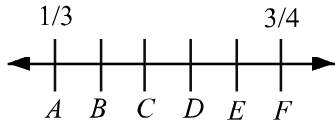


1. Arithmetic with Ratio and Proportion

November 2000

1. Points A through F are evenly spaced on a number line. What common fraction, in simplest form, corresponds to point E ?



Ans. _____

2. The ratio of females to males in a school band is 7 to 4. If three females and twelve males are absent from practice on a certain day, the ratio of females to males on that day becomes 5 to 2. How many members of the band attended practice on that day?

Ans. _____

3. On my 11th birthday I planted a tree that was 3 feet tall and was estimated to grow steadily to 9 feet tall in 4 years. If I was $4\frac{1}{2}$ feet tall when I planted the tree and I grew steadily to be $5\frac{1}{2}$ feet tall by my 15th birthday, how old was I (to the nearest tenth) when I and my tree were the same height?

Ans. _____

1. Arithmetic with Ratio and Proportion

November 2001

1. A rectangular garden measures 31 feet by 41 feet. A fence is erected along the perimeter of the garden. Fence posts must be separated by no more than three feet. Find the fewest number of fence post needed.

Ans. _____

2. Each of three girls were stringing beads on a string. There were 195 beads in all and they were shared in a ratio of $\frac{1}{2}$ to $\frac{1}{3}$ to $\frac{1}{4}$. How many beads did each of the girls receive?

Ans. _____

3. The safe load on a horizontal beam supported at both ends varies jointly as the breadth and the square of the depth, and inversely as the length of the beam. If a 2 by 4 inch beam (2 inch breadth) 6 feet long will support 200 lbs. safely, what is the safe load in lbs. for a 4 by 6 inch beam (4 inch breadth) 15 feet long? Both beams are made of the same material.

Ans. _____

1. Arithmetic with Ratio and Proportion

November 2002

1. x varies inversely with y . When x is 40, y is 50. What is y when x is 25?

Ans. _____

2. If $w = 2x$, $x = 2y$, and $y = 2z$, then $w + x + y = kz$, where k is a number. Find k .

Ans. _____

3. Find all value(s) of $\frac{a}{b}$, in simplest and correct form, if $\frac{a^2 + 3b^2}{b^2 - 3a^2} = 21$.

Ans. _____

1. Arithmetic with Ratio and Proportion

November 2003

1. Simplify completely: $2[8 + 3(8 \cdot 6 \div 4 \cdot 12)]$

Ans. _____

2. Mary is 5 ft. 10 in. tall and at 3 PM casts a shadow 7 ft. 6 in. long. A tree in her yard cast a shadow 41 ft. 3 in. long at the same time, measured from the center of the base of the tree. Find the height of the tree. Give answer in feet and inches.

Ans. _____

3. It takes 18 men 6 hours to dig a trench 720 feet long. Working at the same rate, how many feet of trench can be dug by 24 men in 8 hours?

Ans. _____

1. Arithmetic with Ratio and Proportion

November 2004

1. If the cost of installing a window is proportional to the area of the window, and it cost \$30 to install a window of area 4m^2 , how much would it cost to install a window of 3m^2 ?

Ans. _____

2. Given $y = ax^2z^3$, where no variable equals zero, what happens to the value of y when x is doubled and z is halved?

Ans. _____

3. Ed's grandmother drove her motorcycle at 60 km/hr to his house. She returned home on the same road at a rate of 90 km/hr. If her total time on that road was 2 hours, how far away do they live from each other?

Ans. _____

1. Arithmetic with Ratio and Proportion

November 2005 (No Calculators)

1. At a recent meeting, shoe styles were noticed. For every person wearing sneakers, there were two wearing dress shoes. For every two people wearing sandals, there were three people wearing dress shoes. What is the ratio of sandals to sneakers?

Ans. _____

2. Express the following as a single fraction in lowest terms:

Ans. _____

$$\left(\frac{\frac{1}{\frac{1}{3} + \frac{3}{4}} - 1\frac{5}{6}}{\quad} \right)^2$$

3. If a/b and $a \cdot b$ are in a ratio of 1 to 16 and if $a + b$ and $a - b$ are in a ratio of 2 to 1, find all possible ordered pairs of integers (a, b) that fit the criteria.

