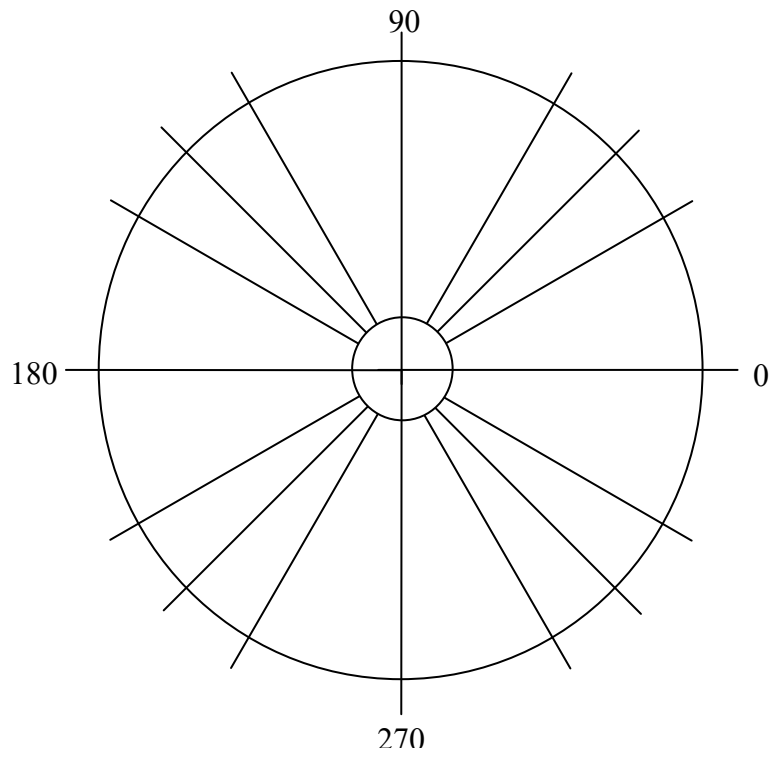OBJECTIVE 5–d: To use trigonometric ratios to find measures of angles of right triangles.

What Do They Call the Big Grass Field on an Orbiting Satellite?

For the first eight exercises, find the length x. For the remaining exercises, find the length needed to solve the problem. Round each answer to the nearest tenth. Cross out each box that contains a correct answer. When you finish, write the letters from the remaining boxes in the spaces at the bottom of the page.

① 4 m, 32°

② 22 cm, 57°

③ 20°, 30 m

④ 8 m, 39°

⑤ 5 m, 61°

⑥ 200 m, 18°

⑦ 5 m, 43°

⑧ 76°, 70 cm

⑨ At a point 20 meters from a flagpole, the angle of elevation of the top of the flagpole is 48°. How tall is the flagpole?

20 m, 48°

⑩ If a rocket flies 2° off course for 1000 miles, how far from the correct path will the rocket be?

1000 mi, 2°

⑪ As it leans against a building, a 9-meter ladder makes an angle of 55° with the ground. How far is the bottom of the ladder from the base of the building?

