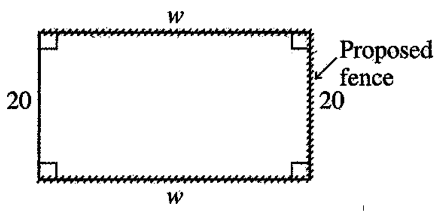
6 **Harriet wants to put up fencing around three sides of her rectangular yard and leave a side of 20 feet unfenced. If the yard has an area of 680 square feet, how many feet of fencing does she need?**

(A) 34
(B) 40
(C) 68
(D) 88
(E) 102

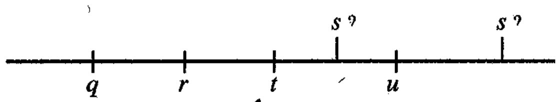


The diagram above shows the rectangular yard with the known dimension, 20 feet, and the unknown dimension, w feet The area of the yard is $20w = 680$ square feet, so $w = \frac{680}{20} = 34$ feet The length of fencing needed is then $34 + 20 + 34 = 88$ feet Thus, the best answer is D

7 **If $u > t$, $r > q$, $s > t$, and $t > r$, which of the following must be true?**

I $u > s$
II. $s > q$
III $u > r$

(A) I only
(B) II only
(C) III only
(D) I and II
(E) II and III



The number line shown above is based on the given inequalities and may be helpful when I, II, and III are considered

I It may be that $q = 0$, $r = 1$, $t = 2$, $u = 3$, and $s = 4$, so that $u > s$ is not necessarily true

II Since $s > t$, $t > r$, and $r > q$, it follows that $s > q$

III Since $u > t$ and $t > r$, it follows that $u > r$

Since II and III must be true, the best answer is E

8 **Increasing the original price of an article by 15 percent and then increasing the new price by 15 percent is equivalent to increasing the original price by**

(A) 32.25%
(B) 31.00%
(C) 30 25%
(D) 30 00%
(E) 22.50%

If p is the original price, then the 15 percent increase in price results in a price of $1\ 15p$ The next 15 percent increase in price results in a price of $1\ 15(1\ 15p)$, or $1\ 3225p$ Thus, the price increased by $1\ 3225p - p = 0\ 3225p$, or 32 25% of p The best answer is A

9 **If k is an integer and 0.0010101×10^k is greater than 1,000, what is the least possible value of k ?**

(A) 2
(B) 3
(C) 4
(D) 5
(E) 6

Since 0 0010101 is being multiplied by the kth power of 10, k is the number of decimal places that the decimal point in 0 0010101 will move to the right (if $k > 0$) in the product $0\ 0010101 \times 10^k$ By inspection, 6 is the least number of decimal places that the decimal point must move to the right in order for the product to be greater than 1,000 Thus, the best answer is E

10. **If $(b - 3)\left(4 + \frac{2}{b}\right) = 0$ and $b \neq 3$, then $b =$**

(A) -8

(B) -2

(C) $-\frac{1}{2}$

(D) $\frac{1}{2}$

(E) 2

Since $(b - 3)\left(4 + \frac{2}{b}\right) = 0$, it follows that either $b - 3 = 0$ or $4 + \frac{2}{b} = 0$ That is, either $b = 3$ or $b = -\frac{1}{2}$ But $b \neq 3$ is given, so $b = -\frac{1}{2}$, and the best answer is C

11. In a weight-lifting competition, the total weight of Joe's two lifts was 750 pounds. If twice the weight of his first lift was 300 pounds more than the weight of his second lift, what was the weight, in pounds, of his <u>first</u> lift?

(A) 225
(B) 275
(C) 325
(D) 350
(E) 400

Let F and S be the weights, in pounds, of Joe's first and second lifts, respectively. Then $F + S = 750$ and $2F = S + 300$. The second equation may be written as $S = 2F - 300$, and $2F - 300$ may be substituted for S in the first equation to get $F + (2F - 300) = 750$ Thus, $3F = 1{,}050$, or $F = 350$ pounds, and the best answer is D

12 One hour after Yolanda started walking from X to Y, a distance of 45 miles, Bob started walking along the same road from Y to X. If Yolanda's walking rate was 3 miles per hour and Bob's was 4 miles per hour, how many miles had Bob walked when they met?

(A) 24
(B) 23
(C) 22
(D) 21
(E) 19.5

Let t be the number of hours that Bob had walked when he met Yolanda Then, when they met, Bob had walked $4t$ miles and Yolanda had walked $3(t + 1)$ miles These distances must sum to 45 miles, so $4t + 3(t + 1) = 45$, which may be solved for t as follows

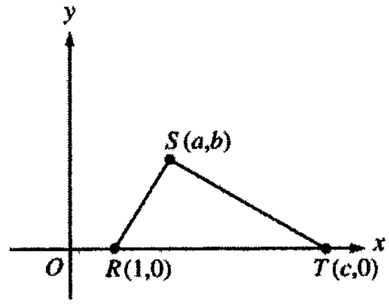
$$4t + 3(t+1) = 45$$
$$4t + 3t + 3 = 45$$
$$7t = 42$$
$$t = 6 \text{ (hours)}$$

Therefore, Bob had walked $4t = 4(6) = 24$ miles when they met The best answer is A.

13. The average (arithmetic mean) of 6 numbers is 8.5. When one number is discarded, the average of the remaining numbers becomes 7.2. What is the discarded number?

(A) 7.8
(B) 9.8
(C) 10.0
(D) 12.4
(E) 15.0

The sum of the 6 numbers is 6(8 5) = 51 0, the sum of the 5 remaining numbers is 5(7 2) = 36 0 Thus, the discarded number must be 51 0 – 36 0 = 15 0, and the best answer is E



14. In the rectangular coordinate system above, the area of ΔRST is

(A) $\dfrac{bc}{2}$

(B) $\dfrac{b(c-1)}{2}$

(C) $\dfrac{c(b-1)}{2}$

(D) $\dfrac{a(c-1)}{2}$

(E) $\dfrac{c(a-1)}{2}$

If segment RT is chosen as the base of ΔRST, then the height is b, the y-coordinate of point S Since $RT = c - 1$ (the difference between the x-coordinates of R and T), the area of ΔRST is $\frac{1}{2}(RT)b = \frac{1}{2}(c-1)b$, and the best answer is B

15. Which of the following equations has a root in common with $x^2 - 6x + 5 = 0$?

(A) $x^2 + 1 = 0$
(B) $x^2 - x - 2 = 0$
(C) $x^2 - 10x - 5 = 0$
(D) $2x^2 - 2 = 0$
(E) $x^2 - 2x - 3 = 0$

Since $x^2 - 6x + 5 = (x-5)(x-1)$, the roots of $x^2 - 6x + 5 = 0$ are 1 and 5 When these two values are substituted in each of the five choices to determine whether or not they satisfy the equation, only in choice D does a value satisfy the equation, namely, $2(1)^2 - 2 = 0$ Thus, the best answer is D

16. One inlet pipe fills an empty tank in 5 hours. A second inlet pipe fills the same tank in 3 hours. If both pipes are used together, how long will it take to fill $\frac{2}{3}$ of the tank?

(A) $\frac{8}{15}$ hr

(B) $\frac{3}{4}$ hr

(C) $\frac{5}{4}$ hr

(D) $\frac{15}{8}$ hr

(E) $\frac{8}{3}$ hr

Since the first pipe fills $\frac{1}{5}$ of the tank in one hour and the second pipe fills $\frac{1}{3}$ of the tank in one hour, together they fill $\frac{1}{5}+\frac{1}{3}=\frac{8}{15}$ of the tank in one hour At this rate, if t is the number of hours needed to fill $\frac{2}{3}$ of the tank, then $\frac{8}{15}t=\frac{2}{3}$, or $t=\frac{2}{3}\left(\frac{15}{8}\right)=\frac{5}{4}$ hours Thus, the best answer is C

17. During the first week of September, a shoe retailer sold 10 pairs of a certain style of oxfords at $35.00 a pair. If, during the second week of September, 15 pairs were sold at the sale price of $27.50 a pair, by what amount did the revenue from weekly sales of these oxfords increase during the second week?

(A) $62.50
(B) $75.00
(C) $112.50
(D) $137 50
(E) $175.00

The total sales revenue from the oxfords during the first week was 10($35 00) = $350 00, and during the second week it was 15($27 50) = $412 50 Thus, the increase in sales revenue was $412 50 – $350 00 = $62 50, and the best answer is A

18. The number 2 – 0.5 is how many times the number 1 – 0.5 ?

(A) 2
(B) 2.5
(C) 3
(D) 3 5
(E) 4

Since 2 – 0 5 = 1 5 and 1 – 0 5 = 0 5, the number 2 – 0 5 is $\frac{1\ 5}{0\ 5}=3$ times the number 1 – 0 5 Thus, the best answer is C

19. If $x=-1$, then $-(x^4+x^3+x^2+x)=$

(A) –10
(B) –4
(C) 0
(D) 4
(E) 10

$-((-1)^4+(-1)^3+(-1)^2+(-1))=-(1-1+1-1)=-0=0$ The best answer is C

20. Coins are dropped into a toll box so that the box is being filled at the rate of approximately 2 cubic feet per hour. If the empty rectangular box is 4 feet long, 4 feet wide, and 3 feet deep, approximately how many hours does it take to fill the box?

(A) 4
(B) 8
(C) 16
(D) 24
(E) 48

The volume of the toll box is (4)(4)(3) = 48 cubic feet Since the box is filled at the rate of 2 cubic feet per hour, it takes $\frac{48}{2}=24$ hours to fill the box. Thus, the best answer is D

21. $\left(\frac{1}{5}\right)^2 - \left(\frac{1}{5}\right)\left(\frac{1}{4}\right) =$

(A) $-\frac{1}{20}$

(B) $-\frac{1}{100}$

(C) $\frac{1}{100}$

(D) $\frac{1}{20}$

(E) $\frac{1}{5}$

$\left(\frac{1}{5}\right)^2 - \left(\frac{1}{5}\right)\left(\frac{1}{4}\right) = \frac{1}{25} - \frac{1}{20} = \frac{4}{100} - \frac{5}{100} = -\frac{1}{100}$ Thus, the best answer is B

22. A club collected exactly $599 from its members. If each member contributed at least $12, what is the greatest number of members the club could have?

(A) 43
(B) 44
(C) 49
(D) 50
(E) 51

If n is the number of members in the club, then at least $12n$ dollars, but perhaps more, was contributed Thus, $12n \le 599$, or $n \le \frac{599}{12} = 49\frac{11}{12}$ Since n is a whole number, the greatest possible value of n is 49 Therefore, the best answer is C

23. A union contract specifies a 6 percent salary increase plus a $450 bonus for each employee. For a certain employee, this is equivalent to an 8 percent salary increase. What was this employee's salary before the new contract?

(A) $21,500
(B) $22,500
(C) $23,500
(D) $24,300
(E) $25,000

If S is the employee's salary before the new contract, then the increase in the employee's earnings is \$450 plus 6 percent of S, or $\$450 + 0\ 06S$ Since this increase is 8 percent of S, it follows that $\$450 + 0\ 06S = 0\ 08S$, or $0\ 02S = \$450$, so that $S = \frac{\$450}{0\ 02} = \$22{,}500$ Thus, the best answer is B

24. If n is a positive integer and $k + 2 = 3^n$, which of the following could NOT be a value of k?

(A) 1
(B) 4
(C) 7
(D) 25
(E) 79

As each of the choices is substituted for k, the sum $k + 2$ can be examined to determine whether or not it is a power of 3 The sums corresponding to A-E are 3, 6, 9, 27, and 81, respectively Note that $3 = 3^1$, $9 = 3^2$, $27 = 3^3$, and $81 = 3^4$, but 6 is not a power of 3 So 4 cannot be a value of k, whereas 1, 7, 25, and 79 can be values of k. Thus, the best answer is B
Alternatively, since any power of 3 must be odd, $k = 3^n - 2$ must also be odd and $k = 4$ is not possible

25. Elena purchased brand X pens for $4.00 apiece and brand Y pens for $2.80 apiece. If Elena purchased a total of 12 of these pens for $42.00, how many brand X pens did she purchase?

(A) 4
(B) 5
(C) 6
(D) 7
(E) 8

Let x denote the number of brand X pens Elena purchased Then the number of brand Y pens she purchased was $12 - x$ and the total cost of the pens was $4x + 2\ 80(12 - x) = 42\ 00$ dollars This equation can be solved as follows.

$$4x + 2\ 80(12 - x) = 42\ 00$$
$$4x + 33\ 60 - 2\ 80x = 42\ 00$$
$$1\ 20x = 8.40$$
$$x = 7$$

Thus, the best answer is D

26. If the length and width of a rectangular garden plot were each increased by 20 percent, what would be the percent increase in the area of the plot?

(A) 20%
(B) 24%
(C) 36%
(D) 40%
(E) 44%

If the length and width are L and W, respectively, then the increased length and width are $1\ 2L$ and $1\ 2W$, respectively Thus, the increased area is $(1\ 2L)(1\ 2W) = 1\ 44LW$, and the percent increase in area is 44% The best answer is therefore E

27 The population of a bacteria culture doubles every 2 minutes Approximately how many minutes will it take for the population to grow from 1,000 to 500,000 bacteria?

(A) 10
(B) 12
(C) 14
(D) 16
(E) 18

After each successive 2-minute period, the bacteria population is 2,000, 4,000, 8,000, 16,000, 32,000, 64,000, 128,000, 256,000, and then 512,000 Therefore, after eight 2-minute periods, or 16 minutes, the population is only 256,000, and after nine 2-minute periods, or 18 minutes, the population is just over 500,000 Thus, the best answer is E

Alternatively, if n denotes the number of 2-minute periods it takes for the population to grow from 1,000 to 500,000, then $2^n(1{,}000) = 500{,}000$, or $2^n = 500$ Since $2^4 = 16$, $2^8 = 16^2 = 256$, and $2^9 = 2(256) = 512$, the value of n is approximately 9. Thus, the approximate time is $2(9) = 18$ minutes

28 When 10 is divided by the positive integer n, the remainder is $n-4$ Which of the following could be the value of n ?

(A) 3
(B) 4
(C) 7
(D) 8
(E) 12

One way to answer the question is to examine each option to see which one satisfies the specified divisibility conditions A If $n = 3$, then $n - 4 = -1$, but 10 divided by 3 has remainder 1 B. If $n = 4$, then $n - 4 = 0$, but 10 divided by 4 has remainder 2. C If $n = 7$, then $n - 4 = 3$, which does equal the remainder when 10 is divided by 7 That neither D nor E gives a possible value of n can be shown in the manner used for A and B Thus, the best answer is C

An alternative solution, which does not involve extensive checking of each option, is to first write the divisibility condition as the equation $10 = nq + (n-4)$, where q denotes the quotient Then,

$$14 = nq + n = n(q+1),$$

so n must be a divisor of 14 Also, $n - 4 \geq 0$, or $n \geq 4$ Thus, $n = 7$ or $n = 14$

29. For a light that has an intensity of 60 candles at its source, the intensity in candles, S, of the light at a point d feet from the source is given by the formula $S = \frac{60k}{d^2}$, where k is a constant. If the intensity of the light is 30 candles at a distance of 2 feet from the source, what is the intensity of the light at a distance of 20 feet from the source?

(A) $\frac{3}{10}$ candle

(B) $\frac{1}{2}$ candle

(C) $1\frac{1}{3}$ candles

(D) 2 candles

(E) 3 candles

In order to compute $S = \frac{60k}{d^2}$ when $d = 20$, the value of the constant k must be determined Since $S = 30$ candles when $d = 2$ feet, substituting these values into the formula yields $30 = \frac{60k}{2^2}$, or $k = 2$ Therefore, when $d = 20$ feet, the intensity is $S = \frac{60(2)}{20^2} = \frac{120}{400} = \frac{3}{10}$ candle Thus, the best answer is A

30. If x and y are prime numbers, which of the following CANNOT be the sum of x and y ?

(A) 5
(B) 9
(C) 13
(D) 16
(E) 23

Note that $5 = 2 + 3$, $9 = 2 + 7$, $13 = 2 + 11$, and $16 = 5 + 11$, so that each of choices A-D may be expressed as a sum of two prime numbers However, if $23 = x + y$, then either x or y (but not both) must be even. Since 2 is the only even prime number, either $x = 2$ and $y = 21$, or $x = 21$ and $y = 2$ Since 21 is not prime, 23 cannot be expressed as the sum of two prime numbers, and the best answer is E

31. Of the 3,600 employees of Company X, $\frac{1}{3}$ are clerical.

If the clerical staff were to be reduced by $\frac{1}{3}$, what percent of the total number of the remaining employees would then be clerical?

(A) 25%
(B) 22.2%
(C) 20%
(D) 12.5%
(E) 11.1%

The number of clerical employees is $\frac{1}{3}(3{,}600) = 1{,}200$ As a result of the proposed reduction, the number of clerical employees would be reduced by $\frac{1}{3}(1{,}200) = 400$ and consequently would equal $1{,}200 - 400 = 800$ The total number of employees would then be $3{,}600 - 400 = 3{,}200$ Hence, the percent of clerical employees would then be $\frac{800}{3{,}200} = \frac{1}{4} = 25\%$ Thus, the best answer is A

32. In which of the following pairs are the two numbers reciprocals of each other?

I. 3 and $\frac{1}{3}$

II. $\frac{1}{17}$ and $\frac{-1}{17}$

III. $\sqrt{3}$ and $\frac{\sqrt{3}}{3}$

(A) I only
(B) II only
(C) I and II
(D) I and III
(E) II and III

Two numbers are reciprocals of each other if and only if their product is 1 Since $3\left(\frac{1}{3}\right) = 1$, $\left(\frac{1}{17}\right)\left(-\frac{1}{17}\right) = -\frac{1}{289} \neq 1$, and $\sqrt{3}\left(\frac{\sqrt{3}}{3}\right) = \frac{3}{3} = 1$, only in I and III are the two numbers reciprocals of each other Thus, the best answer is D

33. What is 45 percent of $\frac{7}{12}$ of 240 ?

(A) 63
(B) 90
(C) 108
(D) 140
(E) 311

Since 45 percent is $\frac{45}{100} = \frac{9}{20}$, 45 percent of $\frac{7}{12}$ of 240 is $\left(\frac{9}{20}\right)\left(\frac{7}{12}\right)(240) = 63$ The best answer is A.

34. If x books cost \$5 each and y books cost \$8 each, then the average (arithmetic mean) cost, in dollars per book, is equal to

(A) $\frac{5x + 8y}{x + y}$

(B) $\frac{5x + 8y}{xy}$

(C) $\frac{5x + 8y}{13}$

(D) $\frac{40xy}{x + y}$

(E) $\frac{40xy}{13}$

The total number of books is $x + y$, and their total cost is $5x + 8y$ dollars. Therefore, the average cost per book is $\frac{5x + 8y}{x + y}$ dollars The best answer is A

35. **If $\frac{1}{2}$ of the money in a certain trust fund was invested in stocks, $\frac{1}{4}$ in bonds, $\frac{1}{5}$ in a mutual fund, and the remaining \$10,000 in a government certificate, what was the total amount of the trust fund?**

(A) \$100,000
(B) \$150,000
(C) \$200,000
(D) \$500,000
(E) \$2,000,000

Since $\frac{1}{2}+\frac{1}{4}+\frac{1}{5}=\frac{19}{20}$, then $\frac{19}{20}$ of the trust fund was invested in stocks, bonds, and a mutual fund Thus, if F is the dollar amount of the trust fund, the remaining $\frac{1}{20}$ of F is \$10,000 That is, $\frac{1}{20}F=\$10,000$, or $F=\$200,000$ The best answer is therefore C

36. **Marion rented a car for \$18.00 plus \$0.10 per mile driven. Craig rented a car for \$25.00 plus \$0.05 per mile driven. If each drove d miles and each was charged exactly the same amount for the rental, then d equals**

(A) 100
(B) 120
(C) 135
(D) 140
(E) 150

Marion's total rental charge was $18\ 00+0\ 10d$ dollars, and Craig's total rental charge was $25\ 00+0.05d$ dollars Since these amounts are the same, $18\ 00+0\ 10d=25\ 00+0\ 05d$, which implies $0\ 05d=7\ 00$, or $d=\frac{7\ 00}{0\ 05}=140$ miles Thus, the best answer is D

37 **Machine A produces bolts at a uniform rate of 120 every 40 seconds, and machine B produces bolts at a uniform rate of 100 every 20 seconds. If the two machines run simultaneously, how many seconds will it take for them to produce a total of 200 bolts?**

(A) 22
(B) 25
(C) 28
(D) 32
(E) 56

Machine A produces $\frac{120}{40}=3$ bolts per second and machine B produces $\frac{100}{20}=5$ bolts per second Running simultaneously, they produce 8 bolts per second At this rate, they will produce 200 bolts in $\frac{200}{8}=25$ seconds The best answer is therefore B

38. $\frac{3{,}003}{2{,}002}=$

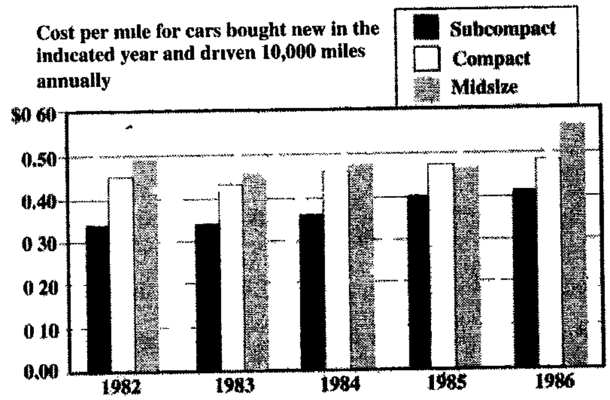
(A) 1.05
(B) 1.50015
(C) 1.501
(D) 1.5015
(E) 1.5

$\frac{3\ 003}{2\ 002}=\frac{3(1\ 001)}{2(1.001)}=\frac{3}{2}=1\ 5$

The best answer is E

Questions 39-41 refer to the following graph.

AVERAGE COSTS OF OPERATING SUBCOMPACT, COMPACT, AND MIDSIZE CARS IN THE UNITED STATES, 1982-1986



39. In 1982 the approximate average cost of operating a subcompact car for 10,000 miles was

(A) $360
(B) $3,400
(C) $4,100
(D) $4,500
(E) $4,900

According to the bar graph, the average cost per mile of operating a subcompact car in 1982 was about $0.34. Thus, the cost of operating the car for 10,000 miles was approximately $0.34(10,000) = $3,400. The best answer is B.

40. In 1984 the average cost of operating a subcompact car was approximately what percent less than the average cost of operating a midsized car?

(A) 12%
(B) 20%
(C) 25%
(D) 33%
(E) 48%

According to the bars shown for 1984, the average operating cost per mile for a subcompact car was approximately $0.36, or $0.12 less than the $0.48 per mile for a midsized car. Thus, in 1984 the operating cost for a subcompact car was approximately $\frac{0.12}{0.48} = 25\%$ less than the operating cost for a midsized car. The best answer is C.

41. For each of the years shown, the average cost per mile of operating a compact car minus the average cost per mile of operating a subcompact car was between

(A) $0.12 and $0.18
(B) $0.10 and $0.15
(C) $0.09 and $0.13
(D) $0.06 and $0.12
(E) $0.05 and $0.08

The differences in the average operating cost per mile between a subcompact car and a compact car may be estimated from the bar graph. For the consecutive years 1982-1986, the differences were approximately $0.11, $0.09, $0.10, $0.07, and $0.07, respectively. Only choice D gives a range that includes all of these amounts. Thus, the best answer is D.

Alternatively, inspection of the bar graph reveals that the largest difference was about $0.11 (in 1982) and the smallest difference was about $0.07 (in 1985 or 1986). Only choice D gives a range that includes these extreme values, and thus the differences for all five years.

42. What is the decimal equivalent of $\left(\frac{1}{5}\right)^5$?

(A) 0.00032
(B) 0.0016
(C) 0.00625
(D) 0.008
(E) 0.03125

$\left(\frac{1}{5}\right)^5 = (0.2)^5 = (0.2)(0.2)(0.2)(0.2)(0.2) = 0.00032$

The best answer is A.

43. Two hundred gallons of fuel oil are purchased at $0.91 per gallon and are consumed at a rate of $0.70 worth of fuel per hour. At this rate, how many hours are required to consume the 200 gallons of fuel oil?

(A) 140
(B) 220
(C) 260
(D) 322
(E) 330

The total worth of the 200 gallons of fuel oil is $0.91(200) = $182.00. The time required to consume the $182.00 worth of fuel at a rate of $0.70 worth of fuel per hour is $\frac{\$182.00}{\$0.70} = 260$ hours. Therefore, the best answer is C.

44 If $\dfrac{4-x}{2+x}=x$, what is the value of x^2+3x-4?

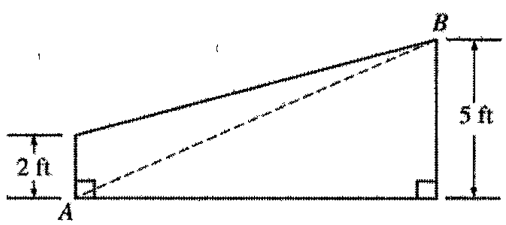
(A) -4
(B) -1
(C) 0
(D) 1
(E) 2

Multiplying both sides of $\dfrac{4-x}{2+x}=x$ by $2+x$ yields $4-x=x(2+x)=2x+x^2$, or $x^2+3x-4=0$ Thus, the value of x^2+3x-4 is 0, and the best answer is C

45. If $b<2$ and $2x-3b=0$, which of the following must be true?

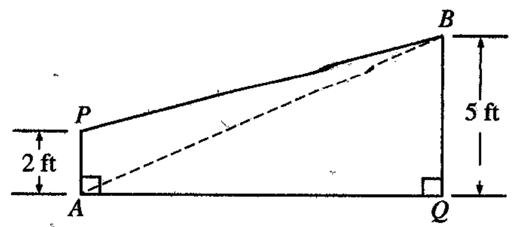
(A) $x>-3$
(B) $x<2$
(C) $x=3$
(D) $x<3$
(E) $x>3$

It follows from $2x-3b=0$ that $b=\dfrac{2}{3}x$. So $b<2$ implies $\dfrac{2}{3}x<2$, or $x<2\left(\dfrac{3}{2}\right)$, which means $x<3$ (choice D) Since none of the other choices must be true (although $x>-3$ and $x<2$ could be true), the best answer is D



46 The trapezoid shown in the figure above represents a cross section of the rudder of a ship. If the distance from A to B is 13 feet, what is the area of the cross section of the rudder in square feet?

(A) 39
(B) 40
(C) 42
(D) 45
(E) 46.5



From the figure above, the area of the trapezoidal cross section is $\dfrac{1}{2}(AP+BQ)(AQ)=\dfrac{1}{2}(2+5)(AQ)=\dfrac{7}{2}(AQ)$ Since $AB=13$ feet, using the Pythagorean theorem, $AQ=\sqrt{13^2-5^2}=\sqrt{144}=12$ feet. Thus, the area is $\dfrac{7}{2}(12)=42$ square feet, and the best answer is C

Alternatively, the areas of the two triangles may be added together If AP is taken as the base of $\triangle APB$ and BQ is taken as the base of $\triangle BQA$, then the height of both triangles is AQ Thus, the area of the trapezoid is

$\dfrac{1}{2}(AP)(AQ)+\dfrac{1}{2}(BQ)(AQ)=\dfrac{1}{2}(2)(12)+\dfrac{1}{2}(5)(12)=42$ square feet

47 $\dfrac{(-1.5)(1.2)-(4.5)(0.4)}{30}=$

(A) -1.2
(B) -0.12
(C) 0
(D) 0.12
(E) 1.2

One way to reduce the expression is

$$\frac{(-1\ 5)(1\ 2)-(4\ 5)(0\ 4)}{30}=\frac{-1\ 80-1\ 80}{30}=\frac{-3\ 60}{30}=-0\ 12$$

Another way is

$$\frac{(-1\ 5)(1\ 2)-(4\ 5)(0\ 4)}{30}=-\frac{15(12)+45(4)}{3{,}000}=-\frac{12+3(4)}{200}$$

$$=-\frac{24}{200}=-\frac{12}{100}=-0\ 12$$

The best answer is B

48. If n is a positive integer, then $n(n+1)(n+2)$ is

(A) even only when n is even
(B) even only when n is odd
(C) odd whenever n is odd
(D) divisible by 3 only when n is odd
(E) divisible by 4 whenever n is even

If n is a positive integer, then either n is even or n is odd (and thus $n+1$ is even) In either case, the product $n(n+1)(n+2)$ is even Thus, each of choices A, B, and C is false Since $n(n+1)(n+2)$ is divisible by 3 when n is 6 (or any even multiple of 3), choice D is false If n is even, then $n+2$ is even as well; thus, $n(n+1)(n+2)$ is divisible by 4 since even numbers are divisible by 2 The best answer is therefore E

49. If Jack had twice the amount of money that he has, he would have exactly the amount necessary to buy 3 hamburgers at \$0.96 apiece and 2 milk shakes at \$1.28 apiece. How much money does Jack have?

(A) \$1.60
(B) \$2.24
(C) \$2.72
(D) \$3.36
(E) \$5.44

Let J be the amount of money Jack has Then

$2J = 3(\$0\ 96) + 2(\$1\ 28) = \$5\ 44$ So $J = \frac{1}{2}(\$5\ 44) = \$2\ 72$,

and the best answer is C

50. If a photocopier makes 2 copies in $\frac{1}{3}$ second, then, at the same rate, how many copies does it make in 4 minutes?

(A) 360
(B) 480
(C) 576
(D) 720
(E) 1,440

The photocopier makes copies at the rate of 2 copies in $\frac{1}{3}$ second, or 6 copies per second Since 4 minutes equals 240 seconds, the photocopier makes $6(240) = 1{,}440$ copies in 4 minutes Therefore, the best answer is E

51. The price of a certain television set is discounted by 10 percent, and the reduced price is then discounted by 10 percent. This series of successive discounts is equivalent to a single discount of

(A) 20%
(B) 19%
(C) 18%
(D) 11%
(E) 10%

If P is the original price of the television set, then $0.9P$ is the price after the first discount, and $0\ 9(0.9P) = 0.81P$ is the price after the second discount Thus, the original price is discounted by 19% (100% – 81%), and the best answer is B

52. If $\dfrac{2}{1+\frac{2}{y}} = 1$, then $y =$

(A) -2

(B) $-\frac{1}{2}$

(C) $\frac{1}{2}$

(D) 2

(E) 3

Since $\dfrac{2}{1+\frac{2}{y}} = 1$, $1+\frac{2}{y} = 2$ Thus, $\frac{2}{y} = 1$, or $y = 2$, and the best answer is D

53. If a rectangular photograph that is 10 inches wide by 15 inches long is to be enlarged so that the width will be 22 inches and the ratio of width to length will be unchanged, then the length, in inches, of the enlarged photograph will be

(A) 33
(B) 32
(C) 30
(D) 27
(E) 25

The ratio of width to length of the original photograph is $\frac{10}{15} = \frac{2}{3}$ If x is the length of the enlarged photograph, in inches, then $\frac{2}{3} = \frac{22}{x}$ since the ratio of width to length will be unchanged Thus, $x = 33$ inches, and the best answer is A

54. **If m is an integer such that $(-2)^{2m} = 2^{9-m}$, then $m =$**

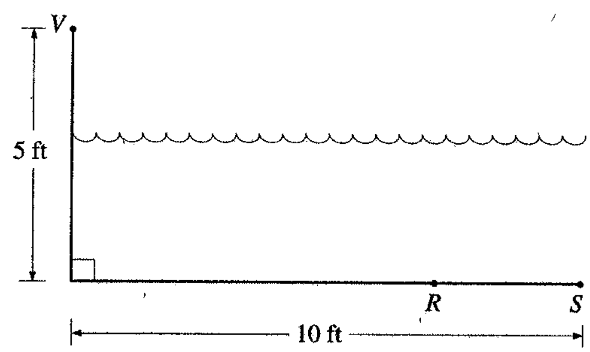
(A) 1
(B) 2
(C) 3
(D) 4
(E) 6

Since $(-2)^{2m} = ((-2)^2)^m = 4^m = 2^{2m}$, it follows that $2^{2m} = 2^{9-m}$. The exponents must be equal, so that $2m = 9 - m$, or $m = 3$. The best answer is therefore C.

55. **If $0 \le x \le 4$ and $y < 12$, which of the following CANNOT be the value of xy?**

(A) -2
(B) 0
(C) 6
(D) 24
(E) 48

Each of choices A, B, and C can be a value of xy. For if $x = 1$, then $xy = y$, and each of these choices is less than 12. If $x = 4$ and $y = 6$, then $xy = 24$, so that choice D also gives a possible value of xy. In choice E, if $xy = 48$, then for all values of x such that $0 < x \le 4$, it follows that $y \ge 12$, which contradicts $y < 12$. Thus, 48 cannot be the value of xy, and the best answer is E.



56. **In the figure above, V represents an observation point at one end of a pool. From V, an object that is actually located on the bottom of the pool at point R appears to be at point S. If $VR = 10$ feet, what is the distance RS, in feet, between the actual position and the perceived position of the object?**

(A) $10 - 5\sqrt{3}$
(B) $10 - 5\sqrt{2}$
(C) 2
(D) $2\frac{1}{2}$
(E) 4

Let P be the point 5 feet directly below V. P is the vertex of the right angle indicated in the figure, and $\triangle VPR$ is thus a right triangle. Then, by the Pythagorean theorem,
$PR = \sqrt{10^2 - 5^2} = \sqrt{75} = 5\sqrt{3}$. Thus,
$RS = PS - PR = 10 - 5\sqrt{3}$, and the best answer is A.

57. **If the total payroll expense of a certain business in year Y was \$84,000, which was 20 percent more than in year X, what was the total payroll expense in year X?**

(A) \$70,000
(B) \$68,320
(C) \$64,000
(D) \$60,000
(E) \$52,320

If p is the total payroll expense in year X, then $1.2p = \$84{,}000$, so that $p = \frac{\$84{,}000}{1.2} = \$70{,}000$. Thus, the best answer is A.

58. **If a, b, and c are consecutive positive integers and $a < b < c$, which of the following must be true?**

I. $c - a = 2$

II. abc is an even integer.

III. $\frac{a+b+c}{3}$ is an integer.

(A) I only
(B) II only
(C) I and II only
(D) II and III only
(E) I, II, and III

Since a, b, and c are consecutive integers and $a < b < c$, it follows that $b = a + 1$ and $c = a + 2$. Statement I follows from $c = a + 2$. Concerning statement II, if a is even, then abc is even; if a is odd, then b is even so that abc is even. In either case, abc is even, so statement II must be true. In statement III,
$\frac{a+b+c}{3} = \frac{a+(a+1)+(a+2)}{3} = \frac{3a+3}{3} = a + 1 = b$,
which is an integer. Therefore, statement III must be true, and the best answer is E.

59. **A straight pipe 1 yard in length was marked off in fourths and also in thirds. If the pipe was then cut into separate pieces at each of these markings, which of the following gives all the different lengths of the pieces, in fractions of a yard?**

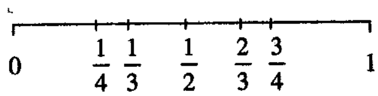
(A) $\frac{1}{6}$ and $\frac{1}{4}$ only

(B) $\frac{1}{4}$ and $\frac{1}{3}$ only

(C) $\frac{1}{6}$, $\frac{1}{4}$, and $\frac{1}{3}$

(D) $\frac{1}{12}$, $\frac{1}{6}$, and $\frac{1}{4}$

(E) $\frac{1}{12}$, $\frac{1}{6}$, and $\frac{1}{3}$



The number line above illustrates the markings on the pipe Since the pipe is cut at the five markings, six pieces of pipe are produced having lengths, in yards,

$\frac{1}{4}-0=\frac{1}{4}$, $\frac{1}{3}-\frac{1}{4}=\frac{1}{12}$, $\frac{1}{2}-\frac{1}{3}=\frac{1}{6}$, $\frac{2}{3}-\frac{1}{2}=\frac{1}{6}$,

$\frac{3}{4}-\frac{2}{3}=\frac{1}{12}$, and $1-\frac{3}{4}=\frac{1}{4}$ The different lengths of the pieces are therefore $\frac{1}{12}$, $\frac{1}{6}$, and $\frac{1}{4}$ yard, and the best answer is D

60. **What is the least integer that is a sum of three different primes each greater than 20 ?**

(A) 69
(B) 73
(C) 75
(D) 79
(E) 83

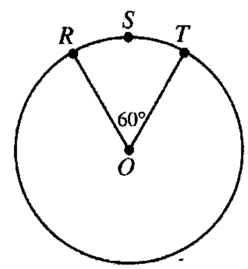
The three smallest primes that are each greater than 20 are 23, 29, and 31, and their sum is 83 Since any other set of three primes, each greater than 20, would include a prime greater than 31 but no prime less than 23, the corresponding sum would be greater than 83 Thus, 83 is the least such sum, and the best answer is E

61. **A tourist purchased a total of \$1,500 worth of traveler's checks in \$10 and \$50 denominations, During the trip the tourist cashed 7 checks and then lost all of the rest. If the number of \$10 checks cashed was one more or one less than the number of \$50 checks cashed, what is the minimum possible value of the checks that were lost?**

(A) \$1,430
(B) \$1,310
(C) \$1,290
(D) \$1,270
(E) \$1,150

Let t be the number of \$10 traveler's checks that were cashed and let f be the number of \$50 traveler's checks that were cashed Then $t+f=7$, and either $t=f+1$ or $t=f-1$ Thus, either $t=4$ and $f=3$, or $t=3$ and $f=4$ In the first case, the value of the lost checks would have been $\$1{,}500 - t(\$10) - f(\$50) = \$1{,}500 - \$40 - \$150 = \$1{,}310$, whereas, in the second case, the value would have been $\$1{,}500 - \$30 - \$200 = \$1{,}270$ Since the lesser of these amounts is \$1,270, the best answer is D

Alternatively, note that the minimum possible value of the lost checks corresponds to the maximum possible value of the checks that were cashed Thus, $t = 3$ and $f = 4$, and the minimum possible value of the lost checks is $\$1{,}500 - \$30 - \$200 = \$1{,}270$



62. **If the circle above has center O and circumference 18π, then the perimeter of sector $RSTO$ is**

(A) $3\pi+9$
(B) $3\pi+18$
(C) $6\pi+9$
(D) $6\pi+18$
(E) $6\pi+24$

If r is the radius of the circle, then the circumference is $2\pi r = 18\pi$, so that $r = 9$ The ratio of the length of arc RST to the circumference is the same as the ratio of 60° to 360° Thus, the length of arc RST is $\frac{60}{360}(18\pi) = 3\pi$, and, consequently, the perimeter of sector $RSTO$ is $3\pi + r + r = 3\pi + 18$ The best answer is therefore B

63. **If each of the following fractions were written as a repeating decimal, which would have the longest sequence of different digits?**

(A) $\frac{2}{11}$

(B) $\frac{1}{3}$

(C) $\frac{41}{99}$

(D) $\frac{2}{3}$

(E) $\frac{23}{37}$

As repeating decimals, choices A-E are $\frac{2}{11} = 0.181818\ldots$, $\frac{1}{3} = 0.333\ldots$, $\frac{41}{99} = 0.414141\ldots$, $\frac{2}{3} = 0.666\ldots$, and $\frac{23}{37} = 0.621621621\ldots$, respectively. The longest sequence of different digits appears in the last decimal, so the best answer is E.