Ans. _____

1. Arithmetic with Ratio and Proportion

November 2006 (No Calculators)

1. In the multiplication
$$\begin{array}{r} A \ 5 \ 3 \\ \times 2 \ 3 \\ \hline 1 \ A \ 3 \ 1 \ 9 \end{array}$$
 A is a place-holder for a single digit. Find A .

Ans. _____

2. If $\frac{3x + 2y}{11x - 4y} = \frac{3}{4}$, find $\frac{x}{y}$ in simplest form.

Ans. _____

3. The safe load on a horizontal beam supported at both ends varies jointly as the breadth and the square of the depth and inversely as the length of the beam. If a 4 by 6 inch beam, 6 inch breadth, 8 feet long will support 1800 lbs safely, what is the safe load for a 3 by 8 inch beam, 3 inch breadth, 15 feet long? Both beams are of the same material.

Ans. _____

1. Arithmetic with Ratio and Proportion

November 2007 (No Calculators)

1. Allen, Brent and Carla altogether have \$5.00, in a ratio respectively of 2:3:5. How much money does Brent have?

Ans. _____

2. Doug has \$8.70. Brian has \$5.70. How much money should Doug give Brian so that he will then have $\frac{15}{17}$ as much as Brian?

Ans. _____

3. m is directly proportional to the cube of h and inversely proportional to the square of p . When m is 45 and p is 20, h is 5. What is h when m is 54 and p is 24?

Ans. _____

1. Arithmetic with Ratio and Proportion

November 2008 (No Calculators)

1. The ratio of two integers is 5:2. If 10 is added to each integer, the ratio will be 5:3. What are the two original integers?

Ans. _____

2. Exactly one of the following six numbers is a perfect square. Which one is it? Write the letter, which appears before the number that is the perfect square, in the answer slot.

Ans. _____

- a. 64,844,231,0986,378 b. 75,406,651,906,592 c. 55,432,988,756,477
d. 23,784,855,888,784 e. 19,830,005,200,433 d. 66,971,114,742,058

3. Five robots produce a total of five automotive parts in five minutes. How many automotive parts can be produced by ten robots in ten hours?

Ans. _____

1. Arithmetic with Ratio and Proportion

November 2009 (No Calculators)

1. The ratio of girls to boys in a class is 3 to 4. If there are 28 students, how many more boys than girls are in the class?

Ans. _____

2. From the set of natural numbers less than or equal to fifty, all the multiples of two, multiples of three, and multiples of five are removed. How many numbers remain?

Ans. _____

3. Presume that there are 29,000 moose at the beginning of moose-hunting season. 3020 moose permits are issued. For each 90 hunters that get their moose, 10 hunters do not. Three out of every ten of the 29,000 moose die by causes not related to hunting. Given these parameters, how many moose would need to be born and survive after one year to preserve the 29,000 moose population?

Ans. _____

2. Sequences and Series

November 2000

1. Which term of the series (7, 20, 33, ...) is 241?

Ans. _____

2. By adding the same positive number to each of 30, 60, and 100, a geometric progression results. What is the constant that must be added?

Ans. _____

3. The sum of an infinite geometric series with a common ratio r , where $r^2 < 1$, is 2. The sum of the cubes of the terms of the series is 24. Find the first term of the original series.

Ans. _____

2. Sequences and Series

November 2001

1. The second term of an arithmetic sequence is $1\frac{3}{4}$. The 5th term is $5\frac{1}{2}$. Find the first term.

Ans. _____

2. The 4th and 11th terms of an arithmetic sequence are 62 and 167 respectively. Find the sum of the first 15 terms.

Ans. _____

3. Find the following sum: $81 + 64 + 54 + 48 + 36 + 36 \dots$

Ans. _____

2. Sequences and Series

November 2002

1. The first two terms of a four term sequence S , are 1 and 3. If S is an arithmetic sequence, the fourth term is x . If S is a geometric sequence, the fourth term is y . Find the numerical average of x and y .

Ans. _____

2. The 9th term of an arithmetic sequence is 20. The 28th term is 153. Find the first term.

Ans. _____

3. By adding the same constant to each of 60, 80, and 104, a geometric progression results. If the order of the resulting three elements is reversed, and an infinite decreasing geometric series is formed, starting with these three, what would be the sum of the series?

