**Age and Coin**

1. Thomas purchases a selection of wrenches for his shop. His bill is $78. He buys the same number of $1.50 and $2.50 wrenches, and half that many of $4 wrenches. The number of $3 wrenches is one more than the number of $4 wrenches. How many of each did he purchase? $2.5 = 10, $1.5 = 10, $4 = 5, $3 = 6
2. 8 years ago, Jimmy was three times as old as Anne. In 4 years, Jimmy will be 3/2 of Anne’s age. How old will Anne be in 2 years?
3. 8
4. 12 C
5. 14
6. 20
7. 22
8. John is 6 years younger than Tina. Beth is 3 times as old as Steve. Tina is twice as old as Mike. Steve is 2 years older than Mike. If the sum of everyone’s age in 2 years is 102, how old is John?
9. 10
10. 12
11. 14 C
12. 20
13. 36

**Algebra**

1. Find the solution set for the following inequality -2|3-2x| < 14? -2<x<5
2. Find the solution set for the following inequality |3x – 2| ≤ |2x – 5|?
3. Is |x-z| + |x| = |z|?  
   (1) zy < xy < 0 A  
   (2) y>0
4. If is s < t? A
5. s > 1
6. t > 0
7. If a *≠* -b, is ?
8. b2 > a2
9. a – b > 1 A
10. Is ? A
11. 10x < 3y -6
12. 12x – 7 > 4y

**Averages**

1. The average weight of a class of 44 students is 36 kg. If the weight of the teacher is included, then the average weight of the class increases by 1 kg. What is the weight of the teacher? 81
2. In Tom’s favorite game he has a certain average for the first 25 rounds. After scoring 140 points in the 26th his average improves by 3 points. What is his new average after the 26th round? 65
3. The average of 11 games is 50. The average of the first 6 is 49 and the last 6 is 52. What is the result of the 6th game? 56
4. Committee X and Committee Y, which have no common members, will combine to form Committee Z. Does Committee X have more members than Committee Y? C
5. The average (arithmetic mean) age of the members of Committee X is 25.7 years and the average age of the members of Committee Y is 29.3 years.
6. The average (arithmetic mean) age of the members of Committee Z will be 26.6 years.

**Combinations and Permutations**

1. A farmer has 10 sheep 4 black and 6 white. He would like to take 3 of the sheep to get shaved. How many different groups of 3 sheep can he select that would have at least one black one?

100

1. There are 10 books on a book shelf, 5 Math, 3 History and 2 Art. If 2 books are selected at random how many different pairs of 2 different kinds of books can be selected? 31
2. Four different science books, six different art books and two different novels are to be arranged on a shelf. How many different arrangements are possible if (a) all the books of one type must stand together, and (b) only the science books must stand together? (a)4!6!2!3! (b)4!9!
3. How many 3 digit numbers exist that have only one 7? 225
4. A manager needs to hire 3 people to work in her marketing department, and one of which is to be the team leader. If there are 10 potential candidates, how many distinct ways can she fill these three positions? 360
5. If Roger lives at point A and works at point B, how many different ways can he travel to work if he must always take the shortest path? 20



1. How many ways can Mike and John sit down at the table so that they don’t sit directly across from each other? 224

**Coordinate Geometry**

1. What is the value of k?
2. In the xy-coordinate system, (a,b) and (a+3, b+k) are two points that lie on the line defined by the equation x = 3y – 7. A
3. k² = 1
4. What is the least possible distance between a point on the circle x2 + y2 = 1 and a point on the line y = 3/4(x) - 3?  
   A) 1.4 A  
   B) √2  
   C) 1.7  
   D) √3  
   E) 2
5. In the xy plane line m has the equation 4x + y = k. Line n passes through the origin and is perpendicular to line m. If point p has the coordinates (r, r+1) and is on both line n and m what is the value of r?
6. -4/3 A
7. 1/4
8. -4
9. 3/4
10. 4/3
11. In xy-plane, y=ax2+bx+c, does the graph intersect with x-axis?  
    (1) a > 0 C  
    (2) c < 0
12. If line k in the xy plane has equation y = mx + b, where m and b are constants, what is the slope of k?  
    (1) k is parallel to the line with equation y = (1-m)x + b + 1 A  
    (2) k intersects the line with equation y = 2x + 3 at the point (2,7)
13. In the *xy*-plane, the line with equation *ax* + *by* + *c* = 0, where *abc* ≠ 0, has slope 2/3. What is the value of *b*?  
    (1) *a* = 4 A  
    (2) *c* = −6

