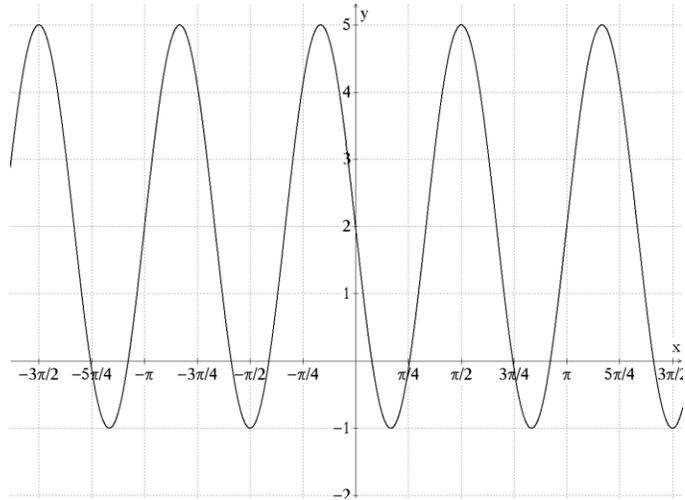Reminder: When doing problem sets, show your thinking as you do these problems. Write down how you arrived at your answer in such a way that anyone that did not understand the problem could follow your work.

1) Given the graph at right

   a) Express the function in terms of sine.

   b) Express the function in terms of cosine.

2) If $f(x) = x^2 + 4x + 2$ and $g(x) = 3x - 1$, find the vertex of the parabola given by: $f \circ g \ (x)$.

3) Find the all solutions (the general solution) to two decimal places the following using radian angle measure.

   $5 \sin \ 2x - 1.2 \ = -3$

4)   From physics, one learns that the time required for a ball to fall from a height of h feet (or rise to that height after a bounce) is $\frac{1}{4}\sqrt{h}$ seconds. Suppose a ball rebounds 90% of the height from which it is dropped. Suppose the ball is dropped from a height of 36 feet. Give answers to 2 decimal places.

a) How much time passes before the ball strikes the ground for the fourth time?

b) What is the total distance (both up and down) the ball has traveled when it strikes the ground for the fourth time?

c) How high does it rebound after the sixth bounce?

d) After which bounce is the first time the ball rebounds less than 3 feet?

Note: The concepts in this problem will be used in a future problem set.

5)   (PEA) Robin borrows $12,000 which will be paid back in equal monthly installments, each of which includes a 1% interest charge on the unpaid balance. (Good time to make use of Excel. Attach document if you do.) Note: This problem will also be referred to in a future problem set.

a) Imagine he pays $300 a month. His first payment includes $120 in interest $0.01 \times 12,000$. The remaining $180 reduces his dept, leaving $11,820 owed. Continue this pattern and make a sequence of the amount he owes at the end of each of the first 6 months, after he has made her payment.

b) In what month will he make his final payment and how much will it be? Note: His final payment will be what remained on his loan the previous month, plus interest.

6) $f(x) = \dfrac{p(x)}{q(x)}$ is a rational function. Fill in the blanks:

   a)   If f has a bounce point at $x = 2$, then _____ has a factor of _____.

   b)   If f has a vertical asymptote at $x = -3$, then _____ has a factor of _____.

   c)   If f has a slant asymptote, what can you say about the degrees of the polynomials $p(x)$ and $q(x)$?

7)   **NC** Solve for the exact value(s) of x:

   a) $\left[\log_9 x^2 \right]^2 + \log_9 x^4 = 3$

   b) $3^{5x} - 38 = 16$

8)   For the unit circle at the right:
   Find the coordinates of points
     A, B, C, and D in order to
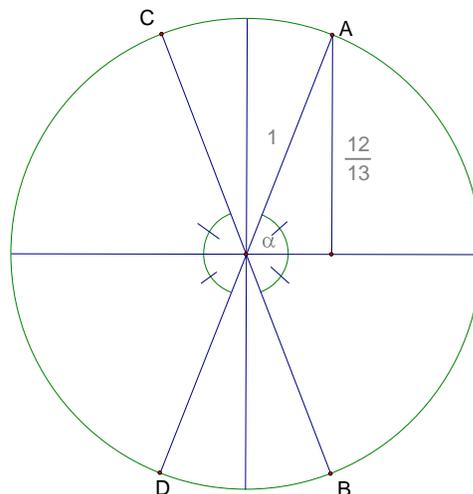   find the values of:

   a. $\cos(-\alpha)$ b. $\sin(\pi + \alpha)$

   c. $\sin\left(\dfrac{\pi}{2} - \alpha\right)$.   d. $\sin(\pi - \alpha)$

   e. $\cos\left(\dfrac{3\pi}{2} - \alpha\right)$ f. $\cos(\alpha - \pi)$

Summation Notation

In mathematics we often need to sum a number of terms of a sequence such as

$$a_1 + a_2 + a_3 + \ldots + a_n$$

Rather than write all these terms, we use the symbol $\sum$ (sigma) to represent the sum. So the sum above may be written

$$a_1 + a_2 + a_3 + \ldots + a_n = \sum_{i=1}^{n} a_i$$

i is called the **index** and it varies from its lower value, $i = 1$ to its ending value, $i = n$, iterating i by one. Often the index is part of a formula that generates each term a_i.

Example: $\displaystyle\sum_{n=1}^{6} n^2 = 1^2 + 2^2 + 3^2 + 4^2 + 5^2 + 6^2$

We call the right side of the above **expanded form**.

9)   State the expanded form of each of the following, then simplify the expression to a single value.

a) $\displaystyle\sum_{n=1}^{5} 2^n$ b) $\displaystyle\sum_{n=0}^{4} \frac{81}{3^n}$ c) $\displaystyle\sum_{k=1}^{5} -1^k (3k)$

10)   Compute: $\displaystyle\sum_{n=1}^{4} (n!)$

11)   Write the sum $6 + 8 + 10 + 12 + \ldots + 54$ in $\sum$ notation.

12)   A large wooden cube is formed by gluing together 216 small, congruent cubes and then it is painted red. After the paint is dry, the large cube is taken apart into the small cubes. How many of these cubes have

a) three faces painted red?

b) two faces painted red?

c) one face painted red?

d) no face painted red?

13) (Continuation) Here is a curiosity: Expand the binomial power $(a+b)^3$ (state expansion on answer sheet) and then replace a by 2 and b by 4 and simplify each term but do not do the addition.

14) Compare your answers in problems 12 and 13. What do you observe?

15) On Jan 1, $ 12,000 is invested at a rate of 4% compounded monthly.

a) Write the sequence of 6 terms that gives the value of this investment on Jan. 1 of each succeeding year.

b) When is the investment first worth at least $ 30,000? Caution: interest is only paid at the end of the month.