9 m, 55°
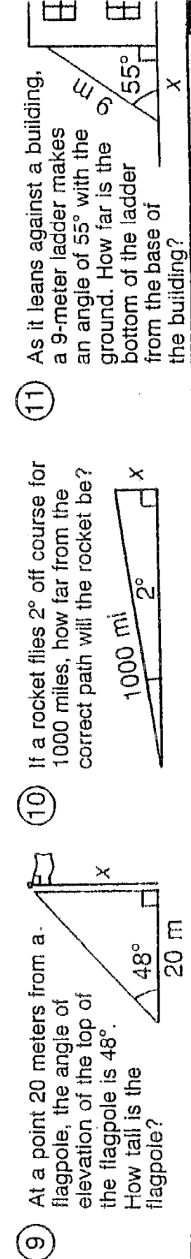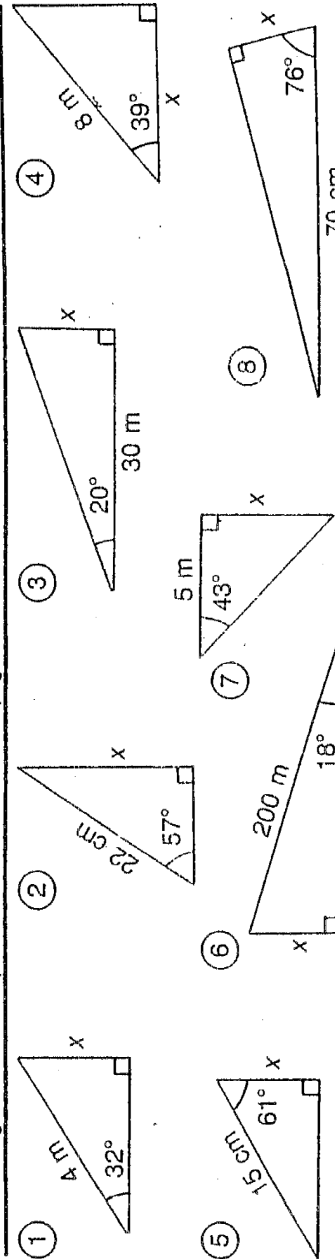
TH	AP	ET	E	AR	UN	A	KI	SS
4.7 m	5.4 m	5.2 m	2.1 m	23.5 m	6.2 m	22.2 m	28.7 mi	61.8 m

RU	NS	TO	P	UP	A	KY	NI	CE
18.5 cm	3.2 m	7.3 cm	63.6 m	34.9 mi	15.3 cm	10.9 m	16.9 cm	17.1 cm

OBJECTIVE 5–c: To use trigonometric ratios to find lengths of sides of right triangles.

	$\sin\theta$	$\cos\theta$		$\sin\theta$	$\cos\theta$		$\sin\theta$	$\cos\theta$		$\sin\theta$	$\cos\theta$
0°			**90°**			**180°**			**270°**		
30°			**120°**			**210°**			**300°**		
45°			**135°**			**225°**			**315°**		
60°			**150°**			**240°**			**330°**		
90°			**180°**			**270°**			**360°**		

DO ALL WORK NEATLY ON A SEPARATE SHEET OF PAPER

Draw an angle with the given measure in standard position

1) $210°$ 　　2) $305°$ 　　3) $580°$

4) $135°$ 　　5) $-450°$ 　　6) $-560°$

Find one angle with positive measurement and one angle with negative measurement

coterminal with each given angle.

7) $65°$ 　　8) $80°$ 　　9) $285°$

10) $110°$ 　　11) $-37°$ 　　12) $-93°$

13) Find the degree measure of the angle through which the hour hand on the clock rotates

from 5:00am to 10:00am.

Find the exact values of $\sin\theta$, $\cos\theta$, and $\tan\theta$ if the terminal side of θ in standard

position contains the given point.

14) $(6, 8)$ 　　15) $(-20, 21)$ 　　16) $(-2, -5)$

Find the reference angle for the angle with the given measure.

17) $236°$ 　　18) $-97°$ 　　19) $-210°$

Find the exact value of each trigonometric function.

20) $\tan 135°$ 　　21) $\sin 210°$ 　　22) $\sin(-90°)$

Suppose θ is an angle in standard position whose terminal side is in the given quadrant. For

each function, find the exact values of the functions listed.

23) Given $\tan\theta = -\dfrac{12}{5}$ in Quadrant IV, find $\sin\theta$ and $\cos\theta$.

24) Given $\sin\theta = \dfrac{2}{3}$ in Quadrant II, find $\cos\theta$ and $\tan\theta$.

DO ALL WORK NEATLY, USING TRIG, ON A SEPARATE SHEET OF PAPER

1. Using the diagram to the right, find the distance from Nick's house to Amy and Samantha's houses. Round your answer to the nearest foot.