**Exponents and Roots**

1. Simplify the following fractions:

a)

b)

c) 4

1. Simplify the following roots:

a) 9

b) 8

c) 10

1. Solve for n for the following equations:

a) 4

b)

c) 31

d) 5

e) 15

**Functions**

1. For all integers b, ~b~ = b2 -2. What is the value of ~(~5~)~? 527
2. For numbers j and r, r @ j = r × (r – j). What is the value of x if x @ 10 = -25? 5
3. For all integers x, \*x = x2 -6. What are all possible values of b if \*(b–1)=10? 5 or -3
4. If f(x) = 125/x³, what is the value of (f(5x)) × (f(x/5)) in terms of f(x)?
5. (f(x))2
6. f(x2) A
7. (f(x))³
8. f(x³)
9. 1
10. For which of the following functions f is f(x) = f(1-x) for all x?
11. f(x) = 1-x
12. f(x) = 1-x2
13. f(x) = x2 – (1-x)2
14. f(x) = x2(1-x)2
15. f(x) = x/(1-x) D

**Mixture Problems**

1. A drink contains 40% gin and 60% vodka. If the volume of the drink is (n) how much vodka must be added in terms of (n) to be left with a 25% concentration of gin?
2. Solution Y is 30 percent liquid X and 70 percent water. If 2 kilograms of water evaporate from 8 kilograms of solution Y and 2 kilograms of solution Y are added to the remaining 6 kilograms of liquid, what percent of this new solution is liquid X? 37.5%
3. A room contains 160 people, 15% of whom are women. A group of people, 30% of whom are women, leaves the room. Of the people remaining in the room, 10% are women. How many people left the room? 40

1. Seed mixture X is 40 percent ryegrass and 60 percent bluegrass by weight; seed mixture Y is 25 percent ryegrass and 75 percent fescue. If a mixture of X and Y contains 30 percent ryegrass, what percent of the weight of this mixture is X? 33%
2. There are two alloys of copper and zinc. In the first alloy, the ratio of copper to zinc is 3:4 and in the second alloy the ratio of copper to zinc is 6:1 In what proportion should these two alloys be mixed so that a new alloy containing equal parts of copper and zinc may be obtained? 5:1

**Number Properties**

1. What is the units digit of 317×1754×13519×3121×4217? Zero
2. Which of the following fractions has a decimal equivalent that is a terminating decimal?

a) 10/189

b) 15/196

c) 16/225 E

d) 25/144

e) 39/256

1. If n = 8111 – 8, what is the units digit of n? 4
2. If *M* and *N* are positive integers that have remainders of 1 and 3, respectively, when divided by 6, which of the following could NOT be a possible value of *M*+*N*?  
   a) 86 A  
   b) 52  
   c) 34  
   d) 28

e) 10

1. When the integer *n* is divided by 17, the quotient is *x* and the remainder is 5. When *n* is divided by 23, the quotient is *y* and the remainder is 14. Which of the following is true?

a) 23*x* + 17*y* =19

b) 17*x* –23*y =* 9 B

c) 17*x* +23*y* =19

d) 14x + 5y = 6

e) 5x – 14y = -6

1. When N is divided by 10 the remainder is 1 and when N is divided by 3 the remainder is 2. What is the remainder when N is divided by 30? 11
2. What is the remainder when 291 is divided by 7? 2
3. If y+2 is divisible by 4 then is y/2 odd or even? odd
4. If k is an even integer and p and r are odd integers, which of the following **cannot** be an integer?
5. r/k
6. k/p A
7. p/r
8. kp/r
9. kr/p
10. How many divisors does 39690 have? 60
11. Which of the following is not a prime number?
12. 323
13. 263 A
14. 241
15. 197
16. 131
17. What is the least common multiple of 8, 9, 10, 11, 12 and 24? 3960
18. When the product of **3070956 and n** divided by **720** there will be no remainder. If n > 0, what is the smallest value of n? 60
19. How many of the positive factors of 42 are not factors of 56?
20. 1
21. 2
22. 3 D
23. 4
24. 5
25. What is the smallest positive integer n for which 324 is a factor of 6n?
26. 2
27. 3
28. 4 C
29. 5
30. 6
31. 1025 – 560 is divisible by all the following EXCEPT?

