

1. Arithmetic with Ratio and Proportion

November 2010 (No Calculators)

1. Find the 3-digit number ABC in the multiplication shown.

$$\begin{array}{r} \text{A B C} \\ x 975 \\ \hline 3435 \\ 4809 \\ \hline 6183 \\ \hline 669825 \end{array}$$

Ans. _____

2. The number of cards Bill has is in a ratio of 2 to 3 to the number that Mark has. If Bill gives Mark 5 cards, then the ratio that Bill has is 9 to 16 to the number that Mark has. How many cards does Mark have?

Ans. _____

3. If $\frac{a}{b} = \frac{8}{9}$, $\frac{a}{c} = \frac{4}{15}$, and $\frac{a}{d} = \frac{2}{3}$, find $\frac{bd}{ac}$.

Ans. _____

1. Arithmetic with Ratio and Proportion

November 2011 (No Calculators)

1. For doing chores around the house, Marge get \$5.00 per week. Her little brother Mark gets \$3.00 per week. After so many weeks Mark has received a total of \$72. How much does Marge earn during the same period of time?

Ans. _____

2. Sarah has a collection of dimes and quarters totaling \$24.40. If she has 136 coins in all, what is the value of all the dimes? Give your answer in dollars and cents – such as \$3.50.

Ans. _____

3. p varies inversely with the cube of q and directly with the square of m . When p is 4 and q is 16, then m is 8. What is m when p is 16 and q is 4? Assume p , q , and m are each greater than zero.

Ans. _____

1. Arithmetic with Ratio and Proportion

November 2012 (No Calculators)

1. A large cylindrical tube is accurately marked from bottom to top in 8ths. When it was $\frac{1}{8}$ full, 15 gallons of liquid were added, making it now $\frac{3}{4}$ full. How many more gallons are needed to fill the tank?

Ans. _____

2. Suppose that $\frac{x}{y} = \frac{4}{7}$ and that $\frac{y}{z} = \frac{14}{3}$. What is the numerical value of $\frac{x+y}{z}$? Express your answer as a fraction in the form $\frac{a}{b}$.

Ans. _____

3. In a class of 100 students, 38 students took calculus, 46 took physics and 55 took US History. 22 took physics and history, 16 took calculus and history, 9 took calculus and physics, and 4 students took all three courses. How many took none of the three subjects?

Ans. _____

2. Sequences and Series

November 2010 (No Calculators)

1. Find $693 + 686 + 679 + 672 + \dots + (-686) + (-693) + (-700)$.

Ans. _____

2. Find x , if $\sqrt{1 + 3 + 5 + 7 + \dots + x} = 11$.

Ans. _____

3. Let $a, b, c,$ and d be natural numbers with $a < b < c < d$. If $a, b, c,$ and d are the first four terms of an arithmetic sequence and $a, b,$ and d are the first three terms of geometric sequence, what is the numerical value of b/c ?

Ans. _____

2. Sequences and Series

November 2011 (No Calculators)

1. Find the 11th term of the sequence which begins 13, 20, 27, ...

Ans. _____

2. Alexa's father gave her a nickel after the first day she was good all day. The next day he gave her 2 nickels for being good all day. The third day he gave her 3 nickels. She put them all in the piggy bank. What would be the total amount of money in dollars and cents (such as \$5.20), that Alexa would have in her bank after 40 days of being good?

Ans. _____

3. Find the sum of the multiples of 6 from 200 to 300 which are not divisible by 9.

Ans. _____

2. Series and Sequences

November 2012 (No Calculators)

1. Find the sum of the series $(-300) + (-297) + (-294) + \dots + (306) + (309)$.

Ans. _____

2. In a sequence, every term after the second term is twice the sum of the two preceding terms. The seventh term of the sequence is 8 and the ninth term is 24. What is the eleventh term of the sequence?

Ans. _____

3. w , x , y , and z are consecutive terms of an arithmetic sequence with common difference of 2012. Find the following: $\frac{z^2 - w^2}{y^2 - x^2}$

Ans. _____

3. Counting Principles and Binomial Theorem

November 2010 (No Calculators)

1. Find the coefficient of x in the expansion of $\left(x + \frac{1}{x}\right)^7$.

Ans. _____

2. A high school Interact Club has 12 members, 7 which are girls. the club has been asked to be represented by 7 members at a convention. How many different groups of members can be sent, if 4 of the group are girls and 3 are boys?

Ans. _____

3. Mr. Trendilines has one of those cars that has 3 separate seats in the front and 3 separate seats in the back. If 5 persons, only of which can drive, get in to take a joyride, how many possible ways can they be seated?

Ans. _____

3. Counting Principles and Binomial Theorem

November 2011 (No Calculators)

1. How many 4-letter distinguishable “words” can be made from the letters M, A, M, L? Words such as MAML do not have to make a real word.

Ans. _____

2. An antique car dealer featured 10 cars from the 1940s. Three of the cars will be chosen at random to go to auction to be sold. How many different groups of cars can go to the auction?

Ans. _____

3. In the expansion of $(3x^2 - 5y^3)^5$, each term has an $x^p y^q$. Find the sum of the coefficients of the two terms where $p + q$ has the largest values.

Ans. _____

3. Counting Principles and Binomial Theorem

November 2012 (No Calculators)

1. How many distinguishable automobile license plates of 6 digits can be made if the first digit (on the left) cannot be 0 (zero)?