2. A triangular lot faces two streets that meet at an angle of 85°. The sides of the lot facing the street are each 160 feet in length. Find the perimeter of the lot to the nearest foot.
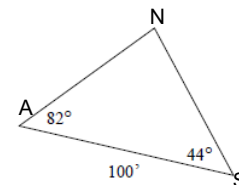
3. A flagpole casts a shadow 40 feet long when the measure of the angle of the sun's rays with the ground is 32°. How tall is the flagpole? Round your answer to the nearest tenth.

4. A lighthouse 55 meters above sea level spots a distress signal from a sailboat. The angle of depression to the sailboat is 21°. How far away is the sailboat from the base of the lighthouse to the nearest meter? (Hint: The angle of depression is formed by the line of sight and a horizontal line).

5. Ben is flying a kite with 125 meters of sting out. His kite string makes an angle of 39° with the level ground. How high is his kite to the nearest meter? Assume that Ben is holding his kite string 2 meters from the ground.

6. It is believed that Galileo used the "Leaning Tower of Pisa" to conduct his experiments on the laws of gravity. When he dropped objects from the top of the 55 meter tower (measured length of tower, not height), they landed 4.8 meters from the base of the tower. To the nearest degree, what is the angle the tower leans from the vertical?

7. Igor's pet bat Natasha is flying at the end of a 50-foot leash which is anchored to the ground. Using an angle measuring device, Igor spots Natasha at an angle of 55° from the horizontal. To the nearest foot, how high is Natasha flying?

8. Meteorologist Wendy Storm is using an angle measuring device to determine the height of a weather balloon. When she views the balloon through the measuring device (which is sighted one meter above the level ground), she measures an angle of elevation to the device of 45°. The radio signal from the balloon tells her that the balloon is 1400 meters from her measuring device. To the nearest meter, how high is the balloon?

9. A plane is flying due West on a very clear day. He spots his house due West in front of him at an angle of depression of 35°. Further along he spots the airport at an angle of depression of 20°. If the ground distance between his house and the airport is 5.5 miles, how high is the plane flying? Round your answer to the nearest tenth of a mile.

10. A 110-foot antenna is on top of a hill. From a point on the ground, the angle of elevation to the bottom of the antenna is 35° and the angle of elevation to the top of the antenna is 40°. How high is the hill to the nearest tenth of a foot?
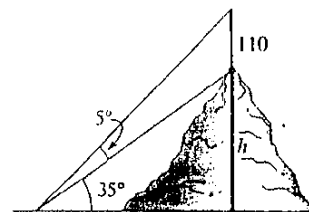
1. 86ft, 122ft 　2. 536ft 　3. 25ft 　4. 143m 　5. 81m
6. 5 Deg 　7. 41ft 　8. 991m 　9. 4.2mi 　10. 554.5ft

Investigation #1
The Sine Function: Amplitude

Name _____

Period _____

In this lesson you will learn how A affects the graph of $y = A\sin(x)$

1. Use a graphing calculator to graph each of the following functions. All work will be done in degrees, so you must set the mode setting on your calculator to degrees. The suggested window settings are Xmin = -360, Xmax = 360, Xscl = 90, Ymin = -4, Ymax = 4, Yscl =1.

Equation	A	Sketch	Max	Min	Amp.	Is the graph inc. or dec. from 0° to 90°?
$y = 1\sin(x)$						
$y = 2\sin(x)$						
$y = 0.5\sin(x)$						
$y = -2\sin(x)$						
$y = -3.5\sin(x)$						

2. Use your graphs to answer the following questions about $y = A\sin(x)$.

    a. As $|A|$ increases, does the graph become steeper or flatter? _____

    b. Does the sign of A affect the value of the maximum, minimum, or amplitude? If so, how? ____
    _____
    _____

    c. How do the graphs of $y = A\sin(x)$ and $y = -A\sin(x)$ differ? _____
    _____
    _____

    d. Are the graphs of $y = A\sin(x)$ and $y = -A\sin(x)$ symmetric? If so, are they symmetric about the x-axis or the y-axis? _____
    _____

    e. If $A = 2.5$, will the maximum be greater or less than the graph with $A = 1$? _____
    _____

    f. Suppose you want the maximum value of $y = A\sin(x)$ to be 1.5 and the graph to be increasing from 0° to 90°. What value of A would you choose? Check your answer on the calculator. __
    _____

    g. Suppose you want the minimum value of $y = A\sin(x)$ to be between -1.25 and -1.50 and the graph to be decreasing from 0° to 90°. What value of A would you choose? Check your answer on the calculator. _____
    _____
    _____
    _____