a) 11

b) 8

c) 5 E

d) 4

e) 3

1. What is the smallest integer that 10584 must be multiplied by so that the resulting number is a perfect cube? 7
2. By using the numbers 1,2,3,5 and 7 only once, how many five digit numbers can be made that are divisible by 25? 12
3. What is the smallest sum of integers m and n so that the five digit number 7m1n0 is divisible by 72?
4. How many positive integers less than 1000 have no factors (other than 1) in common with 1000?  
   a) 400 A  
   b) 410  
   c) 411   
   d) 412  
   e) None of the above

1. The sum of two numbers is 588 and their HCF is 49. How many such pairs of numbers can be formed? 2
2. How many zeros does 100! end with? 24
3. What is the highest integer power of 12 that divides 27! evenly? 11
4. Which is bigger 89! – 88! or 87! × 882? They are equal
5. If n is the product of the integers from1 to 20 inclusive, which of the following is the greatest integer k for which 2k is a factor of n?  
   a) 408  
   b) 437  
   c) 486  
   d) 532 D  
   e) 1242
6. Is 22 a factor of x?

(1) 22 is a factor of 15x A

(2) 22 is a factor of 16x

**Percents**

1. In addition to the price of the meal, Janet paid sales tax equal to 8.5% of the price of the meal, and a tip equal to 15% of the price of the meal. If she paid $2.04 in sales tax, how much was the tip? 3.60
2. During a four-day sale, a store sells 20% of its stock of kitchen tables on the first day, 25% of the remaining stock on the second day and one-third of the unsold tables on the third day and 50% of what was left on the last day. If 18 tables remained after the sale was over, how many tables were in the stock at the beginning of the sale? 90
3. Two items are sold for 1200 each if the merchant made a profit of 25% on one and a loss of 25% on the other, what is his overall profit or loss? -160
4. Mr. Johnson invested $50,000 into two investments. Part of it he put in a gold mine stock from which he hoped to receive a 20% return per year. The rest he invested in a bank stock which was paying 6 percent per year. If he received $400 more the first year from the bank stock than from the mining stock, how much did he invest in each stock? Gold:10000 bank:40000
5. If an item is sold at 80% of its present selling price, the merchant will make a loss of 4%. What percent profit does he make by selling at the current selling price? 20%
6. A merchant marks his goods in such a way that his profit on sale of 50 items equals the selling price of 10 items. What percent profit does he make? 25%
7. Bob bought a goat. He expected to sell it at a price that would give him a 10% profit on his purchase. However, he had to sell it for $50 less than he expected, which was a loss of 15% on what it cost him. What did Bob pay for the goat? 200
8. The interest compounded annually on a certain sum of money is $41.60 after two years. The simple interest on the same amount of money after two years would be $40.00. Find the amount invested if the interest rate would be the same in each investment. 250

**Probability**

$250

1. If any number from set A is multiplied by any number from set B, what is the probability that the product is a multiple of 4? 2/5

A = {21, 22, 23, 24, 25} B = {23, 24, 25, 26, 27}

1. A bowl contains 10 apples, 2 of which are bad. If someone randomly selected four apples from the bowl, what is the probability that at least one of the apples is bad? 2/3
2. In a five day period the chance of rain each day is 50% what is the chance that it will rain only twice? 5/16
3. The probability of picking two red balls from a container of red and blue balls is 2/9. If there are 5 blue balls in the container, how many red balls were in the container?

a) 4

b) 5 B

c) 6

d) 7

e) 8

1. The probability of a man hitting a bull’s-eye in one throw at a dart board is ¼. What is the least number of throws he must take in order for the probability of hitting the bulls eye at least once to be more than 50%? 3

**Ratios**

1. Exactly 3/7 of the people in the room are under the age of 21, and exactly 5/13 of the people in the room are over the age of 65. If the total number of people in the room is greater than 50 and less than 100, how many people in the room are under the age of 21?