64. **Today Rose is twice as old as Sam and Sam is 3 years younger than Tina. If Rose, Sam, and Tina are all alive 4 years from today, which of the following must be true on that day?**

I. Rose is twice as old as Sam.
II. Sam is 3 years younger than Tina.
III. Rose is older than Tina.

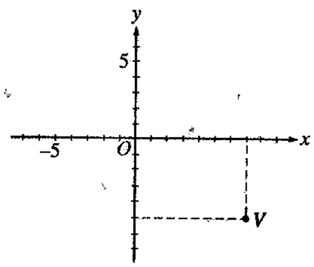
(A) I only
(B) II only
(C) III only
(D) I and II
(E) II and III

When considering the relationships between people's ages, it may be helpful to keep in mind the fact that the difference between two ages remains constant from one year to the next, but their ratio does not. Thus, statement I need not be true, whereas statement II must be true. For statement III, if R, S, and T denote the respective ages of Rose, Sam, and Tina today, then $R = 2S$ and $S = T - 3$, so that $R = 2(T - 3)$. Thus, $R > T$ if and only if $2(T - 3) > T$, or $T > 6$. Therefore, statement III need not be true, and the best answer is B.

65. **The average (arithmetic mean) of 6, 8, and 10 equals the average of 7, 9, and**

(A) 5
(B) 7
(C) 8
(D) 9
(E) 11

The average of 6, 8, and 10 is $\frac{6+8+10}{3} = 8$, which equals the average of 7, 9, and x. Thus, $\frac{7+9+x}{3} = 8$, $16 + x = 24$, and $x = 8$. The best answer is therefore C.



66. **In the figure above, the coordinates of point V are**

(A) (–7, 5)
(B) (–5, 7)
(C) (5, 7)
(D) (7, 5)
(E) (7, –5)

The x-coordinate of V is 7 and the y-coordinate of V is –5. Thus, the coordinates, (x, y), of V are (7, –5), and the best answer is E. Alternatively, since point V lies in quadrant IV, the x-coordinate of V is positive, and the y-coordinate of V is negative. Only choice E meets these conditions and is, therefore, the best answer.

67. **Tickets for all but 100 seats in a 10,000-seat stadium were sold. Of the tickets sold, 20 percent were sold at half price and the remaining tickets were sold at the full price of \$2. What was the total revenue from ticket sales?**

(A) \$15,840
(B) \$17,820
(C) \$18,000
(D) \$19,800
(E) \$21,780

The number of tickets sold was 10,000 – 100 = 9,900. If 20 percent of the tickets were sold at half price, then 80 percent were sold at full price. Total revenue was therefore 0.2(9,900)(\$1.00) + 0.8(9,900)(\$2.00) = \$17,820. The best answer is B.

68. In a mayoral election, Candidate X received $\frac{1}{3}$ more votes than Candidate Y, and Candidate Y received $\frac{1}{4}$ fewer votes than Candidate Z. If Candidate Z received 24,000 votes, how many votes did Candidate X receive?

(A) 18,000
(B) 22,000
(C) 24,000
(D) 26,000
(E) 32,000

If x, y, and z are the number of votes received by Candidates X, Y, and Z, respectively, then $x = \frac{4}{3}y$, $y = \frac{3}{4}z$, and $z = 24{,}000$. By substitution, $y = \left(\frac{3}{4}\right)(24{,}000) = 18{,}000$ and $x = \left(\frac{4}{3}\right)(18{,}000) = 24{,}000$ Candidate X received a total of 24,000 votes, and the best answer is C Alternatively, and more directly, $x = \left(\frac{4}{3}\right)\left(\frac{3}{4}\right)z = z = 24{,}000$

69. René earns \$8.50 per hour on days other than Sundays and twice that rate on Sundays. Last week she worked a total of 40 hours, including 8 hours on Sunday. What were her earnings for the week?

(A) \$272
(B) \$340
(C) \$398
(D) \$408
(E) \$476

René worked a total of 32 hours at \$8 50 per hour during the week, and 8 hours on Sunday at \$17.00 per hour Her total earnings for the week were 32(\$8 50) + 8(\$17) = \$408 The best answer is D

70. In a shipment of 120 machine parts, 5 percent were defective. In a shipment of 80 machine parts, 10 percent were defective. For the two shipments combined, what percent of the machine parts were defective?

(A) 6.5%
(B) 7.0%
(C) 7.5%
(D) 8.0%
(E) 8.5%

In the combined shipments, there was a total of 200 machine parts, of which $0.05(120) + 0.1(80) = 6 + 8 = 14$ were defective. The percent of machine parts that were defective in the two shipments combined was

$\frac{14}{200} = \frac{7}{100} = 7\%$ The best answer is therefore B

71. $\dfrac{2\frac{3}{5} - 1\frac{2}{3}}{\frac{2}{3} - \frac{3}{5}} =$

(A) 16
(B) 14
(C) 3
(D) 1
(E) –1

$$\frac{2\frac{3}{5} - 1\frac{2}{3}}{\frac{2}{3} - \frac{3}{5}} = \frac{\frac{13}{5} - \frac{5}{3}}{\frac{2}{3} - \frac{3}{5}} = \frac{\frac{39-25}{15}}{\frac{10-9}{15}} = \frac{\frac{14}{15}}{\frac{1}{15}} = \frac{14}{15} \times \frac{15}{1} = 14$$

The best answer is B

72. If $x = -1$, then $\dfrac{x^4 - x^3 + x^2}{x - 1} =$

(A) $-\frac{3}{2}$

(B) $-\frac{1}{2}$

(C) 0

(D) $\frac{1}{2}$

(E) $\frac{3}{2}$

Substituting the value -1 for x in the expression results in

$$\frac{(-1)^4 - (-1)^3 + (-1)^2}{-1-1} = \frac{1-(-1)+1}{-2} = -\frac{3}{2}$$

The best answer is A.

73. Which of the following equations is NOT equivalent to $25x^2 = y^2 - 4$?

(A) $25x^2 + 4 = y^2$
(B) $75x^2 = 3y^2 - 12$
(C) $25x^2 = (y + 2)(y - 2)$
(D) $5x = y - 2$
(E) $x^2 = \frac{y^2 - 4}{25}$

Choice A is obtained by adding 4 to both sides of the equation $25x^2 = y^2 - 4$ Choice B is obtained by multiplying both sides of the original equation by 3, while choice C is equivalent because $y^2 - 4 = (y + 2)(y - 2)$ Choice E is obtained by dividing both sides of the original equation by 25 By the process of elimination, the answer must be D Squaring both sides of $5x = y - 2$, choice D, gives $25x^2 = y^2 - 4y + 4$, which is NOT equivalent to the original equation Therefore, the best answer is D

74. A toy store regularly sells all stock at a discount of 20 percent to 40 percent. If an additional 25 percent were deducted from the discount price during a special sale, what would be the lowest possible price of a toy costing $16 before any discount?

(A) $5.60
(B) $7.20
(C) $8.80
(D) $9.60
(E) $15.20

The lowest possible price is paid when the maximum discount is received, so the lowest possible regular price is $16 – 0 40($16) = $9 60 With an additional 25 percent discount, the lowest possible price is $9 60 – 0.25($9 60) = $7 20 The best answer is B

Alternatively, the lowest possible price to be paid for the item can be calculated by realizing that if you are being given a discount of 40 percent you are paying 60 percent of the listed price of the item If an additional 25 percent discount is offered on the item, the price of the item becomes (0 75)(0 60)($16) = $7.20

75. If there are 664,579 prime numbers among the first 10 million positive integers, approximately what percent of the first 10 million positive integers are prime numbers?

(A) 0.0066%
(B) 0.066%
(C) 0.66%
(D) 6.6%
(E) 66%

The ratio of 664,579 to 10 million is approximately 660,000 to 10,000,000 or $\frac{66}{1,000} = 0\ 066 = 6\ 6\%$ The best answer is therefore D

76. A bank customer borrowed $10,000, but received y dollars less than this due to discounting. If there was a separate $25 service charge, then, in terms of y, the service charge was what fraction of the amount that the customer received?

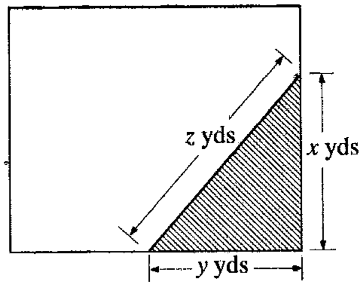
(A) $\frac{25}{10,000 - y}$
(B) $\frac{25}{10,000 - 25y}$
(C) $\frac{25y}{10,000 - y}$
(D) $\frac{y - 25}{10,000 - y}$
(E) $\frac{25}{10,000 - (y - 25)}$

The amount of money the customer received was $(10,000 - y)$ dollars The $25 service charge as a fraction of the amount received was, therefore, $\frac{25}{10,000 - y}$ The best answer is A

77. An airline passenger is planning a trip that involves three connecting flights that leave from Airports A, B, and C, respectively. The first flight leaves Airport A every hour, beginning at 8:00 a.m., and arrives at Airport B $2\frac{1}{2}$ hours later. The second flight leaves Airport B every 20 minutes, beginning at 8:00 a.m., and arrives at Airport C $1\frac{1}{6}$ hours later. The third flight leaves Airport C every hour, beginning at 8:45 a.m. What is the <u>least</u> total amount of time the passenger must spend between flights if all flights keep to their schedules?

(A) 25 min
(B) 1 hr 5 min
(C) 1 hr 15 min
(D) 2 hr 20 min
(E) 3 hr 40 min

Regardless of the time of departure from Airport A, arrival at Airport B will be at 30 minutes past the hour Flights leave Airport B on the hour, and at either 20 or 40 minutes past the hour Therefore, the earliest a passenger from Airport A could leave Airport B would be at 40 minutes past the hour with a 10-minute wait between flights The flight from Airport B to Airport C takes $1\frac{1}{6}$ hours or 1 hour 10 minutes A flight taken at 40 minutes past the hour would arrive at Airport C at 50 minutes past the hour, causing the passenger to have missed the flight from Airport C by 5 minutes The passenger therefore has a 55-minute wait, and the least total amount of time the passenger must spend between flights is 10 + 55 = 65 minutes, or 1 hour 5 minutes The best answer is B



78. The shaded portion of the rectangular lot shown above represents a flower bed. If the area of the bed is 24 square yards and $x = y + 2$, then z equals

(A) $\sqrt{13}$
(B) $2\sqrt{13}$
(C) 6
(D) 8
(E) 10

The area of the triangular flower bed can be found by the formula $A = \frac{1}{2}$ (altitude)(base) or $24 = \frac{1}{2}(x)(y) = \frac{1}{2}(y+2)(y)$ Thus, $y^2 + 2y = 48$ or $y^2 + 2y - 48 = 0$ Factoring yields $(y+8)(y-6) = 0$, and $y = 6$ since the length must be positive The altitude x of the region is $6 + 2 = 8$, and the flower bed is a 6-8-10 right triangle The hypotenuse, z, can be found by using the Pythagorean theorem The best answer is therefore E

79. How many multiples of 4 are there between 12 and 96, inclusive?

(A) 21
(B) 22
(C) 23
(D) 24
(E) 25

The most direct way to find the number of multiples of 4 between 12 and 96, inclusive, would be to write every multiple of 4 starting with 12 (i e , 12, 16, 20, 24, , 96), but this is very time-consuming and leaves many opportunities for error Another approach would be to note that in each group of 4 consecutive integers there is one multiple of 4 Between 12 and 96, inclusive, there are 85 numbers that, when divided by 4, yield 21 groups of 4 with 1 number remaining that must be considered independently In the 21 groups of 4, there are 21 multiples of 4 and the remaining number, 96, is also a multiple of 4 The total number of multiples of 4 between 12 and 96, inclusive, is thus $21 + 1 = 22$ The best answer is B

Alternatively, since $12 = 3 \times 4$ and $96 = 24 \times 4$, the number of multiples of 4 between 12 and 96, inclusive, is the same as the number of integers between 3 and 24, inclusive, namely, 22

80. Jack is now 14 years older than Bill. If in 10 years Jack will be twice as old as Bill, how old will Jack be in 5 years?

(A) 9
(B) 19
(C) 21
(D) 23
(E) 33

Let j and b be Jack's and Bill's current ages Then $j = b + 14$ and $j + 10 = 2(b + 10)$. By substitution, $b + 14 + 10 = 2(b + 10)$, and $b + 24 = 2b + 20$ Therefore, $b = 4$ and $j = 18$, and Jack's age in 5 years is $18 + 5 = 23$ The best answer is D

81. In Country X a returning tourist may import goods with a total value of \$500 or less tax free, but must pay an 8 percent tax on the portion of the total value in excess of \$500. What tax must be paid by a returning tourist who imports goods with a total value of \$730 ?

(A) \$58.40
(B) \$40.00
(C) \$24.60
(D) \$18.40
(E) \$16.00

The tourist must pay tax on \$730 – \$500 = \$230 The amount of the tax is 0 08(\$230) = \$18 40 The best answer is therefore D

82. Which of the following is greater than $\frac{2}{3}$?

(A) $\frac{33}{50}$

(B) $\frac{8}{11}$

(C) $\frac{3}{5}$

(D) $\frac{13}{27}$

(E) $\frac{5}{8}$

One way to determine which of the options given is a value greater than $\frac{2}{3}$ is to establish equivalent fractions In choice A, $\frac{33}{50} < \frac{2}{3}$ because $\frac{99}{150} < \frac{100}{150}$ In B, $\frac{8}{11} > \frac{2}{3}$ because $\frac{24}{33} > \frac{22}{33}$ In C, $\frac{3}{5} < \frac{2}{3}$ because $\frac{9}{15} < \frac{10}{15}$; in D, $\frac{13}{27} < \frac{2}{3}$ because $\frac{13}{27} < \frac{18}{27}$, and in E, $\frac{5}{8} < \frac{2}{3}$ because $\frac{15}{24} < \frac{16}{24}$ Therefore, the best answer is B

Alternatively, convert the fractions to decimal form.

$\frac{2}{3} = 0.666666$, $\frac{33}{50} = 0.66$, $\frac{8}{11} = 0.727272$, $\frac{3}{5} = 0.6$, $\frac{13}{27} = 0.481481$, and $\frac{5}{8} = 0.625$ Thus, by comparing decimal equivalents, only $\frac{8}{11}$ is greater than $\frac{2}{3}$

83. **A rope 40 feet long is cut into two pieces. If one piece is 18 feet longer than the other, what is the length, in feet, of the shorter piece?**

(A) 9
(B) 11
(C) 18
(D) 22
(E) 29

Let x be the length of the shorter piece of rope, and let $x + 18$ be the length of the longer piece Then $x + (x + 18) = 40$, which yields $2x + 18 = 40$, and $x = 11$ The best answer is B

84. **If 60 percent of a rectangular floor is covered by a rectangular rug that is 9 feet by 12 feet, what is the area, in square feet, of the floor?**

(A) 65
(B) 108
(C) 180
(D) 270
(E) 300

The area of the rug is (9)(12) = 108 square feet, which is 60 percent of x, the total area of the floor Thus, $108 = 0.6x$, or $x = \frac{108}{0.6} = 180$ The best answer is therefore C

85. **The Earth travels around the Sun at a speed of approximately 18.5 miles per second. This approximate speed is how many miles per hour?**

(A) 1,080
(B) 1,160
(C) 64,800
(D) 66,600
(E) 3,996,000

There are 60 seconds in one minute, and 60 minutes in one hour In one hour the Earth travels $18.5 \times 60 \times 60 = 66{,}600$ miles, and the best answer is D

86. **A collection of books went on sale, and $\frac{2}{3}$ of them were sold for \$2.50 each. If none of the 36 remaining books were sold, what was the total amount received for the books that were sold?**

(A) \$180
(B) \$135
(C) \$90
(D) \$60
(E) \$54

Since $\frac{2}{3}$ of the books in the collection were sold, $\frac{1}{3}$ were not sold The 36 unsold books represent $\frac{1}{3}$ of the total number of books in the collection, and $\frac{2}{3}$ of the total number of books equals 2(36) or 72 The total proceeds of the sale was 72(\$2.50) or \$180 The best answer is therefore A

87. **If "basis points" are defined so that 1 percent is equal to 100 basis points, then 82.5 percent is how many basis points greater than 62.5 percent?**

(A) 0.02
(B) 0.2
(C) 20
(D) 200
(E) 2,000

There is a difference of 20 percent between 82.5 percent and 62.5 percent If 1 percent equals 100 basis points, then 20 percent equals 20(100) or 2,000 basis points The best answer is E

88. **The amounts of time that three secretaries worked on a special project are in the ratio of 1 to 2 to 5. If they worked a combined total of 112 hours, how many hours did the secretary who worked the longest spend on the project?**

(A) 80
(B) 70
(C) 56
(D) 16
(E) 14

Since the ratio of hours worked by the secretaries on the project is 1 to 2 to 5, the third secretary spent the longest time on the project, that is, $\frac{5}{8}(112)$ or 70 hours The best answer is therefore B

89. If the quotient $\frac{a}{b}$ is positive, which of the following must be true?

(A) $a > 0$
(B) $b > 0$
(C) $ab > 0$
(D) $a - b > 0$
(E) $a + b > 0$

If the quotient $\frac{a}{b}$ is positive, then either $a > 0$ and $b > 0$, or $a < 0$ and $b < 0$ It follows that answer choices A and B need not be true. Choice C must be true, because the product of two positive or two negative numbers is positive Finally, $2 - 3 = -1$ and $-2 + (-1) = -3$ show that choices D and E, respectively, need not be true The best answer is therefore C

90. If $8^{2x+3} = 2^{3x+6}$, then $x =$

(A) -3
(B) -1
(C) 0
(D) 1
(E) 3

Since $8^{2x+3} = (2^3)^{2x+3} = 2^{6x+9}$, it follows, by equating exponents, that $6x + 9 = 3x + 6$, or $x = -1$. The best answer is therefore B

91. Of the following, the closest approximation to $\sqrt{\frac{5.98(601.5)}{15.79}}$ is

(A) 5
(B) 15
(C) 20
(D) 25
(E) 225

The value of the expression under the square root sign is approximately $\frac{6(600)}{16} = 225$ Since $225 = 15^2$, $\sqrt{225} = 15$, and the best answer is B

92. Which of the following CANNOT be the greatest common divisor of two positive integers x and y ?

(A) 1
(B) x
(C) y
(D) $x - y$
(E) $x + y$

Each answer choice except E can be the greatest common divisor (g.c d) of two positive integers For example, if $x = 3$ and $y = 2$, then x and y have g c d 1, which equals $x - y$, eliminating A and D If the two numbers are 2 and 4, then the g c d. is 2, which can be x or y, eliminating B and C However, the greatest common divisor of two positive integers cannot be greater than either one of the integers individually, so the best answer is E

93. An empty pool being filled with water at a constant rate takes 8 hours to fill to $\frac{3}{5}$ of its capacity. How much more time will it take to finish filling the pool?

(A) 5 hr 30 min
(B) 5 hr 20 min
(C) 4 hr 48 min
(D) 3 hr 12 min
(E) 2 hr 40 min

If t is the total time required to fill the entire pool, then $\frac{3}{5}t = 8$ Thus, $t = \frac{40}{3} = 13\frac{1}{3}$ hours, or 13 hours 20 minutes It will therefore take 13 hours 20 minutes – 8 hours = 5 hours 20 minutes to finish filling the pool, and the best answer is B

94. A positive number x is multiplied by 2, and this product is then divided by 3. If the positive square root of the result of these two operations equals x, what is the value of x ?

(A) $\frac{9}{4}$

(B) $\frac{3}{2}$

(C) $\frac{4}{3}$

(D) $\frac{2}{3}$

(E) $\frac{1}{2}$

The value of x must satisfy the equation $x = \sqrt{\frac{2x}{3}}$. Squaring both sides of the equation and multiplying by 3 yields $2x = 3x^2$, and, since $x > 0$, it follows that $x = \frac{2}{3}$ The best answer is therefore D

95. A tank contains 10,000 gallons of a solution that is 5 percent sodium chloride by volume. If 2,500 gallons of water evaporate from the tank, the remaining solution will be approximately what percent sodium chloride?

(A) 1.25%
(B) 3.75%
(C) 6.25%
(D) 6.67%
(E) 11.7%

The amount of sodium chloride in the tank is $0.05 \times 10{,}000$ or 500 gallons. After the evaporation of the water, the total amount of solution is $10{,}000 - 2{,}500 = 7{,}500$ gallons, and 500 gallons of sodium chloride remain. The percent of sodium chloride is thus $\frac{500}{7{,}500} = 6.67$ percent. The best answer is D.

Alternatively, this problem can be approached as an inverse proportion. The original solution contains 5 percent sodium chloride by volume in 10,000 gallons. As water evaporates from the tank, the concentration of sodium chloride in the solution will increase. If x is the fraction of sodium chloride in the remaining solution, then $\frac{10{,}000}{7{,}500} = \frac{x}{0.05}$. Solving for x gives $\frac{(0.05)(10{,}000)}{7{,}500} = 0.0667$, which equals 6.67 percent.

96. A certain grocery purchased x pounds of produce for p dollars per pound. If y pounds of the produce had to be discarded due to spoilage and the grocery sold the rest for s dollars per pound, which of the following represents the gross profit on the sale of the produce?

(A) $(x-y)s - xp$
(B) $(x-y)p - ys$
(C) $(s-p)y - xp$
(D) $xp - ys$
(E) $(x-y)(s-p)$

The grocery paid xp dollars for the produce. The grocery sold $(x-y)$ pounds of the produce for s dollars per pound, and so the total income was $(x-y)s$ dollars. The gross profit, or income minus cost, was therefore $(x-y)s - xp$. The best answer is A.

97. If $x + 5y = 16$ and $x = -3y$, then $y =$

(A) -24
(B) -8
(C) -2
(D) 2
(E) 8

Substituting the second equation into the first equation yields

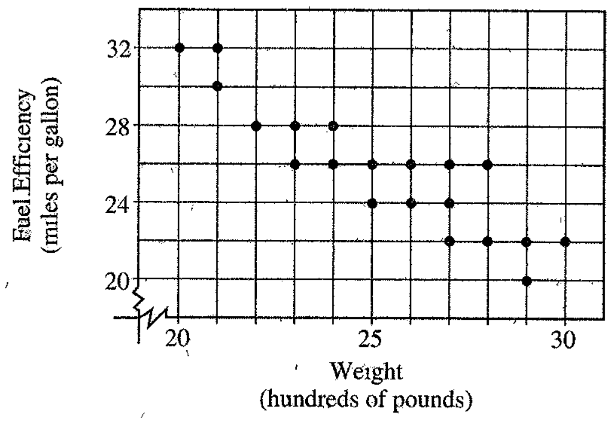
$$(-3y) + 5y = 16$$
$$2y = 16$$
$$y = 8$$

Thus, the best answer is E.

98. An empty swimming pool with a capacity of 5,760 gallons is filled at the rate of 12 gallons per minute. How many hours does it take to fill the pool to capacity?

(A) 8
(B) 20
(C) 96
(D) 480
(E) 720

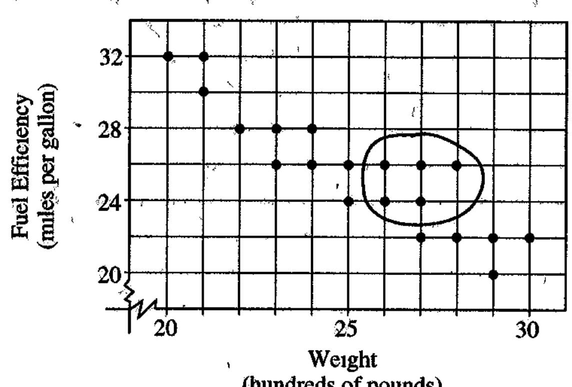
Since the pool fills at the rate of 12 gallons per minute, the number of minutes required to fill the pool is $5760 \div 12 = 480$ minutes. The number of hours required to fill the pool is $\frac{480}{60}$, or 8. The best answer is A.



99. The dots on the graph above indicate the weights and fuel efficiency ratings for 20 cars. How many of the cars weigh more than 2,500 pounds and also get more than 22 miles per gallon?

(A) Three
(B) Five
(C) Eight
(D) Ten
(E) Eleven

Count the number of dots to the right of 25 and above 22 as shown on the graph below. The dots on the vertical line at 25 and those on the horizontal line at 22 are not included. Thus, the best answer is B.



100. $\dfrac{90-8(20\div 4)}{\frac{1}{2}} =$

(A) 25
(B) 50
(C) 100
(D) 116
(E) 170

$$\frac{90-8(20\div 4)}{\frac{1}{2}} = \frac{90-8(5)}{\frac{1}{2}}$$

$$= \frac{90-40}{\frac{1}{2}}$$

$$= \frac{50}{\frac{1}{2}}$$

$$= 50 \times 2$$

$$= 100$$

The best answer is C

101. **If a, b, and c are nonzero numbers and $a+b=c$, which of the following is equal to 1 ?**

(A) $\dfrac{a-b}{c}$

(B) $\dfrac{a-c}{b}$

(C) $\dfrac{b-c}{a}$

(D) $\dfrac{b-a}{c}$

(E) $\dfrac{c-b}{a}$

For any fraction equal to 1, the numerator and the denominator must be equal Using the relationship $a+b=c$ to express the denominator of each fraction in terms of the variables in the numerator, the fractions are

(A) $\dfrac{a-b}{a+b}$ (B) $\dfrac{a-c}{c-a}$ (C) $\dfrac{b-c}{c-b}$ (D) $\dfrac{b-a}{a+b}$ (E) $\dfrac{c-b}{c-b}$

Only choice E has the numerator and denominator equal. Thus, the best answer is E

102. **Bill's school is 10 miles from his home. He travels 4 miles from school to football practice, and then 2 miles to a friend's house. If he is then x miles from home, what is the range of possible values for x ?**

(A) $2 \le x \le 10$
(B) $4 \le x \le 10$
(C) $4 \le x \le 12$
(D) $4 \le x \le 16$
(E) $6 \le x \le 16$

A diagram is helpful to solve this problem The value of x will be greatest if Bill's home (H), school (S), football practice (P), and friend's house (F) are laid out as shown below in Figure 1 with $x = 10 + 4 + 2 = 16$ miles The value of x will be least if Bill's home, school, football practice, and friend's house are situated as shown below in Figure 2 with $x = 10 - 6 = 4$ miles

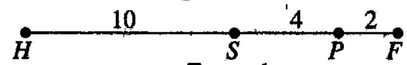


Figure 1

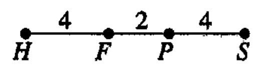


Figure 2

Thus, the best answer is D

103. **Three machines, individually, can do a certain job in 4, 5, and 6 hours, respectively. What is the greatest part of the job that can be done in one hour by two of the machines working together at their respective rates?**

(A) $\dfrac{11}{30}$

(B) $\dfrac{9}{20}$

(C) $\dfrac{3}{5}$

(D) $\dfrac{11}{15}$

(E) $\dfrac{5}{6}$

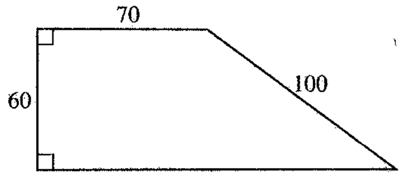
In one hour these machines can do $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{6}$ of the job, respectively Since the third machine does the smallest part of the job in one hour and only two machines are to be used, the third machine should be eliminated Therefore, the first two machines will complete $\frac{1}{4} + \frac{1}{5} = \frac{9}{20}$ of the job in one hour.

The best answer is B

104. **In 1985, 45 percent of a document storage facility's 60 customers were banks, and in 1987, 25 percent of its 144 customers were banks What was the percent increase from 1985 to 1987 in the number of bank customers the facility had?**

(A) 10.7%
(B) 20%
(C) 25%
(D) $33\frac{1}{3}$%
(E) $58\frac{1}{3}$%

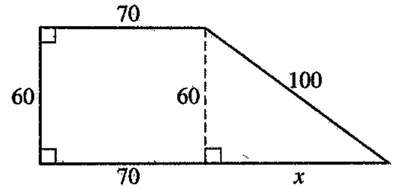
In 1985, the number of banks using the storage facility was $0\ 45(60) = 27$ banks In 1987, the number of banks using the storage facility was $0.25(144) = 36$ banks Between 1985 and 1987, the number of banks increased by 9 Since 27 was the number that was increased, the percent increase equals $\frac{9}{27} = \frac{1}{3}$, which is $33\frac{1}{3}$% Thus, the best answer is D



105. **What is the perimeter of the figure above?**

(A) 380
(B) 360
(C) 330
(D) 300
(E) 230

The figure below shows how the problem can be approached by partitioning the trapezoid into a rectangle and a triangle



The two pieces of the lower horizontal line segment are 70 and x From the Pythagorean theorem, $x^2 + 60^2 = 100^2$, $x^2 = 6{,}400$, and $x = 80$ The length of the lower horizontal line is $70 + 80 = 150$, therefore, the perimeter of the figure is $60 + 70 + 100 + 150 = 380$ The best answer is A

106. **A committee is composed of w women and m men. If 3 women and 2 men are added to the committee, and if one person is selected at random from the enlarged committee, then the probability that a woman is selected can be represented by**

(A) $\frac{w}{m}$

(B) $\frac{w}{w+m}$

(C) $\frac{w+3}{m+2}$

(D) $\frac{w+3}{w+m+3}$

(E) $\frac{w+3}{w+m+5}$

With the additional people the committee has a total of $w + 3$ women and $m + 2$ men for a total of $w + m + 5$ people The probability that a woman is selected is

$$\frac{\text{the number of women}}{\text{the total number of members}} = \frac{w+3}{w+m+5}$$

Thus, the best answer is E

107. **Last year Carlos saved 10 percent of his annual earnings. This year he earned 5 percent more than last year and he saved 12 percent of his annual earnings. The amount saved this year was what percent of the amount saved last year?**

(A) 122%
(B) 124%
(C) 126%
(D) 128%
(E) 130%

If x represents the amount of Carlos' annual earnings last year, then $1\ 05x$ would represent his earnings this year The amount Carlos saved last year was $0\ 10x$, and the amount saved this year is $0\ 12(1.05x) = 0\ 126x$ The amount saved this year as a percent of the amount saved last year is

$$\frac{0\ 126x}{0\ 1x} = 1\ 26 = 126\%$$

The best answer is C

108. Jan lives x floors above the ground floor of a highrise building. It takes her 30 seconds per floor to walk down the steps and 2 seconds per floor to ride the elevator. If it takes Jan the same amount of time to walk down the steps to the ground floor as to wait for the elevator for 7 minutes and ride down, then x equals

(A) 4
(B) 7
(C) 14
(D) 15
(E) 16

Since Jan lives x floors above the ground floor and it takes her 30 seconds per floor to walk and 2 seconds per floor to ride, it takes $30x$ seconds to walk down and $2x$ seconds to ride down after waiting 7 minutes (420 seconds) for the elevator. Thus, $30x = 2x + 420$, $x = 15$ The best answer is D

109. A corporation that had $115.19 billion in profits for the year paid out $230.10 million in employee benefits. Approximately what percent of the profits were the employee benefits? (1 billion = 10^9)

(A) 50%
(B) 20%
(C) 5%
(D) 2%
(E) 0.2%

The employee benefits as a fraction of profits is $\frac{230\ 10 \times 10^6}{115\ 19 \times 10^9}$,

which is approximately $\frac{230}{115 \times 10^3} = \frac{2}{1{,}000} = 0.2\%$ Thus, the

best answer is E

Questions 110–111 refer to the following definition.

For any positive integer n, $n > 1$, the "length" of n is the number of positive primes (not necessarily distinct) whose product is n. For example, the length of 50 is 3 since $50 = (2)(5)(5)$.

110. Which of the following integers has length 3 ?

(A) 3
(B) 15
(C) 60
(D) 64
(E) 105

To solve this problem it is necessary to factor each number into its primes and determine its "length" until the number of "length" 3 is found It is obvious that 3 and 15 have lengths 1 and 2, respectively, and

$60 = (5)(3)(2)(2)$ has length 4
$64 = (2)(2)(2)(2)(2)(2)$ has length 6
$105 = (5)(3)(7)$ has length 3

Therefore, the best answer is E

111. What is the greatest possible length of a positive integer less than 1,000 ?

(A) 10
(B) 9
(C) 8
(D) 7
(E) 6

A positive integer less than 1,000 with greatest possible "length" would be the positive number with the greatest number of prime factors with a product less than 1,000 The greatest number of factors can be obtained by using the smallest prime number, 2, as a factor as many times as possible Since $2^9 = 512$ and $2^{10} = 1{,}024$, the greatest possible "length" is 9 The best answer is B

112. A dealer originally bought 100 identical batteries at a total cost of q dollars. If each battery was sold at 50 percent above the original cost per battery, then, in terms of q, for how many dollars was each battery sold?

(A) $\frac{3q}{200}$

(B) $\frac{3q}{2}$

(C) $150q$

(D) $\frac{q}{100}+50$

(E) $\frac{150}{q}$

The cost per battery (in dollars) is $\frac{q}{100}$. Since the selling price is 150% of the cost, each battery sells for $\frac{150}{100}\times\frac{q}{100}=\frac{3q}{200}$ dollars. The best answer is A.

113. Two oil cans, X and Y, are right circular cylinders, and the height and the radius of Y are each twice those of X. If the oil in can X, which is filled to capacity, sells for \$2, then at the same rate, how much does the oil in can Y sell for if Y is filled to only half its capacity?

(A) \$1
(B) \$2
(C) \$3
(D) \$4
(E) \$8

The volume of a right circular cylinder can be found by using the formula $V=\pi r^2h$. If can X has radius r and height h, then can Y has radius $2r$ and height $2h$. Thus, the volume of can Y is $\pi(2r)^2(2h)=8\pi r^2h$, or 8 times that of can X. Since can Y is filled to only half its capacity, it contains 4 times as much oil as can X, so the cost of the oil in can Y is $4(\$2)=\$8$. The best answer is E.

114. If x, y, and z are positive integers such that x is a factor of y, and x is a multiple of z, which of the following is NOT necessarily an integer?

(A) $\frac{x+z}{z}$

(B) $\frac{y+z}{x}$

(C) $\frac{x+y}{z}$

(D) $\frac{xy}{z}$

(E) $\frac{yz}{x}$

If x is a factor of y and x is a multiple of z, then $y=kx$ and $x=cz$, where c and k are positive integers. Now each answer choice can be evaluated by substituting cz for x or kx for y into each expression until one is found that is not an integer. For example,

$$\frac{x+z}{z}=\frac{cz+z}{z}=\frac{(c+1)z}{z}=(c+1),$$ where $c+1$ is an integer,

but, $$\frac{y+z}{x}=\frac{y}{x}+\frac{z}{x}=\frac{kx}{x}+\frac{z}{cz}=k+\frac{1}{c},$$ where $\frac{1}{c}$ is not necessarily an integer. Therefore, the best answer is B.

Alternatively, since z is a factor of x and y, z is a factor of $x+y$, $x+z$ and xy, also, since x is a factor of y, x is a factor of yz. So choices A, C, D, and E must be integers. Choice B is an integer if and only if x is a factor of z, that is, $x=z$, which obviously need not be the case.

115. If $x+y=8z$, then which of the following represents the average (arithmetic mean) of x, y, and z, in terms of z?

(A) $2z+1$
(B) $3z$
(C) $5z$
(D) $\frac{z}{3}$
(E) $\frac{3z}{2}$

The average of the three numbers is $\frac{x+y+z}{3}$. Since $x+y=8z$, substituting $8z$ for $x+y$ yields $\frac{8z+z}{3}=\frac{9z}{3}=3z$. Therefore, the best answer is B.

116. If the product of the integers w, x, y, and z is 770, and if $1<w<x<y<z$, what is the value of $w+z$?

(A) 10
(B) 13
(C) 16
(D) 18
(E) 21

The prime factorization of 770 is (2)(5)(7)(11). Since $1<w<x<y<z$, the values for the variables must be $w=2$, $x=5$, $y=7$, and $z=11$, so $w+z=2+11=13$. The best answer is B.

117. If the population of a certain country increases at the rate of one person every 15 seconds, by how many persons does the population increase in 20 minutes?