Ans. _____

2. Find the coefficient of the term in the expansion of $\left(4x^2 - \frac{1}{2x^3}\right)^8$ that contains x to a power of 1.

Ans. _____

3. Three fair, standard six-faced dice of different colors are rolled. In how many ways can the dice show a sum of 10 on the top faces?

Ans. _____

4. Polynomials

November 2010 (No Calculators)

1. Find the coefficient of x^3 in the polynomial that results from $(x - 1)(x - 2)(x - 3)(x - 4)$.

Ans. _____

2. Find the distance between the two x-intercepts of the graph of $y = x^2 - \frac{13}{6}x - \frac{28}{6}$

Ans. _____

3. Find the product of the greatest and the least roots of $x^5 - x^4 - 25x^3 - 11x^2 + 144x + 180$

Ans. _____

4. Polynomials

November 2011 (No Calculators)

1. Find the product: $(x + 2y)(2x - y)(x + y)$

Ans. _____

2. If $P(x) = 3x^3 + x^2 - 62x + 40$, find all values of x such that $P(x) = 0$.

Ans. _____

3. If $21x^5 - 50x^4 + 90x^3 - 43x^2 + kx + p$ is divided by $7x^3 - 5x^2 + 3x + 4$, there is no remainder. Find the values of k and p .

Ans. _____

4. Polynomials

November 2012 (No Calculators)

1. Find the solutions of $2x^2 + 3x - 5 = 0$.

Ans. _____

2. Let $P(x) = kx^3 + 2k^2x^2 + k^3$. Find the sum of all real numbers k for which $x - 2$ is a factor of $P(x)$.

Ans. _____

3. If $P(x) = 3x^3 + x^2 - 62x + 40$, find all values of x such that $P(x) = 0$.

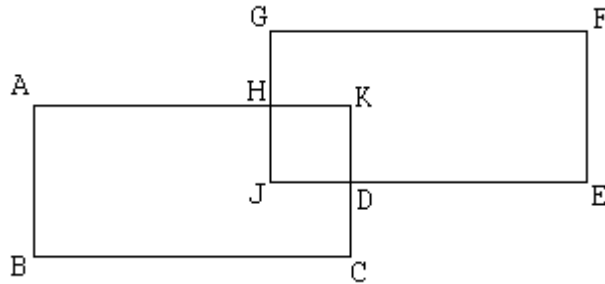
Ans. _____

5. Areas and Volumes

November 2010 (You may use a Calculator)

1. In the figure: $AB = GJ = AH = 2$ units. $ABCK$ and $GFEJ$ are rectangles. $\overline{GJ} \perp \overline{AK}$. $HJ = JD$. $GF = BC = 3$ units. Find the area of $ABCDEFGH$.

Ans. _____

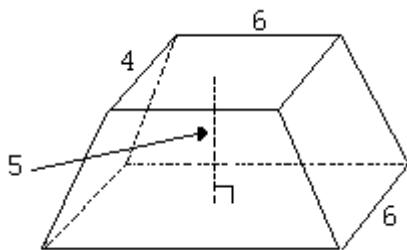


2. A circle intersects a sphere 7 inches from its center. If the area of the circle is 576π square inches, what is the surface area of the sphere? Give answer to nearest square inch.

Ans. _____

3. The opposite lateral faces of this frustum are congruent. Find the volume of the frustum. The height of the frustum is 5.

Ans. _____



5. *Areas and Volumes*

November 2011 (You may use a Calculator)

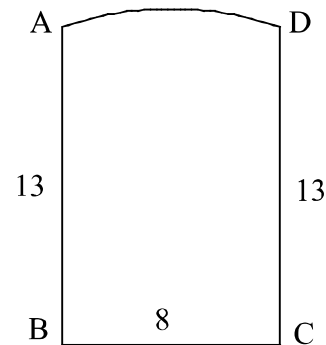
1. How many little cubical blocks with side lengths of 2 units does it take to make a large solid cube with a side length of 8 units?

Ans. _____

2. Assume that all bears have the same body structure. A bear weighing 648 lbs. stands 42 inches high from the bottom of his paws to the tip of his shoulders when on all fours. How tall does a bear weighing 375 lbs. stand?

Ans. _____

3. Given: $AB = CD = 13$, $BC = 8$, and arc AD is an arc of the circle centered at the midpoint of side BC . Find the area of the figure in the drawing. Round your answer to 4 decimal places.



Ans. _____

5. *Areas and Volumes*

November 2012 (You may use a calculator)

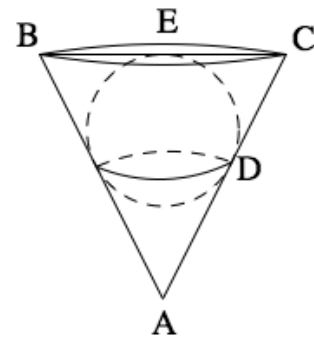
1. A slanted pentagonal pyramid has a base area of 32 cm^2 . If it stands 3 cm high, what is its volume?

Ans. _____

2. The area of a cross-section of a pyramid is 36 cm^2 . The cross-section is 4 cm from the base and the height of the pyramid is 16 cm. What is the volume of the pyramid?

Ans. _____

3. \overline{BC} is the diameter of the base of the right circular cone. The measure of angle BAC is 60° . A metallic ball is placed in the cone tangent to the lateral surface such that $AD = 20$. The ball is also tangent to the base of the cone at point E. Find the exact volume of the cone or round the volume to the nearest 100^{th} .



Ans. _____