Ans. _____

2. Sequences and Series

November 2003

1. The eighth term of an arithmetic sequence is 84. If the first term is 35, what is the second term?

Ans. _____

2. Mr. Hobbs gave his son Calvin \$5 the first week of the year, \$6 the second week, \$7 the third week and so on for 52 weeks until the year ended. By the end of the year, what was the total amount that Mr. Hobbs gave Calvin?

Ans. _____

3. Find all ordered triples in a geometric sequence, such that their sum is 124 and their product is 8000.

Ans. _____

2. Sequences and Series

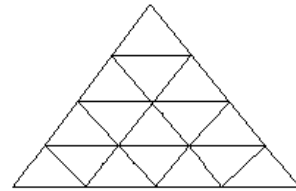
November 2004

1. Each term of a sequence of numbers is one more than twice the preceding term. If the first term of the sequence is 5, find the value of the 6th term.

Ans. _____

2. If you added six(6) rows to the bottom of this picture, how many of the small triangles would you have all together?

Ans. _____



3. A certain type of ball can rebound $\frac{2}{3}$ of the distance that it is dropped from the ground. If it is released 81 feet above the ground, how far will it travel before it comes to rest?

Ans. _____

2. Sequences and Series

November 2005 (No Calculators)

1. The fourth term of a geometric sequence is $\frac{27}{5}$. The second term is 15. R is the common ratio of the sequence. Find all value(s) of R .

Ans. _____

2. The first term of an infinite geometric sequence is 90. If the sum of the infinite sequence is 135, find the 6th term of the sequence.

Ans. _____

3. The sums of two infinite geometric series are equal. All terms are positive. The first term of sequence one is two less than the first term of sequence two. The common ratio of sequence two is 25% less than the common ration of sequence one. The product of the first terms is 8. Find the infinite sum of either series.

Ans. _____

2. Sequences and Series

November 2006 (No Calculators)

1. Find the sum of the first 10 positive multiples of 7.

Ans. _____

2. A person took the a position in a firm with a starting salary of \$40,000 and yearly raises of \$600. If the person retires after 20 years with the firm, what will the person's total earnings be?

Ans. _____

3. x , $x + 2$, and $x + 5$ are the first three terms of a geometric sequence. Which term of the sequence is $\frac{60x + 3}{x + 4}$?

Ans. _____

2. Sequences and Series

November 2007 (No Calculators)

1. The 57th term of an arithmetic series of numbers is 241. The 59th term is 257. What is the 60th term?

Ans. _____

2. The 2nd term of a geometric sequence is 324. The 5th term is 96. Find the first term.

Ans. _____

3. In the sequence of numbers below, 7 is the first term, 16 is the second term, 20 is the third term and so on. Find the 77th term.

7, 16, 20, 28, 37, 41, 49, 58, 62, 70,

Ans. _____

2. Sequences and Series

November 2008 (No Calculators)

1. The first three terms of a sequence are 23, 28, and 33. Which term in this sequence is 243?

Ans. _____

2. Find three integers in an arithmetic progression whose product is prime.

Ans. _____

3. Consider an infinite geometric series of positive terms that start at a , have a common ratio of r , where $r < 1$, and converge to a sum of S . What fractional part of S is the sum of the even-numbered terms? Give your answer in terms of r .

Ans. _____

2. Sequences and Series

November 2009 (No Calculators)

1. Find the seventeenth term of the following sequence:

$-3, -4\frac{1}{2}, -6, -7\frac{1}{2}, \dots$

Ans. _____

2. A science lab has a vacuum pump that removes air from a tank. One-fourth of the air is removed after each pump stroke. What fractional part of the original amount of air remains in the tank after the 4th stroke? Express as a fraction in simplest form.

Ans. _____

3. Given the sequence: 1, 1, 2, 2, 3, 5, 4, 9, 8, 8, . . . What is the 17th term of the sequence?

Ans. _____

3. Counting Principles and Binomial Theorem

November 2000

1. Assume that every seven-digit whole number is a possible telephone number, except those that begin with 0 or 1. What is the fraction of telephone numbers that begin with 9 and end with 0?

Ans. _____

2. In the expansion of $(a + a^{-1/2})^7$, what is the coefficient of the term containing $a^{-1/2}$?

Ans. _____

3. A company with four senior partners and three junior partners wanted to form its management committees so that each committee had at least two senior partners and at most one junior partner. How many different committees could they form?