(A) 80
(B) 100
(C) 150
(D) 240
(E) 300

Since the population increases at the rate of 1 person every 15 seconds, it increases by 4 people every 60 seconds, that is, by 4 people every minute Thus, in 20 minutes the population increases by $20 \times 4 = 80$ people The best answer is A

118. The value of $-3-(-10)$ is how much greater than the value of $-10-(-3)$?

(A) 0
(B) 6
(C) 7
(D) 14
(E) 26

The value of $-3-(-10)$ is $-3+10=7$, and the value of $-10-(-3)$ is $-10+3=-7$ The difference is $7-(-7) = 7+7 = 14$ Thus, the value of the first expression is 14 more than the value of the second The best answer is D

119. For an agricultural experiment, 300 seeds were planted in one plot and 200 were planted in a second plot. If exactly 25 percent of the seeds in the first plot germinated and exactly 35 percent of the seeds in the second plot germinated, what percent of the total number of seeds germinated?

(A) 12%
(B) 26%
(C) 29%
(D) 30%
(E) 60%

In the first plot 25% of 300 seeds germinated, so $0.25 \times 300 = 75$ seeds germinated In the second plot, 35% of 200 seeds germinated, so $0.35 \times 200 = 70$ seeds germinated Since $75 + 70 = 145$ seeds germinated out of a total of $300 + 200 = 500$ seeds, the percent of seeds that germinated is $\frac{145}{500} \times 100\%$, or 29% Thus, the best answer is C

120. If $\frac{a}{b} = \frac{2}{3}$, which of the following is NOT true?

(A) $\frac{a+b}{b} = \frac{5}{3}$

(B) $\frac{b}{b-a} = 3$

(C) $\frac{a-b}{b} = \frac{1}{3}$

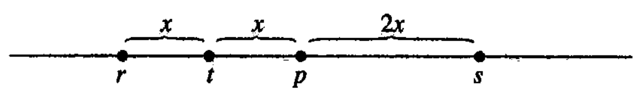
(D) $\frac{2a}{3b} = \frac{4}{9}$

(E) $\frac{a+3b}{a} = \frac{11}{2}$

One approach is to express the left side of each of the choices in terms of $\frac{a}{b}$ Thus, A is true since $\frac{a+b}{b} = \frac{a}{b} + 1 = \frac{2}{3} + 1 = \frac{5}{3}$ D and E can be shown to be true in a similar manner One way to see that B is true is to first invert both sides, that is, show that $\frac{b-a}{b} = \frac{1}{3}$ This is true since $\frac{b-a}{b} = \frac{b}{b} - \frac{a}{b} = 1 - \frac{2}{3} = \frac{1}{3}$ Thus, B is true On the other hand, C is not true since $\frac{a-b}{b} = \frac{a}{b} - \frac{b}{b} = \frac{2}{3} - 1 = -\frac{1}{3}$ not $\frac{1}{3}$

121. On the number line, if $r < s$, if p is halfway between r and s, and if t is halfway between p and r, then $\frac{s-t}{t-r} =$

(A) $\frac{1}{4}$ (B) $\frac{1}{3}$ (C) $\frac{4}{3}$ (D) 3 (E) 4

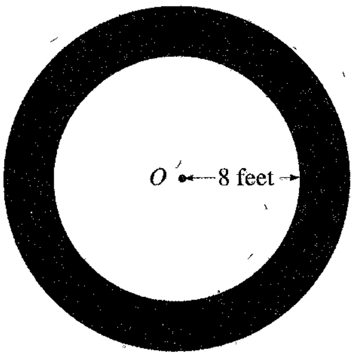


The figure above shows the relative positions of the numbers r, t, p, and s on the number line, where x denotes the length of the line segment from r to t Thus, $\frac{s-t}{t-r} = \frac{x+2x}{x} = \frac{3x}{x} = 3$ The best answer is D

122. **Coins are to be put into 7 pockets so that each pocket contains at least one coin. At most 3 of the pockets are to contain the same number of coins, and no two of the remaining pockets are to contain an equal number of coins. What is the least possible number of coins needed for the pockets?**

(A) 7
(B) 13
(C) 17
(D) 22
(E) 28

To determine the least possible number of coins needed, the smallest possible number of coins should be placed in each pocket, subject to the constraints of the problem Thus, one coin should be put in three of the pockets, 2 coins in the fourth pocket, 3 coins in the fifth, 4 coins in the sixth, and 5 coins in the seventh The least possible number of coins is therefore $1 + 1 + 1 + 2 + 3 + 4 + 5 = 17$, so the best answer is C



123 **The figure above shows a circular flower bed, with its center at O, surrounded by a circular path that is 3 feet wide. What is the area of the path, in square feet?**

(A) 25π (B) 38π (C) 55π (D) 57π (E) 64π

Since the path is 3 feet wide, its outer boundary forms a circle with a radius of $8 + 3 = 11$ feet The area of the path can be found by finding the area of a circle with a radius of 11 feet and subtracting the area of a circle with a radius of 8 feet The area of the path is therefore $\pi(11)^2 - \pi(8)^2 = (121 - 64)\pi = 57\pi$ square feet Thus, the best answer is D

	Brand X	Brand Y
Miles per Gallon	40	36
Cost per Gallon	\$0 80	\$0 75

124 **The table above gives the gasoline costs and consumption rates for a certain car driven at 50 miles per hour, using each of two brands of gasoline. How many miles farther can the car be driven at this speed on \$12 worth of brand X gasoline than on \$12 worth of brand Y gasoline?**

(A) 20 (B) 24 (C) 84 (D) 100 (E) 104

\$12 00 worth of brand X gasoline is $\frac{12\ 00}{0.80} = 15$ gallons Since the car gets 40 miles per gallon on brand X, the car would be able to go $(40)(15) = 600$ miles On the other hand, \$12 00 worth of brand Y gasoline is $\frac{12\ 00}{0\ 75} = 16$ gallons Since the car gets 36 miles per gallon using brand Y, the car would be able to go $(36)(16) = 576$ miles Therefore, the car would be able to go $600 - 576 = 24$ more miles with brand X The best answer is B

125 **If \$1 were invested at 8 percent interest compounded annually, the total value of the investment, in dollars, at the end of 6 years would be**

(A) $(1.8)^6$
(B) $(1\ 08)^6$
(C) $6(1\ 08)$
(D) $1 + (0\ 08)^6$
(E) $1 + 6(0.08)$

Since the 8 percent interest is compounded annually, each year 0 08 times the investment is added to the investment This is the same as multiplying the investment by 1 08 Therefore, after six years the initial investment of \$1 is $(1)(1\ 08)^6 = (1\ 08)^6$ dollars Thus, the best answer is B

126. **A furniture store sells only two models of desks, model A and model B The selling price of model A is \$120, which is 30 percent of the selling price of model B If the furniture store sells 2,000 desks, $\frac{3}{4}$ of which are model B, what is the furniture store's total revenue from the sale of desks?**

(A) \$114,000
(B) \$186,000
(C) \$294,000
(D) \$380,000
(E) \$660,000

The number of model B desks sold was $\frac{3}{4}(2{,}000) = 1{,}500$, so the number of model A desks sold was $2{,}000 - 1{,}500 = 500$ Since the price of model A is \$120 and this is 30 percent of the price of model B, the price of model B is $\frac{\$120}{0\ 3} = \$400$ Thus, the total revenue from the sales of the desks is $500(\$120) + 1{,}500(\$400) = \$60{,}000 + \$600{,}000 = \$660{,}000$ The best answer is E

127. How many minutes does it take John to type y words if he types at the rate of x words per minute?

(A) $\frac{x}{y}$ **(B)** $\frac{y}{x}$ **(C)** xy **(D)** $\frac{60x}{y}$ **(E)** $\frac{y}{60x}$

Let m represent the number of minutes John types John types x words a minute for m minutes, so he would type a total of $xm = y$ words Dividing both sides of the equation by x yields $m = y/x$ Thus, the best answer is B

128. The weights of four packages are 1, 3, 5, and 7 pounds, respectively. Which of the following CANNOT be the total weight, in pounds, of any combination of the packages?

(A) 9
(B) 10
(C) 12
(D) 13
(E) 14

For each of choices A-D there is a combination of the packages that gives that total (A) $9 = 1 + 3 + 5$, (B) $10 = 3 + 7$, (C) $12 = 5 + 7$, and (D) $13 = 1 + 5 + 7$ On the other hand, no combination of the packages weighs 14 pounds, since the total weight of the four packages is $1 + 3 + 5 + 7 = 16$ pounds, and there is no combination of packages weighing 2 pounds, whose removal would result in a combination weighing 14 pounds The best answer is E

129. $\sqrt{(16)(20)+(8)(32)} =$

(A) $4\sqrt{20}$

(B) 24

(C) 25

(D) $4\sqrt{20}+8\sqrt{2}$

(E) 32

$\sqrt{(16)(20)+(8)(32)} = \sqrt{320+256} = \sqrt{576} = 24$

Thus, the best answer is B.

Alternatively, since
$$\begin{aligned}(16)(20) + (8)(32) &= (16)(20) + (8)(2)(16)\\ &= (16)(20 + 16)\\ &= (16)(36),\end{aligned}$$

it follows that

$\sqrt{(16)(20)+(8)(32)} = \sqrt{(16)(36)} = (4)(6) = 24$

130. The positive integer n is divisible by 25. If $\sqrt{n}$ is greater than 25, which of the following could be the value of $\frac{n}{25}$?

(A) 22
(B) 23
(C) 24
(D) 25
(E) 26

If $\sqrt{n} > 25$, then $n > 25^2$, so $n > 625$ Hence $\frac{n}{25} > \frac{625}{25} = 25$

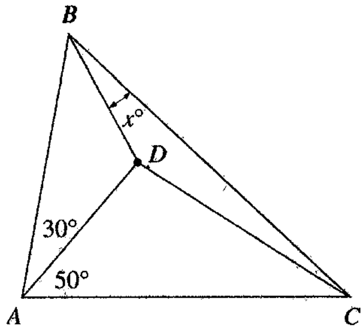
Since only choice E is greater than 25, the best answer is E

131. If x and y are different integers and $x^2 = xy$, which of the following must be true?

I. $x = 0$
II. $y = 0$
III. $x = -y$

(A) I only
(B) II only
(C) III only
(D) I and III only
(E) I, II, and III

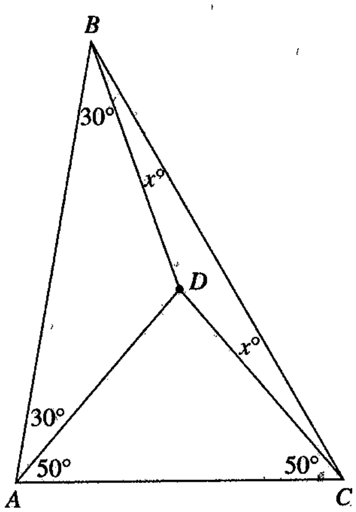
If $x \neq 0$, then both sides of the equation can be divided by x, resulting in $x = y$ Thus, either $x = 0$ or $x = y$. Since it is given that $x \neq y$, it follows that x must be 0 Therefore, statement I must be true. On the other hand, the values $x = 0$ and $y = 3$ clearly satisfy $x^2 = xy$ but do not satisfy II or III, so II and III do not have to be true Thus, the best answer is A



Note. Figure not drawn to scale

132. In the figure above, $DA = DB = DC$ What is the value of x ?

(A) 10 (B) 20 (C) 30 (D) 40 (E) 50



Since $DA = DB = DC$, the interior triangles are all isosceles, and thus the other angles of ΔABC have degree measures as indicated in the figure above (drawn to scale) Since the measures of the three angles of a triangle always add up to 180°, it follows that

$$\begin{aligned} 80 + (30 + x) + (50 + x) &= 180 \\ 160 + 2x &= 180 \\ 2x &= 20 \\ x &= 10 \end{aligned}$$

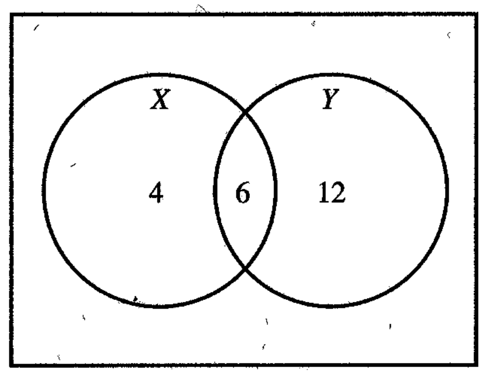
Thus, the best answer is A

133. If X and Y are sets of integers, $X \Delta Y$ denotes the set of integers that belong to set X or set Y, but not both. If X consists of 10 integers, Y consists of 18 integers, and 6 of the integers are in both X and Y, then $X \Delta Y$ consists of how many integers?

(A) 6
(B) 16
(C) 22
(D) 30
(E) 174

Since $X \Delta Y$ denotes the set of integers that belong to the set X or the set Y, but not both, the number of integers in $X \Delta Y$ is the number in the union of X and Y, minus the number in the intersection The number of integers in the union is the number in X plus the number in Y, minus the number in the intersection, which is $10 + 18 - 6 = 22$, and thus the number in $X \Delta Y$ is $22 - 6 = 16$ Thus, the best answer is B

Another way of seeing this is to look at the Venn diagram below $X \Delta Y$ consists of those integers in X alone together with those in Y alone. Thus, $X \Delta Y = 4 + 12 = 16$



134. During the four years that Mrs. Lopez owned her car, she found that her total car expenses were $18,000. Fuel and maintenance costs accounted for $\frac{1}{3}$ of the total and depreciation accounted for $\frac{3}{5}$ of the remainder. The cost of insurance was 3 times the cost of financing, and together these two costs accounted for $\frac{1}{5}$ of the total. If the only other expenses were taxes and license fees, then the cost of financing was how much more or less than the cost of taxes and license fees?

(A) $1,500 more
(B) $1,200 more
(C) $100 less
(D) $300 less
(E) $1,500 less

The table below gives the distribution of the $18,000 in total costs

fuel and maintenance	$\frac{1}{3}$ (\$18,000) = \$6,000
depreciation	$\frac{3}{5}$(\$18,000 – \$6,000) = $\frac{3}{5}$ (\$12,000) = \$7,200
insurance plus financing.	$\frac{1}{5}$ (\$18,000) = \$3,600
	\$16,800
taxes and license	\$18,000 – \$16,800 = \$1,200

Since insurance was 3 times the cost of financing, insurance came to $2,700 and financing came to $900 ($2,700 + $900 = $3,600) Thus, the cost of financing ($900) was $300 less than the cost of taxes and license fees ($1,200), and the best answer is D

135. A car travels from Mayville to Rome at an average speed of 30 miles per hour and returns immediately along the same route at an average speed of 40 miles per hour. Of the following, which is closest to the average speed, in miles per hour, for the round-trip?

(A) 32.0
(B) 33.0
(C) 34.3
(D) 35.5
(E) 36.5

Let m represent the number of miles between Mayville and Rome. On the trip to Rome the car took $\frac{m}{30}$ hours, and on the trip back to Mayville the car took $\frac{m}{40}$ hours. Hence, the average speed for the trip is the total number of miles, or $2m$ divided by the total time, or $\frac{m}{30}+\frac{m}{40}$. Thus, the average speed is $\dfrac{2m}{\frac{m}{30}+\frac{m}{40}} = \dfrac{2}{\frac{1}{30}+\frac{1}{40}} = \dfrac{2}{\frac{70}{1,200}} = \dfrac{2,400}{70}$, which

is approximately 34.3. The best answer is C.

136. If $\dfrac{0.0015\times 10^{m}}{0.03\times 10^{k}} = 5\times 10^{7}$, then $m-k=$

(A) 9
(B) 8
(C) 7
(D) 6
(E) 5

$$\frac{0.0015\times 10^{m}}{0.03\times 10^{k}} = \frac{0.0015}{0.03}\times 10^{m-k} = 0.05\times 10^{m-k}$$
$$= 5\times 10^{-2}10^{m-k} = (5)10^{m-k-2}$$

Since this must be equal to $(5)(10^7)$, $m-k-2=7$, so $m-k=9$. Thus, the best answer is A.

		x
37	38	15
		y

137. In the figure above, the sum of the three numbers in the horizontal row equals the product of the three numbers in the vertical column. What is the value of xy ?

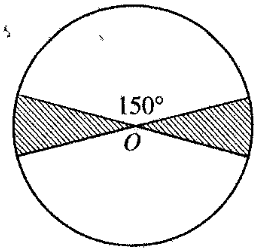
(A) 6
(B) 15
(C) 35
(D) 75
(E) 90

The sum of the three numbers in the horizontal row is $37 + 38 + 15$, or 90. The product of the three numbers in the vertical column is $15xy$. Thus, $15xy = 90$, or $xy = 6$, and the best answer is A.

138. For telephone calls between two particular cities, a telephone company charges \$0.40 per minute if the calls are placed between 5:00 a.m. and 9:00 p.m. and \$0.25 per minute if the calls are placed between 9:00 p.m. and 5:00 a.m. If the charge for a call between the two cities placed at 1:00 p.m. was \$10.00, how much would a call of the same duration have cost if it had been placed at 11.00 p.m.?

(A) \$3.75
(B) \$6.25
(C) \$9.85
(D) \$10.00
(E) \$16.00

The ratio of the charge per minute for a call placed at 11:00 p.m. to the charge per minute for a call placed at 1:00 p.m. is $\frac{\$0.25}{\$0.40}$, or $\frac{5}{8}$. Therefore, if the charge for a call placed at 1:00 p.m. is \$10.00, the charge for a call of the same duration placed at 11:00 p.m. would be $\left(\frac{5}{8}\right)(\$10.00)$, or \$6.25, and the best answer is B.



139. If O is the center of the circle above, what fraction of the circular region is shaded?

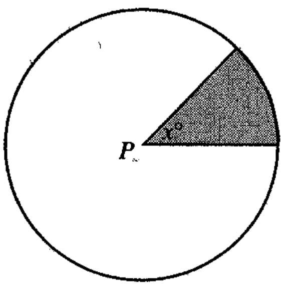
(A) $\frac{1}{12}$

(B) $\frac{1}{9}$

(C) $\frac{1}{6}$

(D) $\frac{1}{4}$

(E) $\frac{1}{3}$



If P is the center of the circle above, then the fraction of the area of the circular region that is shaded is $\frac{x}{360}$ Since vertical angles are equal, the sum of the central angles of the two shaded regions is $360^\circ - 2(150)^\circ$, or 60° Therefore, $\frac{60}{360} = \frac{1}{6}$ of the circular region is shaded, and the best answer is C

140. If a compact disc that usually sells for \$12.95 is on sale for \$9.95, then the percent decrease in price is closest to

(A) 38%
(B) 31%
(C) 30%
(D) 29%
(E) 23%

The percent decrease in the price of an item =

$$\frac{\text{the decrease in the cost of the item}}{\text{the original price of the item}}$$

Thus, the percent decrease in the price of a compact disc is $\frac{12\ 95 - 9\ 95}{12\ 95}$, or $\frac{3}{12\ 95}$, which is a little less than $\frac{30}{12\ 50}$, or 24 percent Thus, the best answer is E

141 $\dfrac{1}{1+\dfrac{1}{2+\dfrac{1}{3}}} =$

(A) $\frac{3}{10}$

(B) $\frac{7}{10}$

(C) $\frac{6}{7}$

(D) $\frac{10}{7}$

(E) $\frac{10}{3}$

$$\frac{1}{1+\dfrac{1}{2+\dfrac{1}{3}}} = \frac{1}{1+\dfrac{1}{\frac{7}{3}}} = \frac{1}{1+\frac{3}{7}} = \frac{1}{\frac{10}{7}} = \frac{7}{10}$$

Thus, the best answer is B

142 A fruit-salad mixture consists of apples, peaches, and grapes in the ratio 6 : 5 : 2, respectively, by weight. If 39 pounds of the mixture is prepared, the mixture includes how many more pounds of apples than grapes?

(A) 15
(B) 12
(C) 9
(D) 6
(E) 4

Since the ratio of apples to peaches to grapes is 6 5 2, for each 6 + 5 + 2 or 13 equal parts by weight of the mixture, 6 parts are apples and 2 parts are grapes There are then $\frac{6}{13}(39) = 18$ pounds of apples and $\frac{2}{13}(39) = 6$ pounds of grapes Therefore, there are 18 – 6 = 12 more pounds of apples than grapes in 39 pounds of the mixture The best answer is B

143. If $\frac{3}{x} = 2$ and $\frac{y}{4} = 3$, then $\frac{3+y}{x+4} =$

(A) $\frac{10}{9}$

(B) $\frac{3}{2}$

(C) $\frac{20}{11}$

(D) $\frac{30}{11}$

(E) 5

Since $\frac{3}{x} = 2$ and $\frac{y}{4} = 3$, it follows that $x = \frac{3}{2}$ and $y = 12$.

Thus, $\frac{3+y}{x+4} = \frac{3+12}{\frac{3}{2}+4} = \frac{15}{\frac{11}{2}} = \frac{30}{11}$, and the best answer is D

144. $\left(1+\sqrt{5}\right)\left(1-\sqrt{5}\right) =$

(A) -4
(B) 2
(C) 6
(D) $-4-2\sqrt{5}$
(E) $6-2\sqrt{5}$

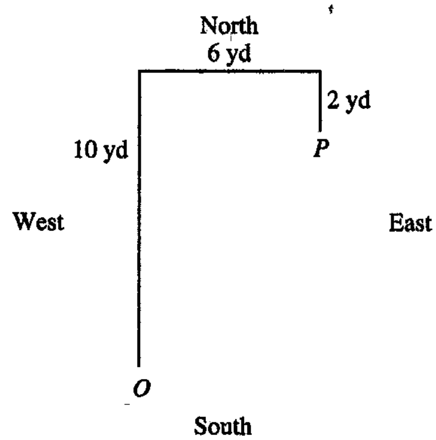
$$\left(1+\sqrt{5}\right)\left(1-\sqrt{5}\right) = 1^2 + \sqrt{5} - \sqrt{5} - \left(\sqrt{5}\right)^2$$
$$= 1^2 - \left(\sqrt{5}\right)^2 = 1 - 5 = -4$$

Thus, the best answer is A

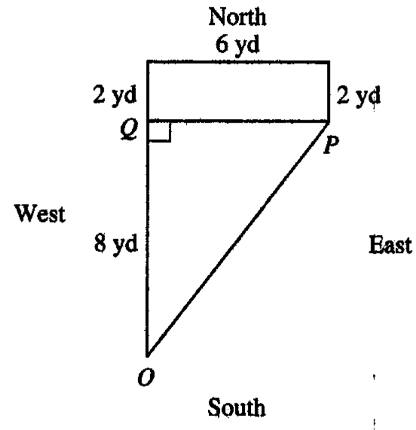
145. **Starting from point O on a flat school playground, a child walks 10 yards due north, then 6 yards due east, and then 2 yards due south, arriving at point P. How far apart, in yards, are points O and P?**

(A) 18
(B) 16
(C) 14
(D) 12
(E) 10

The figure below represents the information given in the question.



Next, two lines can be drawn, one from P perpendicular to the line representing the child's walk due north, and the other connecting O and P.



OPQ is a right triangle, $QP = 6$ yards, and $OQ = (10 - 2)$ yards $= 8$ yards. Thus, by the Pythagorean theorem $OP = \sqrt{6^2 + 8^2} = \sqrt{100} = 10$ yards, and the best answer is E

146. **A certain car increased its average speed by 5 miles per hour in each successive 5-minute interval after the first interval. If in the first 5-minute interval its average speed was 20 miles per hour, how many miles did the car travel in the third 5-minute interval?**

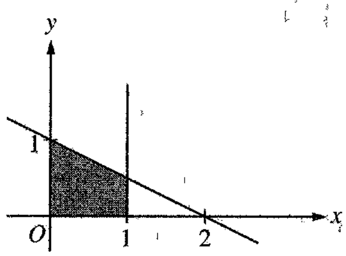
(A) 1.0
(B) 1.5
(C) 2.0
(D) 2.5
(E) 3.0

In the first 5-minute interval the car's average speed was 20 miles per hour, and the car's average speed increased by 5 miles per hour in each successive 5-minute interval. Thus, the average speed was 25 miles per hour in the second 5-minute interval and 30 miles per hour in the third 5-minute interval. Since 5 minutes is $\frac{1}{12}$ of an hour, the car traveled $\frac{1}{12}(30)$, or 2.5, miles in the third 5-minute interval, and the best answer is D.

147. **Lois has x dollars more than Jim has, and together they have a total of y dollars. Which of the following represents the number of dollars that Jim has?**

(A) $\frac{y-x}{2}$
(B) $y-\frac{x}{2}$
(C) $\frac{y}{2}-x$
(D) $2y-x$
(E) $y-2x$

If J is the number of dollars that Jim has, then Lois has $J + x$ dollars. Thus, the amount, y, that they have together is $J + (J+x)$. So $y=J+(J+x)=2J+x$, $J=\frac{y-x}{2}$, and the best answer is A.



148. **In the rectangular coordinate system above, the shaded region is bounded by straight lines. Which of the following is NOT an equation of one of the boundary lines?**

(A) $x = 0$
(B) $y = 0$
(C) $x = 1$
(D) $x - y = 0$
(E) $x + 2y = 2$

The equation of the x-axis is $y = 0$. The equations of the y-axis and the line one unit to the right of the y-axis are $x = 0$ and $x = 1$, respectively. Thus, the answer key cannot be A, B, or C. The top boundary line passes through the point (2, 0). To lie on a certain line the point (2, 0) must satisfy the equation of that line. Substituting in D yields $2 - 0 = 0$, which is not a true statement. Thus, $x - y = 0$ is NOT an equation of one of the boundary lines and the best answer is D.

149. **A certain population of bacteria doubles every 10 minutes. If the number of bacteria in the population initially was 10^4, what was the number in the population 1 hour later?**

(A) $2(10^4)$
(B) $6(10^4)$
(C) $(2^6)(10^4)$
(D) $(10^6)(10^4)$
(E) $(10^4)^6$

If the population of bacteria doubles every 10 minutes, it doubles 6 times in an hour. The population after 10 minutes was $(2)(10^4)$ and after 20 minutes was $(2)(2)(10^4)$, or $(2^2)(10^4)$. Continuing to multiply by 2 each time the population doubles, it follows that the population after an hour is $(2^6)(10^4)$, and the best answer is C.

150. **During a certain season, a team won 80 percent of its first 100 games and 50 percent of its remaining games. If the team won 70 percent of its games for the entire season, what was the total number of games that the team played?**

(A) 180
(B) 170
(C) 156
(D) 150
(E) 105

Let G equal the number of games played by the team this season. Expressed algebraically, 80 percent of its first 100 games and 50 percent of its remaining games is $(0.80)(100) + 0.50(G - 100)$ and 70 percent of its games is $0.70G$. Thus,

$$0.70G = (0.80)(100) + 0.50(G-100)$$
$$0.70G = 80 + 0.50G - 50$$
$$0.20G = 30$$
$$G = 150$$

Therefore, the team played 150 games and the best answer is D.

151. If Juan takes 11 seconds to run y yards, how many seconds will it take him to run x yards at the same rate?

(A) $\frac{11x}{y}$

(B) $\frac{11y}{x}$

(C) $\frac{x}{11y}$

(D) $\frac{11}{xy}$

(E) $\frac{xy}{11}$

If Juan takes 11 seconds to run y yards, it takes him $\frac{11}{y}$ seconds to run 1 yard Therefore, it takes him $x\left(\frac{11}{y}\right)=\frac{11x}{y}$ seconds to run x yards and the best answer is A

Alternatively, recall that rate $\times$ time $=$ distance

Therefore, if Juan takes 11 seconds to run y yards he runs at a rate of $\frac{y}{11}$ yards per second So, to run x yards he takes $\frac{x}{\frac{y}{11}}=\frac{11x}{y}$ seconds

152. Which of the following fractions has the greatest value?

(A) $\frac{6}{(2^2)(5^2)}$

(B) $\frac{1}{(2^3)(5^2)}$

(C) $\frac{28}{(2^2)(5^3)}$

(D) $\frac{62}{(2^3)(5^3)}$

(E) $\frac{122}{(2^4)(5^3)}$

Notice that $(2^2)(5^2)$ is a factor of the denominator of each of the answer choices Factoring it out will make comparison of the sizes of the fractions easier

(A) $\frac{6}{(2^2)(5^2)}=6\times\frac{1}{(2^2)(5^2)}$

(B) $\frac{1}{(2^3)(5^2)}=\frac{1}{2}\times\frac{1}{(2^2)(5^2)}$

(C) $\frac{28}{(2^2)(5^3)}=\frac{28}{5}\times\frac{1}{(2^2)(5^2)}$

(D) $\frac{62}{(2^3)(5^3)}=\frac{62}{(2)(5)}\times\frac{1}{(2^3)(5^2)}=\frac{31}{5}\times\frac{1}{(2^2)(5^2)}$

(E) $\frac{122}{(2^4)(5^3)}=\frac{122}{(2^2)(5)}\times\frac{1}{(2^2)(5^2)}=\frac{61}{10}\times\frac{1}{(2^2)(5^2)}$

Of these fractions, the one with the greatest factor preceding $\frac{1}{(2^2)(5^2)}$ is $\frac{31}{5}\times\frac{1}{(2^2)(5^2)}$ Thus, the best answer is D

153. Of 30 applicants for a job, 14 had at least 4 years experience, 18 had degrees, and 3 had less than 4 years experience and did not have a degree. How many of the applicants had at least 4 years experience and a degree?

(A) 14
(B) 13
(C) 9
(D) 7
(E) 5

The applicants for a job were classified in the problem by (1) whether they had more or less than 4 years experience and (2) whether they had a degree. The given information can be summarized in the following table

	Experience		Total
	At least 4 years	Less than 4 years	
Degree			18
No Degree		3	
Total	14		30

Notice that the sum of the entries in a row or column must equal the total for that row or column Thus, (1) the total number of applicants who have less than 4 years experience is 30 – 14, or 16, (2) the number of applicants who have a degree and less than 4 years experience is 16 – 3, or 13, and (3) the number of applicants who have at least 4 years experience and a degree is 18 – 13, or 5 Therefore, the best answer is E.

154. Which of the following CANNOT yield an integer when divided by 10 ?

(A) The sum of two odd integers
(B) An integer less than 10
(C) The product of two primes
(D) The sum of three consecutive integers
(E) An odd integer

To solve this problem, look at each option to see if there are integers that (1) satisfy the condition in the option and (2) yield an integer when divided by 10.

(A) 3 and 7 are both odd integers and $\frac{3+7}{10}=1$.

(B) -10 is an integer that is less than 10 and $\frac{-10}{10}=-1$

(C) 2 and 5 are primes and $\frac{(5)(2)}{10}=1$

(D) 9, 10, and 11 are three consecutive integers and $\frac{9+10+11}{10}=3$

(E) All multiples of 10 are even integers, therefore, an odd integer divided by 10 CANNOT yield an integer

Thus, the best answer is E

155. A certain clock marks every hour by striking a number of times equal to the hour, and the time required for a stroke is exactly equal to the time interval between strokes. At 6:00 the time lapse between the beginning of the first stroke and the end of the last stroke is 22 seconds. At 12:00, how many seconds elapse between the beginning of the first stroke and the end of the last stroke?

(A) 72
(B) 50
(C) 48
(D) 46
(E) 44

At 6:00 there are 6 strokes and 5 intervals between strokes Thus, there are 11 equal time intervals in the 22 seconds between the beginning of the first stroke and the end of the last stroke Each time interval is $\frac{22}{11}=2$ seconds long At 12:00 there are 12 strokes and 11 intervals between strokes Thus, there are 23 equal 2-second time intervals, or 46 seconds, between the beginning of the first stroke and the end of the last stroke The best answer is D

156. If $k \neq 0$ and $k-\frac{3-2k^2}{k}=\frac{x}{k}$, then $x =$

(A) $-3-k^2$
(B) k^2-3
(C) $3k^2-3$
(D) $k-3-2k^2$
(E) $k-3+2k^2$

Multiplying both sides of the equation $k-\frac{3-2k^2}{k}=\frac{x}{k}$ by k yields $k^2-(3-2k^2)=x$, or $x=3k^2-3$ Thus, the best answer is C

157. $\dfrac{\frac{1}{2}+\frac{1}{3}}{\frac{1}{4}}=$

(A) $\frac{1}{12}$

(B) $\frac{5}{24}$

(C) $\frac{2}{3}$

(D) $\frac{9}{4}$

(E) $\frac{10}{3}$

This complex fraction can be simplified by multiplying numerator and denominator by the lowest common denominator, 12

$$\frac{\frac{1}{2}+\frac{1}{3}}{\frac{1}{4}}=\frac{\left(\frac{1}{2}+\frac{1}{3}\right)\times 12}{\frac{1}{4}\times 12}=\frac{6+4}{3}=\frac{10}{3}$$

Thus, the best answer is E

158 John has 10 pairs of matched socks. If he loses 7 individual socks, what is the greatest number of pairs of matched socks he can have left?

(A) 7
(B) 6
(C) 5
(D) 4
(E) 3

If John loses 7 individual socks, they could belong to either 4, 5, 6, or 7 different pairs Therefore, the greatest possible number of pairs of matched socks is 10 − 4 = 6. Thus, the best answer is B

Alternatively, since there were 20 socks altogether, there are 20 − 7 = 13 socks left, which could be at most 6 pairs

159. Last year's receipts from the sale of candy on Valentine's Day totaled 385 million dollars, which represented 7 percent of total candy sales for the year. Candy sales for the year totaled how many million dollars?

(A) 55
(B) 550
(C) 2,695
(D) 5,500
(E) 26,950

Let x represent the number of millions of dollars spent on candy for the year. Since the Valentine's Day receipts are 7% of the year's receipts, $0.07x = 385$ Solving the equation yields 5,500 million dollars The best answer is D.

160. How many minutes does it take to travel 120 miles at 400 miles per hour?

(A) 3

(B) $3\frac{1}{3}$

(C) $8\frac{2}{3}$

(D) 12

(E) 18

The number of minutes it takes to travel 120 miles at 400 miles per hour can be found by completing the computation $\frac{120 \text{ miles} \times 60 \text{ minutes/hour}}{400 \text{ miles/hour}} = 18$ minutes Therefore, the best answer is E

161. If $1 + \frac{1}{x} = 2 - \frac{2}{x}$, then $x =$

(A) -1

(B) $\frac{1}{3}$

(C) $\frac{2}{3}$

(D) 2

(E) 3

Multiplying both sides of the equation by x yields $x + 1 = 2x - 2$, and combining like terms leaves $x = 3$ The best answer is E

162. Last year, for every 100 million vehicles that traveled on a certain highway, 96 vehicles were involved in accidents. If 3 billion vehicles traveled on the highway last year, how many of those vehicles were involved in accidents? (1 billion = 1,000,000,000)

(A) 288
(B) 320
(C) 2,880
(D) 3,200
(E) 28,800

The problem states that on a certain highway 96 vehicles out of each 100 million were involved in accidents Since 3 billion vehicles is equivalent to 3,000 million, the number of vehicles that were involved in accidents last year was $\frac{96}{100 \text{ million}} \times 3{,}000 \text{ million} = 2{,}880$ vehicles. Thus, the best answer is C.

163. If the perimeter of a rectangular garden plot is 34 feet and its area is 60 square feet, what is the length of each of the longer sides?

(A) 5 ft
(B) 6 ft
(C) 10 ft
(D) 12 ft
(E) 15 ft

Let x represent the width of the rectangular garden and y the length of the garden Since the garden has perimeter 34 feet and area 60 square feet, it follows that $2x + 2y = 34$ and $xy = 60$. Dividing the first equation by 2 gives $x + y = 17$, thus, the problem reduces to finding two numbers whose product is 60 and whose sum is 17 It can be seen by inspection that the two numbers are 5 and 12, so $y = 12$ Therefore, the best answer is D

164. What is the least positive integer that is divisible by each of the integers 1 through 7, inclusive?

(A) 420
(B) 840
(C) 1,260
(D) 2,520
(E) 5,040

A number that is divisible by 1, 2, 3, 4, 5, 6, and 7 must contain 2, 3, 4, 5, 6, and 7 as factors The least positive integer is achieved by assuring there is no duplication of factors Since 2 and 3 are factors of 6, they are not included as factors of our least positive integer Because 4 contains two factors of 2, and 6 contains only one factor of 2, the number must contain a second factor of 2 The number is (2)(5)(6)(7) = 420 Thus, the best answer is A

165. Thirty percent of the members of a swim club have passed the lifesaving test. Among the members who have not passed the test, 12 have taken the preparatory course and 30 have not taken the course. How many members are there in the swim club?

(A) 60
(B) 80
(C) 100
(D) 120
(E) 140

If 30 percent of the members of the swim club have passed the lifesaving test, then 70 percent have not. Among the members who have not passed the test, 12 have taken the course and 30 have not, for a total of 42 members If x represents the number of members in the swim club, $0.70x = 42$, so $x = 60$ The best answer is A

166. For all numbers s and t, the operation $*$ is defined by $s * t = (s-1)(t+1)$. If $(-2) * x = -12$, then $x =$

(A) 2
(B) 3
(C) 5
(D) 6
(E) 11

Since $s * t = (s-1)(t+1)$ and $(-2) * x = (-12)$, $(-2) * x = (-2-1)(x+1) = -12$ Solving $(-3)(x+1) = -12$ for x yields $x = 3$ Therefore, the best answer is B

167. In an increasing sequence of 10 consecutive integers, the sum of the first 5 integers is 560. What is the sum of the last 5 integers in the sequence?

(A) 585
(B) 580
(C) 575
(D) 570
(E) 565

If $x, x+1, x+2, x+3$, and $x+4$ are the first five consecutive integers and their sum is 560, then $5x + 10 = 560$, so $x = 110$ The sixth through tenth consecutive numbers are represented by $x+5, x+6, x+7, x+8$, and $x+9$, so their sum is $5x + 35 = 5(110) + 35 = 585$ Thus, the best answer is A

Alternatively, note that the sixth number is 5 more than the first, the seventh is 5 more than the second, and so on, so the sum of the last five integers is $5(5) = 25$ more than the sum of the first five consecutive integers Therefore, the sum of the last 5 integers is $560 + 25 = 585$

168. A certain manufacturer produces items for which the production costs consist of annual fixed costs totaling \$130,000 and variable costs averaging \$8 per item. If the manufacturer's selling price per item is \$15, how many items must the manufacturer produce and sell to earn an annual profit of \$150,000 ?