3. Write formulas for the maximum value, minimum value, and amplitude in terms of the constant A in the equation $y = A\sin(x)$. Remember that A can be either positive or negative.

    Maximum: _____

    Minimum: _____

    Amplitude: _____

    Explain how the constant A affects the graph of $y = A\sin(x)$. _____
    _____
    _____
    _____

Investigation #2
The Sine Function: Vertical Shift

In this lesson you will learn how A and D affect the graph of $y = A\sin(x) + D$.

1. Use a graphing calculator to graph each of the following functions. All work will be done in degrees, so you must set the mode setting on your calculator to degrees. The suggested window settings are Xmin = -360, Xmax = 360, Xscl = 90, Ymin = -4, Ymax = 4, Yscl =1.

Equation	A	D	Sketch	Max	Min	$\frac{Max + Min}{2}$
$y = 1\sin(x) + 0$						
$y = 1\sin(x) + 2$						
$y = \sin(x) - 3$						
$y = 2\sin(x) + 2$						
$y = -1\sin(x) + 1$						

2. Use your graphs to answer the following questions about $y = A\sin(x) + D$

    a. If the constant D is positive, does the graph shift up or down? _____

    b. If the constant D is negative, does the graph shift up or down? _____

    c. Write a sentence describing what happens to the graph if we add a non-zero constant D to the equation $y = A\sin(x)$. _____
    _____

    d. If you want the graph of $y = A\sin(x)$ to shift 1.5 units above the x-axis, what value of D should you choose? _____

    e. If a function is periodic, like the sine function, then one-half the sum of the maximum value plus the minimum value is the center line of the function. What does the center line of $y = A\sin(x) + D$ tell you about the graph? _____
    _____

    f. The graph of $y = 1\sin(x) + 2$ has a new center line because it has been shifted up from the x-axis. What is the equation of the new center line? _____
    _____

    g. Explain how the constants A and D affect the shape and location of the graph of $y = A\sin(x) + D$. _____
    _____

3. State formulas for the vertical shift, center line, maximum value and minimum value in terms of the constants A and D in the equation $y = A\sin(x) + D$.

    Vertical Shift: _____   Center Line: _____

    Maximum: _____   Minimum: _____

4. Write equations of the form $y = A\sin(x) + D$ for the maximum, minimum, and vertical shift values given below. The first entry has been completed for you.

Maximum	Minimum	Amplitude	Vertical Shift	Equation
3	1	1	2	$y = 1\sin(x) + 2$
1	-3	2	-1	
2	-1			
3	-1			

5. Write an equation whose graph is a sine curve between the graphs of the equations $y = -1\sin(x) + 2$ and $y = -1\sin(x) + 0.5$. Verify your answer using the calculator. _____
    _____
    _____

6. Explain how the constant D affects the graph of $y = A\sin(x) + D$. _____
    _____
    _____

Investigation #3

The Sine Function: Phase Shift

In this lesson you will learn how C affects the graph of $y = \sin(x - C)$. *Phase shift tells how far (in degrees) the graph has moved in the horizontal direction.*

1. Use a graphing calculator to graph each of the following functions. All work will be done in degrees, so you must set the mode setting on your calculator to degrees. The suggested window settings are Xmin = -360, Xmax = 360, Xscl = 90, Ymin = -4, Ymax = 4, Yscl =1. The first has been done for you.