Ans. _____

3. Counting Principles and Binomial Theorem

November 2001

1. How many different sets of 3 consonants (including “y”) are there?

Ans. _____

2. Find the numerical value of the term in the expansion of the following that has no “x” factor. $\left(\frac{x}{6} - \frac{8}{x^3}\right)^8$

Ans. _____

3. In the World Series, the American League team A, and the National League team N, play until one team wins 4 games. If the sequence of winners designated by letters NAAAA means the National League won the first game and lost the next 4, then how many different sequences of winners are there?

Ans. _____

3. Counting Principles and Binomial Theorem

November 2002

1. How many arrangements can be made of the five letters in MAINE, if the 2nd and 4th letters must be consonants?

Ans. _____

2. Find the numerical coefficient of the term that contains x^3 when expanding $\left(2x^2 - \frac{1}{4x^3}\right)^9$. Express answer in simplest form.

Ans. _____

3. 6 boys and 4 girls line up to have their picture taken. Peter, Paul, and Mary are among these, and they always want to be together with Mary in the middle of the two boys. How many different line-ups can be made for the picture?

Ans. _____

3. Counting Principles and Binomial Theorem

November 2003

1. 3 different prizes will be awarded 10 contestants in a contest. If each contestant can receive no more than one prize, in how many ways can the prizes be distributed?

Ans. _____

2. Find the numeric value of the term containing no variables in the expansion of $\left(4x^2 + \frac{1}{2x}\right)^9$

Ans. _____

3. A mail carrier has three identical pieces of junk mail. She has 8 mail boxes that she can put them in. If she can put all three into one mailbox, or two pieces in one mailbox and one piece in another, or only one in each of 3 mailboxes, in how many different ways can she distribute the junk mail?

Ans. _____

3. Counting Principles and Binomial Theorem

November 2004

1. Find, in simplest form, the value of the coefficient (in terms of r and t) that contains t^{15} in the expansion of $(r^2 - t^3)^{15}$.

Ans. _____

2. A grocery makes fruit baskets using as many as four apples, three pears, and four oranges. A basket must contain at least one piece of fruit. How many different fruit baskets are possible? (For instance, if there was only 2 apples and 1 pear, the choices would be: 1 apple, or 2 apples, or 1 pear, or 1 pear and 1 apple, or 1 pear and 2 apples – 5 different baskets).

Ans. _____

3. In the World Series, the American League team A, and the National League team N, play until one has won 4 games. If the sequence (NAAAA) means the National League team won the 1st game and lost the next 4, how many different sequences are possible so that the Boston Red Sox win the World Series?

Ans. _____

3. Counting Principles and Binomial Theorem

November 2005 (No Calculators)

1. In how many distinguishable ways can the letters AAAABBBBB be arranged?

Ans. _____

2. If the 5th term in the expansion of $\left(x + \frac{1}{2}\right)^7$ is equal to $-\frac{20}{49}$, find x .

Ans. _____

3. Ford has a new car with 3 individual front seats and three individual back seats. Five teenagers intend to take a ride in the car. Only two can drive. How many different ways can they be seated in the car for the journey?

Ans. _____

3. Counting Principles and Binomial Theorem

November 2006 (No Calculators)

1. In how many ways can 5 students be placed in line, from first to last, if Ellen, one of the students, cannot be first?

Ans. _____

2. Every school day, Ms. Noether picks a two-student team to help with algebra class. Her class contains the minimum number of students to allow her to pick a unique two-student team each day of the 180 day school year. How many students are in Ms. Noether's class?

Ans. _____

3. Find the sum of the numerical coefficients of all of the terms in the expansion of $(a + b + c)^5$ containing the factor c^2 .

Ans. _____

3. Counting Principles and Binomial Theorem

November 2007 (No Calculators)

1. Find the 4th term in the expansion of $\left(\frac{1}{3}x + 9y\right)^6$. Express your answer in simplest form.

Ans. _____

2. There are 8 girls and 8 boys at a dance. In how many ways can they be matched up so that each girl has a boy to dance with?

Ans. _____

3. A flagpole on a ship can hold up to 5 flags. The flags represent a signal. Put vertically on the pole, a red flag above a blue flag would make a certain signal. A blue flag above a red flag would make a different signal. If all flags are different colors, how many signals of at least one flag can be made?