(A) 2,858
(B) 18,667
(C) 21,429
(D) 35,000
(E) 40,000

Let x represent the number of items produced The manufacturer's profit, $P(x)$, is determined by subtracting cost from revenue, that is, $P(x) = R(x) - C(x)$. Since $R(x) = 15x$ dollars, $C(x) = 8x + 130{,}000$ dollars, and $P(x) = \$150{,}000$, $15x - (8x + 130{,}000) = 150{,}000$ Solving this equation yields $x = 40{,}000$ Therefore, the best answer is E

169. How many two-element subsets of {1, 2, 3, 4} are there that do not contain the pair of elements 2 and 4 ?

(A) One
(B) Two
(C) Four
(D) Five
(E) Six

This problem can be solved by finding the difference between the total number of two-element subsets and the number that contain both 2 and 4 There is only one two-element subset that contains both 2 and 4 The total number of two-element subsets is $\frac{(4)(3)}{2} = 6$, therefore, the difference is five Thus, the best answer is D.

Alternatively, the two-element subsets of $\{1, 2, 3, 4\}$ are $\{1, 2\}$, $\{1, 3\}$, $\{1, 4\}$, $\{2, 3\}$, $\{2, 4\}$, and $\{3, 4\}$ There are 5 two-element subsets that do not contain both 2 and 4

170. In a certain company, the ratio of the number of managers to the number of production-line workers is 5 to 72. If 8 additional production-line workers were to be hired, the ratio of the number of managers to the number of production-line workers would be 5 to 74. How many managers does the company have?

(A) 5
(B) 10
(C) 15
(D) 20
(E) 25

If m represents the number of managers and p represents the number of production-line workers, then the ratio of managers to production-line workers is $\frac{m}{p} = \frac{5}{72}$. With 8 additional production-line workers, $p + 8$ represents the new number of production-line workers and the new ratio is $\frac{m}{p+8} = \frac{5}{74}$. The two ratios form the system of two equations $5p - 72m = 0$ and $5p - 74m = -40$. Subtracting the two equations to eliminate p yields $m = 20$. Therefore, the best answer is D.

171. If $(x-1)^2 = 400$, which of the following could be the value of $x - 5$?

(A) 15
(B) 14
(C) −24
(D) −25
(E) −26

Since $(x-1)^2 = 400$, $(x-1) = 20$ or -20, so $x = 21$ or -19. Thus, $x - 5 = 16$ or -24. The best answer is C.

172. Salesperson *A*'s compensation for any week is \$360 plus 6 percent of the portion of *A*'s total sales above \$1,000 for that week. Salesperson *B*'s compensation for any week is 8 percent of *B*'s total sales for that week. For what amount of total weekly sales would both salespeople earn the same compensation?

(A) \$21,000
(B) \$18,000
(C) \$15,000
(D) \$4,500
(E) \$4,000

Let x represent the total weekly sales amount at which both salespersons earn the same compensation. Salesperson *B*'s compensation is represented by $0.08x$ and Salesperson *A*'s compensation is represented by $360 + 0.06(x - 1{,}000)$. Solving the equation $0.08x = 360 + 0.06(x - 1{,}000)$ yields $x = 15{,}000$. Therefore, the best answer is C.

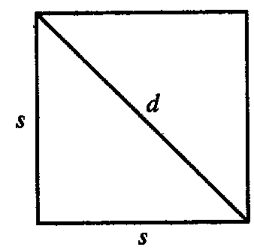
173. If a square region has area x, what is the length of its diagonal in terms of x?

(A) $\sqrt{x}$
(B) $\sqrt{2x}$
(C) $2\sqrt{x}$
(D) $x\sqrt{2}$
(E) $2x$

Since the area of the square region is x, $s^2 = x$, where $s = \sqrt{x}$ is the length of the side of the square. Because a diagonal divides the square into two right triangles as shown in the figure below, the Pythagorean theorem yields

$d^2 = \left(\sqrt{x}\right)^2 + \left(\sqrt{x}\right)^2 = x + x = 2x$, or $d = \sqrt{2x}$.

Thus, the best answer is B.



174. In a certain class consisting of 36 students, some boys and some girls, exactly $\frac{1}{3}$ of the boys and exactly $\frac{1}{4}$ of the girls walk to school. What is the greatest possible number of students in this class who walk to school?

(A) 9
(B) 10
(C) 11
(D) 12
(E) 13

Let x represent the number of boys in the class and $36 - x$ the number of girls in the class. The numbers of boys and girls who walk to school are $\frac{1}{3}x$ and $\frac{1}{4}(36 - x)$, respectively. The greatest possible number of students who walk is the greatest number that $\frac{1}{3}x + \frac{1}{4}(36 - x) = 9 + \frac{1}{12}x$ can be. Since there are some girls in the class, x cannot equal 36, so $\frac{1}{12}x$ can be a maximum of 2. Hence, the best answer is C.

Alternatively, if x boys and y girls ($x > 0$ and $y > 0$) walk to school, then $3x + 4y = 36$. Since $4y$ and 36 are divisible by 4, it follows that $3x$, and thus x, must be divisible by 4. The only pairs (x, y) that satisfy these conditions are $(4, 6)$ and $(8, 3)$, so the maximum value of $x + y$ is $8 + 3 = 11$.

175. **The sum of the ages of Doris and Fred is y years. If Doris is 12 years older than Fred, how many years old will Fred be y years from now, in terms of y?**

(A) $y-6$

(B) $2y-6$

(C) $\frac{y}{2}-6$

(D) $\frac{3y}{2}-6$

(E) $\frac{5y}{2}-6$

Let d represent the age of Doris and f represent the age of Fred Since the sum of Doris' age and Fred's age is y years, $d+f=y$, and since Doris is 12 years older than Fred, $d=f+12$ Substituting the second equation into the first yields $(12+f)+f=y$ Solving for f, $f=\frac{y-12}{2}=\frac{y}{2}-6$

Fred's age after y years is $f+y=\frac{y}{2}-6+y=\frac{3y}{2}-6$

Therefore, the best answer is D

$$\begin{array}{r} 1,234 \\ 1,243 \\ 1,324 \\ \cdots\cdot \\ \cdots \\ +\,4,321 \\ \hline \end{array}$$

176. **The addition problem above shows four of the 24 different integers that can be formed by using each of the digits 1, 2, 3, and 4 exactly once in each integer. What is the sum of these 24 integers?**

(A) 24,000
(B) 26,664
(C) 40,440
(D) 60,000
(E) 66,660

Note that each column contains six 1's, six 2's, six 3's, and six 4's, whose sum is $6(1+2+3+4)=6(10)=60$ In the tens, hundreds, and thousands columns, the sum is 66 due to the 6 carried from the previous column. Therefore, the sum of these 24 integers is 66,660 Hence, the best answer is E

177. **If $x = -(2-5)$, then $x =$**

(A) -7 (B) -3 (C) 3 (D) 7 (E) 10

Since $x=-(2-5)$, $x=-(-3)=3$ The best answer is C

178 **What percent of 30 is 12?**

(A) 2 5% (B) 3.6% (C) 25%
(D) 40% (E) 250%

$\frac{12}{30}=\frac{2}{5}=\frac{40}{100}=40\%$. The best answer is D

179 **On a 3-day fishing trip, 4 adults consumed food costing \$60. For the same food costs per person per day, what would be the cost of food consumed by 7 adults during a 5-day fishing trip?**

(A) \$300
(B) \$175
(C) \$105
(D) \$100
(E) \$84

On the 3-day fishing trip, each adult consumed an average of $\frac{\$60}{4}$ or \$15 worth of food Thus, the cost of food per person per day was \$5 At the same rate, the cost of food consumed by 7 adults during a 5-day fishing trip would be 5(7)(\$5) = \$175 The best answer is B

180. **In a poll of 66,000 physicians, only 20 percent responded, of these, 10 percent disclosed their preference for pain reliever X How many of the physicians who responded did <u>not</u> disclose a preference for pain reliever X?**

(A) 1,320
(B) 5,280
(C) 6,600
(D) 10,560
(E) 11,880

The number of physicians who responded to the poll was 0 2 (66,000) or 13,200 If 10 percent of the respondents disclosed a preference for X, then 90 percent did not disclose a preference for X Thus, the best answer is 0 9 (13,200) or choice E

181. If $\frac{1.5}{0.2+x} = 5$, then $x =$

(A) -3.7
(B) 0.1
(C) 0.3
(D) 0.5
(E) 2.8

Multiplying both sides of the equation by $0.2 + x$ yields the equation $1.5 = 1 + 5x$, so that $5x = 0.5$ and $x = 0.1$. The best answer is B

182. **If a basketball team scores an average (arithmetic mean) of x points per game for n games and then scores y points in its next game, what is the team's average score for the $n + 1$ games?**

(A) $\frac{nx+y}{n+1}$

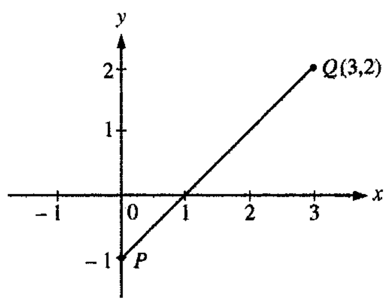
(B) $x+\frac{y}{n+1}$

(C) $x+\frac{y}{n}$

(D) $\frac{n(x+y)}{n+1}$

(E) $\frac{x+ny}{n+1}$

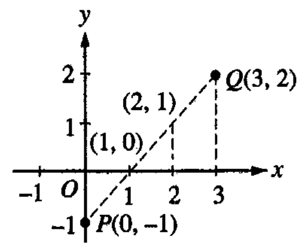
For the first n games, the team has scored a total of nx points, and for the $n + 1$ games, the team has scored a total of $nx + y$ points. Thus, the average score for the $n + 1$ games is $\frac{nx+y}{n+1}$. The best answer is A



183. **In the figure above, the point on segment PQ that is twice as far from P as from Q is**

(A) (3, 1)
(B) (2, 1)
(C) (2, −1)
(D) (1.5, 0.5)
(E) (1, 0)

Since the slope of PQ is 1 and the y-intercept is −1, the points (0, −1), (1, 0), (2, 1), and (3, 2) are on segment PQ and divide the segment into three intervals of equal length as shown in the figure below



Note that the point (2, 1) is twice as far from $P(0, -1)$ as from $Q(3, 2)$, and the best answer is B.

Alternatively, to solve this problem we need to find a point, X, on segment PQ such that $PX = 2QX$. Since the slope and y-intercept of PQ are 1 and −1, respectively, the coordinates for X are of the form $(x, x-1)$. Therefore,

$$PX = \sqrt{(x-0)^2+((x-1)+1)^2} = \sqrt{2x^2} = \sqrt{2}x \quad \text{and}$$

$$QX = \sqrt{(3-x)^2+(2-(x-1))^2} = \sqrt{2(3-x)^2} = \sqrt{2}(3-x)$$

So since $PX = 2QX$, it follows that $\sqrt{2}x = 2\sqrt{2}(3-x)$, or $x = 2(3-x)$, or $x = 2$. Thus, X has coordinates (2, 1) and the best answer is B

184. $\frac{3}{100}+\frac{5}{1{,}000}+\frac{7}{100{,}000} =$

(A) 0.357
(B) 0.3507
(C) 0.35007
(D) 0.0357
(E) 0.03507

If each fraction is written in decimal form, the sum to be found is

0.03
0.005
<u>0.00007</u>
0.03507

Thus, the best answer is E

185. If the number n of calculators sold per week varies with the price p in dollars according to the equation $n = 300 - 20p$, what would be the total weekly revenue from the sale of \$10 calculators?

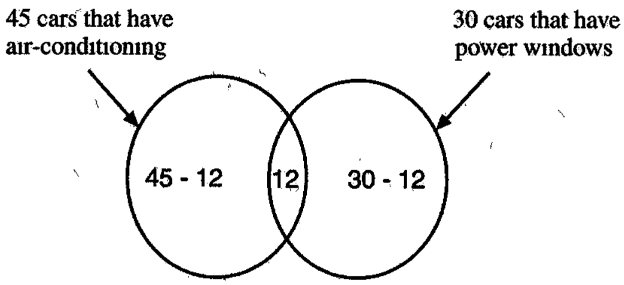
(A) \$100 (B) \$300 (C) \$1,000
(D) \$2,800 (E) \$3,000

If the price of a calculator is \$10, then the number n of calculators that would be sold is $n = 300 - 20(10) = 100$. Thus, the total revenue from the sale of 100 calculators at \$10 each would be \$1,000, and the best answer is C

186. Of the 65 cars on a car lot, 45 have air-conditioning, 30 have power windows, and 12 have both air-conditioning and power windows. How many of the cars on the lot have neither air-conditioning nor power windows?

(A) 2
(B) 8
(C) 10
(D) 15
(E) 18

One way to solve problems of this type is to construct a Venn diagram and to assign values to the nonoverlapping regions For example,



If there were 65 cars in all, then the number of cars that have neither air-conditioning nor power windows is $65 - (33 + 12 + 18) = 2$ Thus, the best answer is A.

187. Of the following numbers, which one is third greatest?

(A) $2\sqrt{2} - 1$ (B) $\sqrt{2} + 1$ (C) $1 - \sqrt{2}$
(D) $\sqrt{2} - 1$ (E) $\sqrt{2}$

Since each option involves the $\sqrt{2}$, it is convenient to think of how each quantity compares to the $\sqrt{2}$ Since $\sqrt{2} > 1$, only option C is negative If A, B, C, D, and E denote the respective quantities, it can be determined by inspection that $B > E > D > C$ Since $A = \sqrt{2} + (\sqrt{2} - 1)$, clearly $A > E$, but $A < B$ Therefore, $B > A > E > D > C$, and the best answer is E

Alternatively, the value of each option can be estimated by using 1 4 for the $\sqrt{2}$

188. During the second quarter of 1984, a total of 2,976,000 domestic cars were sold. If this was 24 percent greater than the number sold during the first quarter of 1984, how many were sold during the first quarter?

(A) 714,240
(B) 2,261,760
(C) 2,400,000
(D) 3,690,240
(E) 3,915,790

If q represents the number of cars sold during the first quarter, then 124 percent of q represents the number sold during the second quarter, or $1.24q = 2{,}976{,}000$, and $q = 2{,}400{,}000$ Thus, the best answer is C

189. If a positive integer n is divisible by both 5 and 7, the n must also be divisible by which of the following?

I. 12
II. 35
III. 70

(A) None (B) I only (C) II only
(D) I and II (E) II and III

Since 5 and 7 are prime numbers, if n is divisible by both, then n must also be divisible by $5(7) = 35$ Thus, n is of the form $35k$, where k is some integer Note that if k is an odd integer, n will not be divisible by either 12 or 70 Hence, the best answer is C.

190. **An author received \$0.80 in royalties for each of the first 100,000 copies of her book sold, and \$0.60 in royalties for each additional copy sold. If she received a total of \$260,000 in royalties, how many copies of her book were sold?**

(A) 130,000
(B) 300,000
(C) 380,000
(D) 400,000
(E) 420,000

If the author sold n copies, then she received \$0.80(100,000) or \$80,000 for the first 100,000 copies sold, and \$0.60 $(n - 100,000)$ for the rest of the copies sold, for a total of \$260,000. The equation

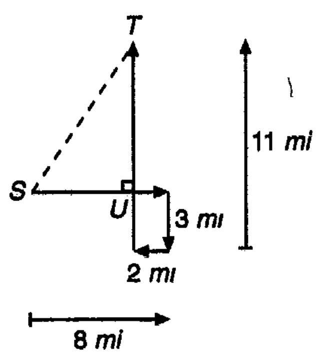
$$\$260,000 = \$80,000 + \$0.60\,(n - 100,000)$$

yields $0.6n = 240,000$ and $n = 400,000$. Thus, the best answer is D

191. **Starting from Town S, Fred rode his bicycle 8 miles due east, 3 miles due south, 2 miles due west, and 11 miles due north, finally stopping at Town T. If the entire region is flat, what is the straight-line distance, in miles, between Towns S and T?**

(A) 10
(B) $8\sqrt{2}$
(C) $\sqrt{157}$
(D) 14
(E) 24

The map below shows the consecutive paths that Fred rode in his roundabout trip from Town S to Town T



From the map, it can be seen that his path crossed at point U and that $SU = (8 - 2)$ or 6 miles and $TU = (11 - 3)$ or 8 miles. Thus, by the Pythagorean theorem, the straight line distance (dotted line) is $\sqrt{6^2 + 8^2} = 10$ miles, and the best answer is A

192. **Which of the following describes all values of x for which $1 - x^2 \geq 0$?**

(A) $x \geq 1$
(B) $x \leq -1$
(C) $0 \leq x \leq 1$
(D) $x \leq -1$ or $x \geq 1$
(E) $-1 \leq x \leq 1$

An equivalent expression of the inequality is $(1 + x)(1 - x) \geq 0$. The product of the two factors will equal 0 if $x = -1$ or $x = 1$, the product of the two factors will be greater than 0 if both factors are positive or if both factors are negative In the first case, $1 + x > 0$ and $1 - x > 0$, so that $x > -1$ and $1 > x$, or $-1 < x < 1$ If both factors are negative, then $1 + x < 0$ and $1 - x < 0$, so that $x < -1$ and $1 < x$, which is impossible and, thus, yields no additional values of x. Therefore, taking all cases into consideration, the solution is $-1 \leq x \leq 1$, and the best answer is E

Alternatively, adding x^2 to both sides of the inequality $1 - x^2 \geq 0$ yields $1 \geq x^2$ To solve this inequality we need to consider cases where $x \geq 0$ and cases where $x < 0$ If $x \geq 0$, then $1 \geq x^2$ whenever $1 \geq x \geq 0$. If $x < 0$, then $1 \geq x^2$ whenever $-1 \leq x < 0$ Thus, $1 \geq x^2$ whenever $-1 \leq x \leq 1$, and the best answer is E

193. **Four hours from now, the population of a colony of bacteria will reach 1.28×10^6. If the population of the colony doubles every 4 hours, what was the population 12 hours ago?**

(A) 6.4×10^2
(B) 8.0×10^4
(C) 1.6×10^5
(D) 3.2×10^5
(E) 8.0×10^6

If the population of bacteria doubles every 4 hours, then it must now be half of what it will be in 4 hours or

$\dfrac{1.28 \times 10^6}{2} = 0.64 \times 10^6$ Since 12 hours consists of three 4-hour intervals, the population 12 hours ago was $\left(\dfrac{1}{2}\right)^3$, or $\dfrac{1}{8}$, of 0.64×10^6, which would be written in scientific notation, not as 0.08×10^6, but as 8.0×10^4. Thus, the best answer is B

194 At a certain pizzeria, $\frac{1}{8}$ of the pizzas sold in one week were mushroom and $\frac{1}{3}$ of the remaining pizzas sold were pepperoni If n of the pizzas sold were pepperoni, how many were mushroom?

(A) $\frac{3}{8}n$

(B) $\frac{3}{7}n$

(C) $\frac{7}{16}n$

(D) $\frac{7}{8}n$

(E) $3n$

If t is the total number of pizzas sold, then $\frac{1}{8}t$ of the pizzas sold were mushroom, and $\frac{1}{3}\left(\frac{7}{8}t\right)$ or $\frac{7t}{24}$ of the pizzas sold were pepperoni The ratio of the number of mushroom pizzas sold to the number of pepperoni pizzas sold was $\frac{3t}{24}$ to $\frac{7t}{24}$, or $\frac{3}{7}$ Thus, if there were n pepperoni pizzas sold, there were $\frac{3}{7}n$ mushroom pizzas sold and the best answer is B

Alternatively, if $\frac{1}{8}$ of the pizzas sold were mushroom, then $\frac{1}{3}\left(1-\frac{1}{8}\right)$ or $\frac{7}{24}$ of the pizzas were pepperoni Thus, if n pepperoni pizzas were sold, then a total of $\frac{24}{7}n$ pizzas were sold Of the $\frac{24}{7}n$ pizzas sold, $\frac{1}{8}\left(\frac{24}{7}\right)n$ were pepperoni, and the best answer is B

195. If 4 is one solution of the equation $x^2 + 3x + k = 10$, where k is a constant, what is the other solution?

(A) -7 (B) -4 (C) -3 (D) 1 (E) 6

If 4 is one solution of the equation, then $4^2 + 3(4) + k = 10$ and $k = -18$ Thus, the equation to be solved is $x^2 + 3x - 18 = 10$ or $x^2 + 3x - 28 = 0$ Factoring the quadratic yields $(x + 7)(x - 4) = 0$, which has solutions -7 and 4 Therefore, $x = -7$ is the other solution, and the best answer is A

196. The probability is $\frac{1}{2}$ that a certain coin will turn up heads on any given toss. If the coin is to be tossed three times, what is the probability that on at least one of the tosses the coin will turn up tails?

(A) $\frac{1}{8}$ (B) $\frac{1}{2}$ (C) $\frac{3}{4}$ (D) $\frac{7}{8}$ (E) $\frac{15}{16}$

The probability that on at least one of the tosses the coin will turn up tails is 1 minus the probability that the coin will turn up heads on all three tosses Since each toss is an independent event, the probability of getting three heads is $\left(\frac{1}{2}\right)^3$, so that the probability of getting at least one tail is $1 - \frac{1}{8} = \frac{7}{8}$ Thus the best answer is D

197 A caterer ordered 125 ice-cream bars and 125 sundaes. If the total price was \$200 00 and the price of each ice-cream bar was \$0.60, what was the price of each sundae?

(A) \$0.60
(B) \$0 80
(C) \$1 00
(D) \$1.20
(E) \$1.60

Let y represent the price of a sundae ordered by the caterer Since the caterer ordered 125 sundaes and 125 ice-cream bars, and the price of each ice-cream bar was \$0 60 and the total price of ice-cream bars and sundaes was \$200 00, it follows that $125(0\ 60) + 125y = 200\ 00$ Solving this equation yields $y = \$1\ 00$ Hence, the best answer is C

198. Lloyd normally works 7.5 hours per day and earns \$4.50 per hour. For each hour he works in excess of 7.5 hours on a given day, he is paid 1.5 times his regular rate. If Lloyd works 10 5 hours on a given day, how much does he earn for that day?

(A) \$33.75
(B) \$47 25
(C) \$51.75
(D) \$54 00
(E) \$70.00

Lloyd's earnings for a 10 5-hour day is calculated by combining his earnings for a normal 7 5-hour work day and his earnings for 3 hours overtime Since he earns \$4 50 per hour regularly and 1 5 times his regular rate for overtime, he earns 7 5(\$4.50) = \$33 75 for a normal day and 3(1 5)(\$4 50) = \$20 25 for his overtime Therefore, his total earnings for the day is \$54 00, and the best answer is D

199. If $x = -3$, what is the value of $-3x^2$?

(A) -27 (B) -18 (C) 18 (D) 27 (E) 81

Since $x = -3$, the value of $-3x^2 = -3(-3)^2 = -27$. Thus, the best answer is A

200. Of the final grades received by the students in a certain math course, $\frac{1}{5}$ are A's, $\frac{1}{4}$ are B's, $\frac{1}{2}$ are C's, and the remaining 10 grades are D's. What is the number of students in the course?

(A) 80
(B) 110
(C) 160
(D) 200
(E) 400

If there are x students in the course, then $\left(\frac{1}{5}+\frac{1}{4}+\frac{1}{2}\right)x$ or $\left(\frac{19}{20}\right)x$ of the students received grades of A, B, or C, leaving only $\frac{x}{20}$ or 10 students that received a D grade Thus, $\frac{x}{20} = 10$ and $x = 200$ Hence, the best answer is D

201. $\frac{29^2+29}{29} =$

(A) 870 (B) 841 (C) 58 (D) 31 (E) 30

The easiest way to evaluate the expression is to factor 29 out of each term in the numerator Thus, $\frac{29^2+29}{29} = \frac{29(29+1)}{29} = \frac{29(30)}{29} = 30$; so, the best answer is E

202. Mr. Hernandez, who was a resident of State X for only 8 months last year, had a taxable income of \$22,500 for the year. If the state tax rate were 4 percent of the year's taxable income prorated for the proportion of the year during which the taxpayer was a resident, what would be the amount of Mr. Hernandez's State X tax for last year?

(A) \$900 (B) \$720 (C) \$600
(D) \$300 (E) \$60

Mr Hernandez's State X tax for last year can be calculated by multiplying the tax rate by his taxable income and then by the fraction of the year that he was a resident His tax for last year was (0 04) (\$22,500) $\left(\frac{8}{12}\right) =$ \$600 Thus, the best answer is C

203. If $x = 1 - 3t$ and $y = 2t - 1$, then for what value of t does $x = y$?

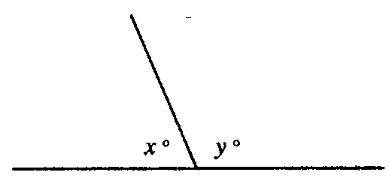
(A) $\frac{5}{2}$ (B) $\frac{3}{2}$ (C) $\frac{2}{3}$ (D) $\frac{2}{5}$ (E) 0

Since $x = y$, the two expressions for x and y can be set equal to each other Thus, the equation $1 - 3t = 2t - 1$ yields $t = \frac{2}{5}$, and the best answer is D

204. Which of the following fractions is equal to the decimal 0.0625 ?

(A) $\frac{5}{8}$ (B) $\frac{3}{8}$ (C) $\frac{1}{16}$ (D) $\frac{1}{18}$ (E) $\frac{3}{80}$

The fraction that is equal to the decimal 0 0625 is $\frac{625}{10,000} = \frac{1}{16}$ Hence, the best answer is C



205. In the figure above, if $\frac{x}{x+y} = \frac{3}{8}$, then $x =$

(A) 60
(B) 67.5
(C) 72
(D) 108
(E) 112.5

If $\frac{x}{x+y} = \frac{3}{8}$ is multiplied by $8(x+y)$, the result is $8x = 3x + 3y$, or $5x = 3y$ Since the angles of the figure are supplementary, $x + y = 180$ Solving the first equation for y yields $y = \frac{5}{3}x$ and substituting into the second equation yields $x + \frac{5}{3}x = 180$ Therefore, $x = 67\ 5$, and the best answer is B

206. **The number of coronary-bypass operations performed in the United States increased from 13,000 in 1970 to 191,000 in 1983. What was the approximate percent increase in the number of coronary-bypass operations from 1970 to 1983 ?**

(A) 90%
(B) 140%
(C) 150%
(D) 1,400%
(E) 1,600%

The approximate percent increase in the number of coronary-bypass operations from 1970 to 1983 is calculated by dividing the increase in the number of operations by the original number of operations in 1970. Hence, $\frac{178,000}{13,000} = 13.7$ or approximately 1,400 percent. Thus, the best answer is D.

207. **If positive integers x and y are not both odd, which of the following must be even?**

(A) xy
(B) $x + y$
(C) $x - y$
(D) $x + y - 1$
(E) $2(x + y) - 1$

Since x and y are not both odd, either one or both of them is even. To determine which answer choice is even, each choice must be checked for both cases as shown in the table below.

	both even	one even and one odd
xy	even	even
$x+y$	even	odd
$x-y$	even	odd
$x+y-1$	odd	even
$2(x+y)-1$	odd	odd

Since xy is the only one of the expressions that must be even in both cases, the best answer is A.

208. **Two trains, X and Y, started simultaneously from opposite ends of a 100-mile route and traveled toward each other on parallel tracks. Train X, traveling at a constant rate, completed the 100-mile trip in 5 hours; train Y, traveling at a constant rate, completed the 100-mile trip in 3 hours. How many miles had train X traveled when it met train Y ?**

(A) 37.5 (B) 40.0 (C) 60.0
(D) 62.5 (E) 77.5

Let t be the number of hours the trains had traveled before they met. The rate of the train is determined by dividing the distance by the time. Train X was traveling at $\frac{100}{5} = 20$ miles per hour, and train Y was traveling at $\frac{100}{3}$ miles per hour. Since the two trains were traveling in opposite directions and $d = rt$, the distance, covered before they met, must add to 100 miles. The equation $20t + \frac{100}{3}t = 100$ yields $t = 1.875$ hours. The number of miles train X had traveled before it met train Y was $20t = 20(1.875) = 37.5$ miles. Hence, the best answer is A.

Another way to look at the problem is as follows: the distances that each of the trains traveled in the same amount of time is directly proportional to their relative speeds. The ratio of the speed of train X to that of train Y is $\frac{100}{5}$ to $\frac{100}{3}$, or 3 to 5. Thus, if the entire trip is divided into eighths, at the time they passed, train X had traveled $\frac{3}{8}$ of the distance and train Y had traveled $\frac{5}{8}$ of the distance. Hence, $\frac{3}{8}(100 \text{ miles}) = 37.5$ and the best answer is A.

209. **As x increases from 165 to 166, which of the following must increase?**

I. $2x - 5$

II. $1 - \frac{1}{x}$

III. $\frac{1}{x^2 - x}$

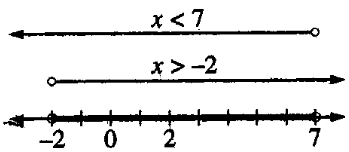
(A) I only
(B) III only
(C) I and II
(D) I and III
(E) II and III

With respect to I, as x increases from 165 to 166, expression $2x - 5$ increases since $2x$ increases, therefore, the value of the expression is increasing. With respect to II, as x increases, its reciprocal decreases, therefore, the value of the expression as a whole increases. With respect to III, for integers greater than 1, x^2 increases more rapidly than x increases so that the value of $x^2 - x$ in the denominator increases, causing the reciprocal to decrease. Therefore, I and II increase but III decreases, and the best answer is C.

210. If it is true that $x > -2$ and $x < 7$, which of the following must be true?

(A) $x > 2$
(B) $x > -7$
(C) $x < 2$
(D) $-7 < x < 2$
(E) None of the above

A graph of $x > -2$ and $x < 7$, as shown below, will establish the x values that satisfy the two inequalities $(-2 < x < 7)$. $x > 2$ is not true since there are x values on the graph that are not greater than 2. Likewise $x < 2$ is also false, since there are x values on the graph that are not less than 2. $-7 < x < 2$ is also false since it includes values that are not on the graph. Every value on the graph is greater than -7, which implies $x > -7$ is true, thus, the best answer is B.



211. A club sold an average (arithmetic mean) of 92 raffle tickets per member. Among the female members, the average number sold was 84, and among the male members, the average number sold was 96. What was the ratio of the number of male members to the number of female members in the club?

(A) 1 : 1
(B) 1 : 2
(C) 1 : 3
(D) 2 : 1
(E) 3 : 1

The average numbers of raffle tickets sold per member, per female member, and per male member were 92, 84, and 96, respectively. If f represents the number of female members and m represents the number of male members, then $84f + 96m = 92(f + m)$, which yields $4m = 8f$; hence, $\frac{m}{f} = \frac{8}{4}$. Therefore, the ratio of the number of male members to female members is 2 to 1. Hence, the best answer is D.

212. How many bits of computer memory will be required to store the integer x, where $x = -\sqrt{810{,}000}$, if each digit requires 4 bits of memory and the sign of x requires 1 bit?

(A) 25 (B) 24 (C) 17 (D) 13 (E) 12

The expression $-\sqrt{810{,}000}$ is equivalent to -900, which contains three digits and a negative sign for a total use of $3(4) + 1 = 13$ bits of memory. Therefore, the best answer is D.

213. One week a certain truck rental lot had a total of 20 trucks, all of which were on the lot Monday morning. If 50 percent of the trucks that were rented out during the week were returned to the lot on or before Saturday morning of that week, and if there were at least 12 trucks on the lot that Saturday morning, what is the greatest number of different trucks that could have been rented out during the week?

(A) 18
(B) 16
(C) 12
(D) 8
(E) 4

The difference between the number of trucks on the lot on Monday and the minimum number of trucks on the lot on Saturday is 8 trucks, which is the maximum number of trucks not on the lot Saturday morning. Since 50 percent of the trucks that were rented out during the week were returned to the lot on or before Saturday morning, the greatest number of different trucks that could have been rented out during the week was $2(8) = 16$ or twice the maximum number of trucks not on the lot Saturday morning. Thus, the best answer is B.

214. Ms. Adams sold two properties, X and Y, for \$30,000 each. She sold property X for 20 percent more than she paid for it and sold property Y for 20 percent less than she paid for it. If expenses are disregarded, what was her total net gain or loss, if any, on the two properties?

(A) Loss of \$1,250
(B) Loss of \$2,500
(C) Gain of \$1,250
(D) Gain of \$2,500
(E) There was neither a net gain nor a net loss.

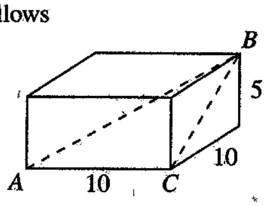
Let x represent the amount of money Ms. Adams paid for property X and y represent the amount of money Ms. Adams paid for property Y. Since she sold X for 20 percent more than she paid for it, $1.20x = \$30{,}000$. Since she sold Y for 20 percent less than she paid for it, $0.8y = \$30{,}000$. Solving the two equations yields $x = \$25{,}000$ and $y = \$37{,}500$. It follows that a \$5,000 profit was made on property X and a \$7,500 loss was realized on property Y. The net outcome was a \$2,500 loss, thus, the best answer is B.

215. A rectangular box is 10 inches wide, 10 inches long, and 5 inches high. What is the greatest possible (straight-line) distance, in inches, between any two points on the box?

(A) 15
(B) 20
(C) 25
(D) $10\sqrt{2}$
(E) $10\sqrt{3}$

The greatest possible distance between any two points on the box is the space diagonal (AB) of the rectangular solid as shown below To compute the length of AB, the Pythagorean theorem must be used twice as follows

$AB^2 = AC^2 + BC^2$
$AC^2 = 10^2 = 100$
$BC^2 = 5^2 + 10^2 = 125$
$AB^2 = 100 + 125 = 225$
$AB = 15$



Therefore, the best answer is A

216. How many positive integers less than 20 are either a multiple of 2, an odd multiple of 9, or the sum of a positive multiple of 2 and a positive multiple of 9 ?

(A) 19 (B) 18 (C) 17 (D) 16 (E) 15

There are 9 multiples of 2 less than 20 The only odd multiple of 9 less than 20 is 9 There are 5 numbers less than 20 that can be written as the sum of a positive multiple of 2 and a positive multiple of 9 They are 9 + 2, 9 + 4, 9 + 6, 9 + 8, and 9 + 10 Hence, the total is 9 + 1 + 5 = 15 and the best answer is E

217 On 3 sales John has received commissions of \$240, \$80, and \$110, and he has 1 additional sale pending If John is to receive an average (arithmetic mean) commission of exactly \$150 on the 4 sales, then the 4th commission must be

(A) \$164
(B) \$170
(C) \$175
(D) \$182
(E) \$185

If x is the 4th commission and the average commission is \$150, then

$$\frac{240+80+110+x}{4} = 150$$
$$430 + x = 600$$
$$x = 170$$

Therefore, the best answer is B.

218. $\sqrt{463}$ is between

(A) 21 and 22
(B) 22 and 23
(C) 23 and 24
(D) 24 and 25
(E) 25 and 26

Since $21^2 = 441$ and $22^2 = 484$, $\sqrt{463}$ is between 21 and 22 The best answer is A

219. The annual budget of a certain college is to be shown on a circle graph. If the size of each sector of the graph is to be proportional to the amount of the budget it represents, how many degrees of the circle should be used to represent an item that is 15 percent of the budget?

(A) 15°
(B) 36°
(C) 54°
(D) 90°
(E) 150°

If the sector is to represent 15 percent of the budget, the measure of its central angle should be 15 percent of 360°, or 0 15(360°), or 54° Thus, the best answer is C.

220. A company accountant estimates that airfares next year for business trips of a thousand miles or less will increase by 20 percent and airfares for all other business trips will increase by 10 percent. This year total airfares for business trips of a thousand miles or less were \$9,900 and airfares for all other business trips were \$13,000 According to the accountant's estimate, if the same business trips will be made next year as this year, how much will be spent for airfares next year?

(A) \$22,930
(B) \$26,180
(C) \$26,330
(D) \$26,490
(E) \$29,770

Since the airfare for business trips of a thousand miles or less will increase by 20 percent next year, the amount spent will be (1 20) (\$9,900), or \$11,880 Since the airfares for all other business trips will increase by 10 percent next year, the amount spent will be (1 10) (\$13,000), or \$14,300 Thus, the total amount spent for airfares next year is estimated to be \$11,880 + \$14,300 = \$26,180 Therefore the best answer is B

221. What is the value of $2x^2 - 2.4x - 1.7$ for $x = 0.7$?

(A) -0.72
(B) -1.42
(C) -1.98
(D) -2.40
(E) -2.89

For $x = 0.7$, the value of $2x^2 - 2.4x - 1.7$ is $2(0.7)^2 - 2.4(0.7) - 1.7$, or -2.40. The best answer is D

222. If $x * y = xy - 2(x + y)$ for all integers x and y, then $2 * (-3) =$

(A) -16
(B) -11
(C) -4
(D) 4
(E) 16

Since $x * y = xy - 2(x + y)$, therefore $2 * (-3) = 2(-3) - 2(2 + (-3))$, or -4. The best answer is C

223. During a two-week period, the price of an ounce of silver increased by 25 percent by the end of the first week and then decreased by 20 percent of this new price by the end of the second week. If the price of silver was x dollars per ounce at the beginning of the two-week period, what was the price, in dollars per ounce, by the end of the period?

(A) $0.8x$
(B) $0.95x$
(C) x
(D) $1.05x$
(E) $1.25x$

At the end of the first week the price of an ounce of silver was $1.25x$. Therefore, at the end of the second week the price was 20 percent less than $1.25x$, or $(0.80)(1.25)x$, which equals x. Therefore, the best answer is C

224. If a cube has a volume of 64, what is its total surface area?

(A) 16
(B) 24
(C) 48
(D) 64
(E) 96

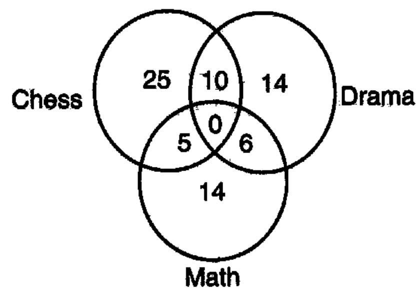
Since the volume of the cube is 64, $x^3 = 64$, where x is the length of each edge of the cube. Thus, $x = 4$. The surface area of each side of the cube is 4^2, or 16, and the cube has 6 sides. Thus, the total surface area is (16)(6), or 96. The best answer is E

Club	Number of Students
Chess	40
Drama	30
Math	25

225. The table above shows the number of students in three clubs at McAuliffe School. Although no student is in all three clubs, 10 students are in both chess and drama, 5 students are in both chess and math, and 6 students are in both drama and math. How many different students are in the three clubs?