a) 21

b) 35

c) 39 C

d) 60

e) 65

1. A certain bag contains a mixture of nuts and raisins, in the ratio of 3:2, nuts to raisins by weight. If 15 pounds of nuts are removed, and are replaced with 20 pounds of raisins, so that the new ratio is 3:4, how many pounds of raisins were in the original mixture? 40
2. Andy, Ben, Carl and Dave bought a car for $6000. Andy paid half the sum of the other boys, Ben paid one third the sum of the other boys and Carl paid one fourth the sum of the other boys. How much did Dave have to pay? 1300
3. Bag A contains red, white and blue marbles such that the red to white marble ratio is 1:3 and the white to blue marble ratio is 2:3. Bag B contains red and white marbles in the ratio of 1:4. Together, the two bags contain 30 white marbles. How many red marbles could be in bag A?

a) 1

b) 3

c) 4

d) 6 D

e) 8

1. Michael sells twice as many $20 tickets as Thomas, and Thomas sells three times as many $10 tickets as Michael does. If there are only $10 and $20 tickets, how many tickets does Michael sell?

(1) Thomas sold a total of 35 tickets. B

(2) Together Michael and Thomas sold 70 tickets for a total of $1,000

1. An investment fund manager is considering three stocks, *P*, *Q*, and *R* for her portfolio. For the cost of 1 share of *P*, she could buy 3 shares of *Q* or 5 shares of *R*. If she invested an amount equal to the cost of 4,500 shares of *Q* but purchased equal numbers of shares of *P* and *R* and no shares of *Q*, how many shares of *R* did she buy?

1250

1. Andy and Bob enter into a partnership. Andy invests $5000. At the end of 3 months, he withdraws $500 and at the end of 7 months he withdraws $900. If Bob does not withdraw any money throughout the year and gets $800 as his share of the total profit of $1800 at the end of the year, how much did he invest? 3400

**Right Triangles and other Geometry**

1. What is the area of a rectangular garden with diagonal length of 200 feet and a perimeter of 560 feet? 19200
2. What is the area of a circle that has an equilateral triangle with an area of 4√3 inscribed in it?
3. If Radius BC equals 2, What is the area of the shaded region of the circle formed by the rectangle inscribed in the circle?

 



1. In the Square above the length of line AB is 4 and angle BAC is 45 degrees. Approximately what is the circumference of the circle? 20π



1. In the circle above with center C and radius 2 what is area of the shaded region if angle ABF = 30° and line FG and Line AB are parallel? (2/3)π - √3



1. CDEB is a parallelogram and P is the midpoint of ED. If GB = 5 what is the length of BA =? 15

**Sequences and Series**

1. How many numbers between 200 and 3600 inclusive are divisible by 4, 5 and 6? 57
2. Find the sum of all two digit numbers which leave a remainder of 3 when divided by 7? 676
3. If the sum of 10 consecutive integers is 1005 how many of the numbers are prime? 3
4. If the sequence *x*1, *x*2, *x*3, ..*xn*, is such that *x*1 = 3 and *xn*+1= 2*xn* – 1 for *n* ≥ 1, then *x*20 – *x*19 equals?
5. 219
6. 220
7. 221
8. 220 – 1 A
9. 221 – 1
10. A sequence of numbers a1, a2, a3… is given by the rule an2 = an+1. Does 3 appear in the sequence?
11. a1 = 2
12. a3 = 16 D

**Set Problems and Venn Diagrams**

1. One evening at a party with 50 people it was discovered that 22 people study accounting, 15 people study marketing and 14 people study economics. If there are 9 people that study exactly two subjects and 1 person studies all three, how many people study none of the topics? 10
2. At alpha athletics club the members are required to play at least one sport besides their normal fitness training. In fact 33 members play tennis, 43 members play squash, and 42 members play golf. 16 members play at least tennis and squash, 18 members play at least squash and golf and 8 members play golf and tennis. If 5 members play all three sports, how many members are in the club? 81
3. In a consumer survey, 85% of those surveyed liked at least one of three products: 1, 2, and 3. 50% of those asked liked product 1, 30% liked product 2, and 20% liked product 3. If 5% of the people in the survey liked all three of the products, what percentage of the survey participants liked more than one of the three products? 10%
4. At a certain health club, 30% of the members use both the pool and the sauna, but 40% of the members who use the pool do not use the sauna. What percent of the members use the pool? 50%
5. At a chess tournament there are 46 participants. The ratio of the participants that speak Spanish and English is 3:2 and 6 speak neither of these languages. If the number of participants that speak both Spanish and English is 5, how many participants speak only Spanish? 22