Ans. _____

3. Counting Principles and Binomial Theorem

November 2008 (No Calculators)

1. Five contestants enter an athletic competition. Assuming no ties, in how many ways can the three top medal positions be awarded?

Ans. _____

2. In the expansion of $\left(x^2 + \frac{2}{x}\right)^{12}$, find the value of the term that contains no x .

Ans. _____

3. A box contains 6 red, 5 white, and 4 blue marbles. Alex, Bryce, and Chuck will each be given 5 of the marbles to take home with them. Alex chooses first. He chooses 2 red, 2 white and 1 blue marble. Bryce chooses second. He chooses 2 red, 1 white and 2 blue marbles. Then Chuck gets what is left. How many possible choices are there if each boy takes home 5 marbles?

Ans. _____

3. Counting Principles and Binomial Theorem

November 2009 (No Calculators)

1. In how many distinguishable ways can the letters “stressed” be arranged?

Ans. _____

2. Find the 5th term in the expansion of $\left(2x + \frac{y}{4}\right)^7$.

Ans. _____

3. Five cards from a deck of 52 are drawn. How many different combinations of 3 cards of one value and two cards of another value (a full house) are there?

Ans. _____

4. Polynomials

November 2000

1. Find the remainder when $6x^5 - x^4 - 35x^3 + 40x^2 - 17x + 33$ is divided by $3x^3 - 5x^2 + 2x - 3$.

Ans. _____

2. Find the zeroes of the polynomial $p(x)$ if $p(x) = 2x^3 - 5x^2 - 9x + 18$.

Ans. _____

3. If $f(x) = x^3 - 3x^2 + kx - 5$ and $f(2) = f(-1) + 12$, find $f(3)$.

Ans. _____

4. Polynomials

November 2001

1. Find the remainder when dividing $x^3 + 5x^2 + 7x + 8$ by $x + 3$.

Ans. _____

2. Find a , given that 5 is the remainder when $x^4 - 2x^3 + ax^2 - x - 1$ is divided by $x + 2$.

Ans. _____

3. Find p so that the roots of $x^3 + 2px^2 - px + 10 = 0$ are integers and are in arithmetic progression.

Ans. _____

4. Polynomials

November 2002

1. Find the sum of the coefficients and the constant of the product $(x^3 + 3x - 1)(2x^4 - 5x^2 + 3x + 2)$.

Ans. _____

2. Find n so that $\frac{x^3 + nx^2 + 21x - 18}{x - 3}$ has no remainder.

Ans. _____

3. Factor completely: $x^5 - 7x^4 + 19x^3 - 25x^2 + 16x - 4$.

Ans. _____

4. Polynomials

November 2003

1. If $f(x) = 3x^4 - 2x^3 - 3x + 4$, find $f(2)$.

Ans. _____

2. Determine the values of a and b so that $x^3 - 3x^2 + 2x - 5$ is a factor of $3x^5 - 10x^4 + 12x^3 - 26x^2 + ax + b$.

Ans. _____

3. If 5 is one of the roots of $x^5 - 7x^4 + 3x^3 + 43x^2 - 28x - 60 = 0$, find the other 4 roots.

Ans. _____

4. Polynomials

November 2004

1. Find the quotient when $a^5 - 32$ is divided by $a - 2$.

Ans. _____

2. The difference between the square of the sum of two numbers and the sum of the squares of the same two numbers is 40. Find all of the possible products of the two numbers.

Ans. _____

3. If one root of $x^2 - 2x + n = 0$ is the square of the second root, find all possible values of n .

Ans. _____

4. Polynomials

November 2005 (No Calculators)

1. Find the value of k , so that $f(x)$ has only one real zero, given that

$$f(x) = x^2 - 10x + 2k - 3.$$

Ans. _____

2. If $(x-1)(x-2)(x-3)$ divides into $2x^4 + \dots + 6$ with no remainder find the missing terms of the polynomial.

Ans. _____

3. Find the value(s) of b so that $4x^4 + 2x^2 + bx - 21$ has the same remainder when divided by $x + 2$ as it does when divided by $x - 3$.

