ARITHMETIC SOLVED QUESTIONS

Problem Solving

1) A boy has a few articles, all identical. If he sells them at $8 apiece, he loses $250. However, if he sells them at $9 per piece he gains $125. How many articles does he have?

A. 125
B. 250
C. 300
D. 375
E. 400

Explanation: Let the number of articles be x.
Total selling price if sold at $8 apiece = $\$8x$
Since his loss is $250, total cost price = $\$(8x + 250)$
Total selling price if sold at $9 apiece = $\$9x$
Since his loss is $125, total cost price = $\$(9x - 125)$

Thus, we have:
$8x + 250 = 9x - 125$
$=> x = 375$

The correct answer is option D.

2) A person sold an article at $56 and got a percentage profit equal to the numerical value of the cost price. What is the cost price of the article?

A. $24.64
B. $31.36
C. $35.00
D. $40.00
E. $42.34

Explanation:
Let the cost price be $\$x$.

Percent profit = $x\%$

Thus, selling price

$= \$(x + x\% \text{ of } x)$
$= \$\left\{x\left(1 + \frac{x}{100}\right)\right\}$

Thus, we have:
$x\left(1 + \frac{x}{100}\right) = 56$
$=> x(100 + x) = 5600$
$=> x^2 + 100x - 5600 = 0$
$=> x^2 + 140x - 40x - 5600 = 0$
$=> (x + 140)(x - 40) = 0$
$=> x = -140$ OR 40
Since x must be positive, we have: $x = 40$

The correct answer is option D.

3) A, B and C have some marbles. The number of marbles with A is 20% greater than that with C and 40% less than that with B. The number of marbles with B is what percent of the number of marbles with C?

A. 25%
B. 50%
C. 100%
D. 125%
E. 200%

Explanation: Let the number of marbles with C be 100.

Since the number of marbles with A is 20% greater than that with C, we have:
The number of marbles with A = 100 + 20% of 100 = 120
Let the number of marbles with B be x.
Since the number of marbles with A is 40% less than that with B, we have:
The number of marbles with A = $x - 40\%$ of $x = x\left(1 - \frac{40}{100}\right) = 0.6x$
Thus, we have:
$0.6x = 120$
$=> x = 200$

Thus, the number of marbles with B = 200

Thus, the required percent

$$= \frac{\text{Number of marbles of B}}{\text{Number of marbles of C}} = \frac{200}{100} * 100 = 200\%$$

The correct answer is option E.

4) In a class, 30% of the students are boys. 25% of the boys and 50% of the girls wear glasses. What is the minimum number of students in the class?

A. 20
B. 40
C. 100
D. 120
E. 200

Explanation: Let the number of students in the class be x.
Thus, the number of boys = 30% of $x = \frac{3x}{10}$ … (i)

Number of girls = $x - \frac{3x}{10} = \frac{7x}{10}$ … (ii)

Number of boys with glasses = 25% of $\left(\frac{3x}{10}\right) = \frac{25}{100} * \frac{3x}{10} = \frac{3x}{40}$ … (iii)

Number of girls with glasses = 50% of $\left(\frac{7x}{10}\right) = \frac{50}{100} * \frac{7x}{10} = \frac{7x}{20}$ … (iv)

Since the number of students are integers, each of (i), (ii), (iii) and (iv) must be integers.

Thus, the value of x must be the LCM of the denominators of the above fractions
= LCM (10, 10, 40, 20) = 40

The correct answer is option B.

5) In a camp of 100 soldiers, the food supply is estimated to last a certain number of days. However, after 13 days, 100 more soldiers join the camp and the food supply now lasts for

12 more days. What was the original time estimate? Assume that each soldier always consumes the same fixed quantity of food each day.

A. 24 days
B. 25 days
C. 31 days
D. 37 days
E. 43 days

Explanation: Let the original estimate of the number of days = x days.
Let each soldier consume 1 unit of food per day.

Thus, the total food supply for 100 soldiers = $100 * x * 1 = 100x$ units.

In 13 days, food consumed = $100 * 13 * 1 = 1300$ units.

Quantity of food left = $(100x - 1300)$ units.

Number of soldiers present now = 100 + 100 = 200.