(A) 68 **(B)** 69 **(C)** 74 **(D)** 79 **(E)** 84

For each pair of the three clubs, the number of students in both is counted twice in the table. Therefore, the total number of students in the table, 95, is too large by an amount equal to $10 + 5 + 6$, or 21. Thus, the number of different students in the three clubs is $95 - 21$, or 74. The diagram below shows the distribution of these 74 students



Therefore, the best answer is C.

226. If s, u, and v are positive integers and $2s = 2u + 2v$, which of the following must be true?

I. $s = u$
II. $u \neq v$
III. $s > v$

(A) None
(B) I only
(C) II only
(D) III only
(E) II and III

I s cannot equal u, because if $s = u$, then $2v = 0$, which is not true for any integer v. Thus, statement I is not true.
II u can equal v; for example $2^3 = 2^2 + 2^2$. Thus, statement II is not true.
III Using the same reasoning as in I above $s \neq v$. Since $2u$ must be positive, $2s$ must be greater than $2v$. So, s must be greater than v. Thus, statement III must be true, and the best answer is D.

227. **In a nationwide poll, N people were interviewed. If $\frac{1}{4}$ of them answered "yes" to question 1, and of those, $\frac{1}{3}$ answered "yes" to question 2, which of the following expressions represents the number of people interviewed who did <u>not</u> answer "yes" to both questions?**

(A) $\frac{N}{7}$

(B) $\frac{6N}{7}$

(C) $\frac{5N}{12}$

(D) $\frac{7N}{12}$

(E) $\frac{11N}{12}$

The number of people who answered "yes" to question 1 was $\frac{N}{4}$ Since $\frac{1}{3}$ of the $\frac{N}{4}$ people answered "yes" to question 2, $\left(\frac{1}{3}\right)\frac{N}{4}$, or $\frac{N}{12}$, people answered "yes" to both questions Thus the number of people who did <u>not</u> answer "yes" to both questions was $N-\frac{N}{12}$, or $\frac{11N}{12}$ Therefore, the best answer is E

228. **In a certain pond, 50 fish were caught, tagged, and returned to the pond. A few days later, 50 fish were caught again, of which 2 were found to have been tagged. If the percent of tagged fish in the second catch approximates the percent of tagged fish in the pond, what is the approximate number of fish in the pond?**

(A) 400
(B) 625
(C) 1,250
(D) 2,500
(E) 10,000

Let N be the number of fish in the pond Then $\frac{50}{N}$ is the fraction of fish in the pond that were tagged The fraction of fish in the sample of 50 that were tagged was $\frac{2}{50}$, or $\frac{1}{25}$

Therefore, $\frac{50}{N}=\frac{1}{25}$, or $N=(50)(25)=1{,}250$
Thus, the best answer is C

229. **The ratio of two quantities is 3 to 4. If each of the quantities is increased by 5, what is the ratio of these two new quantities?**

(A) $\frac{3}{4}$

(B) $\frac{8}{9}$

(C) $\frac{18}{19}$

(D) $\frac{23}{24}$

(E) It cannot be determined from the information given.

Let x and y be the two quantities such that $\frac{x}{y}=\frac{3}{4}$

If $x=3$ and $y=4$, then $\frac{x+5}{y+5}=\frac{3+5}{4+5}=\frac{8}{9}$ If $x=6$ and $y=8$ (which would still make $\frac{x}{y}=\frac{3}{4}$), then $\frac{x+5}{y+5}=\frac{6+5}{8+5}=\frac{11}{13}$
Therefore, the ratio of the two new quantities cannot be uniquely determined from the information given Thus, the best answer is E.

230. **In 1986 the book value of a certain car was $\frac{2}{3}$ of the original purchase price, and in 1988 its book value was $\frac{1}{2}$ of the original purchase price. By what percent did the book value of this car decrease from 1986 to 1988 ?**

(A) $16\frac{2}{3}\%$

(B) 25%

(C) $33\frac{1}{3}\%$

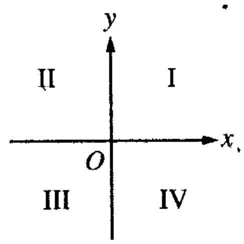
(D) 50%

(E) 75%

If B is the original purchase price of the car, then the book value of the car in 1986 was $\frac{2B}{3}$ and the book value in 1988 was $\frac{B}{2}$ Therefore, the percent decrease in the book value from 1986 to 1988 was

$$\frac{\frac{2B}{3}-\frac{B}{2}}{\frac{2B}{3}}=\frac{\frac{4B}{6}-\frac{3B}{6}}{\frac{2B}{3}}=\frac{\frac{B}{6}}{\frac{2B}{3}}=\frac{B}{6}\cdot\frac{3}{2B}=\frac{3B}{12B}=\frac{1}{4}=25\%$$

Thus, the best answer is B.



231. In the rectangular coordinate system shown above, which quadrant, if any, contains no point (x, y) that satisfies the inequality $2x - 3y \leq -6$?

(A) None
(B) I
(C) II
(D) III
(E) IV

Since $2x - 3y \leq -6$, $2x \leq 3y - 6$, or $x \leq \frac{3y-6}{2}$ Note that if y is negative, x must be negative Therefore, no point (x, y) that satisfies the inequality can have y negative and x positive Therefore, no points that satisfy the inequality are in quadrant IV. The best answer is E

232. A hiker walked for two days. On the second day the hiker walked 2 hours longer and at an average speed 1 mile per hour faster than he walked on the first day. If during the two days he walked a total of 64 miles and spent a total of 18 hours walking, what was his average speed on the first day?

(A) 2 mph
(B) 3 mph
(C) 4 mph
(D) 5 mph
(E) 6 mph

If t is the number of hours the hiker walked on the first day, then $t + 2$ is the number of hours he walked on the second day Therefore, $t + t + 2 = 18$, or $t = 8$ If s was the hiker's average speed in miles per hour on the first day, then $s + 1$ was his average speed on the second day So, the total distance hiked in 2 days was $(8)(s) + (10)(s + 1)$ Therefore,

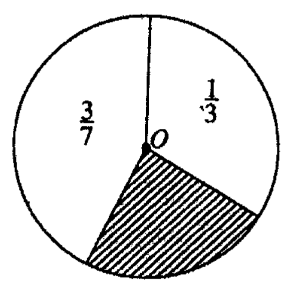
$$\begin{aligned} 8s + 10(s+1) &= 64 \\ 8s + 10s + 10 &= 64 \\ 18s &= 54 \\ s &= 3 \end{aligned}$$

Therefore, the best answer is B

233. If a printer can print 2 pages of text per second, then, at this rate, approximately how many minutes will it take to print 5,000 pages of text?

(A) 4
(B) 25
(C) 42
(D) 250
(E) 417

Since the printer can produce 2 pages per second, it can produce 5,000 pages in $\frac{5,000}{2}$, or 2,500 seconds, which is equal to $\frac{2,500}{60}$, or approximately 42, minutes Therefore, the best answer is C



234. In the circular region with center O, shown above, the two unshaded sections comprise $\frac{3}{7}$ and $\frac{1}{3}$ of the area of the circular region. The shaded section comprises what fractional part of the area of the circular region?

(A) $\frac{3}{5}$

(B) $\frac{6}{7}$

(C) $\frac{2}{21}$

(D) $\frac{5}{21}$

(E) $\frac{16}{21}$

The two unshaded sections comprise $\frac{3}{7} + \frac{1}{3} = \frac{9}{21} + \frac{7}{21} = \frac{16}{21}$ of the area of the circular region. Thus, the shaded section comprises $1 - \frac{16}{21} = \frac{5}{21}$ of the circular region Therefore, the best answer is D

235 **Envelopes can be purchased for \$1.50 per pack of 100, \$1.00 per pack of 50, or \$0 03 each What is the greatest number of envelopes that can be purchased for \$7 30 ?**

(A) 426
(B) 430
(C) 443
(D) 460
(E) 486

The cheapest rate is \$1 50 per pack of 100, followed by \$1 00 per pack of 50, and the most expensive rate is \$0.03 per envelope Therefore, the greatest number of envelopes that can be purchased for \$7 30 would be

$$\begin{aligned} 4 \times \$1\ 50 &= \$6\ 00 \text{ (for 400 envelopes)} \\ 1 \times \$1\ 00 &= \$1\ 00 \text{ (for 50 envelopes)} \\ 10 \times \$0\ 03 &= \underline{\$0.30 \text{ (for 10 envelopes)}} \\ \text{Total} &= \$7\ 30 \text{ (for 460 envelopes)} \end{aligned}$$

Therefore, the best answer is D

236. $\sqrt{16+16} =$

(A) $4\sqrt{2}$

(B) $8\sqrt{2}$

(C) $16\sqrt{2}$

(D) 8

(E) 16

$\sqrt{16+16} = \sqrt{(16)(2)} = (\sqrt{16})(\sqrt{2}) = 4\sqrt{2}$

Thus, the best answer is A

237. An automobile's gasoline mileage varies, depending on the speed of the automobile, between 18.0 and 22.4 miles per gallon, inclusive. What is the maximum distance, in miles, that the automobile could be driven on 15 gallons of gasoline?

(A) 336
(B) 320
(C) 303
(D) 284
(E) 270

The maximum distance would occur at the 22 4 miles per gallon rate Thus, the maximum would be (22 4) (15), or 336 miles. Therefore, the best answer is A

238. $\frac{(0.3)^5}{(0.3)^3} =$

(A) 0 001
(B) 0.01
(C) 0 09
(D) 0.9
(E) 1.0

$\frac{(0\ 3)^5}{(0\ 3)^3} = (0.3)^{5-3} = (0.3)^2 = 0\ 09$. Therefore, the best answer is C

239. In a horticultural experiment, 200 seeds were planted in plot I and 300 were planted in plot II. If 57 percent of the seeds in plot I germinated and 42 percent of the seeds in plot II germinated, what percent of the total number of planted seeds germinated?

(A) 45.5%
(B) 46 5%
(C) 48.0%
(D) 49 5%
(E) 51.0%

Of the 500 seeds planted, the total number that germinated was 200 (0 57) + 300 (0 42) = 114 + 126 = 240 Thus, the percent of the total planted that germinated was $\frac{240}{500} = 0\ 48$, or 48.0% Therefore, the best answer is C

240. The organizers of a fair projected a 25 percent increase in attendance this year over that of last year, but attendance this year actually decreased by 20 percent What percent of the projected attendance was the actual attendance?

(A) 45%
(B) 56%
(C) 64%
(D) 75%
(E) 80%

If A was last year's attendance, then the projected attendance for this year was 25 percent higher than last year, or 1 25A The actual attendance for this year was 20 percent less than last year, or 0 80A Thus, the percent of the projected attendance that was the actual attendance is $\frac{0\ 80A}{1\ 25A} = 0\ 64 = 64\%$

Therefore, the best answer is C

241. An optometrist charges \$150 per pair for soft contact lenses and \$85 per pair for hard contact lenses. Last week she sold 5 more pairs of soft lenses than hard lenses. If her total sales for pairs of contact lenses last week were \$1,690, what was the total number of pairs of contact lenses that she sold?

(A) 11 (B) 13 (C) 15 (D) 17 (E) 19

If x is the number of hard contact lenses sold last week, then $x+5$ is the number of soft contact lenses sold. Therefore,

$$\begin{aligned} x(\$85)+(x+5)(\$150) &= \$1{,}690 \\ 85x+150x+750 &= 1{,}690 \\ 235x &= 940 \\ x &= 4 \end{aligned}$$

So, the total number of hard and soft contact lenses sold was $x+(x+5)=4+9=13$. Therefore, the best answer is B.

242. What is the ratio of $\frac{3}{4}$ to the product $4\left(\frac{3}{4}\right)$?

(A) $\frac{1}{4}$

(B) $\frac{1}{3}$

(C) $\frac{4}{9}$

(D) $\frac{9}{4}$

(E) 4

The ratio of $\frac{3}{4}$ to $4\left(\frac{3}{4}\right)$ is $\dfrac{\frac{3}{4}}{4\left(\frac{3}{4}\right)}=\frac{1}{4}$. Thus, the best answer is A.

243. The cost to rent a small bus for a trip is x dollars, which is to be shared equally among the people taking the trip. If 10 people take the trip rather than 16, how many more dollars, in terms of x, will it cost per person?

(A) $\frac{x}{6}$

(B) $\frac{x}{10}$

(C) $\frac{x}{16}$

(D) $\frac{3x}{40}$

(E) $\frac{3x}{80}$

If 16 take the trip, the cost per person would be $\frac{x}{16}$ dollars. If 10 take the trip, the cost per person would be $\frac{x}{10}$ dollars. Thus, if 10 take the trip, the increase in dollars per person would be $\frac{x}{10}-\frac{x}{16}=\frac{16x-10x}{160}=\frac{6x}{160}=\frac{3x}{80}$. Therefore, the best answer is E.

244. If x is an integer and $y=3x+2$, which of the following CANNOT be a divisor of y?

(A) 4
(B) 5
(C) 6
(D) 7
(E) 8

Since $3x$ is always divisible by 3, $3x+2$ cannot be divisible by 3, which means that $3x+2$ cannot be divisible by 6. Therefore, the answer is C.

245. The size of a television screen is given as the length of the screen's diagonal. If the screens were flat, then the area of a square 21-inch screen would be how many square inches greater than the area of a square 19-inch screen?

(A) 2
(B) 4
(C) 16
(D) 38
(E) 40

If x is the length of a side of a square television screen and d is the length of the diagonal, then by the Pythagorean Theorem,

$$\begin{aligned} x^2+x^2 &= d^2 \\ 2x^2 &= d^2 \\ x^2 &= \frac{d^2}{2}, \end{aligned}$$

which is the area of the screen in square inches.

If $d=19$, then the area $=\frac{19^2}{2}=\frac{361}{2}=180.5$ sq. in.

If $d=21$, then the area $=\frac{21^2}{2}=\frac{441}{2}=220.5$ sq. in.

Thus, the area of the 21-inch screen is greater by $220.5-180.5=40$ square inches. Therefore, the best answer is E.

246. If the average (arithmetic mean) of x and y is 60 and the average (arithmetic mean) of y and z is 80, what is the value of $z - x$?

(A) 70
(B) 40
(C) 20
(D) 10
(E) It cannot be determined from the information given.

The average of x and y = $\frac{x+y}{2} = 60$, so $x + y = 120$ The average of y and z = $\frac{y+z}{2} = 80$, so $y + z = 160$ Subtracting $x + y = 120$ from $y + z = 160$, you get

$$\begin{aligned} y + z - (x + y) &= 160 - 120 \\ y + z - x - y &= 40 \\ z - x &= 40 \end{aligned}$$

Therefore, the best answer is B

247 If 3 and 8 are the lengths of two sides of a triangular region, which of the following can be the length of the third side?

I. 5
II. 8
III. 11

(A) II only
(B) III only
(C) I and II only
(D) II and III only
(E) I, II, and III

Since 3 and 8 are the lengths of two sides of a triangular region, the length of the third side, x, must be greater than $8 - 3$, or 5, and less than $8 + 3$, or 11 So, $5 < x < 11$ Thus, of the three lengths given, 5, 8, and 11, only 8 can be the length of the third side Therefore, the best answer is A

248 One night a certain motel rented $\frac{3}{4}$ of its rooms, including $\frac{2}{3}$ of its air-conditioned rooms. If $\frac{3}{5}$ of its rooms were air-conditioned, what percent of the rooms that were <u>not</u> rented were air-conditioned?

(A) 20%
(B) $33\frac{1}{3}$%
(C) 35%
(D) 40%
(E) 80%

The motel rented $\frac{3}{4}$ of its rooms, including $\frac{2}{3}$ of its air-conditioned rooms Since $\frac{3}{5}$ of its rooms were air-conditioned, $\frac{2}{3} \times \frac{3}{5}$, or $\frac{2}{5}$, of its rooms were rented, air-conditioned rooms This information is summarized in the table below

	Rented	Not Rented	
Air-Conditioned	$\frac{2}{5}$		$\frac{3}{5}$
Not Air-Conditioned			
	$\frac{3}{4}$		1

From the table you can see that $\frac{3}{5} - \frac{2}{5}$, or $\frac{1}{5}$, of its rooms were air-conditioned but not rented, and $1 - \frac{3}{4}$, or $\frac{1}{4}$, of its rooms were not rented Thus, the percent of air-conditioned rooms among the not-rented rooms was $\frac{\frac{1}{5}}{\frac{1}{4}} = \frac{4}{5} = 80\%$

Therefore, the best answer is E

249. If $3 - x = 2x - 3$, then $4x =$

(A) -24
(B) -8
(C) 0
(D) 8
(E) 24

If $3 - x = 2x - 3$, then adding $x + 3$ to both sides of the equation yields $6 = 3x$ Dividing both sides of the equation by 3 yields $x = 2$ Thus, $4x = 8$ and the answer is D

250. **A certain electronic component is sold in boxes of 54 for $16.20 and in boxes of 27 for $13.20. A customer who needed only 54 components for a project had to buy 2 boxes of 27 because boxes of 54 were unavailable. Approximately how much more did the customer pay for each component due to the unavailability of the larger boxes?**

(A) $0.33
(B) $0.19
(C) $0.11
(D) $0.06
(E) $0.03

The customer paid 2 × $13 20 or $26 40 for 2 boxes of 27 components This was $26 40 – $16 20, or $10 20 more than it would have cost to buy one 54-component box Thus the additional cost per component due to the unavailability of the larger boxes was $\frac{\$10\ 20}{54}$, which is approximately $0 19 This can be seen by noting that $\frac{10\ 20}{50} = 0.204$ which is close to, but slightly greater than, $\frac{10\ 20}{54}$ Thus the answer is B

251. **On a certain street, there is an odd number of houses in a row, The houses in the row are painted alternately white and green, with the first house painted white. If n is the total number of houses in the row, how many of the houses are painted white?**

(A) $\frac{n+1}{2}$

(B) $\frac{n-1}{2}$

(C) $\frac{n}{2}+1$

(D) $\frac{n}{2}-1$

(E) $\frac{n}{2}$

Since there are an odd number of houses in the row and they are painted alternately white and green, the number of houses that are white is one more than the number of houses that are green Denoting the number of houses that are white by w, the number of houses that are green is $w - 1$ Therefore, the total number of houses n is equal to $w + (w - 1)$, so $n = 2w - 1$ and $w = \frac{n+1}{2}$ Thus the answer is A

$$\begin{array}{r} \square\triangle \\ \times\ \triangle\square \\ \hline \end{array}$$

252. **The product of the two-digit numbers above is the three-digit number $\square\diamond\square$, where $\square$, $\triangle$, and $\diamond$ are three different nonzero digits. If $\square \times \triangle < 10$, what is the two-digit number $\square\triangle$?**

(A) 11
(B) 12
(C) 13
(D) 21
(E) 31

It follows, from considering the units column of

$$\begin{array}{r} \square\triangle \\ \times\ \triangle\square \\ \hline \square\diamond\square \end{array}$$

and the fact that $\square \times \triangle < 10$, that $\square \times \triangle = \square$ So $\triangle = 1$ and $\square \neq 1$

Writing out the product gives

$$\begin{array}{r} \square\triangle \\ \times\ \triangle\square \\ \hline \square^2\square \\ \square 1\ \ \\ \hline \square\diamond\square \end{array}$$

Since the circled digits are the same it follows that $\square^2 + 1 < 10$, or $\square^2 < 9$ Thus, since $\square \neq 1$ and $\square^2 < 9$ it follows that $\square = 2$ and $\square\triangle = 21$ Thus the answer is D

253. **As a salesperson, Phyllis can choose one of two methods of annual payment: either an annual salary of $35,000 with no commission or an annual salary of $10,000 plus a 20 percent commission on her total annual sales. What must her total annual sales be to give her the same annual pay with either method?**

(A) $100,000
(B) $120,000
(C) $125,000
(D) $130,000
(E) $132,000

If s is the amount of sales needed to generate commissions so that $35,000 = $10,000 + 0 2$s$, then 0 2$s$ = $25,000 and

$s = \frac{\$25{,}000}{0\ 2} = \$125{,}000$ The best answer is C

254. **A restaurant buys fruit in cans containing $3\frac{1}{2}$ cups of fruit each. If the restaurant uses $\frac{1}{2}$ cup of the fruit in each serving of its fruit compote, what is the least number of cans needed to prepare 60 servings of the compote?**

(A) 7
(B) 8
(C) 9
(D) 10
(E) 12

If the restaurant uses $\frac{1}{2}$ cup of fruit per serving, then $\frac{1}{2}(60)$ or 30 cups of fruit are needed for 60 servings. Since there are $3\frac{1}{2}$ cups in one can and 30 cups are needed, $\frac{30}{3\frac{1}{2}}$, or $8\frac{4}{7}$ cans are needed. Because it is not possible to purchase part of a can, 9 cans are needed. Therefore, the best answer is C.

255. **If $x > 3{,}000$, then the value of $\frac{x}{2x+1}$ is closest to**

(A) $\frac{1}{6}$
(B) $\frac{1}{3}$
(C) $\frac{10}{21}$
(D) $\frac{1}{2}$
(E) $\frac{3}{2}$

If x is greater than 3,000, the value of $\frac{x}{2x+1}$ is very close to the value of $\frac{x}{2x}$, which is equal to $\frac{1}{2}$. The best answer is D.

256. **Machine A produces 100 parts twice as fast as machine B does. Machine B produces 100 parts in 40 minutes. If each machine produces parts at a constant rate, how many parts does machine A produce in 6 minutes?**

(A) 30
(B) 25
(C) 20
(D) 15
(E) 7.5

If machine A produces the parts twice as fast as machine B does, then machine A requires half as much time as machine B does, or 20 minutes, to produce 100 parts. In 6 minutes, machine A will produce $\frac{100}{20}(6)$ or 30 parts. The best answer is A.

257. **If 18 is 15 percent of 30 percent of a certain number, what is the number?**

(A) 9
(B) 36
(C) 40
(D) 81
(E) 400

If n represents the number, then $18 = 0.15(0.3n)$ and $n = \frac{18}{0.045} = 400$. The best answer is E.

258. **A necklace is made by stringing N individual beads together in the repeating pattern red bead, green bead, white bead, blue bead, and yellow bead. If the necklace design begins with a red bead and ends with a white bead, then N could equal**

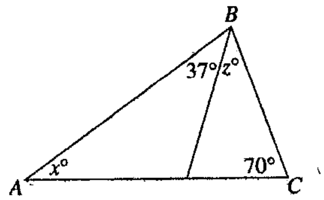
(A) 16
(B) 32
(C) 41
(D) 54
(E) 68

The pattern of red, green, white, blue, and yellow repeats after every 5th bead. Since the first bead is red (first in the pattern) and the last bead is white (third in the pattern), the number of beads is of the form $5n + 3$, where n is an integer. Of the options, only $68 = 5(13) + 3$ is of this form. Therefore, the best answer is E.

259. **If $x = (0.08)^2$, $y = \frac{1}{(0.08)^2}$, and $z = (1 - 0.08)^2 - 1$, which of the following is true?**

(A) $x = y = z$
(B) $y < z < x$
(C) $z < x < y$
(D) $y < x$ and $x = z$.
(E) $x < y$ and $x = z$.

It is not necessary to compute the precise values of x, y, and z. It is sufficient to see that x is between 0 and 1, y is greater than 1, and $z = (0.92)^2 - 1$ is less than 0. Therefore, $z < x < y$, and the best answer is C.



260. In $\triangle ABC$ above, what is x in terms of z ?

(A) $z+73$
(B) $z-73$
(C) $70-z$
(D) $z-70$
(E) $73-z$

The sum of the angle measures of $\triangle ABC$ is equal to $x+37+z+70=180$ Thus, $x+z=180-(37+70)=73$, and $x=73-z$ The best answer is E

261. In 1990 a total of x earthquakes occurred worldwide, some but not all of which occurred in Asia. If m of these earthquakes occurred in Asia, which of the following represents the ratio of the number of earthquakes that occurred in Asia to the number that did <u>not</u> occur in Asia?

(A) $\frac{x}{m}$
(B) $\frac{m}{x}$
(C) $\frac{m}{x-m}$
(D) $\frac{x}{x-m}$
(E) $1-\frac{m}{x}$

If there was a total of x earthquakes and m of them occurred in Asia, then $x-m$ of them did not occur in Asia. Therefore, the ratio of the number that occurred in Asia to the number that did not occur in Asia is $\frac{m}{x-m}$ The best answer is C

262. If $\frac{x+y}{xy}=1$, then $y=$

(A) $\frac{x}{x-1}$
(B) $\frac{x}{x+1}$
(C) $\frac{x-1}{x}$
(D) $\frac{x+1}{x}$
(E) x

It follows from the equation that $x+y=xy$, so $x=xy-y$ or $x=y(x-1)$ Therefore, $y=\frac{x}{x-1}$, and the best answer is A

263. If $\frac{1}{2}$ of the air in a tank is removed with each stroke of a vacuum pump, what fraction of the original amount of air has been removed after 4 strokes?

(A) $\frac{15}{16}$
(B) $\frac{7}{8}$
(C) $\frac{1}{4}$
(D) $\frac{1}{8}$
(E) $\frac{1}{16}$

With the first stroke of the pump, $\frac{1}{2}$ of the air is removed, with the second stroke $\frac{1}{2}$ of the remaining $\frac{1}{2}$, or $\frac{1}{4}$, of the air is removed, leaving $\frac{1}{2}-\frac{1}{4}=\frac{1}{4}$ of the air; with the third stroke $\frac{1}{2}$ of $\frac{1}{4}$, or $\frac{1}{8}$, is removed, leaving $\frac{1}{4}-\frac{1}{8}=\frac{1}{8}$, and with the fourth stroke $\frac{1}{2}$ of $\frac{1}{8}$, or $\frac{1}{16}$, is removed Therefore, $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}=\frac{15}{16}$ of the air has been removed, and the best answer is A

264. Last year Department Store X had a sales total for December that was 4 times the average (arithmetic mean) of the monthly sales totals for January through November. The sales total for December was what fraction of the sales total for the year?

(A) $\frac{1}{4}$
(B) $\frac{4}{15}$
(C) $\frac{1}{3}$
(D) $\frac{4}{11}$
(E) $\frac{4}{5}$

If A was the average sales total per month for the first 11 months, the December sales total was $4A$, the sales total for the first 11 months was $11A$, and the sales total for the year was $11A+4A=15A$ Thus, the ratio of the sales total for December to the sales total for the year was $\frac{4A}{15A}=\frac{4}{15}$ The best answer is B

265 How many integers n are there such that $1 < 5n + 5 < 25$?

(A) Five
(B) Four
(C) Three
(D) Two
(E) One

If $1 < 5n + 5 < 25$, then subtracting 5 from each of the three parts of the inequality yields $-4 < 5n < 20$, and dividing by 5 yields $-\frac{4}{5} < n < 4$ The four integers that satisfy this inequality are 0, 1, 2, and 3 Therefore, the best answer is B

266. If the two-digit integers M and N are positive and have the same digits, but in reverse order, which of the following CANNOT be the sum of M and N ?

(A) 181
(B) 165
(C) 121
(D) 99
(E) 44

If t and u are the two digits, integer M is 10 times the tens digit plus the units digit, or $10t + u$ Similarly, n is $10u + t$, and the sum of the numbers M and N is $(10t + u) + (10u + t)$ $= 11t + 11u = 11(t + u)$ Because the sum of M and N must be a multiple of 11, you need only find which of the answer choices is *not* a multiple of 11 Since $181 = 11(16) + 5$, 181 is not a multiple of 11, and the best answer is A

267. Working alone, printers X, Y, and Z can do a certain printing job, consisting of a large number of pages, in 12, 15, and 18 hours, respectively. What is the ratio of the time it takes printer X to do the job, working alone at its rate, to the time it takes printers Y and Z to do the job, working together at their individual rates?

(A) $\frac{4}{11}$

(B) $\frac{1}{2}$

(C) $\frac{15}{22}$

(D) $\frac{22}{15}$

(E) $\frac{11}{4}$

If X requires 12 hours to do the job, then X can do $\frac{1}{12}$ of the job per hour Similarly, Y can do $\frac{1}{15}$ of the job per hour and Z can do $\frac{1}{18}$ of the job per hour Together, Y and Z can do $\left(\frac{1}{15}+\frac{1}{18}\right)$ or $\frac{11}{90}$ of the job per hour, which implies that it takes them $\frac{90}{11}$ hours to complete the job Therefore, the ratio of the time required for X to do the job (12 hours) to the time required for Y and Z working together to do the job $\left(\frac{90}{11} \text{ hours}\right)$ is $\frac{12}{\frac{90}{11}} = \frac{12(11)}{90} = \frac{22}{15}$ The best answer is D

268. In 1985 a company sold a brand of shoes to retailers for a fixed price per pair. In 1986 the number of pairs of the shoes that the company sold to retailers decreased by 20 percent, while the price per pair increased by 20 percent. If the company's revenue from the sales of the shoes in 1986 was \$3.0 million, what was the approximate revenue from the sale of the shoes in 1985 ?

(A) \$2.4 million
(B) \$2.9 million
(C) \$3 0 million
(D) \$3.1 million
(E) \$3.6 million

Let n be the number of pairs of shoes sold in 1985 and p be the price per pair in 1985 Then in 1986, the number of pairs sold was 20 percent less, or $0\ 8n$, and the price per pair was 20 percent more, or $1\ 2p$ The company's revenue in 1986 was $(0.8n)(1\ 2p) = 0\ 96np = \$3$ million. Therefore, np, the company's revenue in 1985, was $\frac{\$3 \text{ million}}{\$0\ 96}$ or approximately \$3 1 million The best answer is D

269. $\frac{(3)(0.072)}{0.54} =$

(A) 0.04
(B) 0.3
(C) 0.4
(D) 0.8
(E) 4.0

To perform this computation, it is convenient to multiply $\frac{(3)(0.072)}{0.54}$ by $\frac{100}{100}$, which gives $\frac{3(7.2)}{54} = \frac{21.6}{54} = \frac{3.6}{9} = 0.4$ The best answer is C.

270. **A car dealer sold x used cars and y new cars during May. If the number of used cars sold was 10 greater than the number of new cars sold, which of the following expresses this relationship?**

(A) $x > 10y$
(B) $x > y + 10$
(C) $x > y - 10$
(D) $x = y + 10$
(E) $x = y - 10$

According to the problem, if x is 10 greater than y, then $x = y + 10$, and the best answer is D.

271. **What is the maximum number of $1\frac{1}{4}$-foot pieces of wire that can be cut from a wire that is 24 feet long?**

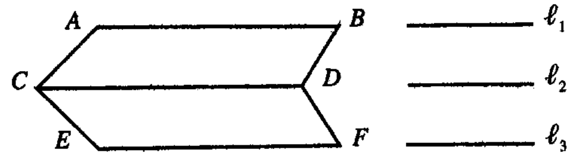
(A) 11
(B) 18
(C) 19
(D) 20
(E) 30

The maximum number is the greatest integer less than or equal to the quotient when 24 feet is divided by $1\frac{1}{4}$ feet The quotient is 19.2, and the maximum number of $1\frac{1}{4}$-foot pieces is 19 The best answer is C

272. **If each of the two lines ℓ_1 and ℓ_2 is parallel to line ℓ_3, which of the following must be true?**

(A) Lines ℓ_1, ℓ_2, and ℓ_3 lie in the same plane.
(B) Lines ℓ_1, ℓ_2, and ℓ_3 lie in different planes.
(C) Line ℓ_1 is parallel to line ℓ_2.
(D) Line ℓ_1 is the same line as line ℓ_2.
(E) Line ℓ_1 is the same line as line ℓ_3.

It is a well-known fact that two lines that are parallel to the same line are parallel to each other, thus the best answer is C To see that the other options are not necessarily true, we first recall that two lines are parallel if they lie in the same plane and are everywhere equidistant To show A and B need not be true, consider the figure below,



D is not necessarily true because no assumption can be made about whether or not lines ℓ_1 and ℓ_2 are coincident That E is not necessarily true can be seen from the figures in the discussion of A and B

$$\frac{61.24 \times (0.998)^2}{\sqrt{403}}$$

273. **The expression above is approximately equal to**

(A) 1
(B) 3
(C) 4
(D) 5
(E) 6

Since $\sqrt{403}$ is approximately 20 and $(0.998)^2$ is approximately 1, the value of the expression is approximately $\frac{60(1)}{20}$ or 3 The best answer is B.

274. **Car X and car Y traveled the same 80-mile route. If car X took 2 hours and car Y traveled at an average speed that was 50 percent faster than the average speed of car X, how many hours did it take car Y to travel the route?**

(A) $\frac{2}{3}$

(B) 1

(C) $1\frac{1}{3}$

(D) $1\frac{3}{5}$

(E) 3

If car X took 2 hours to drive the 80 miles, then car X drove an average speed of $\frac{80}{2}$, or 40 miles per hour, and car Y drove an average speed of $1.5(40) = 60$ miles per hour Therefore, it took $\frac{80}{60}$ or $1\frac{1}{3}$ hours for car Y to travel the route The best answer is C

275. If the numbers $\frac{17}{24}, \frac{1}{2}, \frac{3}{8}, \frac{3}{4}$, and $\frac{9}{16}$ were ordered from greatest to least, the middle number of the resulting sequence would be

(A) $\frac{17}{24}$

(B) $\frac{1}{2}$

(C) $\frac{3}{8}$

(D) $\frac{3}{4}$

(E) $\frac{9}{16}$

The least common denominator of the five fractions is 48.

When the fractions are expressed with denominator 48, they are, in the order given, $\frac{34}{48}, \frac{24}{48}, \frac{18}{48}, \frac{36}{48}$, and $\frac{27}{48}$

Once the fractions are expressed with the same denominator, one need only order the numerators from greatest to least

Clearly, the middle number is $\frac{27}{48}$ or $\frac{9}{16}$, and the best answer is E

276. If a 10 percent deposit that has been paid toward the purchase of a certain product is $110, how much more remains to be paid?

(A) $880
(B) $990
(C) $1,000
(D) $1,100
(E) $1,210

If 10 percent of the purchase is $110, the 90 percent that remains to be paid is 9($110) = $990 The best answer is B.

277. Kim purchased n items from a catalog for $8 each. Postage and handling charges consisted of $3 for the first item and $1 for each additional item Which of the following gives the total dollar amount of Kim's purchase, including postage and handling, in terms of n?

(A) $8n + 2$
(B) $8n + 4$
(C) $9n + 2$
(D) $9n + 3$
(E) $9n + 4$

The purchase price of the n items at $8 each was $8n$ dollars Postage and handling was $3 for the first item and $\$1(n-1)$ for the remaining $n-1$ items The total cost was, therefore, $8n+3+1(n-1)=9n+2$ dollars The best answer is C

278. $\left(\sqrt{7}+\sqrt{7}\right)^2 =$

(A) 98
(B) 49
(C) 28
(D) 21
(E) 14

$\left(\sqrt{7}+\sqrt{7}\right)^2 = \left(2\sqrt{7}\right)^2 = 4(7) = 28$ The best answer is C

279. If the average (arithmetic mean) of the four numbers K, $2K+3$, $3K-5$, and $5K+1$ is 63, what is the value of K?

(A) 11

(B) $15\frac{3}{4}$

(C) 22

(D) 23

(E) $25\frac{3}{10}$

The average of the four numbers is

$$\frac{K+(2K+3)+(3K-5)+(5K+1)}{4} = \frac{11K-1}{4} = 63, \text{ or}$$

$11K-1=252$, $11K=253$ and $K=23$ The best answer is D.

280. A rabbit on a controlled diet is fed daily 300 grams of a mixture of two foods, food X and food Y. Food X contains 10 percent protein and food Y contains 15 percent protein If the rabbit's diet provides exactly 38 grams of protein daily, how many grams of food X are in the mixture?

(A) 100
(B) 140
(C) 150
(D) 160
(E) 200

Let x be the number of grams of food X in the mixture.

Then the number of grams of food Y in the mixture is $300-x$

According to the problem, $0.10x + 0.15(300-x) = 38$ grams,

$0.10x - 0.15x = 38 - 45 = -7$ Thus, $x = \frac{-7}{-0.05} = 140$ grams

The best answer is B

281. A company that ships boxes to a total of 12 distribution centers uses color coding to identify each center. If either a single color or a pair of two different colors is chosen to represent each center and if each center is uniquely represented by that choice of one or two colors, what is the minimum number of colors needed for the coding? (Assume that the order of the colors in a pair does not matter.)

(A) 4
(B) 5
(C) 6
(D) 12
(E) 24

It is sometimes a good idea to look at the answer choices before tackling the problem For example, if 4 colors were used, 4 centers could be identified with a single color and $_4C_2 = \frac{4!}{2!2!} = 6$ centers could be identified with two colors. Thus, only 10 centers could be identified with 4 colors Similarly, with 5 colors, 5 centers could be identified with a single color and $_5C_2 = \frac{5!}{2!3!} = \frac{(5)(4)}{2} = 10$ centers could be identified with two colors for a total of 15 Therefore, a minimum of 5 colors is needed, and the best answer is B

282. If $x + y = a$ and $x - y = b$, then $2xy =$

(A) $\frac{a^2 - b^2}{2}$

(B) $\frac{b^2 - a^2}{2}$

(C) $\frac{a - b}{2}$

(D) $\frac{ab}{2}$

(E) $\frac{a^2 + b^2}{2}$

$(x + y)^2 = x^2 + 2xy + y^2 = a^2$, and $(x - y)^2 = x^2 - 2xy + y^2 = b^2$ Subtracting the second equation from the first yields $4xy = a^2 - b^2$ and $2xy = \frac{a^2 - b^2}{2}$ The best answer is A

283. A rectangular circuit board is designed to have width w inches, perimeter p inches, and area k square inches. Which of the following equations must be true?