Ans. _____

4. Polynomials

November 2006 (No Calculators)

1. What is the largest solution to the equation $x^3 - 48x^2 - x + 48 = 0$?

Ans. _____

2. Solve for x : $-144x^4 + 145x^2 - 36 = 0$.

Ans. _____

3. $y = ax^2 + bx + c$ is the only quadratic equation that intersects with $y = 2x^3 - \frac{11}{2}x^2 - x + \frac{13}{2}$ at $x = -1, 1$ and 3 . Find the product of abc .

Ans. _____

4. Polynomials

November 2007 (No Calculators)

1. In the product of $3x^2 - 7x + 5$ and $4x^2 + 8x - 6$, what is the coefficient of the middle term, if the product is written in ascending powers of x .

Ans. _____

2. If $\frac{15x^2 + 5x - 13}{5x - 3} = R(x) + \frac{4x - 7}{5x - 3}$, find $R(x)$.

Ans. _____

3. The equation $6x^4 - 11x^3 - 84x^2 - 61x + 30 = 0$ has two integral solutions and two fractional solutions. Find the fractional solutions.

Ans. _____

4. Polynomials

November 2008 (No Calculators)

1. Denise wants to solve the polynomial equation $3x^3 - 4x^2 - 5x + 2 = 0$. She writes down all the possible rational roots which she is able to try by using synthetic division. What does she write down?

Ans. _____

2. Factor completely over the set of polynomials with integral coefficients.
 $x^4 - 4x^3 + 14x^2 - 4x + 13$

Ans. _____

3. If a ball is thrown vertically upward at 30 meters/sec, Its approximate height in meters t seconds later is given by the function: $f(t) = 30t - 5t^2$. How high does the ball go?

Ans. _____

4. Polynomials

November 2009 (No Calculators)

1. Find the product: $(x^3 + 4x^2 - 1)(x^2 + 5x - 6)$.

Ans. _____

2. Determine the remainder when $x^5 + 3x^4 - x^3 + 1$ is divided by $x + 1$.

Ans. _____

3. The real zeroes of the following function exist between the integers a and b , where a and b form the smallest possible interval. Find a and b where $a < b$.

$$f(x) = x^6 - 5x - 1$$

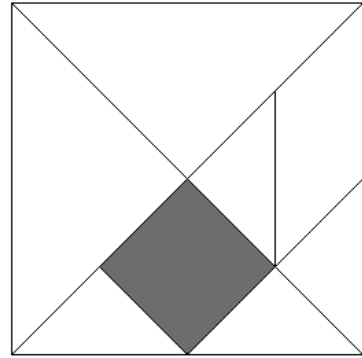
Ans. _____

5. *Areas and Volumes*

November 2000

1. What is the ratio of the area of the shaded square to the area of the large square? (The figure is drawn to scale.)

Ans. _____



2. A regular square pyramid has an altitude of 9 inches and a base perimeter of 8 feet. Find its lateral area.

Ans. _____

3. A right circular cone is inscribed in a cube so that its base is tangent to the base of the cube and its vertex is at the center of the opposite face. Find the exact ratio of the volume of the cone to that of the cube.

Ans. _____

5. Areas and Volumes

November 2001

1. Use the information below for the diagram at right:

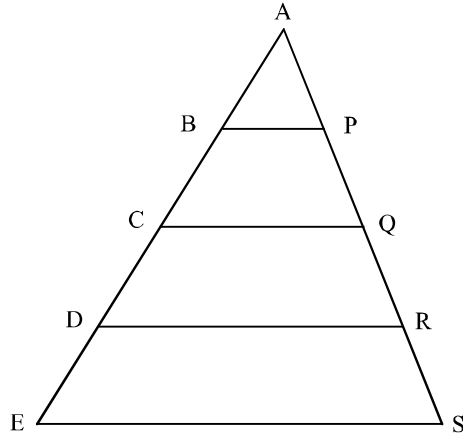
Ans. _____

Given : $\overline{AB} \cong \overline{BC} \cong \overline{CD} \cong \overline{DE}$

$\overline{PB} \parallel \overline{QC} \parallel \overline{RD} \parallel \overline{SE}$

$\overline{SE} \perp \overline{AE}, AE = 16, SE = 12$

Find the area of quadrilateral PBDR.