Equation	C	Sketch	Phase Shift	x-intercepts between 0 and 360°
$y = \sin(x)$	0		none	0°, 180°, 360°
$y = \sin(x - 45)$				
$y = \sin(x - 90)$				
$y = \sin(x - 180)$				
$y = \sin(x - 270)$				

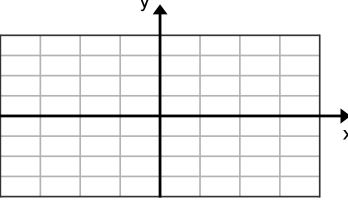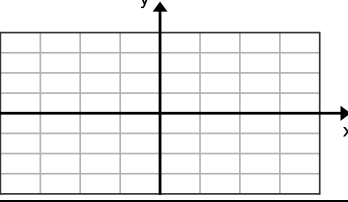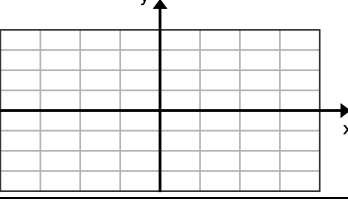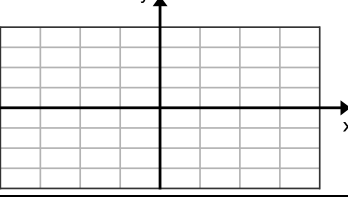| Equation	C	Sketch	Phase Shift	x-intercepts between 0 and 360°
$y = \sin(x + 45)$				
$y = \sin(x + 90)$				
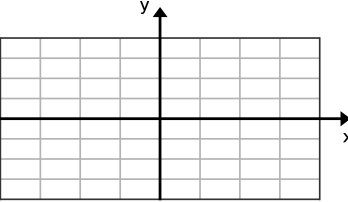
2. Compared to $y = \sin(x)$, have the graphs in Exercise 1 been shifted horizontally or vertically? _____
_____

3. In what direction does the graph shift when C > 0? _____

4. In what direction does the graph shift when C < 0? _____

5. Explain why the x-intercepts of $y = \sin(x)$ and $y = \sin(x - 45)$ are different. _____
_____
_____

6. Explain the difference between the phase shifts in the graphs $y = \sin(x - 45)$ and $y = \sin(x + 45)$.
_____
_____

7. What is the formula for the phase shift in terms of C? _____

8. Use what you know about phase shift and period to explain why $y = \sin(x - 360)$ has the same graph as $y = \sin(x)$. _____
_____
_____

9. Write an equation of the form $y = \sin(x - C)$ that has x-intercepts at 60° and 240°. Check your answer using the calculator. _____

10. Give a value of C in the equation $y = \sin(x - C)$ that would produce a graph between
$y = \sin(x + 120)$ and $y = \sin(x + 45)$. Check your answer using the calculator. _____
_____
_____

11. Explain how the constant C affects the graph of $y = \sin(x - C)$ _____
_____
_____

Investigation #4
The Sine Function: Period

In this lesson you will learn how B affects the graph of $y = \sin(Bx)$. Recall that the period of a sine graph is the length along the x- axis of one complete cycle.

1. Use a graphing calculator to graph each of the following functions. Our work will be done in degrees, so you must set the calculator mode to DEG. The suggested window settings are Xmin = -360, Xmax = 360, Xscl = 90, Ymin = -4, Ymax = 4, Yscl =1. The first one has been done for you.
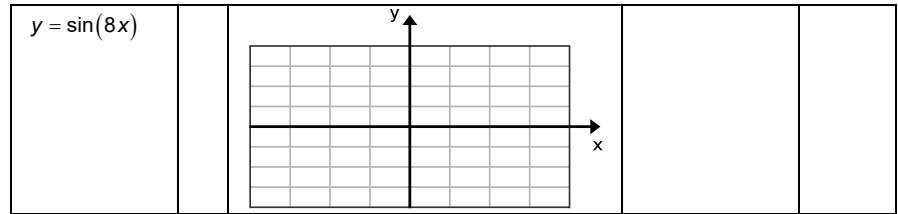
Equation	B	Sketch	Number of Cycles in 360°	Period
$y = \sin(1x)$	1		1	360°
$y = \sin(2x)$				
$y = \sin\left(\dfrac{1}{2}x\right)$				
$y = \sin(4x)$				
$y = \sin\left(\dfrac{1}{4}x\right)$				