(A) $w^2 + pw + k = 0$
(B) $w^2 - pw + 2k = 0$
(C) $2w^2 + pw + 2k = 0$
(D) $2w^2 - pw - 2k = 0$
(E) $2w^2 - pw + 2k = 0$

If the perimeter is p and the width is w, the length ℓ can be determined from the formula $2\ell + 2w = p$ Solving this equation for ℓ gives $\ell = \frac{p - 2w}{2}$ The area, k, of the rectangle is equal to ℓw Substituting $\frac{p - 2w}{2}$ for ℓ gives $k = \left(\frac{p - 2w}{2}\right)w$ or $2k = (p - 2w)w = pw - 2w^2$, which is equivalent to $2w^2 - pw + 2k = 0$ The best answer is E

284. On a certain road, 10 percent of the motorists exceed the posted speed limit and receive speeding tickets, but 20 percent of the motorists who exceed the posted speed limit do not receive speeding tickets. What percent of the motorists on that road exceed the posted speed limit?

(A) $10\frac{1}{2}\%$

(B) $12\frac{1}{2}\%$

(C) 15%

(D) 22%

(E) 30%

Let t be the total number of motorists and let e be the number of motorists who exceed the speed limit Then if 20 percent of the motorists who exceed the speed limit do not receive tickets, 80 percent of those who exceed the speed limit, or $0.8e$, receive tickets Since $0.1t$ exceed the speed limit and receive tickets, $0.8e = 0.1t$ and the ratio of e to t is 1 to 8, which is equivalent to 12.5 percent The best answer is B

285 **If p is an even integer and q is an odd integer, which of the following must be an odd integer?**

(A) $\frac{p}{q}$

(B) pq

(C) $2p+q$

(D) $2(p+q)$

(E) $\frac{3p}{q}$

The product of an even integer and any other integer is even, and the sum of an even integer and an odd integer is odd An examination of the answer choices shows that both B, pq, and D, $2(p+q)$, must be even and that C, $2p+q$, must be an odd integer, since $2p$ is even and it is given that q is odd With this approach, choices A and E do not have to be examined, but substitution of values for p and q, such as $p=12$ and $q=3$, shows that $\frac{p}{q}$ and $\frac{3p}{q}$ do not have to be odd integers The best answer is C

286. **A certain college has a student-to-teacher ratio of 11 to 1. The average (arithmetic mean) annual salary for teachers is $26,000. If the college pays a total of $3,380,000 in annual salaries to its teachers, how many students does the college have?**

(A) 130
(B) 169
(C) 1,300
(D) 1,430
(E) 1,560

Let s be the number of students and t be the number of teachers Then $\frac{s}{t}=\frac{11}{1}$ The number of teachers can be found by dividing total salaries by the average salary per teacher, $\frac{\$3{,}380{,}000}{\$26{,}000}=130$ Substituting this value for t in the equation $\frac{s}{t}=\frac{11}{1}$ gives $\frac{s}{130}=\frac{11}{1}$, and $s=1{,}430$. The best answer is D

287. **Last year if 97 percent of the revenues of a company came from domestic sources and the remaining revenues, totaling $450,000, came from foreign sources, what was the total of the company's revenues?**

(A) $1,350,000
(B) $1,500,000
(C) $4,500,000
(D) $15,000,000
(E) $150,000,000

If 97 percent of the revenues came from domestic sources, then the remaining 3 percent, totaling $450,000, came from foreign sources If r represents total revenue, then $0.03r=\$450{,}000$ and $r=\$15{,}000{,}000$ The best answer is D

288 **Drum X is $\frac{1}{2}$ full of oil and drum Y, which has twice the capacity of drum X, is $\frac{2}{3}$ full of oil. If all of the oil in drum X is poured into drum Y, then drum Y will be filled to what fraction of its capacity?**

(A) $\frac{3}{4}$

(B) $\frac{5}{6}$

(C) $\frac{11}{12}$

(D) $\frac{7}{6}$

(E) $\frac{11}{6}$

Let x and y represent the capacities of drums X and Y, respectively The amount of oil in drum X is $\frac{1}{2}x$ and the amount of oil in drum Y is $\frac{2}{3}y$ Since the capacity of drum Y is twice the capacity of drum X, it follows that $y=2x$, or $x=\frac{1}{2}y$, and the oil in drum X is $\frac{1}{2}x=\frac{1}{4}y$ When the oil in drum X is poured into drum Y, Y contains $\frac{1}{4}y+\frac{2}{3}y=\frac{11}{12}y$, which is $\frac{11}{12}$ of its capacity The best answer is C

289. **In a certain population, there are 3 times as many people aged twenty-one or under as there are people over twenty-one The ratio of those twenty-one or under to the total population is**

(A) 1 to 2
(B) 1 to 3
(C) 1 to 4
(D) 2 to 3
(E) 3 to 4

If v represents the number of people over twenty-one, then $3v$ represents the number of people twenty-one or under, and $v+3v$ represents the total population. Thus, the ratio of those twenty-one or under to the total population is $\frac{3v}{v+3v}=\frac{3v}{4v}=\frac{3}{4}$, or 3 to 4, and the best answer is E

290. $\frac{2+2\sqrt{6}}{2}=$

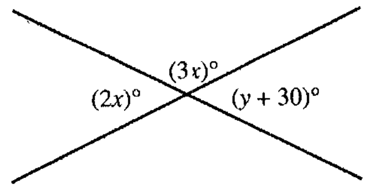
(A) $\sqrt{6}$
(B) $2\sqrt{6}$
(C) $1+\sqrt{6}$
(D) $1+2\sqrt{6}$
(E) $2+\sqrt{6}$

$\frac{2+2\sqrt{6}}{2}=\frac{2(1+\sqrt{6})}{2}=1+\sqrt{6}$, and the best answer is C

291. **A certain telescope increases the visual range at a particular location from 90 kilometers to 150 kilometers. By what percent is the visual range increased by using the telescope ?**

(A) 30%
(B) $33\frac{1}{2}\%$
(C) 40%
(D) 60%
(E) $66\frac{2}{3}\%$

The telescope increases the visual range by $150-90=60$ kilometers Thus, the increase in visual range is $\frac{60}{90}=\frac{2}{3}=66\frac{2}{3}\%$ The best answer is E



Note: Figure not drawn to scale.

292 **In the figure above, the value of y is**

(A) 6
(B) 12
(C) 24
(D) 36
(E) 42

Since the indicated angles are formed by the intersection of two lines, the adjacent angles are supplementary (i e , the sum of their measures is 180°) Thus, $2x+3x=180$, or $x=36$, and $3x+y+30=180$, or $3(36)+y+30=180$, or $y=42$ The best answer is E

293. **A part-time employee whose hourly wage was increased by 25 percent decided to reduce the number of hours worked per week so that the employee's total weekly income would remain unchanged. By what percent should the number of hours worked be reduced?**

(A) 12.5%
(B) 20%
(C) 25%
(D) 50%
(E) 75%

Let h be the original number of hours the employee worked per week and w be the hourly wage, for weekly income of wh The increased wage is 1 25w, or $\frac{5}{4}w$, and the reduced number of hours can be represented by H, for a weekly income of $\frac{5}{4}wH$ If the total weekly income is to be unchanged, then $wh=\frac{5}{4}wH$ and $h=\frac{5}{4}H$, or $H=\frac{4}{5}h$ The reduced hours are $\frac{4}{5}$ or 80% of the original hours, which is a reduction of 20% The best answer is B

294. If $x > 0$, $\frac{x}{50} + \frac{x}{25}$ is what percent of x ?

(A) 6%

(B) 25%

(C) $37\frac{1}{2}$%

(D) 60%

(E) 75%

If $x > 0$, $\frac{x}{50} + \frac{x}{25} = \frac{x}{50} + \frac{2x}{50} = \frac{3x}{50} = \frac{6x}{100}$ or 6% of x

The best answer is A

295. If the operation $\circledast$ is defined for all a and b by the equation $a \circledast b = \frac{a^2 b}{3}$, then $2 \circledast (3 \circledast -1) =$

(A) 4

(B) 2

(C) $-\frac{4}{3}$

(D) -2

(E) -4

To find the value of $2 \circledast (3 \circledast -1)$, the value of $3 \circledast -1$ must be found first. By definition, $a \circledast b = \frac{a^2 b}{3}$; so $3 \circledast -1 = \frac{3^2(-1)}{3} = \frac{-9}{3} = -3$ Thus, $2 \circledast (3 \circledast -1) =$ $2 \circledast -3 = \frac{2^2(-3)}{3} = 4(-1) = -4$, and the best answer is E

296 A factory that employs 1,000 assembly-line workers pays each of these workers \$5 per hour for the first 40 hours worked during a week and $1\frac{1}{2}$ times that rate for hours worked in excess of 40. What was the total payroll for the assembly-line workers for a week in which 30 percent of them worked 20 hours, 50 percent worked 40 hours, and the rest worked 50 hours?

(A) \$180,000
(B) \$185,000
(C) \$190,000
(D) \$200,000
(E) \$205,000

Since there are 1,000 workers, 30 percent, or 300, worked 20 hours each, 50 percent, or 500, worked 40 hours each; and the remaining 200 worked 50 hours each The 300 workers earned $300(20)(\$5) = \$30{,}000$, the 500 workers earned $500(40)(\$5) = \$100{,}000$, and the 200 workers earned $200[(40)(\$5) + (50-40)(1\frac{1}{2})(\$5)] = \$55{,}000$ Thus, the total payroll was $\$30{,}000 + \$100{,}000 + \$55{,}000 = \$185{,}000$, and the best answer is B

297 If $x \neq 2$, then $\frac{3x^2(x-2) - x + 2}{x-2} =$

(A) $3x^2 - x + 2$
(B) $3x^2 + 1$
(C) $3x^2$
(D) $3x^2 - 1$
(E) $3x^2 - 2$

If $x \neq 2$, then $\frac{3x^2(x-2)-x+2}{x-2} = \frac{3x^2(x-2)-(x-2)}{x-2} =$ $\frac{(x-2)(3x^2-1)}{x-2} = 3x^2 - 1$ The best answer is D

298. In a certain school, 40 more than $\frac{1}{3}$ of all the students are taking a science course and $\frac{1}{4}$ of those taking a science course are taking physics. If $\frac{1}{8}$ of all the students in the school are taking physics, how many students are in the school?

(A) 240
(B) 300
(C) 480
(D) 720
(E) 960

If s represents the number of students in the school, then $40 + \frac{1}{3}s$ are taking a science course and $\frac{1}{4}(40 + \frac{1}{3}s)$ are taking physics If $\frac{1}{8}$ of the students in the school are taking physics, then $\frac{1}{8}s = \frac{1}{4}(40 + \frac{1}{3}s)$, or $s = 2(40 + \frac{1}{3}s) = 80 + \frac{2}{3}s$, and $s - \frac{2}{3}s = 80$

Thus, $s = 240$, and the best answer is A

299. If $d > 0$ and $0 < 1 - \frac{c}{d} < 1$, which of the following must be true?

I. $c > 0$

II. $\frac{c}{d} < 1$

III. $c^2 + d^2 > 1$

(A) I only
(B) II only
(C) I and II only
(D) II and III only
(E) I, II, and III

If every value of c and d satisfying the inequalities $d > 0$ and $0 < 1 - \frac{c}{d} < 1$ also satisfies the inequality in statement I, II, or III, then that statement must be true If even one value of c and d satisfying the inequalities $d > 0$ and $0 < 1 - \frac{c}{d} < 1$ does not satisfy the inequality in statement I, II, or III, then that statement need not be true

I Since $1 - \frac{c}{d} < 1$, it follows that $\frac{c}{d} > 0$ This together with $d > 0$ implies $c > 0$, and statement I must be true

II Since $0 < 1 - \frac{c}{d} < 1$, it follows that $-1 < -\frac{c}{d} < 0$, which is equivalent to $0 < \frac{c}{d} < 1$, and statement II must be true

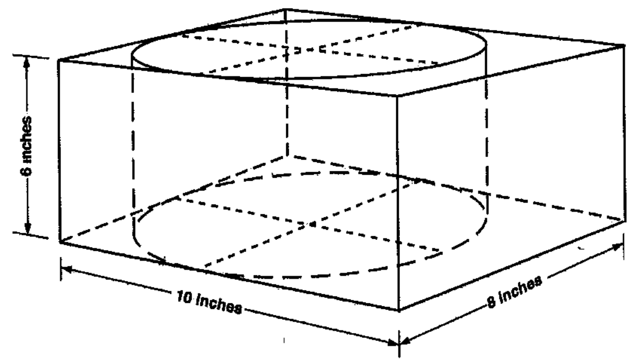
III The inequalities $d > 0$ and $0 < 1 - \frac{c}{d} < 1$ give information about the size of $\frac{c}{d}$ but do not appear to give information about the size of $c^2 + d^2$, so it is reasonable to try to find positive values of c and d for which $\frac{c}{d}$ is less than 1 Choosing $c = \frac{1}{4}$ and $d = \frac{1}{3}$ yields $c^2 + d^2 = \left(\frac{1}{4}\right)^2 + \left(\frac{1}{3}\right)^2 = \frac{1}{16} + \frac{1}{9}$, which is less than 1 Therefore, statement III need not be true

The best answer is C

300. The inside dimensions of a rectangular wooden box are 6 inches by 8 inches by 10 inches. A cylindrical cannister is to be placed inside the box so that it stands upright when the closed box rests on one of its six faces. Of all such cannisters that could be used, what is the radius, in inches, of the one that has maximum volume?

(A) 3
(B) 4
(C) 5
(D) 6
(E) 8

The formula for the volume of a right circular cylinder is $v = \pi r^2 h$, where r is the radius and h is the height of the cylinder The diameter of the circular top of the cannister must equal the length of the shorter dimension of the top of the box, as illustrated in the figure below



Since the box can rest on any one of its six faces, there are three possibilities to consider These are summarized in the following table

Dimensions of the box top	r	h	v
6 by 8	3	10	90π
6 by 10	3	8	72π
8 by 10	4	6	96π

Thus, the radius, in inches, of the cannister having the maximum volume is 4 The best answer is B

301. $\dfrac{\frac{1}{2}}{\frac{1}{4}+\frac{1}{6}} =$

(A) $\frac{6}{5}$

(B) $\frac{5}{6}$

(C) $\frac{5}{24}$

(D) $\frac{1}{5}$

(E) $\frac{1}{12}$

One way to solve the problem is to express all fractions with the common denominator 12, that is, $\dfrac{\frac{6}{12}}{\frac{3}{12}+\frac{2}{12}} = \dfrac{\frac{6}{12}}{\frac{5}{12}} = \frac{6}{5}$

The best answer is A

302 **Kelly and Chris packed several boxes with books. If Chris packed 60 percent of the total number of boxes, what was the ratio of the number of boxes Kelly packed to the number of boxes Chris packed?**

(A) 1 to 6
(B) 1 to 4
(C) 2 to 5
(D) 3 to 5
(E) 2 to 3

If Chris packed 60 percent of the boxes, then Kelly packed 40 percent of the boxes The ratio of the number of boxes Kelly packed to the number Chris packed is $\frac{40\%}{60\%} = \frac{2}{3}$

The best answer is E

303 **A train travels from New York City to Chicago, a distance of approximately 840 miles, at an average rate of 60 miles per hour and arrives in Chicago at 6.00 in the evening, Chicago time. At what hour in the morning, New York City time, did the train depart for Chicago? (<u>Note.</u> Chicago time is one hour earlier than New York City time.)**

(A) 4:00
(B) 5:00
(C) 6.00
(D) 7:00
(E) 8.00

Because time is found by dividing distance by rate, the trip took $\frac{840}{60} = 14$ hours The train arrived in Chicago at 6 00 in the evening Chicago time or 7 00 in the evening New York time New York time 14 hours before 7 00 in the evening is 5 00 in the morning The best answer is B

304. **Of the following, which is the closest approximation of $\frac{50.2 \times 0.49}{199.8}$?**

(A) $\frac{1}{10}$

(B) $\frac{1}{8}$

(C) $\frac{1}{4}$

(D) $\frac{5}{4}$

(E) $\frac{25}{2}$

$\frac{50\ 2 \times 0\ 49}{199\ 8}$ is approximately $\frac{50 \times 0\ 5}{200} = \frac{25}{200} = \frac{1}{8}$

The best answer is B

305. **Last year Manfred received 26 paychecks. Each of his first 6 paychecks was \$750; each of his remaining paychecks was \$30 more than each of his first 6 paychecks. To the nearest dollar, what was the average (arithmetic mean) amount of his paychecks for the year?**

(A) \$752
(B) \$755
(C) \$765
(D) \$773
(E) \$775

The total amount in dollars of the 26 paychecks was

$6(750) + (26-6)(750+30) = 6(750) + 20(780) = 4,500 + 15,600 = 20,100$ Thus, the average paycheck was $\frac{\$20,100}{26}$ or approximately \$773 The best answer is D

306. A certain pair of used shoes can be repaired for \$12 50 and will last for 1 year. A pair of the same kind of shoes can be purchased new for \$28.00 and will last for 2 years. The average cost per year of the new shoes is what percent greater than the cost of repairing the used shoes?

(A) 3%
(B) 5%
(C) 12%
(D) 15%
(E) 24%

Having the used shoes repaired will cost \$12 50 for 1 year The new shoes will cost \$28 00 and will last for 2 years, which is an average cost of \$14 00 for 1 year or \$1 50 greater than the cost of repairing the used shoes Thus, the average cost per year of the new shoes is $\frac{\$1\ 50}{\$12\ 50} = 12\%$ greater than the cost of repairing the used shoes. The best answer is C

307. In a certain brick wall, each row of bricks above the bottom row contains one less brick than the row just below it. If there are 5 rows in all and a total of 75 bricks in the wall, how many bricks does the bottom row contain?

(A) 14
(B) 15
(C) 16
(D) 17
(E) 18

If b represents the number of bricks in the bottom row, the numbers of bricks in the next 4 rows are $b-1$, $b-2$, $b-3$, and $b-4$, respectively The total number of bricks in the 5 rows is $b+(b-1)+(b-2)+(b-3)+(b-4)=5b-10=75$ Thus, $5b=85$ and $b=17$ The best answer is D

308. If 25 percent of p is equal to 10 percent of q, and $pq \neq 0$, then p is what percent of q?

(A) 2.5%
(B) 15%
(C) 20%
(D) 35%
(E) 40%

If $0\ 25p = 0\ 10q$, dividing both sides of the equation by 0 25 gives $p = \frac{0\ 10q}{0\ 25} = \frac{10q}{25}$ Thus, p is 40% of q, and the best answer is E

309. If the length of an edge of cube X is twice the length of an edge of cube Y, what is the ratio of the volume of cube Y to the volume of cube X?

(A) $\frac{1}{2}$
(B) $\frac{1}{4}$
(C) $\frac{1}{6}$
(D) $\frac{1}{8}$
(E) $\frac{1}{27}$

If y represents the length of one edge of cube Y, then the length of one edge of cube X is $2y$ The ratio of the volume of cube Y to the volume of cube X is $\frac{y^3}{(2y)^3} = \frac{y^3}{8y^3} = \frac{1}{8}$ The best answer is D

310. $(\sqrt{2}+1)(\sqrt{2}-1)(\sqrt{3}+1)(\sqrt{3}-1) =$

(A) 2
(B) 3
(C) $2\sqrt{6}$
(D) 5
(E) 6

From the relationship $(a+b)(a-b) = a^2 - b^2$,
$(\sqrt{2}+1)(\sqrt{2}-1) = 2-1 = 1$ and $(\sqrt{3}+1)(\sqrt{3}-1) = 3-1 = 2$
Thus, $(\sqrt{2}+1)(\sqrt{2}-1)(\sqrt{3}+1)(\sqrt{3}-1) = (1)(2) = 2$,
and the best answer is A

311. In a certain calculus class, the ratio of the number of mathematics majors to the number of students who are not mathematics majors is 2 to 5. If 2 more mathematics majors were to enter the class, the ratio would be 1 to 2. How many students are in the class?

(A) 10
(B) 12
(C) 21
(D) 28
(E) 35

Let m be the number of mathematics majors and n be the number of nonmathematics majors in the class. Thus, the ratio of $\frac{m}{n}=\frac{2}{5}$. If the number of mathematics majors is increased by 2, the ratio of $\frac{m+2}{n}=\frac{1}{2}$. From the first equation, $m=\frac{2}{5}n$, and from the second equation, $m+2=\frac{1}{2}n$, or $m=\frac{1}{2}n-2$. Thus, $\frac{1}{2}n-2=\frac{2}{5}n$ or $\frac{1}{2}n-\frac{2}{5}n=2$, and $\frac{1}{10}n=2$. Therefore, $n=20$ and $m=\frac{2}{5}(20)=8$, and the total number of students is $m+n=20+8=28$.

The best answer is D.

312. Machines A and B always operate independently and at their respective constant rates. When working alone, machine A can fill a production lot in 5 hours, and machine B can fill the same lot in x hours. When the two machines operate simultaneously to fill the production lot, it takes them 2 hours to complete the job. What is the value of x?

(A) $3\frac{1}{3}$

(B) 3

(C) $2\frac{1}{2}$

(D) $2\frac{1}{3}$

(E) $1\frac{1}{2}$

Since machine A can fill a production lot in 5 hours, machine A can complete $\frac{1}{5}$ of the job in 1 hour. Similarly, machine B can complete $\frac{1}{x}$ of the job in 1 hour, and the two machines operating simultaneously can fill $\frac{1}{2}$ of the job in 1 hour. Therefore, $\frac{1}{5}+\frac{1}{x}=\frac{1}{2}$ and $\frac{1}{x}=\frac{1}{2}-\frac{1}{5}=\frac{3}{10}$ or $x=\frac{10}{3}=3\frac{1}{3}$. The best answer is A.

313. In the xy-coordinate system, if (a, b) and $(a+3, b+k)$ are two points on the line defined by the equation $x=3y-7$, then $k=$

(A) 9

(B) 3

(C) $\frac{7}{3}$

(D) 1

(E) $\frac{1}{3}$

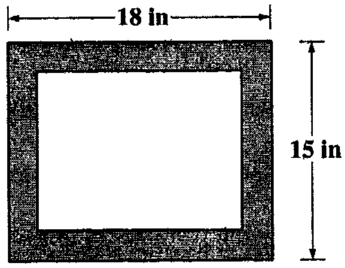
Since the points (a, b) and $(a+3, b+k)$ lie on the line $x=3y-7$, their coordinates can be substituted for x and y in the equation for the line. Thus, $a=3b-7$ and $a+3=3(b+k)-7$. Substituting $3b-7$ for a in the second equation gives $(3b-7)+3=3b+3k-7=(3b-7)+3k$. Thus, $3=3k$ and $k=1$. The best answer is D.

Alternatively, the slope-intercept form of the equation of the line is $y=\frac{1}{3}x+\frac{7}{3}$, so the slope of the line is $\frac{1}{3}$. Since the slope is the $\frac{\textit{difference of } y-\textit{coordinates}}{\textit{difference of } x-\textit{coordinates}}$ of the two points, $\frac{(b+k)-b}{(a+3)-a}=\frac{1}{3}$, or $\frac{k}{3}=\frac{1}{3}$ and $k=1$.

314. What is the units digit of $(13)^4(17)^2(29)^3$?

(A) 9
(B) 7
(C) 5
(D) 3
(E) 1

The units digit of 13^4 is 1, since $3\times3\times3\times3=81$, the units digit of 17^2 is 9, since $7\times7=49$, and the units digit of 29^3 is 9, since $9\times9\times9=729$. Therefore, the units digit of $(13)^4(17)^2(29)^3$ is 1, since $1\times9\times9=81$, and the best answer is E.



Note: Figure not drawn to scale.

315. **The shaded region in the figure above represents a rectangular frame with length 18 inches and width 15 inches. The frame encloses a rectangular picture that has the same area as the frame itself. If the length and width of the picture have the same ratio as the length and width of the frame, what is the length of the picture, in inches?**

(A) $9\sqrt{2}$

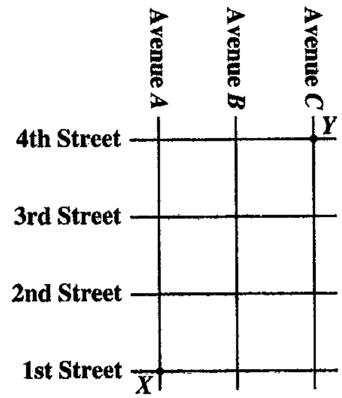
(B) $\frac{3}{2}$

(C) $\frac{9}{\sqrt{2}}$

(D) $15\left(1-\frac{1}{\sqrt{2}}\right)$

(E) $\frac{9}{2}$

Let ℓ and w represent the length and width in inches, respectively, of the picture Because the length and width of the picture have the same ratio as the length and width of the frame, $\frac{\ell}{w}=\frac{18}{15}=\frac{6}{5}$ The areas, in square inches, of the picture and the frame are ℓw and $(18\times 15)-\ell w=270-\ell w$, respectively Since the two areas are equal, $\ell w=270-\ell w$ or $\ell w=135$ From the ratio $\frac{\ell}{w}=\frac{6}{5}$, $w=\frac{5}{6}\ell$ Substituting $\frac{5}{6}\ell$ for w in the equation $\ell w=135$ yields $\ell(\frac{5}{6}\ell)=135$ or $5\ell^2=6(135)$ and $\ell^2=6(27)=(2)(3)(3)(3)(3)=2(9)^2$ Thus, $\sqrt{\ell^2}=\sqrt{2(9)^2}$ and $\ell=9\sqrt{2}$ The best answer is A



316. **Pat will walk from intersection X to intersection Y along a route that is confined to the square grid of four streets and three avenues shown in the map above. How many routes from X to Y can Pat take that have the minimum possible length?**

(A) Six
(B) Eight
(C) Ten
(D) Fourteen
(E) Sixteen

In order to walk from intersection X to intersection Y by one of the routes of minimum possible length, Pat must travel upward or rightward between intersections on the map Thus, the routes of minimum length consist of walking upwards, U, 3 times and rightward, R, twice, for a total of 5 blocks There are 10 ways in which Pat can walk upward 3 times and rightward twice

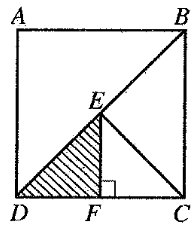
$UUURR$	$URRUU$
$UURUR$	$RRUUU$
$UURRU$	$RUUUR$
$URUUR$	$RUURU$
$URURU$	$RURUU$

Thus, there are 10 routes of minimum length, and the best answer is C

317. A certain fishing boat is chartered by 6 people who are to contribute equally to the total charter cost of \$480. If each person contributes equally to a \$150 down payment, how much of the charter cost will each person still owe?

(A) \$80 (B) \$66 (C) \$55 (D) \$50 (E) \$45

Since each person contributed equally to the \$150 down payment and the total cost of the chartered boat is \$480, each person still owes $\frac{\$480-\$150}{6} = \$55$. Thus, the best answer is C.



318. In square *ABCD* above, if *DE* = *EB* and *DF* = *FC*, then the area of the shaded region is what fraction of the area of square region *ABCD*?

(A) $\frac{1}{16}$ (B) $\frac{1}{8}$ (C) $\frac{1}{6}$ (D) $\frac{1}{4}$ (E) $\frac{1}{3}$

Since $DE = EB$ and $DF = FC$, the area of the shaded region is one-fourth the area of triangular region *BCD*. Since *BD* divides square *ABCD* into two equal triangular regions, the shaded region is $\left(\frac{1}{2}\right)\left(\frac{1}{4}\right)$, or $\frac{1}{8}$, of the area of square region *ABCD*. Hence, the best answer is B.

319. Craig sells major appliances. For each appliance he sells, Craig receives a commission of \$50 plus 10 percent of the selling price. During one particular week Craig sold 6 appliances for selling prices totaling \$3,620. What was the total of Craig's commissions for that week?

(A) \$412 (B) \$526 (C) \$585
(D) \$605 (E) \$662

Since Craig receives a commission of \$50 on each appliance plus a 10 percent commission on total sales, his commission for that week was $6(\$50) + (0.1)(\$3,620) = \$662$. Thus, the best answer is E.

320. The average (arithmetic mean) of 10, 30, and 50 is 5 more than the average of 20, 40, and

(A) 15 (B) 25 (C) 35 (D) 45 (E) 55

Since the average of 10, 30, and 50 is 30, the average of 20, 40, and some number x is $30 - 5$, or 25. If the average of 20, 40, and x is 25, then the sum of the three numbers is 75, and $x = 15$. The best answer is A.

321. What number when multiplied by $\frac{4}{7}$ yields $\frac{6}{7}$ as the result?

(A) $\frac{2}{7}$ (B) $\frac{2}{3}$ (C) $\frac{3}{2}$ (D) $\frac{24}{7}$ (E) $\frac{7}{2}$

If n represents the number, $\frac{4}{7}n = \frac{6}{7}$, which yields $n = \frac{3}{2}$. Thus, the best answer is C.

322. If $y = 4 + (x-3)^2$, then y is least when $x =$

(A) −4 (B) −3 (C) 0 (D) 3 (E) 4

Since the expression $(x-3)^2$ must be greater than or equal to zero, y will be least when $(x-3) = 0$. Therefore, the least value for y occurs when x is 3, and the best answer is D.

323. If 3 pounds of dried apricots that cost x dollars per pound are mixed with 2 pounds of prunes that cost y dollars per pound, what is the cost, in dollars, per pound of the mixture?

(A) $\frac{3x+2y}{5}$

(B) $\frac{3x+2y}{x+y}$

(C) $\frac{3x+2y}{xy}$

(D) $5(3x+2y)$

(E) $3x+2y$

The total number of pounds in the mixture is $3 + 2 = 5$ pounds, and the total cost of the mixture is $3x + 2y$ dollars. Therefore, the cost per pound of the mixture is $\frac{3x+2y}{5}$ dollars, and the best answer is A.

324. A cashier mentally reversed the digits of one customer's correct amount of change and thus gave the customer an incorrect amount of change. If the cash register contained 45 cents more than it should have as a result of this error, which of the following could have been the correct amount of change in cents?

(A) 14 (B) 45 (C) 54 (D) 65 (E) 83

Let x represent the units' digit and y represent the tens' digit in the correct amount of change before the digits were reversed Since the cash register contained 45 cents more than it should have, it follows that $(10x + y) - (10y + x) = 45$ Simplifying yields $9x - 9y = 45$, or $x - y = 5$, which implies that the difference in the two digits is 5 Since 83 is the only number given whose digits have a difference of 5, the best answer is E

325. Which of the following is NOT equal to the square of an integer?

(A) $\sqrt{\sqrt{1}}$ (B) $\sqrt{4}$ (C) $\frac{18}{2}$

(D) 41 − 25 (E) 36

In choice B, $\sqrt{4} = 2$, which is not the square of an integer. Thus, the best answer is B It can be verified that the remaining answer choices represent the squares of 1, 3, 4, and 6, respectively

326. An artist wishes to paint a circular region on a square poster that is 2 feet on a side. If the area of the circular region is to be $\frac{1}{2}$ the area of the poster, what must be the radius of the circular region in feet?

(A) $\frac{1}{\pi}$ (B) $\sqrt{\frac{2}{\pi}}$ (C) 1 (D) $\frac{2}{\sqrt{\pi}}$ (E) $\frac{\pi}{2}$

The area of the square poster is $2^2 = 4$ square feet Since the area of the circular region is to be $\frac{1}{2}$ the area of the poster, $\pi r^2 = \frac{1}{2}(4)$, where r is the radius of the circle Solving the equation yields $r = \sqrt{\frac{2}{\pi}}$ Thus, the best answer is B

327. Which of the following must be equal to zero for all real numbers x ?

I. $-\frac{1}{x}$

II. $x + (-x)$

III. x^0

(A) I only
(B) II only
(C) I and III only
(D) II and III only
(E) I, II, and III

With respect to I, $-\frac{1}{x}$ cannot be zero since 1 divided by any number can never be zero With respect to II, $x + (-x)$ equals zero for all real numbers x With respect to III, x^0 equals 1 for all nonzero real numbers x Therefore, the best answer is B

328 At the rate of m meters per s seconds, how many meters does a cyclist travel in x minutes?

(A) $\frac{m}{sx}$ (B) $\frac{mx}{s}$ (C) $\frac{60m}{sx}$
(D) $\frac{60ms}{x}$ (E) $\frac{60mx}{s}$

Since the cyclist travels $\frac{m}{x}$ meters per second, the cyclist travels $\frac{60m}{s}$ meters per minute Thus, in x minutes the cyclist will travel $\frac{60mx}{s}$ meters, and the best answer is E.

	City *A*	City *B*	City *C*	City *D*	City *E*	City *F*
City *A*						
City *B*						
City *C*						
City *D*						
City *E*						
City *F*	•					

329 In the table above, what is the least number of table entries that are needed to show the mileage between each city and each of the other five cities?

(A) 15 (B) 21 (C) 25 (D) 30 (E) 36

In the table, draw a diagonal from the upper left to the lower right corner The entries along this diagonal should not be counted since a cell on the diagonal represents the distance from the city to itself Because the diagonal divides the remaining cells into two equal halves, each of which would contain the same set of distances, count only the cells in one of the halves, $5 + 4 + 3 + 2 + 1 = 15$ Hence, the best answer is A

330 A certain tax rate is \$0.82 per \$100 00. What is this rate, expressed as a percent?

(A) 82% (B) 8.2% (C) 0.82%
(D) 0.082% (E) 0.0082%

The tax rate \$0 82 per \$100 00 can be written as the fraction $\frac{\$0\ 82}{\$100.00} = 0\ 82\%$ The best answer is C

331. Fermat primes are prime numbers that can be written in the form $2k + 1$, where k is an integer and a power of 2. Which of the following is NOT a Fermat prime?

(A) 3 (B) 5 (C) 17 (D) 31 (E) 257

Since Fermat primes can be written in the form $2^k + 1$, where k is an integer and a power of 2, check each answer choice to find the number that cannot be so expressed

$3 = 2^1 + 1$, where $k = 1 = 2^0$
$5 = 2^2 + 1$, where $k = 2 = 2^1$
$17 = 2^4 + 1$, where $k = 4 = 2^2$
$31 = 30 + 1$, but 30 cannot be expressed as an integer power of 2
$257 = 2^8 + 1$, where $k = 8 = 2^3$

Thus, the best answer is D

332 A shipment of 1,500 heads of cabbage, each of which was approximately the same size, was purchased for \$600 The day the shipment arrived, $\frac{2}{3}$ of the heads were sold, each at 25 percent above the cost per head The following day the rest were sold at a price per head equal to 10 percent less than the price each head sold for on the day before What was the gross profit on this shipment?

(A) \$100 (B) \$115 (C) \$125
(D) \$130 (E) \$135

The cost of a head of cabbage was $\frac{\$600\ 00}{1,500} = \$0\ 40$ Since the selling price of a head of cabbage on the day the shipment arrived was $(1\ 25)(\$0\ 40) = \$0\ 50$, the revenue for the first day was $\frac{2}{3}(1,500)(\$0\ 50) = \$500\ 00$ On the second day the remaining cabbage heads were sold at a selling price of $(0\ 9)(\$0\ 50) = \$0\ 45$ per head, which yields $\frac{1}{3}(1,500)(\$0\ 45) = \$225.00$ in revenue The gross profit for the shipment was $\$500\ 00 + \$225\ 00 - \$600\ 00 = \$125\ 00$ Thus, the best answer is C

333. If $(t - 8)$ is a factor of $t^2 - kt - 48$, then $k =$

(A) -6 (B) -2 (C) 2 (D) 6 (E) 14

If $(t - 8)$ is a factor of the expression $t^2 - kt - 48$, then the expression can be written as the product $(t - 8)(t + a)$ When multiplying this product, $(-8)(a) = -48$, or $a = 6$ Thus, the product becomes $(t - 8)(t + 6)$, which has the middle term $6t - 8t = -2t$ Therefore, $k = 2$, and the best answer is C

334. If a is a positive integer, and if the units' digit of a^2 is 9 and the units' digit of $(a + 1)^2$ is 4, what is the units' digit of $(a + 2)^2$?

(A) 1 (B) 3 (C) 5 (D) 7 (E) 9

If 9 is the units' digit of a^2, then either 3 or 7 must be the units' digit of a, since only numbers ending in 3 or 7 would yield a units' digit of 9 when squared Then $a + 1$ must have a units' digit of either $3 + 1$ or $7 + 1$ But if 4 were the units' digit of $a + 1$, then $(a + 1)^2$ would have units' digit 6 instead of 4 as given Therefore, the units' digit of $a + 1$ must be 8, which implies that the units' digit of $a + 2$ would have to be $8 + 1 = 9$ Since the units' digit of 9^2 is 1, the units digit of $(a + 2)^2$ must be 1 Thus, the best answer is A

335 The ratio, by volume, of soap to alcohol to water in a certain solution is 2 . 50 . 100. The solution will be altered so that the ratio of soap to alcohol is doubled while the ratio of soap to water is halved. If the altered solution will contain 100 cubic centimeters of alcohol, how many cubic centimeters of water will it contain?