2. A rectangular container with base 9 cm by 11 cm has a height of 38.5 cm. Assuming that water expands 10 percent when it freezes, determine the depth to which the container can be filled so that the ice does not rise above the top of the container when the contents freeze.

Ans. _____

3. Nine lines parallel to the base of a triangle divide the other sides each into 10 equal segments and the area into 10 distinct parts. If the area of the largest of these parts is 76, find the area of the original triangle.

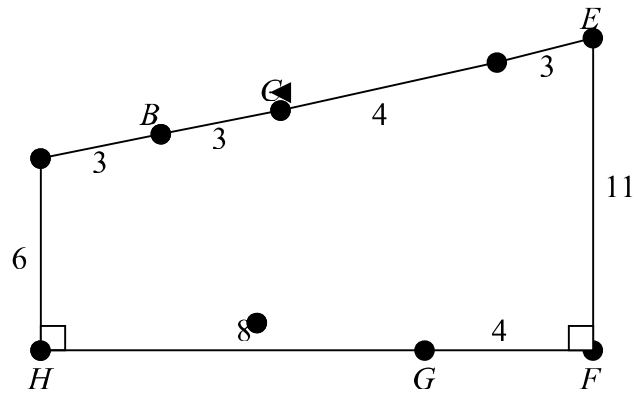
Ans. _____

5. *Areas and Volumes*

November 2002

1. In the trapezoid $AEFH$, a triangle is to be formed with vertices at F and G . The third vertex is to be selected from one of the points $\{A, B, C, D, E\}$. Which point will produce the triangle with the least area?

Ans. _____



2. A cubical water tank has a volume of 1728 cu. In. of water when completely filled. A cone is forced point down into the tank, spilling water out, until the cone touches the bottom and the base of the cone touches all four sides at the top of the tank. The cone is then removed. What is the height of the water now left in the tank? Round answer to nearest 100th of an inch.

Ans. _____

3. Find the length in feet rounded to the nearest tenth, of a side of a perfectly square plot of land containing 100 acres. Note: there are 640 acres in a square mile.

Ans. _____

5. *Areas and Volumes*

November 2003

1. A right octagonal pyramid has a volume of 12 and a height of 2. Find the area of the octagon at the base of the pyramid.

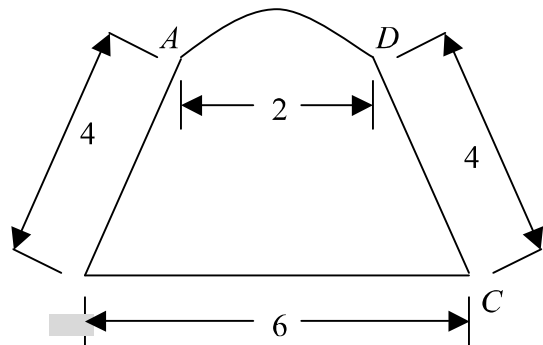
Ans. _____

2. Find the surface area of a solid, spherical ball with volume of $\frac{\sqrt{3}}{2}\pi$. Express answer in exact form.

Ans. _____

3. The figure shown is created by drawing part of a circle over the isosceles trapezoid $ABCD$ so that the segments AB and DC are tangent to the circle made by the arc at points A and D respectively. Find its exact area or give answer to the nearest hundredth.

Ans. _____



5. *Areas and Volumes*

November 2004 (You may use a Calculator)

1. The area of a rectangle and a square are equal. If the perimeter of the square is 16 and the length of the rectangle is four times its width, what is the perimeter of the rectangle?

Ans. _____

2. Four (4) bowling balls each with a radius of 12 inches are to be shipped in a box which is in the shape of a rectangular prism and is of least volume. A plastic foam is then sprayed into the box containing the bowling balls to completely fill the space between the balls and the box. Find the volume of the foam needed. Round answer to nearest 100th.

Ans. _____

3. A square pyramid has all edges congruent. If the area of a lateral face is $81\sqrt{3}$, find the volume of the pyramid. Give exact answer or round to nearest 100th.

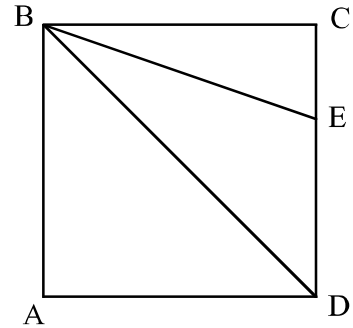
Ans. _____

5. *Areas and Volumes*

November 2005 (You may use a Calculator)

1. Given the square $ABCD$ as shown with $DE = 2EC$. What is the ratio of the area of $\triangle BED$ to the area of square $ABCD$? Express your answer as a common fraction in reduced form.