Number of days the food lasts = 12 days.

Thus, quantity of food consumed in 12 days = $200 * 12 * 1 = 2400$ units.

Thus, we have: $100x - 1300 = 2400 => x = 37$

Alternate approach:
We know that, for 200 soldiers, the remaining food lasts for 12 days.

Thus, if there were only 100 soldiers, i.e. no new soldiers joined, the food would have lasted for $12 * 2 = 24$ days.
However, the food had already been consumed for 13 days initially.
Thus, the initial estimate = $13 + 24 = 37$ days.

The correct answer is option D.

6) A cistern can be filled by two pipes in 20 minutes and 30 minutes, and can be emptied by a third pipe. If all the pipes are turned on at once and after 8 minutes the cistern is half full, in what time can the third pipe empty the full cistern?

A. 36 minutes
B. 45 minutes
C. 48 minutes
D. 54 minutes
E. 60 minutes

Explanation: Let the time taken by the third pipe to empty the full cistern be x minutes.

Thus, the emptying pipe can empty $\frac{1}{x}$ part of the cistern.
The filling pipes can fill the cistern in 20 minutes and 30 minutes.

Thus, in 1 minute, the filling pipes can fill $\frac{1}{20}$ and $\frac{1}{30}$ part of the cistern, respectively.
Thus, with all three pipes working together, part of the cistern filled in 1 minute
$= \frac{1}{20} + \frac{1}{30} - \frac{1}{x}$

Since the cistern is half filled in 8 minutes, it would be filled in 2 * 8 = 16 minutes.

Thus, $\frac{1}{16}$ of the part of the cistern is filled in 1 minute.

Thus, we have:
$\frac{1}{20} + \frac{1}{30} - \frac{1}{x} = \frac{1}{16}$
$=> \frac{1}{x} = \frac{1}{20} + \frac{1}{30} - \frac{1}{16} = \frac{1}{48}$
$=> x = 48$

Alternate approach:
The filling pipes can fill the cistern in 20 minutes and 30 minutes.
Since the cistern is half filled in 8 minutes, it would be filled in 2 * 8 = 16 minutes.
Thus, the fractions of the cistern they fill in 16 minutes are $\frac{16}{20}$ and $\frac{16}{30}$ part, respectively.

Thus, fraction of the cistern filled = $\frac{16}{20} + \frac{16}{30} = \frac{16}{12} = \frac{4}{3}$

This implies that the cistern in filled in excess of its capacity.
Thus, fraction of the cistern emptied by the third pipe = $\frac{4}{3} - 1 = \frac{1}{3}$
Thus, the emptying pipe empties $\frac{1}{3}$ of the cistern in 16 minutes.

Thus, it can empty the entire cistern in 3 * 16 = 48 minutes.

The correct answer is option C.

7) Two brothers, A and B, set out for a station 9 miles away from their home. They both walk at 3 miles per hour. After going one mile, A decided to return to their home for an urgent work. At what rate (in miles per hour) must A now walk in order that he reaches the station at the same time as B, given that he spends 30 minutes at his home?

A. $3\frac{1}{2}$
B. $3\frac{3}{4}$
C. $4\frac{8}{13}$
D. $5\frac{1}{3}$
E. 6

Explanation: Distance to be covered = 9 miles.
Speed of each brother = 3 miles per hour.
Thus, time taken by B to reach the station = $\frac{9}{3} = 3$ hours.
Time taken by A to cover 1 mile = $\frac{1}{3}$ hour.

Since A decides to return home, spend 30 minutes ($\frac{1}{2}$ an hour) there and again travel to the station, reaching at the same time as B, he needs to complete the above in $3 - \frac{1}{3} = \frac{8}{3}$ hours.

Thus, time needed to return home and travel to the station = $\frac{8}{3} - \frac{1}{2} = \frac{13}{6}$ hours.
Total distance he needs to cover = 1 mile (return) + 9 miles (forward) = 10 miles.

Thus, his speed = $\frac{10}{\left(\frac{13}{6}\right)} = \frac{60}{13} = 4\frac{8}{13}$ miles per hour.

The correct answer is option C.