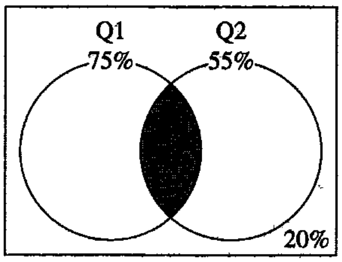
(A) 50 (B) 200 (C) 400 (D) 625 (E) 800

Originally the ratio of soap to alcohol to water was 2 50 100 When the ratio 2.50 is doubled, the new ratio will be 4 50, when the ratio 2 100 is halved, the new ratio will be 1.100 or 4 400 Thus, the ratio of soap to alcohol to water will be 4.50 400 Since 100 cubic centimeters represents the 50 parts of alcohol in the new solution, 800 cubic centimeters will represent the 400 parts of water in the solution Thus, the best answer is E

336. **If 75 percent of a class answered the first question on a certain test correctly, 55 percent answered the second question on the test correctly, and 20 percent answered neither of the questions correctly, what percent answered both correctly?**

(A) 10% (B) 20% (C) 30%
(D) 50% (E) 65%

For questions of this type, it is convenient to draw a Venn diagram to represent the conditions in the problem For example



Now it is clear that the two circles represent 80 percent of the students If x is the percent corresponding to the shaded region (the percent who answered both questions correctly), then $75\% + 55\% - x = 80\%$, and $x = 50\%$ Thus, the best answer is D

Alternatively, if 75 percent of the class answered the first question correctly and 20 percent of the class answered both questions incorrectly, then 5 percent of the class answered the second question correctly but the first incorrectly. Since 55 percent of the class answered the second question correctly, the percent who answered both questions correctly is
$55\% - 5\% = 50\%$

337. $\frac{31}{125} =$

(A) 0.248
(B) 0.252
(C) 0.284
(D) 0.312
(E) 0.320

The fraction $\frac{31}{125}$ can be converted to decimal form by dividing 31 by 125, which yields 0 248 Thus, the best answer is A

Alternatively, since $8(125) = 1{,}000$, $\frac{31}{125} \times \frac{8}{8} = \frac{248}{1{,}000} = 0\ 248$

338. **Members of a social club met to address 280 newsletters. If they addressed $\frac{1}{4}$ of the newsletters during the first hour and $\frac{2}{5}$ of the remaining newsletters during the second hour, how many newsletters did they address during the second hour?**

(A) 28 (B) 42 (C) 63 (D) 84 (E) 112

Three-fourths of 280, or 210, newsletters were not addressed during the first hour Therefore, $\frac{2}{5}(210) = 84$ newsletters were addressed during the second hour, and the best answer is D

339 **If $x^2 = 2y^3$ and $2y = 4$, what is the value of $x^2 + y$?**

(A) −14
(B) −2
(C) 3
(D) 6
(E) 18

If $2y = 4$, then $y = 2$ and $x^2 = 2y^3 = 2(2)^3 = 16$ Therefore, $x^2 + y = 16 + 2 = 18$, and the best answer is E

340. **If the cost of 12 eggs varies between \$0.90 and \$1 20, then the cost per egg varies between**

(A) \$0.06 and \$0.08
(B) \$0.065 and \$0.085
(C) \$0.07 and \$0.09
(D) \$0.075 and \$0.10
(E) \$0.08 and \$0.105

If the cost of 12 eggs varies between \$0 90 and \$1 20, the cost per egg varies between $\frac{\$0\ 90}{12}$ and $\frac{\$1\ 20}{12}$, or between \$0 075 and \$0 10 Thus, the best answer is D

341. $(\sqrt{3} + 2)(\sqrt{3} - 2) =$

(A) $\sqrt{3} - 4$ (B) $\sqrt{6} - 4$ (C) -1
(D) 1 (E) 2

$$(\sqrt{3} + 2)(\sqrt{3} - 2) = (\sqrt{3})^2 + 2\sqrt{3} - 2\sqrt{3} + 2(-2)$$
$$= 3 - 4 = -1$$

Thus, the best answer is C

342. **A glucose solution contains 15 grams of glucose per 100 cubic centimeters of solution. If 45 cubic centimeters of the solution were poured into an empty container, how many grams of glucose would be in the container?**

(A) 3.00
(B) 5.00
(C) 5.50
(D) 6.50
(E) 6.75

If x is the number of grams of glucose in the 45 cubic centimeters of solution, then $\frac{x}{45}=\frac{15}{100}$, and $x = 6.75$. Thus, the best answer is E.

343. **If Sam were twice as old as he is, he would be 40 years older than Jim. If Jim is 10 years younger than Sam, how old is Sam?**

(A) 20
(B) 30
(C) 40
(D) 50
(E) 60

Let S be Sam's current age and let J be Jim's current age. The statement "if Sam were twice as old as he is, he would be 40 years older than Jim" can be represented by the equation $2S = J + 40$, and the statement "Jim is 10 years younger than Sam" can be represented by the equation $S - 10 = J$. Substituting $S - 10$ for J in the equation $2S = J + 40$ yields $2S = S + 30$. Thus, $S = 30$, and the best answer is B.

344. **If $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}=\frac{13}{x}$, which of the following must be an integer?**

I. $\frac{x}{8}$

II. $\frac{x}{12}$

III. $\frac{x}{24}$

(A) I only
(B) II only
(C) I and III only
(D) II and III only
(E) I, II, and III

The fractions can be added using the least common denominator 12.

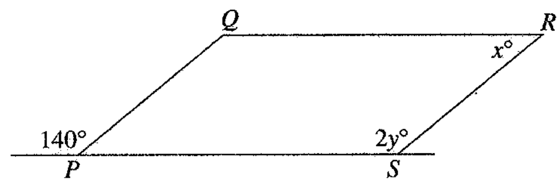
$\frac{13}{x}=\frac{1}{2}+\frac{1}{3}+\frac{1}{4} = \frac{6}{12}+\frac{4}{12}+\frac{3}{12}=\frac{13}{12}$, so $x = 12$

I $\frac{x}{8}=\frac{12}{8}$, which is not an integer

II. $\frac{x}{12}=\frac{12}{12} = 1$, which is an integer

III $\frac{x}{24}=\frac{12}{24}=\frac{1}{2}$, which is not an integer

Thus, only II is an integer, and the best answer is B.



345. **In the figure above, if $PQRS$ is a parallelogram, then $y - x =$**

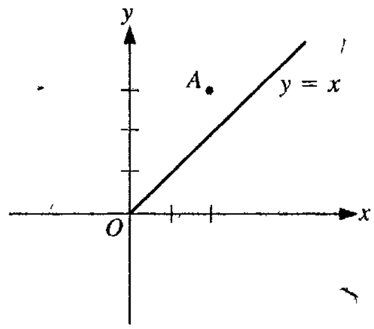
(A) 30 (B) 35 (C) 40 (D) 70 (E) 100

Since PQ and SR are parallel, $2y = 140$ and $y = 70$. Since QR and PS are parallel, $x + 2y = 180$; so $x + 2(70) = 180$, or $x = 40$. Thus, $y - x = 30$, and the best answer is A.

346. **The temperature in degrees Celsius (C) can be converted to temperature in degrees Fahrenheit (F) by the formula $F = \frac{9}{5}C + 32$. What is the temperature at which $F = C$?**

(A) 20° (B) $\left(\frac{32}{5}\right)$° (C) 0°
(D) −20° (E) −40°

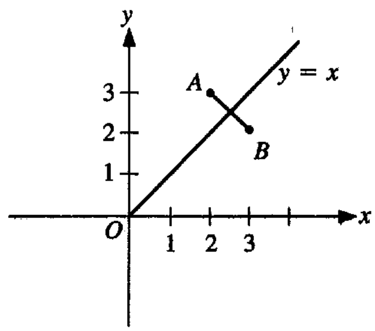
Substituting F for C in the equation $F = \frac{9}{5}C + 32$ yields $F = \frac{9}{5}F + 32$. Thus, $-\frac{4}{5}F = 32$, or $F = 32(-\frac{5}{4}) = -40$, and the best answer is E.



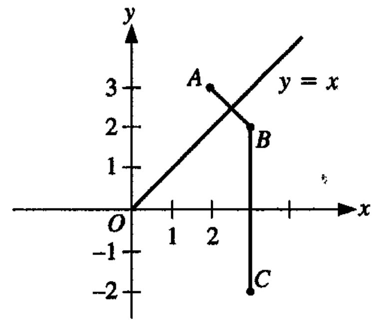
347. **In the rectangular coordinate system above, the line $y = x$ is the perpendicular bisector of segment AB (not shown), and the x-axis is the perpendicular bisector of segment BC (not shown). If the coordinates of point A are (2, 3), what are the coordinates of point C ?**

(A) $(-3, -2)$
(B) $(-3, 2)$
(C) $(2, -3)$
(D) $(3, -2)$
(E) $(2, 3)$

Since the line $y = x$ is the perpendicular bisector of AB, B is the reflection of A through this line. In any reflection through the line $y = x$, the x-coordinate and y-coordinate of a point become interchanged. Thus, the coordinates of B are (3,2).



Since the x-axis is the perpendicular bisector of BC, C is the reflection of B through the x-axis. Thus, the x-coordinates of C and B are the same, and the y-coordinate of C is the negative of the y-coordinate of B.



The coordinates of C are therefore $(3, -2)$, and the best answer is D.

348. **If 1 kilometer is approximately 0.6 mile, which of the following best approximates the number of kilometers in 2 miles?**

(A) $\frac{10}{3}$ (B) 3 (C) $\frac{6}{5}$ (D) $\frac{1}{3}$ (E) $\frac{3}{10}$

If x is the number of kilometers in 2 miles, then $\frac{1}{0.6} = \frac{x}{2}$. So $x = \frac{2}{0.6} = \frac{20}{6} = \frac{10}{3}$, and the best answer is A.

349. **A \$500 investment and a \$1,500 investment have a combined yearly return of 8.5 percent of the total of the two investments. If the \$500 investment has a yearly return of 7 percent, what percent yearly return does the \$1,500 investment have?**

(A) 9%
(B) 10%
(C) $10\frac{5}{8}$%
(D) 11%
(E) 12%

The total of the two investments, or \$2,000, has a yearly return of 8.5 percent, or \$170. The \$500 investment has a yearly return of 7 percent, or \$35. Thus, the \$1,500 investment has a yearly return of \$170 − \$35, or \$135. The \$135 yearly return is $\frac{135}{1,500}$, or 9 percent, of \$1,500. The best answer is A.

350. A store currently charges the same price for each towel that it sells. If the current price of each towel were to be increased by \$1, 10 fewer of the towels could be bought for \$120, excluding sales tax. What is the current price of each towel?

(A) \$1
(B) \$2
(C) \$3
(D) \$4
(E) \$12

Let p be the price per towel and let n be the number of towels that can be sold for \$120 Thus, $np = 120$ and $(p + 1)(n - 10) = 120$ Solving the first equation for n yields $n = \frac{120}{p}$ Substituting $\frac{120}{p}$ for n in the second equation yields $(p + 1)(\frac{120}{p} - 10) = 120$, which can be solved as follows:

$$\begin{aligned}
(p + 1)(120 - 10p) &= 120p \\
10(p + 1)(12 - p) &= 120p \\
(p + 1)(12 - p) &= 12p \\
-p^2 + 11p + 12 &= 12p \\
p^2 + p - 12 &= 0 \\
(p - 3)(p + 4) &= 0 \\
p &= 3 \text{ or } -4
\end{aligned}$$

Since p is the price per towel, p cannot be -4 Thus, $p = 3$, and the best answer is C

351 If the sum of n consecutive integers is 0, which of the following must be true?

I. n is an even number.
II. n is an odd number.
III. The average (arithmetic mean) of the n integers is 0.

(A) I only (B) II only (C) III only
(D) I and III (E) II and III

Recall that for every integer a, $a + (-a) = 0$. Therefore, by pairing 1 with -1, 2 with -2, and so on, one can see that in order to sum to zero, a list of consecutive integers must contain the same number of positive integers as negative integers, in addition to containing the integer 0. Therefore, the list has an odd number of integers Thus, I is false and II is true The average of a list of n numbers is equal to their sum divided by n Thus, III is true, and the best answer is E

352 In the formula $V = \frac{1}{(2r)^3}$, if r is halved, then V is multiplied by

(A) 64

(B) 8

(C) 1

(D) $\frac{1}{8}$

(E) $\frac{1}{64}$

If $V = \frac{1}{(2r)^3} = \frac{1}{8r^3}$, then substituting $\frac{1}{2}r$ for r yields

$\frac{1}{8\left(\frac{r}{2}\right)^3} = \frac{1}{r^3} = 8 \times \frac{1}{8r^3} = 8V$ Thus, if r is halved, V is multiplied by 8, and the best answer is B

353 For any integer n greater than 1, $\underline{|n}$ denotes the product of all the integers from 1 to n, inclusive. How many prime numbers are there between $\underline{|6} + 2$ and $\underline{|6} + 6$, inclusive?

(A) None (B) One (C) Two
(D) Three (E) Four

$\underline{|6} = (6)(5)(4)(3)(2)(1) = 720$
Thus, the question is asking how many prime numbers are between 722 and 726, inclusive The numbers 722, 724, and 726 are divisible by 2, and 725 is divisible by 5 The only remaining number is 723, which is divisible by 3 Thus, there are no prime numbers between $\underline{|6} + 2$ and $\underline{|6} + 6$, inclusive, and the best answer is A.

354. In how many arrangements can a teacher seat 3 girls and 3 boys in a row of 6 seats if the boys are to have the first, third, and fifth seats?

(A) 6 (B) 9 (C) 12 (D) 36 (E) 720

Any one of the 3 boys could be seated in the first seat, either of the remaining 2 boys in the third seat, and the remaining boy in the fifth seat Thus there are $3(2)(1) = 6$ ways the boys could be arranged There are also 3 girls to be arranged in 3 seats, thus, by the same reasoning, there are 6 ways in which the girls can be arranged Since for each arrangement of the boys, there are 6 arrangements of the girls, there are $6(6) = 36$ ways in which the 3 boys and the 3 girls can be arranged Thus, the best answer is D

355. A circular rim 28 inches in diameter rotates the same number of inches per second as a circular rim 35 inches in diameter. If the smaller rim makes x revolutions per second, how many revolutions per <u>minute</u> does the larger rim make in terms of x ?

(A) $\frac{48\pi}{x}$

(B) $75x$

(C) $48x$

(D) $24x$

(E) $\frac{x}{75}$

One rotation of circular rims of diameters 28 and 35 inches is 28π and 35π inches, respectively Since the two circular rims rotate the same number of inches per second, the number of rotations per second of the larger rim is $\frac{28}{35}$ times the number of rotations of the smaller rim Thus, if the smaller rim rotates x times per second, the larger rim rotates $\frac{28}{35}x$ times per second Since there are 60 seconds in 1 minute, the larger rim rotates $(60)\frac{28}{35}x = 48x$ times per minute, and the best answer is C

356. The cost C of manufacturing a certain product can be estimated by the formula $C = 0.03rst^2$, where r and s are the amounts, in pounds, of the two major ingredients and t is the production time, in hours. If r is increased by 50 percent, s is increased by 20 percent, and t is decreased by 30 percent, by approximately what percent will the estimated cost of manufacturing the product change?

(A) 40% increase
(B) 12% increase
(C) 4% increase
(D) 12% decrease
(E) 24% decrease

If r is increased by 50 percent, s is increased by 20 percent, and t is decreased by 30 percent, then, according to the formula, the new estimated cost of manufacturing the product will be

$$0.03(1.5r)(1.2s)(0.7t)^2 = [0.03(1.5)(1.2)(0.7)^2]rst^2 = 0.882(0.03rst^2)$$

This is a decrease of approximately 12 percent, and the best answer is D

357. Reggie purchased a car costing $8,700. As a down payment he used a $2,300 insurance settlement, and an amount from his savings equal to 15 percent of the difference between the cost of the car and the insurance settlement. If he borrowed the rest of the money needed to purchase the car, how much did he borrow?

(A) $6,400
(B) $6,055
(C) $5,440
(D) $5,095
(E) $3,260

The difference between the cost of the car and the insurance settlement was $8,700 – $2,300, or $6,400 Since Reggie used an amount equal to 15 percent of $6,400 as part of the down payment, the rest of the money needed to purchase the car was 85 percent of $6,400, or 0 85 ($6,400), which is $5,440 The best answer is C

MEMBERSHIP OF ORGANIZATION *X*, 1988

Honorary Members	**78**
Fellows	**9,209**
Members	**35,509**
Associate Members	**27,909**
Affiliates	**2,372**

358 According to the table above, the number of fellows was approximately what percent of the total membership of Organization *X* ?

(A) 9%
(B) 12%
(C) 18%
(D) 25%
(E) 35%

From the table, the number of fellows is 9,209, and the total membership is the sum of the 5 numbers, which is 75,077 Therefore, the number of fellows is $\frac{9,209}{75,077}$ of the total membership, or approximately 12 percent The best answer is B

359. The arithmetic mean and standard deviation of a certain normal distribution are 13.5 and 1.5, respectively. What value is exactly 2 standard deviations less than the mean?

(A) 10.5
(B) 11.0
(C) 11.5
(D) 12.0
(E) 12 5

Since the arithmetic mean is 13 5 and one standard deviation is 1 5, two standard deviations less than the mean is 13 5 – 2(1 5) = 10 5 The best answer is A

360. Mark bought a set of 6 flower pots of different sizes at a total cost of $8.25. Each pot cost $0.25 more than the next one below it in size. What was the cost, in dollars, of the largest pot?

(A) $1.75
(B) $1.85
(C) $2 00
(D) $2.15
(E) $2.30

If the largest pot cost x dollars, the next smaller pot cost x – 0 25 dollars, the next smaller x – 0 50 dollars, and so forth Thus, the total cost in dollars for the 6 pots was x + (x – 0 25) + (x – 0 50) + (x – 0 75) + (x – 1 00) + (x – 1 25) Therefore, combining terms, $6x$ – 3 75 = 8 25, or x = 2 00 The best answer is C

361. When N is divided by T, the quotient is S and the remainder is V. Which of the following expressions is equal to N ?

(A) ST
(B) $S + V$
(C) $ST + V$
(D) $T(S + V)$
(E) $T(S - V)$

The first sentence implies that N equals the product of S and T plus a remainder of V, that is, $N = ST + V$ For example, when 17 is divided by 5, the quotient is 3 and the remainder is 2, so 17 = (3)(5) + 2 The best answer is C

38, 69, 22, 73, 31, 47, 13, 82

362. Which of the following numbers is greater than three-fourths of the numbers but less than one-fourth of the numbers in the list above?

(A) 56
(B) 68
(C) 69
(D) 71
(E) 73

The numbers in the list reordered from least to greatest are as follows 13, 22, 31, 38, 47, 69, 73, 82. Since there are 8 numbers in the list, $\frac{3}{4}(8) = 6$ and $\frac{1}{4}(8) = 2$ Therefore, any number that is greater than the first 6 numbers on the list must be greater than 69, and any number that is less than the last 2 numbers in the list must be less than 73 Of the answer choices given, the only one that is greater than 69 but less than 73 is 71 The best answer is D

363 Lucy invested $10,000 in a new mutual fund account exactly three years ago. The value of the account increased by 10 percent during the first year, increased by 5 percent during the second year, and decreased by 10 percent during the third year. What is the value of the account today?

(A) $10,350
(B) $10,395
(C) $10,500
(D) $11,500
(E) $12,705

Since the account increased by 10 percent during the first year, the value of the account at the end of the first year was $10,000 (1 10), or $11,000 The account increased by 5 percent during the second year, so its value at the end of the second year was $11,000 (1 05), or $11,550 The account decreased by 10 percent during the third year, which reduced its value to 90 percent of $11,550 by the end of the third year, or $11,550(0 90) = $10,395 The best answer is B

364. A certain bakery has 6 employees. It pays annual salaries of $14,000 to each of 2 employees, $16,000 to 1 employee, and $17,000 to each of the remaining 3 employees. The average (arithmetic mean) annual salary of these employees is closest to which of the following?

(A) $15,200
(B) $15,500
(C) $15,800
(D) $16,000
(E) $16,400

The sum of the salaries of the 6 employees is (2)($14,000) + (1)($16,000) + (3)($17,000), which equals $95,000 Therefore, the average salary for the 6 employees is $\frac{\$95,000}{6}$, or $15,833 to the nearest dollar Of the 5 options given, $15,800 is closest to $15,833. The best answer is C

365. If x is equal to the sum of the even integers from 40 to 60, inclusive, and y is the number of even integers from 40 to 60, inclusive, what is the value of $x + y$?

(A) 550
(B) 551
(C) 560
(D) 561
(E) 572

There are 21 integers between 40 and 60, inclusive, with 11 of the integers being even Thus, the value of y is 11 The sum of the 11 even integers from 40 to 60, inclusive, can be obtained by multiplying the average of the integers by 11. Since the integers are consecutive, the average of all the integers is halfway between 40 and 60, or $\frac{40+60}{2} = 50$ Thus, the sum is (11)(50) = 550, which is the value of x The value of $x + y$ is therefore 550 + 11= 561 The best answer is D.

366 If $\left(7^{\frac{3}{4}}\right)^n = 7$, what is the value of n ?

(A) $\frac{1}{3}$

(B) $\frac{2}{3}$

(C) $\frac{4}{3}$

(D) $\frac{5}{3}$

(E) $\frac{6}{3}$

Since $\left(7^{\frac{3}{4}}\right)^n = 7^{\frac{3n}{4}} = 7^1$, it follows, by equating exponents, that $\frac{3n}{4} = 1$, or $n = \frac{4}{3}$ The best answer is C

367 Which of the following is equal to the average (arithmetic mean) of $(x + 2)^2$ and $(x - 2)^2$?

(A) x^2
(B) $x^2 + 2$
(C) $x^2 + 4$
(D) $x^2 + 2x$
(E) $x^2 + 4x$

The average of $(x+2)^2$ and $(x-2)^2$ is

$\frac{(x+2)^2+(x-2)^2}{2}$, or

$\frac{(x^2+4x+4)+(x^2-4x+4)}{2} = \frac{2x^2+8}{2} = x^2+4$

The best answer is C

368. If $x^4 + y^4 = 100$ then the greatest possible value of x is between

(A) 0 and 3
(B) 3 and 6
(C) 6 and 9
(D) 9 and 12
(E) 12 and 15

The value of x is greatest when $y = 0$ In that case $x^4 = 100$ Since $3^4 = 81$ and $4^4 = 256$, it follows that the greatest possible value of x is between 3 and 4. The best answer is B

369. During a car trip, Maria stopped to rest after she traveled $\frac{1}{2}$ of the total distance to her destination. She stopped again after she traveled $\frac{1}{4}$ of the distance remaining between her first stop and her destination, and then she drove the remaining 120 miles to her destination. What was the total distance, in miles, from Maria's starting point to her destination?

(A) 280
(B) 320
(C) 360
(D) 420
(E) 480

Let D be the total distance, in miles, from starting point to destination Maria first traveled $\frac{D}{2}$ miles, leaving a distance of $\frac{D}{2}$ miles to go She then traveled $\frac{1}{4}$ of the remaining distance, which was $\frac{1}{4}\left(\frac{D}{2}\right)$, or $\frac{D}{8}$ miles So, after the second stop she had traveled a total of $\frac{D}{2} + \frac{D}{8}$ miles, or $\frac{5D}{8}$ miles She still had $D - \frac{5D}{8}$, or $\frac{3D}{8}$ miles to go, which is given as 120 miles Therefore, $\frac{3D}{8} = 120$, or D = 320 The best answer is B

NUMBER OF SOLID-COLORED MARBLES IN THREE JARS

Jar	Number of Red Marbles	Number of Green Marbles	Total Number of Red and Green Marbles
P	x	y	80
Q	y	z	120
R	x	z	160

370. In the table above, what is the number of green marbles in jar R ?

- (A) 70
- (B) 80
- (C) 90
- (D) 100
- (E) 110

From the table, the total number of red marbles and green marbles in the 3 jars is $2x + 2y + 2z$, which equals $80 + 120 + 160$, or 360 Dividing by 2 gives you $x + y + z = 180$ But the total number of red marbles and green marbles in jar P is $x + y = 80$, so substituting into the previous equation for $x + y$, you get $80 + z = 180$ Therefore z, which is the number of green marbles in jar R, is 100 The best answer is D

371. The cost of picture frame M is \$10.00 less than 3 times the cost of picture frame N. If the cost of frame M is \$50.00, what is the cost of frame N ?

- (A) \$13.33
- (B) \$16.66
- (C) \$20.00
- (D) \$26.66
- (E) \$40.00

If m is the cost, in dollars, of frame M, and n is the cost, in dollars, of frame N, it follows that $m = 3n - 10$

Therefore, if $m = 50$, then $50 = 3n - 10$, or $n = \frac{60}{3} = 20$

The best answer is C

372. If x is to be chosen at random from the set {1, 2, 3, 4} and y is to be chosen at random from the set {5, 6, 7}, what is the probability that xy will be even?

- (A) $\frac{1}{6}$
- (B) $\frac{1}{3}$
- (C) $\frac{1}{2}$
- (D) $\frac{2}{3}$
- (E) $\frac{5}{6}$

There are 4 different numbers (x) that can be chosen from {1, 2, 3, 4} and 3 different numbers (y) that can be chosen from {5, 6, 7} Therefore, the number of different pairs of numbers x and y that can be chosen is 4×3, or 12. Note that if xy is to be even, at least one of x and y must be even. If x is even, then y can be odd or even Since there are 2 even values of x, there are $2 \times 3 = 6$ possibilities that xy will be even If x is odd, then y must be even Since there is 1 even value of y and 2 odd values of x, there are $2 \times 1 = 2$ additional possibilities Thus, there are $6 + 2 = 8$ possibilities for xy to be even, and the probability that xy will be even is $\frac{8}{12} = \frac{2}{3}$ The best answer is D

373. If $S = \{0, 4, 5, 2, 11, 8\}$, how much greater than the median of the numbers in S is the mean of the numbers in S ?

- (A) 0.5
- (B) 1.0
- (C) 1.5
- (D) 2.0
- (E) 2.5

If the numbers in S are ordered according to size, 0, 2, 4, 5, 8, 11, the median of those numbers, which is the average of the two middle numbers, is $\frac{4+5}{2} = 4\ 5$ The mean of the numbers in S is the sum of all the numbers divided by 6, or $\frac{30}{6} = 5$ Therefore, the mean is 0 5 greater than the median The best answer is A

374. The value of $\sqrt[3]{-89}$ is

(A) between –9 and –10
(B) between –8 and –9
(C) between –4 and –5
(D) between –3 and –4
(E) undefined

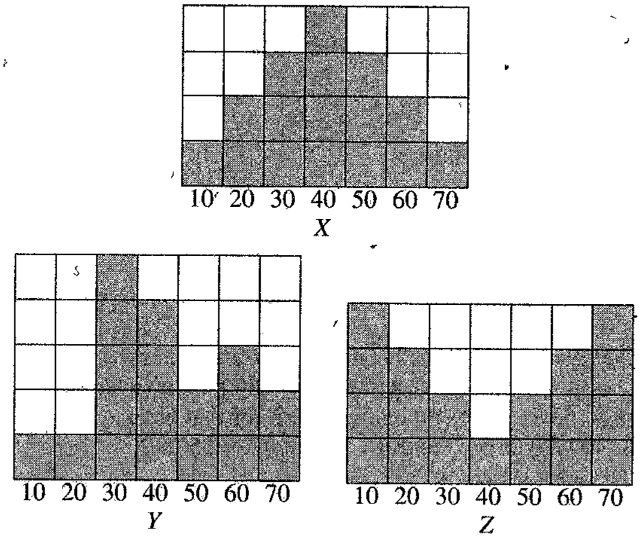
The cube root of –89, or $\sqrt[3]{-89}$, is a number x such that $x^3 = -89$. Therefore, x must be negative. Since $(-4)^3 = -64$ and $(-5)^3 = -125$, the cube root of –89 must be a number between –4 and –5. The best answer is C.

Shipment	Number of Defective Chips in the Shipment	Total Number of Chips in the Shipment
*S*1	2	5,000
*S*2	5	12,000
*S*3	6	18,000
*S*4	4	16,000

375. A computer chip manufacturer expects the ratio of the number of defective chips to the total number of chips in all future shipments to equal the corresponding ratio for shipments *S*1, *S*2, *S*3, and *S*4 combined, as shown in the table above. What is the expected number of defective chips in a shipment of 60,000 chips?

(A) 14
(B) 20
(C) 22
(D) 24
(E) 25

According to the table, for the four shipments combined, there are 17 defective chips out of a total of 51,000 chips, which is a ratio of $\frac{17}{51{,}000} = \frac{1}{3{,}000}$. Thus, if n is the number of defective chips in a shipment of 60,000 chips, $\frac{1}{3{,}000} = \frac{n}{60{,}000}$, or $n = 20$. The best answer is B.



376. If the variables, *X*, *Y*, and *Z* take on only the values 10, 20, 30, 40, 50, 60, or 70 with frequencies indicated by the shaded regions above, for which of the frequency distributions is the mean equal to the median?

(A) *X* only
(B) *Y* only
(C) *Z* only
(D) *X* and *Y*
(E) *X* and *Z*

Note that the frequency distributions for both *X* and *Z* are symmetric about 40, which implies that both variables have mean = median = 40. [Note: Although the mean of *Y* is $42\frac{2}{9}$ and the median is 40, it is not necessary to speculate about or calculate them, since there is no answer choice "*X*, *Y* and *Z*".] The best answer is E.

377. In a certain furniture store, each week Nancy earns a salary of \$240 plus 5 percent of the amount of her total sales that exceeds \$800 for the week. If Nancy earned a total of \$450 one week, what were her total sales that week?

(A) \$2,200
(B) \$3,450
(C) \$4,200
(D) \$4,250
(E) \$5,000

Let x represent Nancy's total sales for a week. Each week she earns \$240 plus 5 percent of her total sales that exceed \$800 for the week Therefore, in a week she would earn $\$240 + (0.05)(x - \$800)$ It is given that she earned \$450 one week, so for that week $\$240 + (0.05)(x - \$800) = \$450$, or $x = \$5,000$. The best answer is E

$$A = \{2, 3, 4, 5\}$$
$$B = \{4, 5, 6, 7, 8\}$$

378. Two integers will be randomly selected from the sets above, one integer from set A and one integer from set B. What is the probability that the sum of the two integers will equal 9?

(A) 0.15
(B) 0.20
(C) 0.25
(D) 0.30
(E) 0.33

The number of possible selections from A is 4, and the number of possible selections from B is 5 Therefore, the number of different pairs of numbers, one from A and one from B, is $4 \times 5 = 20$ Of these 20 pairs of numbers, there are 4 possible pairs that sum to 9, namely 2 and 7, 3 and 6, 4 and 5, and 5 and 4 Therefore, the probability that the sum of the 2 integers selected will equal 9 is $\frac{4}{20} = 0.20$ The best answer is B

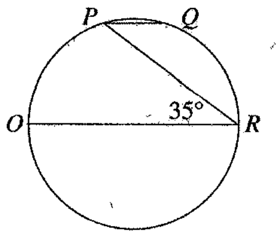
$$p, r, s, t, u$$

379. An arithmetic sequence is a sequence in which each term after the first is equal to the sum of the preceding term and a constant. If the list of numbers shown above is an arithmetic sequence, which of the following must also be an arithmetic sequence?

I. $2p, 2r, 2s, 2t, 2u$
II. $p - 3, r - 3, s - 3, t - 3, u - 3$
III. p^2, r^2, s^2, t^2, u^2

(A) I only
(B) II only
(C) III only
(D) I and II
(E) II and III

It follows from the definition of arithmetic sequence given in the first sentence that there is a constant c such that $r - p = s - r = t - s = u - t = c$. In sequence I, the difference between any two consecutive terms is equal to twice the constant c For example, $2r - 2p = 2(r - p) = 2c$ Thus, I is an arithmetic sequence In sequence II, the difference between any two consecutive terms is equal to the same constant c in the original sequence For example, $r - 3 - (p - 3) = r - p = c$ Thus, II is an arithmetic sequence In sequence III, the difference between two consecutive terms is *not* constant For example, if p, q, r, t and u were 1, 2, 3, 4, and 5, then sequence III would be 1, 4, 9, 16 and 25, which is not arithmetic since, for example, $4 - 1 \neq 9 - 4$. The best answer is D



380. In the circle above, PQ is parallel to diameter OR, and OR has length 18. What is the length of minor arc PQ ?

(A) 2π

(B) $\frac{9\pi}{4}$

(C) $\frac{7\pi}{2}$

(D) $\frac{9\pi}{2}$

(E) 3π

Since the measure of inscribed angle PRO is 35°, the measure of minor arc OP is 70°. Since PQ is parallel to OR, the measure of inscribed angle QPR is 35°, and so the measure of minor arc QR is also 70° Thus, the measure of minor arc PQ is $180° - 70° - 70° = 40°$, and the length of minor arc PQ is $\frac{40}{360} = \frac{1}{9}$ of the length of the circumference of the circle Since the diameter OR has length 18, the circumference is $\pi d = 18\pi$ Thus the length of minor arc PQ is $\frac{1}{9}(18\pi) = 2\pi$ The best answer is A.

381. Dick and Jane each saved \$3,000 in 1989. In 1990 Dick saved 8 percent more than in 1989, and together he and Jane saved a total of \$5,000. Approximately what percent less did Jane save in 1990 than in 1989 ?

(A) 8%
(B) 25%
(C) 41%
(D) 59%
(E) 70%

In 1990 Dick saved 8 percent more than the \$3,000 he saved in 1989, which amounted to (1 08)(\$3,000), or \$3,240 In 1990 he and Jane together saved \$5,000 Thus, Jane must have saved only \$5,000 – \$3,240 = \$1,760, which is \$1,240 less than she saved in 1990 Therefore, in 1990 Jane saved approximately $\frac{\$1,240}{\$3,000} = 41\%$ less than she saved in 1989 The best answer is C

382. Of the following, which is <u>least</u>?

(A) $\frac{1}{0.2}$

(B) $(0\ 2)^2$

(C) 0.02

(D) $\frac{0.2}{2}$

(E) 0 2

The choices can be compared quickly, as follows

The first choice is $\frac{1}{0\ 2} = 5$, the second choice is $(0\ 2)^2 = 0\ 04$, the third choice is 0 02, the fourth choice is $\frac{0\ 2}{2} = 0\ 1$, and the fifth choice is 0 2 The best answer is B

383. S represents the sum of the weights of n fish in pounds. Which of the following represents the average (arithmetic mean) of the n weights in ounces? (1 pound = 16 ounces)

(A) $16nS$

(B) $\frac{16S}{n}$

(C) $\frac{16n}{S}$

(D) $\frac{nS}{16}$

(E) $\frac{S}{16n}$

The average of the n weights in pounds is represented by $\frac{S}{n}$. Since 1 pound = 16 ounces, the average of the n weights in ounces is $16\left(\frac{S}{n}\right)$, or $\frac{16S}{n}$. The best answer is B.

NET INCOME BY SECTOR, SECOND QUARTER, 1996

Sector	Net Income (in billions)	Percent Change from First Quarter, 1996
Basic Materials	$4.83	–26%
Energy	7.46	+40
Industrial	5.00	–1
Utilities	8.57	+303
Conglomerates	2 07	+10

384. The table above represents the combined net income of all United States companies in each of five sectors for the second quarter of 1996. Which sector had the greatest net income during the first quarter of 1996 ?

(A) Basic Materials
(B) Energy
(C) Industrial
(D) Utilities
(E) Conglomerates

The table shows net income in billions of dollars and the percent change from the first quarter to the second. According to the table, net income in the basic materials sector decreased by 26 percent from the first quarter to the second. If x represents the net income in the first quarter, $(0.74)x = 4.83$, and $x = 6.53$. The energy sector net income increased by 40 percent. If y represents the net income in the first quarter, $(1.40)\,y = 7.46$, so $y < 6$. The industrial sector changed by only 1 percent to 5.00, so the first quarter value had to be less than 6.53. For utilities, the net income increased about 300 percent, which means that the net income in the first quarter was about $\frac{1}{4}$ of 8.57, which is clearly less than 6.53. The conglomerates sector net income the first quarter was less than 2.07, so the basic materials net income was greatest in the first quarter. The best answer is A.

385. For how many integers n is $2^n = n^2$?

(A) None
(B) One
(C) Two
(D) Three
(E) More than three

For all negative values of n, 2^n would be less than 1, and n^2 would be 1 or more. If $n = 0$, $2^n = 1$ and $n^2 = 0$. If $n = 1$, $2^n = 2$ and $n^2 = 1$. If $n = 2$, $2^n = 4$ and $n^2 = 4$. If $n = 3$, $2^n = 8$ and $n^2 = 9$. If $n = 4$, $2^n = 16$ and $n^2 = 16$. And if $n \geq 5$, $2^n > n^2$. So, for only two values of n, namely 2 and 4, is $2^n = n^2$. The best answer is C.

386. The manager of a theater noted that for every 10 admission tickets sold, the theater sells 3 bags of popcorn at $2.25 each, 4 sodas at $1.50 each, and 2 candy bars at $1.00 each. To the nearest cent, what is the average (arithmetic mean) amount of these snack sales per ticket sold?

(A) $1.48
(B) $1.58
(C) $1.60
(D) $1.64
(E) $1.70

For every 10 admission tickets sold, the theater sells 3($2.25) = $6.75 in popcorn, 4($1.50) = $6.00 in sodas, and 2($1.00), = $2.00 in candy bars, for a total of $14.75. Thus, the average amount per ticket sold is $\frac{\$14.75}{10}$, or $1.48, to the nearest cent. The best answer is A.

387. If $n = 4p$, where p is a prime number greater than 2, how many different positive <u>even</u> divisors does n have, including n ?

(A) Two
(B) Three
(C) Four
(D) Six
(E) Eight

Since p is a prime greater than 2, p must be odd Therefore, the possible even divisors of $n = 4p$ are 2, 4, $2p$, and $4p$ The best answer is C

388. S is a set containing 9 different numbers. T is a set containing 8 different numbers, all of which are members of S. Which of the following statements CANNOT be true?

(A) The mean of S is equal to the mean of T.
(B) The median of S is equal to the median of T.
(C) The range of S is equal to the range of T.
(D) The mean of S is greater than the mean of T.
(E) The range of S is less than the range of T.