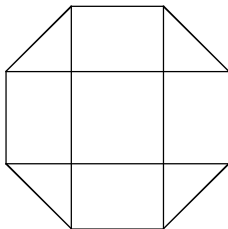
Ans. _____



2. A trapezoid is inscribed in a semicircle of radius 3 so that one base is a diameter and the other base has length 3. What is the area of the trapezoid? Express answer in simplest radical form.

Ans. _____

3. The base of a right, rectangular prism is a regular octagon and the area of the center square made by horizontal and vertical diagonals as shown is 4 in^2 . What is the volume of the prism in simplest radical form, if the height of the prism is 6 in.



Ans. _____

5. *Areas and Volumes*

November 2006 (You may use a Calculator)

1. The total surface area of a hemisphere including its base is 18.75π . Find the measure of the length of the radius.

Ans. _____

2. An equilateral triangle is attached to the exterior of the lower base of a square, such that the side of the square and the side of the triangle coincide. Attached to the exterior of the upper base of the square is a semicircle, such that the diameter of the semicircle and the side of the square coincide. If a side of the square is 6 inches long, what is the area of the enclosed region made by the square, equilateral triangle and semicircle? Round answer to the nearest 100th.

Ans. _____

3. The faces of a square pyramid are made of equilateral triangles and a square. Joining the midpoints of the lateral edges of this pyramid forms a square. If segments are drawn from the vertices of this smaller square to the center of the base, it will form another square pyramid. If the height of the larger pyramid is 6 units long, what is the volume of the smaller pyramid?

Ans. _____

5. *Areas and Volumes*

November 2007 (You may use a Calculator)

1. A triangle has its vertices on the intersections of the following six lines: $x = 0$, $x = 2$, $x = 4$, $y = 0$, $y = 2$, and $y = 5$. Find the positive difference between the maximum and minimum possible areas of the triangle.

Ans. _____

2. Assuming the earth is a sphere with radius 4000 miles, then 50% of the earth's volume is within R miles of the center. Find the value of R rounded to the nearest mile.

Ans. _____

3. Elmer has a fenced in petunia patch in the shape of an equilateral triangle. He notes that if each side of the triangle were 1 unit longer, the ratio of the area fenced to the perimeter of the larger triangle would be 10% greater than that same ratio for the smaller triangle. How many petunia plants are in Elmer's patch, if each plant occupies $\sqrt{3}$ square units of area?

Ans. _____

5. *Areas and Volumes*

November 2008 (You may use a Calculator)

1. The length of a rectangular garden is 10 feet longer than twice the width. What is its area, if its perimeter is 110 feet?

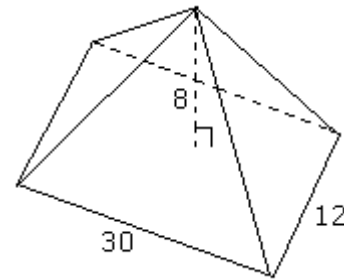
Ans. _____

2. The diameter of the base of a sand pile which is in the shape of a right circular cone is 14 meters. The distance from the outer edge of the base to the peak of the sand pile is 25 meters. What is the volume of the sand pile? Give exact answer or rounded to the nearest 100th.

Ans. _____

3. The right rectangular pyramid at right has base edges of 12 and 30 and a height of 8. Find its total surface area.

Ans. _____



5. *Areas and Volumes*

November 2009 (You may use a Calculator)

1. One angle of a rhombus measures 120° . The perimeter is 96. Find the area of the rhombus.

Ans. _____

2. A right rectangular pyramid is 15 inches high and has base edges which measure 9 inches by 12 inches. Find the area of a cross-section 10 inches above the base.

Ans. _____

3. In the diagram, the circle and square share the same center. If the area of the region ABC, which is outside the circle and inside the square, equals the area of the region bounded by chord CD and minor arc CD, which is inside the circle and outside the square, find the exact ratio of the side of the square to the radius of the circle.

Ans. _____