**Speed Problems**

1. A cop clocks a motorcyclist speeding down the highway at 90 mph. 2 minutes later the cop tears off after him averaging a speed of 120mph. At this rate how long will it take for our friendly copper to catch the speeder? 6 min.
2. A man travels 75% of the way from point A to point B traveling at a speed of 50mph. How fast must he travel the rest of the trip in order to maintain an overall average speed of 40 mph? 25
3. It takes an hour more by train to cover a distance of 360 miles when the usual speed of the train is decreased by 4 mph. What is the usual speed of the train?

a) 60

b) 55

c) 50

d) 45

e) 40 E

1. A train traveling at 72 km/h passes a man on a bicycle traveling at 36 km/h completely in 40 seconds. If the length of the bicycle is 2 meters, what is the length of the train? 398 meters
2. Two trains pass each other in 80 seconds, one traveling at 40 km/h and the other at 32 km/h. If the length of one of the trains is 540 meters, what is the length of the other? 1060 meters
3. A boat travels up the river and down the river the same distance. If the average relative speed of the boat 48 mph and the speed of the river is 10 mph, what is the upriver speed of the boat? 40 mph
4. A track is exactly 1 km in length. If Andy gives Bill a head start of 60 m or 12 seconds, they both finish at the same time. How long does Andy need to run around the track? 188 sec

**Standard Deviation**

1. For a certain exam a score of 58 is 2 standard deviations below the mean and a score of 98 is 3 standard deviations above mean. What was the mean score of the exam? 74
2. A set of data consists of the following 5 numbers: 0,2,4,6, and 8. Which two numbers, if added to create a set of 7 numbers, will result in a new standard deviation that is close to the standard deviation for the original 5 numbers?  
   a) -1 and 9  
   b) 4 and 4  
   c) 3 and 5  
   d) 2 and 6 D  
   e) 0 and 8
3. A certain characteristic in a large population has a distribution that is symmetric about the mean *m*. If 68 percent of the distribution lies within one standard deviation *d* of the mean, what percent of the distribution is less than *m + d?* 84%
4. A series of x consecutive numbers where the mean has a value of R and a standard deviation of Q. What would be the new standard deviation if each number in the series increased equally in order to create a new mean of R + Z?
   1. Q A
   2. Q + Z
   3. Qx + Z
   4. QR +Z
   5. R + Z
5. Two different groups of test-takers received scores on the GXYZ standardized test. Group A''s scores had a normal distribution with a mean of 460 and a standard deviation of 20. Group B''s scores had a normal distribution with a mean of 520 and a standard deviation of 40. If each group has the same number of test-takers, what fraction of the test-takers who scored below 440 belonged to Group B? 1/9

**Work Problems**

1. DAfter 40 minutes pipe A can fill a tank. Pipe B can fill the same tank in 20 minutes. A leak at the bottom of the tank can empty the tank in 120 minutes. If both pipes are open and the tank is already half full, how long will it take to fill the tank? 7.5min.
2. Three small pumps and a large pump are filling a tank. Each of the three small pumps works at 2/3 the rate of the large pump. If all pumps work at the same time, they should fill the tank in what fraction of the time that it would have taken the large pump alone? 1/3
3. Pipe X can fill the tank in 10 minutes. Pipe Y can fill the tank in 15 minutes. Drain A is used to drain the tank. After opening pipe X and pipe Y, a man returns when the tank should have been full. However he finds that the drain was also left open. At that point he shuts the drain and in the next two minutes the tank is full. How many minutes will it take for Drain A to empty the tank? 18 min.
4. The ratio of the rates of Bob, John and Craig is 1 to 2 to 5 respectively, if the three work together on the project it takes 4 hours to complete. How long does it take John to do the job alone? 16
5. At a bottling factory six machines working together can bottle 5000 bottles in 4 hours. If only three machines are operational, how long will it take them to bottle 3000 bottles? 24/5