To determine which of the statements cannot be true, it may be easiest to consider specific sets of numbers for S and T For example, suppose S consists of the integers from 1 to 9 and T consists of the same integers except 5 Then the mean and median of S are both 5, and since the median of T is $\frac{4+6}{2} = 5$, the mean and median of T are both 5 as well Since the range of a set is the difference between the greatest and smallest numbers in the set, S and T also have the same range, $9 - 1 = 8$ Thus, the first three choices can be true. The fourth choice is true if S is the same as above and T is the set of integers from 1 to 8 The mean of S would be 5, as stated earlier, and the mean of T would be 4 5 To see that the fifth choice <u>cannot</u> be true, suppose that x denotes the number in S that is not in T If x is either the smallest or the greatest number in S, then the range of T would be less than the range of S However, if x is between the smallest number and greatest number in S, then the range of T would be equal to the range of S In any case, the range of S cannot be less than the range of T The best answer is E

389. In a recent election, James received 0.5 percent of the 2,000 votes cast. To win the election, a candidate needed to receive more than 50 percent of the vote How many additional votes would James have needed to win the election?

(A) 901
(B) 989
(C) 990
(D) 991
(E) 1,001

James received 0 5 percent of 2,000 votes, which is (0 005)(2,000) = 10 votes To win he needed more than 50 percent of 2,000, so he needed (0 5)(2,000) + 1 = 1,001 votes Therefore, he needed an additional 1,001-10 = 991 votes The best answer is D

390. The regular price per can of a certain brand of soda is \$0.40 If the regular price per can is discounted 15 percent when the soda is purchased in 24-can cases, what is the price of 72 cans of this brand of soda purchased in 24-can cases?

(A) \$16.32
(B) \$18.00
(C) \$21.60
(D) \$24.48
(E) \$28.80

The discounted price of one can of soda is (0 85)(\$0 40), or \$0 34 Therefore, the price of 72 cans of soda at the discounted price would be (72)(\$0 34), or \$24 48. The best answer is D.

391. If r and s are integers and $rs + r$ is odd, which of the following must be even?

(A) r
(B) s
(C) $r + s$
(D) $rs - r$
(E) $r^2 + s$

Since $rs + r = r(s + 1)$, which is odd, r and $s + 1$ must both be odd Therefore, r is odd and s is even Note that the other answer choices $r + s$, $rs - r$, and $r^2 + s$ must all be odd The best answer is B

List I: 3, 6, 8, 19
List II: x, 3, 6, 8, 19

392. If the median of the numbers in list I above is equal to the median of the numbers in list II above, what is the value of x ?

(A) 6
(B) 7
(C) 8
(D) 9
(E) 10

In general, to calculate the median of n numbers, first order the numbers from least to greatest If n is odd, the median is the middle number, while if n is even, the median is the average of the two middle numbers Thus, the median of the numbers in list I is $\frac{6+8}{2}$, or 7 In list II, there are 5 numbers, so the median must be the 3rd number in the list if the numbers are ordered from least to greatest Since the median must be 7 (the median of list I), x must be 7 The best answer is B

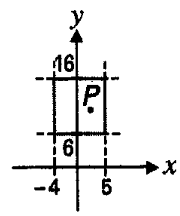
393. If $d = 2.0453$ and d^* is the decimal obtained by rounding d to the nearest hundredth, what is the value of $d^* - d$?

(A) −0.0053
(B) −0.0003
(C) 0.0007
(D) 0.0047
(E) 0.0153

d rounded to the nearest hundredth is 2 05 Therefore, $d^* = 2\ 05$, and $d^* - d = 2\ 05 - 2\ 0453$, or 0 0047 The best answer is D

394. Right triangle PQR is to be constructed in the xy-plane so that the right angle is at P and PR is parallel to the x-axis. The x- and y-coordinates of P, Q, and R are to be integers that satisfy the inequalities $-4 \le x \le 5$ and $6 \le y \le 16$. How many different triangles with these properties could be constructed?

(A) 110
(B) 1,100
(C) 9,900
(D) 10,000
(E) 12,100



In the xy-plane, point P is located in the rectangular area determined by $-4 \le x \le 5$ and $6 \le y \le 16$ (see above). Since the coordinates of points P, Q, and R are integers, there are 10 possible x values and 11 possible y values, so point P can be any one of 10(11) = 110 points in the rectangular area In the horizontal direction (left or right) from each point P there are 9 points that could be point R, and in the vertical direction (up or down) from each point P there are 10 points that could be point Q. Thus, there are 110(9)(10) = 9,900 sets of 3 points P, Q, and R, each of which determines a right triangle PQR with the right angle at P and PR parallel to the x-axis The best answer is C

395. A box contains 100 balls, numbered from 1 to 100. If three balls are selected at random and with replacement from the box, what is the probability that the sum of the three numbers on the balls selected from the box will be odd?

(A) $\frac{1}{4}$

(B) $\frac{3}{8}$

(C) $\frac{1}{2}$

(D) $\frac{5}{8}$

(E) $\frac{3}{4}$

For the sum of the three numbers on the selected balls to be odd, either (1) the numbers must all be odd, or (2) exactly one of the numbers must be odd and the other two numbers must be even Possibility (2) occurs in three different ways depending on whether the first, second, or third number is odd Thus, there are four different outcomes in which the sum could be odd Since the selection is done with replacement, each selection will be made from 50 odd-numbered and 50 even-numbered balls Therefore, the probability of selecting an odd-numbered ball is

$$\frac{\text{the number of balls with an odd number}}{\text{the total number of balls}} = \frac{50}{100} = \frac{1}{2}$$

Similarly, the probability of selecting an even-numbered ball is also $\frac{1}{2}$ Since each choice of a ball is independent of another, each of the four outcomes mentioned above has probability $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$, and so the probability that the sum of the three numbers is odd is $4\left(\frac{1}{8}\right) = \frac{1}{2}$

The best answer is C

396. How many different positive integers are factors of 441 ?

(A) 4
(B) 6
(C) 7
(D) 9
(E) 11

$441 = (9)(49) = (3^2)(7^2)$ Therefore, the factors of 441 are 1, 3, 7, 3^2, (3)(7), 7^2, $(3^2)(7)$, $(3)(7^2)$, and 441, or 1, 3, 7, 9, 21, 49, 63, 147, and 441. The best answer is D

397. Company *K*'s earnings were $12 million last year If this year's earnings are projected to be 150 percent greater than last year's earnings, what are Company *K*'s projected earnings this year?

(A) $13.5 million
(B) $15 million
(C) $18 million
(D) $27 million
(E) $30 million

If this year's earnings are projected to be 150 percent <u>greater</u> than the $12 million earned last year, then this year's earnings will be 250 percent of $12 million, or (2 5)($12 million) = $30 million The best answer is E

2, 4, 6, 8, *n*, 3, 5, 7, 9

398 In the list above, if *n* is an integer between 1 and 10, inclusive, then the median must be

(A) either 4 or 5
(B) either 5 or 6
(C) either 6 or 7
(D) *n*
(E) 5.5

The reordering of the 8 actual numbers in the list from least to greatest is 2, 3, 4, 5, 6, 7, 8, 9 Since n is an integer, it cannot have a value between the two middle numbers on the list, 5 and 6 Thus, if $n \geq 6$, the median of the 9 numbers would be 6, and if $n \leq 5$, the median of the 9 numbers would be 5 The best answer is B

399. If $0 < x < 1$, which of the following inequalities must be true?

I. $x^5 < x^3$
II. $x^4 + x^5 < x^3 + x^2$
III. $x^4 - x^5 < x^2 - x^3$

(A) None
(B) I only
(C) II only
(D) I and II only
(E) I, II, and III

If x is between 0 and 1, and if n is a positive integer, then the greater the value of n, the smaller the value of x^n. Thus, in particular, $x^5 < x^4 < x^3 < x^2$. In statement I, x^5 must be less than x^3. Concerning statement II, since x^4 and x^5 are each less than x^3 or x^2, it follows that $x^4 + x^5 < x^3 + x^2$. In statement III, note that $x^4 - x^5 = x^4(1 - x)$ and $x^2 - x^3 = x^2(1 - x)$. Thus, since $x^4 < x^2$ and $1 - x$ is positive, it follows that $x^4 - x^5 < x^2 - x^3$, and III is also true. The best answer is E

400. If $(2^x)(2^y) = 8$ and $(9^x)(3^y) = 81$, then $(x, y) =$

(A) (1, 2)
(B) (2, 1)
(C) (1, 1)
(D) (2, 2)
(E) (1, 3)

Since $(2^x)(2^y) = 8$ can be written as $2^{x+y} = 2^3$, it follows, by equating exponents, that $x + y = 3$. Similarly, $(9^x)(3^y) = 81$ can be written as $3^{2x+y} = 3^4$, so $2x + y = 4$. Therefore, from the first equation $y = 3 - x$, and substituting for y into the second equation gives $2x + 3 - x = 4$, or $x = 1$. Therefore, $y = 2$ and $(x, y) = (1, 2)$. The best answer is A

401. If $a = 1$ and $\frac{a-b}{c} = 1$, which of the following is NOT a possible value of b ?

(A) −2
(B) −1
(C) 0
(D) 1
(E) 2

From $\frac{a-b}{c} = 1$, it follows that $a - b \neq 0$, or $a \neq b$. Since it is given that $a = 1$, b cannot be equal to 1. The best answer is D

402. Which of the following is equal to x^{18} for all positive values of x ?

(A) $x^9 + x^9$
(B) $(x^2)^9$
(C) $(x^9)^9$
(D) $(x^3)^{15}$
(E) $\frac{x^4}{x^{22}}$

Note that $x^9 + x^9 = 2x^9$, $\left(x^2\right)^9 = x^{(2)(9)} = x^{18}$, $\left(x^9\right)^9 = x^{81}$, $\left(x^3\right)^{15} = x^{45}$, and $\frac{x^4}{x^{22}} = x^{-18}$. The best answer is B

403. A television manufacturer produces 600 units of a certain model each month at a cost to the manufacturer of \$90 per unit and all of the produced units are sold each month. What is the minimum selling price per unit that will ensure that the monthly profit (revenue from sales minus the manufacturer's cost to produce) on the sales of these units will be at least \$42,000 ?

(A) \$110
(B) \$120
(C) \$140
(D) \$160
(E) \$180

If the manufacturer will sell each unit for x dollars, and the cost to manufacture each unit is \$90, then the profit per unit is x − \$90. To attain a profit of at least \$42,000 on the production and sale of 600 units, $600(x - \$90) \geq \$42,000$, or $x \geq \$160$. The best answer is D

404. A square countertop has a square tile inlay in the center, leaving an untiled strip of uniform width around the tile. If the ratio of the tiled area to the untiled area is 25 to 39, which of the following could be the width, in inches, of the strip?

I. $1\frac{1}{2}$
II. 3
III. $4\frac{1}{2}$

(A) I only
(B) II only
(C) I and II only
(D) I and III only
(E) I, II, and III

Since the ratio of the tiled area to the untiled area is 25 to 39, the ratio of the total area of the countertop to the tiled area is $\frac{39+25}{25}=\frac{64}{25}$ Therefore, the ratio of the length of a side of the countertop to the length of a side of the tiled area is $\frac{8}{5}$ If x is the length of a side of the countertop and y is the length of a side of the tiled area, this means that $y = \frac{5}{8}x$ If w is the width of the untiled strip, then $w = \frac{x-y}{2}$, which implies that $w = \frac{3}{16}x$ Therefore, for any positive value of w, a countertop with a side of length $\frac{16}{3}w$ inches will have an untiled strip of width w inches, and thus any width is possible for such a countertop For example, an untiled strip of width 3 inches can be found in a countertop with a side of length $\frac{16}{3}(3) = 16$ inches Therefore, all of the values I, II, and III could be the width of the strip The best answer is E

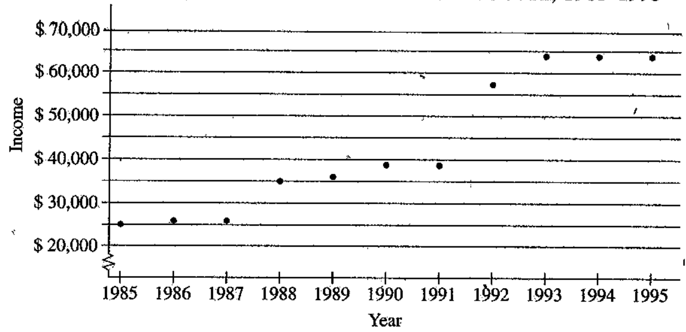
$$\begin{array}{r} 4\,\square\,7 \\ \triangle\,2\,3 \\ +\ 1\,6\,2 \\ \hline 1{,}\,2\,2\,2 \end{array}$$

405. If $\square$ and $\triangle$ represent single digits in the correctly worked computation above, what is the value of $\square + \triangle$?

(A) 7
(B) 9
(C) 10
(D) 11
(E) 13

Since the sum of the units digits is $7 + 3 + 2 = 12$, the sum of the tens digits must be $1+\square+2+6 = 12$ because 1 is carried from the sum of the units digits Thus, $\square = 3$, and 1 is carried to the hundreds column, where the sum of the digits is $1 + 4 + \triangle + 1 = 12$, or $\triangle = 6$ Therefore, $\square + \triangle = 9$ The best answer is B

THE KLEIN FAMILY'S ANNUAL INCOME, 1985-1995



406. Which of the following statements can be inferred from the data above?

I. The Klein family's annual income more than doubled from 1985 to 1995.

II. The Klein family's annual income increased by a greater amount from 1985 to 1990 than from 1990 to 1995.

III. The Klein family's average (arithmetic mean) annual income for the period shown was greater than $40,000.

(A) I only
(B) II only
(C) I and III only
(D) II and III only
(E) I, II, and III

The Klein family's income increased from $25,000 in 1985 to over $60,000 in 1995, so it more than doubled, and statement I can be inferred from the data The family's income increased from $25,000 in 1985 to approximately $38,000 in 1990, an increase of about $13,000 From 1990 to 1995 its income increased by more than $20,000 (from about $38,000 to more than $60,000), so statement II cannot be inferred from the data The family's average income per year for the 7 years from 1985–1991 appears to be about $35,000, and for the 4 years 1992–1995 it appears to average more than $60,000 per year Thus, the average annual income for the 11 years is about,

$$\frac{7(\$35{,}000)+4(\$60{,}000)}{11}=\frac{\$245{,}000+\$240{,}000}{11}=\frac{\$485{,}000}{11},$$

which is greater than $40,000 Therefore, statement III can be inferred from the data The best answer is C

407. Anne bought a computer for $2,000 and then paid a 5 percent sales tax, and Henry bought a computer for $1,800 and then paid a 12 percent sales tax. The total amount that Henry paid, including sales tax, was what percent less than the total amount that Anne paid, including sales tax?

(A) 3%
(B) 4%
(C) 7%
(D) 10%
(E) 12%

Anne paid a total amount of (1 05)($2,000) = $2,100, and Henry paid a total amount of (1 12)(1,800) = $2,016 Therefore, Henry paid $2,100 – $2,016 = $84 less than Anne paid, which was $\frac{84}{2,100}$ = 4 percent less The best answer is B

408. If $\frac{x}{y} = \frac{2}{3}$, then $\frac{x-y}{x} =$

(A) $-\frac{1}{2}$

(B) $-\frac{1}{3}$

(C) $\frac{1}{3}$

(D) $\frac{1}{2}$

(E) $\frac{5}{2}$

$\frac{x}{y} = \frac{2}{3}$ and $\frac{x-y}{x} = \frac{x}{x} - \frac{y}{x} = 1 - \frac{y}{x}$ Therefore, $\frac{x-y}{x} = 1 - \frac{3}{2} = -\frac{1}{2}$ The best answer is A

409. If $4x + 3y = -2$ and $3x + 6 = 0$, what is the value of y ?

(A) $-3\frac{1}{3}$

(B) -2

(C) $-\frac{2}{3}$

(D) $\frac{2}{3}$

(E) 2

Since $3x + 6 = 0$, $x = -2$ Then, substituting -2 into the equation $4x + 3y = -2$ for x, $4(-2) + 3y = -2$, or $y = 2$ The best answer is E

I. 72, 73, 74, 75, 76
II. 74, 74, 74, 74, 74
III. 62, 74, 74, 74, 89

410. The data sets I, II, and III above are ordered from greatest standard deviation to least standard deviation in which of the following?

(A) I, II, III
(B) I, III, II
(C) II, III, I
(D) III, I, II
(E) III, II, I

In data set II there is no variation, so the standard deviation is 0 Data set I has small deviations from the mean of 74, so the standard deviation is greater in I than in II Because of the extreme values 62 and 89, the variation in set III is clearly greater than the variation in I So, the standard deviation in III is greater than the standard deviation in I The best answer is D

411. The contents of a certain box consist of 14 apples and 23 oranges. How many oranges must be removed from the box so that 70 percent of the pieces of fruit in the box will be apples?

(A) 3
(B) 6
(C) 14
(D) 17
(E) 20

There are a total of 37 pieces of fruit in the box If x oranges must be removed, leaving $37 - x$ pieces of fruit, then the 14 apples in the box would constitute 70 percent of $37 - x$ Therefore, $\frac{14}{37-x} = 0.70$, or $x = 17$ Alternatively, since 14 is 70 percent of 20, the number of oranges must be reduced to 6. Since there are currently 23 oranges in the box, this means that $23 - 6 = 17$ oranges must be removed The best answer is D.

412. If n is a positive integer and n^2 is divisible by 72, then the largest positive integer that must divide n is

(A) 6
(B) 12
(C) 24
(D) 36
(E) 48

If n^2 is divisible by 72, then $n^2 = 72k$ for some positive integer k Since n^2 is a perfect square and $72 = 2^3 3^2$, k must be even, so 144 must divide n^2 and 12 must divide n Now note that if $n = 12$, then $n^2 = 144$ is divisible by 72 Therefore, no integer greater than 12 will necessarily divide all n such that n^2 is divisible by 72 The best answer is B

413. If −3 is 6 more than x, what is the value of $\frac{x}{3}$?

(A) −9
(B) −6
(C) −3
(D) −1
(E) 1

If −3 is 6 more than x, then $-3 = x + 6$ Therefore, $x = -9$ and $\frac{x}{3} = \frac{-9}{3}$, or −3 The best answer is C

$$r = 400\left(\frac{D+S-P}{P}\right)$$

414. If stock is sold three months after it is purchased, the formula above relates P, D, S, and r, where P is the purchase price of the stock, D is the amount of any dividend received, S is the selling price of the stock, and r is the yield of the investment as a percent. If Rose purchased \$400 worth of stock, received a dividend of \$5, and sold the stock for \$420 three months after purchasing it, what was the yield of her investment according to the formula? (Assume that she paid no commissions.)

(A) 1.25%
(B) 5%
(C) 6.25%
(D) 20%
(E) 25%

In this example, D is \$5, S is \$420, and P is \$400 Therefore, according to the formula, the yield r of the investment, as a percent is $400\left(\frac{5+420-400}{400}\right)$, or $r = 25$ So, the yield is 25% The best answer is E

415. An athlete runs R miles in H hours, then rides a bicycle Q miles in the same number of hours. Which of the following represents the athlete's average speed, in miles per hour, for these two activities combined?

(A) $\frac{R-Q}{H}$

(B) $\frac{R-Q}{2H}$

(C) $\frac{2(R+Q)}{H}$

(D) $\frac{2(R+Q)}{2H}$

(E) $\frac{R+Q}{2H}$

Average speed in miles per hour is defined as distance in miles divided by time in hours The athlete travels a total of $R + Q$ miles in $H + H$ hours, so the average speed in miles per hour can be represented by $\frac{R+Q}{2H}$ The best answer is E

416. If a certain sample of data has a mean of 20 0 and a standard deviation of 3.0, which of the following values is more than 2 5 standard deviations from the mean?

(A) 12.0
(B) 13.5
(C) 17.0
(D) 23.5
(E) 26.5

To be more than 2 5 standard deviations from the mean of a sample of data, a value must be either more than 2 5 standard deviations above the mean or more than 2 5 standard deviations below the mean. So, in this case, to be more than 2 5 standard deviations from the mean of 20, the value must be either greater than $20 + 2.5(3) = 27\ 5$, or less than $20 - 2\ 5(3) = 12\ 5$ The best answer is A

417. Which of the following is the least positive integer that is divisible by 2, 3, 4, 5, 6, 7, 8, and 9 ?

(A) 15,120
(B) 3,024
(C) 2,520
(D) 1,890
(E) 1,680

The 8 numbers 2, 3, 4, 5, 6, 7, 8, and 9, have only the prime factors 2, 3, 5, and 7 So the least positive integer that is divisible by each of those numbers must have as factors 2^a, 3^b, 5^c and 7^d, where a, b, c, and d are each the maximum number of times that the particular prime occurs as a factor in any of the 8 numbers The maximum number of times that 2 occurs in any number is 3 (That is, $2^3 = 8$) The maximum for 3 is 2 (that is, $3^2 = 9$), and the maximum for 5 and 7 are each 1 So, the least positive integer is $2^3 \times 3^2 \times 5^1 \times 7^1$, or 2,520 The best answer is C

418. Of the 50 researchers in a workgroup, 40 percent will be assigned to team *A* and the remaining 60 percent to team *B* However, 70 percent of the researchers prefer team *A* and 30 percent prefer team *B* What is the least possible number of researchers who will NOT be assigned to the team they prefer?

(A) 15
(B) 17
(C) 20
(D) 25
(E) 30

The number of researchers assigned to team *A* will be (0 40)(50), or 20 So, 30 will be assigned to team *B* The number of researchers who prefer team *A* is (0 70)(50), or 35, and the rest, 15, prefer team *B* Therefore, to minimize the number who will not be assigned to the team they prefer, let the 15 who prefer *B* be assigned to *B* That leaves 35 who prefer *A*, but only 20 of them can be assigned to *A*, leaving 15 workers who will not be assigned to the team they prefer The best answer is A

419. Last year, a certain public transportation system sold an average (arithmetic mean) of 41,000 tickets per day on weekdays (Monday through Friday) and an average of 18,000 tickets per day on Saturday and Sunday. Which of the following is closest to the total number of tickets sold last year?

(A) 1 million
(B) 1 25 million
(C) 10 million
(D) 12.5 million
(E) 125 million

Last year, on the average, each week the number of tickets sold was 5(41,000) + 2(18,000) or 241,000 Assuming 52 weeks in the year, the total number sold for the year was (52)(241,000), or 12,532,000, which is approximately 12 5 million. For a less detailed calculation, one can note that (52)(241,000) is slightly greater than (50)(240,000) or 12,000,000. The best answer is D

County	Amount Recycled	Amount Disposed of
A	16,700	142,800
B	8,800	48,000
C	13,000	51,400
D	3,900	20,300
E	3,300	16,200

420 The table above shows the amount of waste material, in tons, recycled by each of five counties in a single year and the amount of waste material, also in tons, that was disposed of in landfills by the five counties in that year. Which county had the lowest ratio of waste material disposed of to waste material recycled in the year reported in the table?

(A) *A*
(B) *B*
(C) *C*
(D) *D*
(E) *E*

The county with the lowest ratio of material disposed of to material recycled is the one with the lowest fraction $\frac{\text{Amount Disposed of}}{\text{Amount Recycled}}$ If this fraction were calculated from each county, County *C* would have the lowest ratio Without doing the actual calculations, however, a close look at each pair of amounts reveals that the ratio is greater than 4 for Counties *A*, *B*, *D*, and *E*, but less than 4 for County *C* So, the ratio in County *C* is lowest The best answer is C

421. If a number between 0 and $\frac{1}{2}$ is selected at random, which of the following will the number most likely be between?

(A) 0 and $\frac{3}{20}$

(B) $\frac{3}{20}$ and $\frac{1}{5}$

(C) $\frac{1}{5}$ and $\frac{1}{4}$

(D) $\frac{1}{4}$ and $\frac{3}{10}$

(E) $\frac{3}{10}$ and $\frac{1}{2}$

Each of the given pairs of numbers defines a segment of the number line between 0 and $\frac{1}{2}$, and the length of each segment is found by subtracting the first number from the second The number selected is most likely to be in the longest of these segments Therefore, it is most likely that the number selected will be between the given pair of numbers whose difference is greatest To compare the five differences most easily, one can use 20 as a common denominator when computing each difference The differences would then be $\frac{3}{20}$, $\frac{1}{20}$, $\frac{1}{20}$, $\frac{1}{20}$, and $\frac{4}{20}$, respectively The best answer is E

District	Number of Votes	Percent of Votes for Candidate *P*	Percent of Votes for Candidate *Q*
1	800	60	40
2	1,000	50	50
3	1,500	50	50
4	1,800	40	60
5	1,200	30	70

422. The table above shows the results of a recent school board election in which the candidate with the higher total number of votes from the five districts was declared the winner. Which district had the greatest number of votes for the winner?

(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

A careful look at the table reveals that candidates *P* and *Q* were even in districts 2 and 3, and they reversed percents (60 and 40) in districts 1 and 4, although there were many more voters in district 4, in which *Q* had 60 percent of the vote Finally, *Q* clearly won in district 5 with 70 percent of the vote So, *Q* was the winner, and *Q* received 1,800 (0 60), or 1,080 votes in district 4, which was the greatest number of votes for *Q* in any district The best answer is D

423. If m is the average (arithmetic mean) of the first 10 positive multiples of 5 and if M is the median of the first 10 positive multiples of 5, what is the value of $M - m$?

(A) –5
(B) 0
(C) 5
(D) 25
(E) 27.5

The first 10 positive multiples of 5 are 5, 10, 15, , 50 The mean m is the sum of these numbers divided by 10, or $\frac{5+10+15+\ \ +50}{10} = \frac{5(1+2+3+\ \ +10)}{10} = \frac{5(55)}{10} =$ 27 5. The median M of these numbers is the mean of the two middle-valued numbers, 25 and 30 So, $M = \frac{25+30}{2}$, or 27 5 Therefore $M - m = 0$ The best answer is B

424. If n is a positive integer less than 200 and $\frac{14n}{60}$ is an integer, then n has how many different positive prime factors?

(A) Two
(B) Three
(C) Five
(D) Six
(E) Eight

Since $\frac{14n}{60}$, which equals $\frac{7n}{60}$, is an integer, it follows that n is divisible by 30 The possible values of n are therefore 30, 60, 90, 120, 150, and 180. Each of these values has exactly three different positive prime factors 2, 3, and 5 The best answer is B

Day	Change in Dollars
Monday	$+1\frac{1}{2}$
Tuesday	$-\frac{3}{4}$
Wednesday	0
Thursday	$-\frac{1}{8}$
Friday	$+2\frac{1}{4}$

425. The table above shows the daily change in the price of a certain stock last week. What was the net change in dollars in the price of the stock for the week?

(A) $-4\frac{5}{8}$

(B) $-2\frac{7}{8}$

(C) $+2\frac{7}{8}$

(D) $+3\frac{3}{4}$

(E) $+4\frac{5}{8}$

The net change in the price of the stock for the week, in dollars, is the sum of all the change values for the week, that is, $1\frac{1}{2} + (-\frac{3}{4}) + 0 + (-\frac{1}{8}) + 2\frac{1}{4}$, or $2\frac{7}{8}$ The best answer is C

426. **A group of store managers must assemble 280 displays for an upcoming sale. If they assemble 25 percent of the displays during the first hour and 40 percent of the remaining displays during the second hour, how many of the displays will not have been assembled by the end of the second hour?**

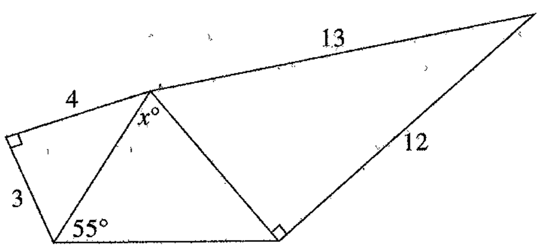
(A) 70
(B) 98
(C) 126
(D) 168
(E) 182

During the first hour, (0 25)(280), or 70, displays will be assembled, and during the second hour (0 40)(280 – 70), or 84, will be assembled Therefore, at the end of the second hour there will be 280 – 70 – 84, or 126, displays that will not have been assembled The best answer is C

427. **The temperatures in degrees Celsius recorded at 6 in the morning in various parts of a certain country were 10°, 5°, –2°, –1°, –5°, and 15°. What is the median of these temperatures?**

(A) –2°C
(B) –1°C
(C) 2°C
(D) 3°C
(E) 5°C

There are 6 temperature values, so after the values are listed in increasing order –5°, –2°, –1°, 5°, 10°, 15°, the median of the values is the mean of the 2 middle values So, the median is $\frac{-1^\circ + 5^\circ}{2} = 2^\circ$ The best answer is C



428. **In the figure above, what is the value of x ?**

(A) 55
(B) 60
(C) 65
(D) 70
(E) 75

In the right triangle with sides of lengths 3 and 4, the length of the third side s can be found by using the Pythagorean theorem. $s^2 = 3^2 + 4^2$, so $s = 5$ Similarly, in the other right triangle the same theorem can be used to find the third side $t^2 + 12^2 = 13^2$, or $t = 5$ Therefore, the triangle with the angle of $x°$ has two sides of length 5 and the angles opposite these sides must have equal measures So, in that triangle, $55° + 55° + x° = 180°$, or $x = 70$ The best answer is D

1	2	3	4	5	6	7
–2	–4	–6	–8	–10	–12	–14
3	6	9	12	15	18	21
–4	–8	–12	–16	–20	–24	–28
5	10	15	20	25	30	35
–6	–12	–18	–24	–30	–36	–42
7	14	21	28	35	42	49

429 **What is the sum of the integers in the table above?**

(A) 28
(B) 112
(C) 336
(D) 448
(E) 784

The sum of the numbers in the first row is $1 + 2 + 3 + \quad + 7 = 28$ Note that in each of the other 6 rows, the sum can be expressed as an integer n multiplied by $1 + 2 + 3 + \quad + 7$, or simply $(n)(28)$ For example, in the 2nd row n would be –2 and the sum would be $(-2)(28)$ For the 7 rows, the values of n are 1, –2, 3, –4, 5, –6, and 7 So, the total sum of all rows is the sum of the 7 values of n multiplied by 28, or $4(28) = 112$ The best answer is B

430. **If $m > 0$ and x is m percent of y, then, in terms of m, y is what percent of x ?**

(A) $100m$

(B) $\frac{1}{100m}$

(C) $\frac{1}{m}$

(D) $\frac{10}{m}$

(E) $\frac{10{,}000}{m}$

Since x is m percent of y, $\frac{x}{y} = \frac{m}{100}$, and therefore, $\frac{y}{x} = \frac{100}{m}$ To convert the fraction $\frac{100}{m}$ to an equivalent percent, one can multiply by 100 to obtain $\frac{10{,}000}{m}$

The best answer is E

3, *k*, 2, 8, *m*, 3

431. The arithmetic mean of the list of numbers above is 4. If k and m are integers and $k \neq m$, what is the median of the list?

(A) 2
(B) 2.5
(C) 3
(D) 3.5
(E) 4

Since the arithmetic mean of the 6 numbers is 4, $\frac{3+k+2+8+m+3}{6} = 4$, and therefore $k + m = 8$

The list of the 4 numbers other than k and m, in order of size, is 2, 3, 3, 8 Since k and m are integers such that $k \neq m$ and $k + m = 8$, either $k \leq 3$ and $m \geq 5$ or $m \leq 3$ and $k \geq 5$ Therefore, when the 6 numbers are listed in increasing order, the two middle numbers in the list will both be 3 So the median of the list is 3

The best answer is C

432. A certain junior class has 1,000 students and a certain senior class has 800 students. Among these students, there are 60 sibling pairs, each consisting of 1 junior and 1 senior. If 1 student is to be selected at random from each class, what is the probability that the 2 students selected will be a sibling pair?

(A) $\frac{3}{40,000}$

(B) $\frac{1}{3,600}$

(C) $\frac{9}{2,000}$

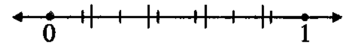
(D) $\frac{1}{60}$

(E) $\frac{1}{15}$

The probability of selecting a student from the 1,000 juniors who is a member of a sibling pair is $\frac{60}{1,000}$

Then, the probability of selecting the 1 student among the 800 seniors who is the other member of that pair is $\frac{1}{800}$ Therefore, the probability that the 2 students selected will be a sibling pair is $\left(\frac{60}{1,000}\right)\left(\frac{1}{800}\right) = \frac{3}{40,000}$

The best answer is A



433. On the number line above, the segment from 0 to 1 has been divided into fifths, as indicated by the large tick marks, and also into sevenths, as indicated by the small tick marks. What is the <u>least</u> possible distance between any two of the tick marks?

(A) $\frac{1}{70}$

(B) $\frac{1}{35}$

(C) $\frac{2}{35}$

(D) $\frac{1}{12}$

(E) $\frac{1}{7}$

The small tick marks are placed at $\frac{1}{7}, \frac{2}{7}, \frac{3}{7}, \frac{4}{7}, \frac{5}{7}$, and, $\frac{6}{7}$ and the large tick marks are at $\frac{1}{5}, \frac{2}{5}, \frac{3}{5}$, and $\frac{4}{5}$ It would be much easier to compare distances between any 2 tick marks if the fractions all had the same denominator The least common denominator of all the fractions is 35, so if all fractions were converted to 35, the comparison of the numerators would be sufficient to determine the least distance So, the numerators for the small ticks would be 5, 10, 15, 20, 25, and 30, and the others would be 7, 14, 21, and 28 The least distance between any 2 of these numerators is 1, so the least actual distance is $\frac{1}{35}$

The best answer is B

434. A certain musical scale has 13 notes, each having a different frequency, measured in cycles per second In the scale, the notes are ordered by increasing frequency, and the highest frequency is twice the lowest For each of the 12 lower frequencies, the ratio of a frequency to the next higher frequency is a fixed constant. If the lowest frequency is 440 cycles per second, then the frequency of the 7th note in the scale is how many cycles per second?

(A) $440\sqrt{2}$

(B) $440\sqrt{2^7}$

(C) $440\sqrt{2^{12}}$

(D) $440\sqrt[12]{2^7}$

(E) $440\sqrt[7]{2^{12}}$

If x represents the constant ratio from one frequency to the next, the 2nd frequency, in cycles per second, would be $440x$, the 3rd would be $440x^2$, the 7th would be $440x^6$ and the 13th would be $440x^{12}$ Since the 13th frequency is twice the 1st, $440x^{12}$ must be (2)(440), or 880 Thus, $440x^{12} = 880$, or $x^{12} = 2$ Therefore, since $x^{12} = (x^6)^2 = 2$, $x^6 = \sqrt{2}$, and so the 7th frequency is $440x^6$, $= 440\sqrt{2}$ The best answer is A

435. If $a = 7$ and $b = -7$, what is the value of $2a - 2b + b^2$?

(A) -49
(B) 21
(C) 49
(D) 63
(E) 77

By substitution, the value of $2a - 2b + b^2 =$ $2(7) - 2(-7) + (-7)^2 = 14 + 14 + 49$, or 77 The best answer is E

436. Equal amounts of water were poured into two empty jars of different capacities, which made one jar $\frac{1}{4}$ full and the other jar $\frac{1}{3}$ full. If the water in the jar with the lesser capacity is then poured into the jar with the greater capacity, what fraction of the larger jar will be filled with water?

(A) $\frac{1}{7}$

(B) $\frac{2}{7}$

(C) $\frac{1}{2}$

(D) $\frac{7}{12}$

(E) $\frac{2}{3}$

Since the amounts of water in the two jars were equal, the jar with the greater capacity is $\frac{1}{4}$ full and the jar with the lesser capacity is $\frac{1}{3}$ full. Therefore, when the water in the smaller jar is poured into the larger jar, it will double the amount in the larger jar, which will then be $\frac{1}{2}$ full The best answer is C.

437. If Mel saved more than \$10 by purchasing a sweater at a 15 percent discount, what is the smallest amount the original price of the sweater could be, to the nearest dollar?

(A) 45
(B) 67
(C) 75
(D) 83
(E) 150

If the original price of the sweater was P dollars, then (0 15) P must be greater than 10, or (0 15) $P > 10$

Since $P > \frac{10}{0\ 15}$, $P > 66\ 67$ The best answer is B

438. Which of the following CANNOT be the median of the three positive integers x, y, and z ?

(A) x
(B) z
(C) $x + z$
(D) $\frac{x+z}{2}$
(E) $\frac{x+z}{3}$

If x, y, and z were ordered according to size, any one of them could be the middle one, which is the median Thus, either of the first two choices is a possible median Since x, y, and z are all positive, either of the smaller numbers added to the greatest number would be greater than the middle number, and the smallest number added to the middle number would be greater than the middle number Therefore, $x + z$ cannot be the median [Note $\frac{x+z}{2}$ could be the median if x, y, and z were 2, 4, and 6, respectively, and $\frac{x+z}{3}$ could be the median if x, y, and z were 2, 4, and 10, respectively] The best answer is C

439 $\frac{(8^2)(3^3)(2^4)}{96^2} =$

(A) 3
(B) 6
(C) 9
(D) 12
(E) 18

$96^2 = (8^2)(12^2) = (8^2)(3^2)(4^2)$ and $4^2 = 2^4$ Thus,

$\frac{(8^2)(3^3)(2^4)}{96^2} = \frac{(8^2)(3^3)(2^4)}{(8^2)(3^3)(2^4)} = 3$ The best answer is A

440. What is the 25th digit to the right of the decimal point in the decimal form of $\frac{6}{11}$?

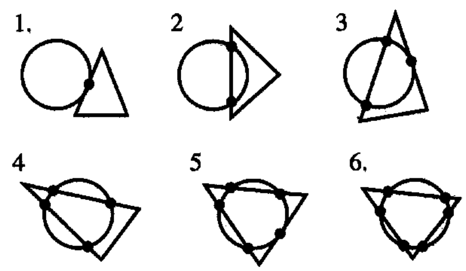
(A) 3
(B) 4
(C) 5
(D) 6
(E) 7

In the decimal form of $\frac{6}{11}$, the digits 54 repeat indefinitely, that is, $\frac{6}{11} = 0\ 545454$ Since every odd-numbered digit to the right of the decimal point is 5, the 25th digit must be 5 The best answer is C.

441. Which of the following lists the number of points at which a circle can intersect a triangle?

(A) 2 and 6 only
(B) 2, 4, and 6 only
(C) 1, 2, 3, and 6 only
(D) 1, 2, 3, 4, and 6 only
(E) 1, 2, 3, 4, 5, and 6

A circle can intersect a triangle in 1, 2, 3, 4, 5, or 6 points, as shown



The best answer is E