$y = \sin(8x)$

2. Use the results of Exercise 1 to answer the following questions:

    a. If B = 1, the period of $y = \sin(Bx)$ is 360°. As B gets larger than 1, what happens to the period?
    _____

    b. As B gets smaller than 1 (but still greater than 0) what happens to the period of the graph? _
    _____

    c. How does the number of cycles in 360° of a sine graph compare to the constant B? _____
    _____

    d. Give a formula for the period of the sine function in terms of B. (Your formula must work for each graph in Exercise 1) _____

3. If the graph of a sine wave shows 10 complete cycles in 360°, what is its period? _____
    _____

4. Write an equation of the form $y = \sin(Bx)$ for each of the following periods.

    a. Period = 180°   Equation: _____

    b. Period = 120°   Equation: _____

    c. Period = 60°   Equation: _____

5. Write an equation of the form $y = A\sin(Bx) + D$ whose graph is:

    a. A sine curve with amplitude 2 and period 180°.
    _____

    b. A sine curve with vertical shift -2 and period 90°.
    _____

    c. A sine curve with amplitude 1.5, vertical shift 0.5 and period 720°.
    _____

6. Explain how the constant B affects the graph of $y = \sin(Bx)$. _____
    _____
    _____
    _____

Investigation #5

The General Sine Function

In this lesson you will learn how A, B, C, and D affect the graph of $y = A\sin\big(B(x-C)\big)+D$.

1. Use a graphing calculator to graph each of the following functions. Our work will be done in degrees, so you must set the calculator mode to DEG. The suggested window settings are Xmin = -360, Xmax = 360, Xscl = 90, Ymin = -4, Ymax = 4, Yscl =1.

Be sure to identify the values of A, B, C, and D for each graph.

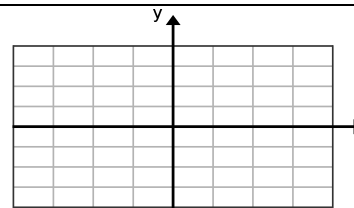| Equation	Sketch	Max & Min	Amp	Vert Shift	Per.	Phase Shift
$y = \sin(x)$ A = B = C = D =						
$y = \sin(x-90)$ A = B = C = D =						
$y = 2\sin(x-90)$ A = B = C = D =						
$y = 2\sin(x-90)+1$ A = B = C = D =						
$y = -2\sin(x-90)+1$ A = B = C = D =						

$y = 2\sin\big(2(x+90)\big)+1$

A =

B =

C =

D =

2. In the equation $y = 1.5\sin\big(2(x-45)\big)-0.5$,

The value 1.5 determines the _____

The value 2 determines the _____

The value 0.5 determines the _____

The value 45 determines the _____

3. Examine the graph below and find the values of A, B, C, and D that would generate it. Check your answer on the calculator.
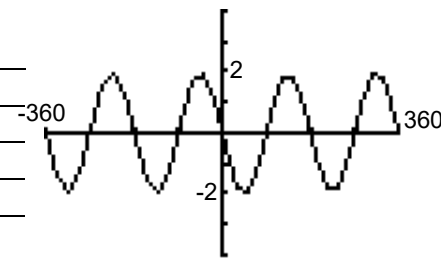
Amplitude _____

Vertical Shift _____

Period _____

Phase Shift _____

Equation _____

4. Complete the table below. The first one has been done for you.

Max	Min	Vertical Shift	Period	Phase Shift	A	B	C	D	Equation
2	-2	0	360	0	2	1	0	0	y = 2sin(x)
1	-1	0	180	-90					
2	0	1	360	0					
1	-3	-1	180	0					

5. In your own words, explain how the constants A, B, C, and D affect the graph of the equation

$y = A\sin\big(B(x-C)\big)+D$. _____

_____

_____

_____

_____