8) If p, q, r, s are distinct numbers such that: $p + r = 2s$ and $q + s = 2r$, which of the following statements must be true?

I. p cannot be the average (arithmetic mean) of p, q, r, s

II. q cannot be the average (arithmetic mean) of p, q, r, s
III. s cannot be the average (arithmetic mean) of p, q, r, s

A. Only statement I
B. Only statement II
C. Only statement III
D. Both statements I and II
E. I, II and III

Explanation: Since $p + r = 2s$, we can say that s is the average of p and r.

Thus, if p, r, s are arranged in order, the order would be either p, s, r or r, s, p.

Similarly, since $q + s = 2r$, we can say that r is the average of q and s.

Thus, if q, s, r are arranged in order, the order would be either q, r, s or s, r, q.

Thus, combining the above two results, we can have the following two orders:

p, s, r, q

OR

q, r, s, p

Since p and q are the numbers in the extreme positions, neither of them can be the average of the four numbers.

Again, since s is the mean of p and r, s is equidistant from p and r.

Similarly, r is equidistant from q and s.

Thus, when arranged in order, the gap between any two consecutive numbers must be the same.

Since the four numbers are distinct, we can thus say that the average of the four numbers would be a number between r and s.

Hence, the average of the four numbers cannot be r or s.

Hence, all the three statements are correct.

The correct answer is option E.

9) A manufacturer fixes the sales price of an article by adding together the cost of production, excise duty (5% of the cost of the production) and his profit (20% of the cost of production) and sells the article to the retailer. The retailer marks the price at 20% above his cost price and allows 6% discount on that price for cash payment. Find the manufacturing cost of an article for which a customer makes a cash payment of $705 to the retailer.

A. $508
B. $500
C. $482
D. $423
E. $400

Explanation: Let the manufacturing cost be $100
Thus, the sales price of the manufacturer = $(100 + 5\% \text{ of } 100 + 20\% \text{ of } 100) = \$125$
Thus, the cost price of the retailer = $125

Marked price set by the retailer = $(125 + 20\% \text{ of } 125) = \$150$
Discount offered by the retailer for cash payment = $(6\% \text{ of } 150) = \$9$
Thus, sales price for cash payment = $(150 - 9) = \$141$
Thus, if the final sales price is $141, the manufacturing cost is $100

Thus, if the final sales price is $705, the manufacturing cost

$$= \$\left(\frac{100}{141} * 705\right)$$
$$= \$\left(100 * \frac{705}{141}\right)$$
$$= \$500$$

The correct answer is option B.

10) A completes a piece of work in 24 days, B in 40 days and D in 60 days. They all begin together but A alone continues the work till the end while B leaves 2 days before the completion and D, 7 days before the completion of the work. In how many days is the work completed?

A. 12 days
B. 14 days
C. 16 days
D. 18 days
E. 19 days

Explanation: Let the work lasts for x days.

Thus, A works for x days, B works for $(x-2)$ days and D works for $(x-7)$ days.

Since A completes a piece of work in 24 days, B in 40 days and D in 60 days, fractions of the work completed by them in 1 day are $\frac{1}{24}, \frac{1}{40}$ and $\frac{1}{60}$, respectively.

Thus, total work completed by A in x days, B in $(x-2)$ days and D in $(x-7)$ days

$$= \frac{x}{24} + \frac{x-2}{40} + \frac{x-7}{60} = \frac{5x + 3(x-2) + 2(x-7)}{120}$$

$$= \frac{10x - 20}{120}$$

$$= \frac{x-2}{12}$$

Since the work is completed, we have:

$$\frac{x-2}{12} = 1$$

$$=> x = 14$$

Alternate approach:
We can say that at the end, A worked for 2 days alone, where he completed

$= \frac{2}{24} = \frac{1}{12}$ of the work

Before that, A and B worked for 5 days, where they completed

$= 5\left(\frac{1}{24} + \frac{1}{40}\right) = \frac{1}{3}$ of the work

Thus, work left = $1 - \left(\frac{1}{12} + \frac{1}{3}\right) = \frac{7}{12}$

This was completed by all three working together.

Since all three together complete $\left(\frac{1}{24} + \frac{1}{40} + \frac{1}{60}\right) = \frac{1}{12}$ of the work in 1 day.

Thus, time required $= \frac{\left(\frac{7}{12}\right)}{\left(\frac{1}{12}\right)} = 7$ days.

Thus, total time taken = 7 days + 5 days + 2 days = 14 days.

The correct answer is option B.

Data Sufficiency

Directions: These data sufficiency problem consists of a question and two statements, labeled (1) and (2), in which certain data are given. You have to decide whether the data given in the statements are sufficient for answering the question. Using the data given in the statements, plus your knowledge of mathematics and everyday facts (such as the number of days in July or the meaning of the word counterclockwise), you must indicate whether:

A. Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient to answer the question asked.
B. Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient to answer the question asked.
C. BOTH statements (1) and (2) TOGETHER are sufficient to answer the question asked, but NEITHER statement ALONE is sufficient to answer the question asked.
D. EACH statement ALONE is sufficient to answer the question asked.
E. Statements (1) and (2) TOGETHER are NOT sufficient to answer the question asked, and additional data specific to the problem are needed.

11) Is the percent change in perimeter of a right angled isosceles triangle greater than 10%?

1. A new triangle is formed by increasing only one side of the triangle by 20%.
2. A new triangle is formed by increasing the longest side of the triangle by 20%.

Explanation: In a right angled isosceles triangle, the sides are in the ratio $1 : 1 : \sqrt{2}$

Let the sides be 10, 10 and $10\sqrt{2}$

Thus, perimeter = $20 + 10\sqrt{2} = 20 + 10 * 1.4 = 34$

From statement 1:

- One of the shorter side is increased by 20%:

  Thus, the new sides are: 12, 10, $10\sqrt{2}$

  Thus, new perimeter = $22 + 10\sqrt{2} = 22 + 10 * 1.4 = 36$

  Thus, percent increase in perimeter = $\frac{36-34}{34} * 100 = \frac{100}{17} \approx 6\%$

  Thus, the answer is 'No'.

- The longer side is increased by 20%:

  Thus, the new sides are: 10, 10, $12\sqrt{2}$

  Thus, new perimeter = $20 + 12\sqrt{2} = 20 + 12 * 1.4 = 36.8$

  Thus, percent increase in perimeter = $\frac{36.8-34}{34} * 100 = \frac{140}{17} \approx 8\%$

  Thus, the answer is 'No'.

Thus, the answer is 'No'. – Sufficient

From statement 2:
We have already seen above that even if the longest side is increased by 20%, the answer to the question is 'No'. – Sufficient

The correct answer is option D.

12) If oil and water are mixed in the ratio 1 : 1 in a beaker, filling it to its capacity, the weight of the beaker and its contents is 102 grams, by what percent is water heavier than oil?

1. The combined weight of oil and water mixed in the ratio 2 : 3 in the same beaker as above is 104 grams.
2. The combined weight of oil and water mixed in the ratio 3 : 2 in the same beaker as above is 100 grams.

Explanation: Let the capacity of the beaker is 100 ml and its weight is x grams.
Let the weight of water and oil per ml be w grams and l grams, respectively.

Thus, quantity of oil and water in the beaker when mixed in the ratio 1 : 1 is 50 ml each.

Since total weight is 102 grams, we have:
$x + 50w + 50l = 102$ … (i)
We need to determine the percent by which water is heavier than oil, i.e. $\left(\frac{w-l}{l}\right) * 100\%$.

From statement 1:

Since oil and water are mixed in the ratio 2 : 3, we have 40 ml oil and 60 ml water.

Since total weight is 104 grams, we have:

$x + 60w + 40l = 104$ … (ii)

From (i) and (ii) we have three variables and two equations, we cannot determine the values of w and l. – Insufficient

From statement 2:

Since oil and water are mixed in the ratio 3 : 2, we have 60 ml oil and 40 ml water.

Since total weight is 100 grams, we have:

$x + 40w + 60l = 100$ … (iii)

From (i) and (iii) we have three variables and two equations, we cannot determine the values of w and l. – Insufficient

Thus, from both statements together:
From (ii) – (i):

$10w - 10l = 2$ ... (iv)
From (i) – (iii):

$10w - 10l = 2$ ... (v)

Since (iv) and (v) are the same equation, we still cannot determine the values of w and l. – Insufficient

The correct answer is option E.

13) At what percent profit did the dealer sell the article?

1. Had the dealer sold the article at $1200, his profit would have been 20%.
2. Had the dealer sold the article after a discount of 20%, his profit would have been 10%.

Explanation: Let the cost price and the actual selling price of the article be $\$c$ and $\$s$, respectively. We need to determine the value of $\left(\frac{s-c}{c} * 100\right)$ %.

From statement 1:

We know that if the selling price were $1200, the profit would have been 20%

$=> 1200 = 120\%$ of c

$=> c = 1000$

However, we have no information about the actual selling price. – Insufficient

From statement 2:

We know that if there was 20% discount on the actual selling price, the profit would have been 10%.

Thus, the new selling price = 80% of $s = 0.8s$

Thus, we have:
$0.8s = 110\%$ of c

$=> \frac{s}{c} = \frac{1.1}{0.8} = \frac{11}{8}$

Thus, we have:

$\frac{s-c}{c} = \frac{11-8}{8} = \frac{3}{8}$

$=> \frac{s-c}{c} * 100 = \frac{3}{8} * 100 = 37.5\%$ - Sufficient

The correct answer is option B.

14) Three liquids, A, B and C, are formed by mixing petrol and spirit in varying ratios. What is the percent of petrol in liquid C?

1. The ratio of petrol and spirit in A and B are 2 : 3 and 3 : 4, respectively.
2. If 20 liters of A, 21 liters of B and 27 liters of C are mixed, the resulting ratio of petrol and spirit is 29 : 39.

Explanation: From statement 1:

There is no information about liquid C. – Insufficient

From statement 2:

There is no information about ratios of petrol and spirit in A or B. – Insufficient

Thus, from both statements together:

Quantity of petrol in 20 liters of liquid A = $\frac{2}{2+3} * 20 = 8$ liters
Quantity of petrol in 21 liters of liquid B = $\frac{3}{3+4} * 21 = 9$ liters
Total volume = 20 + 21 + 27 = 68 liters.

Since the final petrol to spirit ratio is 29 : 39, total quantity of petrol in the mixture

= $\frac{29}{29+39} * 68 = 29$ liters.
Thus, quantity of petrol in 27 liters of liquid C = 29 – 8 – 9 = 12 liters.

Thus, percent of petrol in liquid C = $\frac{12}{27} * 100 = 44.4\%$ – Sufficient

The correct answer is option C.

15) What is the percent increase in the area of a trapezium?

1. The lengths of parallel sides of the trapezium are each increased by 20%.
2. The distance between the parallel sides is increased by 10%.

Explanation: Let ABCD be the trapezium where AB and CD are the parallel sides and H is the distance between the parallel sides.

The area of ABCD = $\frac{1}{2}(AB + CD) * H$

From statement 1:

There is no information about the percent change in the distance between the parallel sides. – Insufficient

From statement 2:

There is no information about the percent change in the length of the parallel sides. – Insufficient

Thus, from both statements together:

The new lengths of the parallel sides are:

- For AB: New length = 120% of AB = 1.2 * AB
- For CD: New length = 120% of CD = 1.2 * CD

Thus, the new value of $(AB + CD)$ is $1.2 * (AB + CD)$

The new distance between the parallel sides is 110% of H = $1.1 * H$

Thus, the new area

$$= \frac{1}{2} * 1.2 * (AB + CD) * 1.1 * H$$

$$= 1.32 * \left\{\frac{1}{2}(AB + CD) * H\right\}$$

Thus, we see that the new area is 1.32 times the earlier area.

Thus, required percent change = 32%. – Sufficient

The correct answer is option C.

16) At what price did a store sell each laptop?

1. Had the store sold each printer for $800 more than what it actually did, the total profit made would have been $64000.
2. The store's cost price for each laptop was $1200.

Explanation: From statement 1:

There is no information about the cost price of each laptop for the store. – Insufficient

From statement 2:

There is no information about the profit made by selling each laptop. – Insufficient

Thus, from both statements together:

If the price of each printer was increased by $800, additional profit generated per laptop = $800.

However, there is no information about the number of laptops sold.

Thus, the profit for each laptop cannot be determined.

Thus, the selling price of each laptop cannot be determined. – Insufficient

The correct answer is option E.

17) If $\frac{2a}{a+3b} = k$, what is the value of k?

1. $\frac{a}{3b} = k$
2. $b \neq 0$

Explanation: We have:

$\frac{2a}{a+3b} = k$

$=> 2a = ak + 3bk$ ... (i)

From statement 1:

$\frac{a}{3b} = k$

$=> a = 3bk$ ... (ii)

Thus, from (i) and (ii):

$2a = ak + a => a(k-1) = 0$

$=> k = 1$ or $a = 0$

Thus, if $a = 0$, we have: $k = \frac{0}{3b} = 0$

Note: Since division by '0' results in indeterminate values, it is implied that $b \neq 0$.

Thus, the value of k cannot be uniquely determined. – Insufficient

From statement 2:

Only $b \neq 0$ cannot be used to determine the value of k. – Insufficient

Thus, from both statements together:

Even after combining both statements, we still have the possibilities of $k = 1$ or 0. – Insufficient

The correct answer is option E.

18) From a 60 ml sugar solution, a part was removed and replaced with an equal quantity of pure water. What volume of the mixture was removed?

1. The resulting mixture contained 10% sugar.
2. The original solution had 60% sugar.

Explanation: From statement 1:

There is no information about the concentration of sugar in the original solution. – Insufficient
From statement 2:

There is no information about the concentration of sugar in the final solution. – Insufficient

Thus, from both statements together:

Let the volume removed be x ml.

Sugar content in original mixture = 60% of 60 = 36

Sugar present in the volume removed = 60% of $x = \frac{3x}{5}$

Thus, sugar remaining = $\left(36 - \frac{3x}{5}\right)$

Since x ml water is added, the volume becomes 60 ml, however, the quantity of sugar remains unchanged.

Since the final sugar concentration is 10%, we have:

$36 - \frac{3x}{5} = 10\%$ of $60 \Rightarrow\Rightarrow 36 - \frac{3x}{5} = 6$

$\Rightarrow x = 50$ – Sufficient

The correct answer is option C.

19) A football team has 40% win rate in the first half of the season. What is the minimum number of additional matches that the team needs to play in order to increase its win rate to 60%?

1. The team had played 20 matches in the first half of the season.
2. The total number of matches the team would play in the season is 36.

Explanation: In the 20 matches, number of wins = 40% of 20 = 8
Thus, the number of losses = 20 – 8 = 12

Since the problem asks for the minimum number of matches, it implies that the team needs to win all the additional matches it plays.
Let the team plays x more matches, all of which it wins.

Thus, the number of losses remains the same, i.e. 12

Since the win rate is 60% finally, the loss rate is 40%

Thus, 40% of all matches played = 12

$=>$ Total number of matches = $12 * \frac{100}{40} = 30$

Thus, the minimum number of additional matches required = 30 – 20 = 10 – Sufficient

From statement 2:

The number of matches the team would eventually play in the season cannot be used to calculate the required answer. – Insufficient

The correct answer is option A.

20) What is the number of seats in the seminar-room?

1. If all employees of the finance department attend an orientation program in the seminar-room, five people would be left standing.
2. If only 80% of all employees of the finance department attend an orientation program in the seminar-room, 10 seats would be left unoccupied.

Explanation: Let the number of seats be x.

From statement 1:

Let the number of employees be y.

Since 5 employees would be standing, we have:

$y = x + 5$ ... (i)

However, the value of x cannot be determined. – Insufficient

From statement 2:

Let the number of employees be y.

Since 10 seats would be unoccupied if 80% of the employees attend, we have:

$x = 10 + (80\% \text{ of } y)$

$=> x = 10 + \frac{4y}{5}$ ... (ii)

However, the value of x cannot be determined. – Insufficient

Thus, from both statements together:

From (i) and (ii):

$x = 10 + \frac{4}{5}(x + 5) => 5x = 50 + 4x + 20$

$=> x = 70$ – Sufficient

The correct answer is option C.