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GENERAL APTITUDE

CIVIL ENGINEERING

Date of Test : 03/05/2023**ANSWER KEY >**

- | | | | | |
|--------|---------|---------|---------|---------|
| 1. (a) | 7. (c) | 13. (b) | 19. (b) | 25. (c) |
| 2. (b) | 8. (d) | 14. (b) | 20. (a) | 26. (b) |
| 3. (b) | 9. (b) | 15. (c) | 21. (d) | 27. (b) |
| 4. (d) | 10. (c) | 16. (c) | 22. (b) | 28. (b) |
| 5. (a) | 11. (c) | 17. (a) | 23. (b) | 29. (d) |
| 6. (b) | 12. (d) | 18. (b) | 24. (c) | 30. (b) |

DETAILED EXPLANATIONS

1. (a)

Let the filling capacity of the pump = $x \text{ m}^3/\text{min}$

Then the emptying capacity of the pump = $(x + 5) \text{ m}^3/\text{min}$

Time required for filling the tank = $\frac{5040}{x}$ minutes

Time required for emptying the tank = $\frac{5040}{(x + 5)}$ minutes

$$\frac{5040}{x} - \frac{5040}{(x + 5)} = 14$$

$$\frac{360}{x} - \frac{360}{(x + 5)} = 1$$

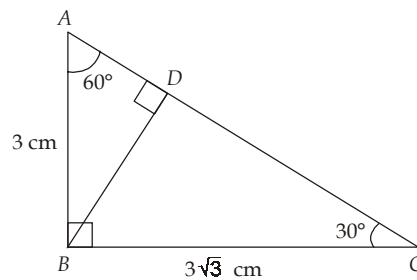
$$1800 = x^2 + 5x$$

$$(x + 45)(x - 40) = 0$$

$$x = 40 \text{ m}^3/\text{min}$$

$$\text{Capacity of the container} = 40 \times 90 = 3600 \text{ m}^3$$

2. (b)



In a right angled triangle if ratio of two perpendicular side is $1:\sqrt{3}$,

then the triangle is a $30^\circ - 60^\circ - 90^\circ$ triangle

$$\Rightarrow \angle BAC = 60^\circ$$

$$\angle BCA = 30^\circ$$

Given: $BD \perp AC$

$$\Rightarrow \angle DBC = 60^\circ$$

and $\angle DAB = 60^\circ$ and $\angle DBA = 30^\circ$

Right Δ s BAD and CBD are also $30^\circ - 60^\circ - 90^\circ$ triangles.

$$\Rightarrow AD : BD : AB = 1 : \sqrt{3} : 2$$

$$\text{and } BD : DC : BC = 1 : \sqrt{3} : 2$$

Which enables us to compute

$$AD = \frac{AB}{2} = \frac{3}{2}$$

$$\text{and } CD = \frac{3\sqrt{3}}{2/\sqrt{3}} = \frac{9}{2}$$

$$\Rightarrow DC : AD = \frac{9}{2} : \frac{3}{2} = 3 : 1$$

3. (b)

In triangle OAB, Angle O + Angle A + Angle B = 180 -----1

$$OA = OB \text{ (Radius)}$$

$$\Rightarrow \text{Angle A} = \text{Angle B}$$

In triangle ACB,

$$\text{Angle C} = \text{Angle O} + \text{Angle OAC (Sum of interior opposite angles)}$$

$$\Rightarrow \text{Angle ACB} = 2x;$$

$$\text{Also, } AC = AB$$

$$\Rightarrow \text{Angle ACB} = \text{Angle ABC} = 2x \text{ each}$$

$$\text{Thus, } \text{Angle A} = \text{Angle B} = 2x \text{ each.}$$

So, substituting in 1

$$5x = 180$$

$$\Rightarrow x = 36 \text{ degrees}$$

4. (d)

The first 3 digit number divisible by 7 is 105 and last is 994.

This is an A.P. with $a = 105$, $d = 7$, $l = 994$

$$n^{\text{th}} \text{ term of A.P.} = t_n = a + (n - 1)d$$

$$\Rightarrow 994 = 105 + (n - 1)7$$

$$\Rightarrow 889 = 7(n - 1)$$

$$\Rightarrow n - 1 = 127$$

$$\therefore n = 128$$

5. (a)

We are given 2 specific inputs:

(a) the four athletes are moving at the same speed and

(b) they are moving along the sides of the park only.

They will NOT collide if the direction of their movement is identical i.e. either all four of them move in clockwise direction OR all of them move in anticlockwise direction.

$$P(\text{all move in clockwise direction}) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{16}$$

$$P(\text{all move in anti clockwise direction}) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{16}$$

$$\text{Required probability} = P(\text{clockwise}) + P(\text{anticlockwise}) = \frac{1}{16} + \frac{1}{16} = \frac{1}{8} = 0.125$$

6. (b)

$$t = 31 + 32 + \dots + 59 + 60$$

$$s = 1 + 2 + \dots + 29 + 30$$

$$\text{So } t - s = (31 - 1) + (32 - 2) + \dots + (59 - 29) + (60 - 30) \text{ i.e.}$$

30 terms and each equals 30

$$\text{Hence } t - s = 30 \times 30 = 900$$

7. (c)

Let x be the number of men who joined the group and y be the number of men who left the group.

$$\text{Thus, } \frac{(10 + x)}{(12 + x)} = \frac{6}{7}$$

So, $x = 2$

Now, the number of men and women become 12 and 14 respectively.

$$\frac{12+y}{14+y} = \frac{4}{5}$$

So, $y = 4$

Now, the number of men and women become 8 and 10 respectively.

8. (d)

Since 'm' number of team Avengers are formed. So, in team Avengers; total boys = 20 m and total girls = 10 m.

And 'n' number of team Guardians are formed. So, in team Guardians; total boys = 30 n and total girls = 20 n.

$$\text{Total boys} = 20m + 30n = 1300 \quad \dots(i)$$

$$\text{Total girls} = 10m + 20n = 800 \quad \dots(ii)$$

From equation (i) and (ii), we get

$$2 \times (10m + 20n) - (20m + 30n) = 2 \times 800 - 1300$$

$$\Rightarrow 40n - 30n = 300$$

$$\Rightarrow n = 30 \text{ and } m = 20$$

$$\text{Required percent} = \left(\frac{m}{n}\right) \times 100 = \left(\frac{20}{30}\right) \times 100 = 66.67\%$$

9. (b)

Total ways of arranging 5 letters in any possible order = $5 \times 4 \times 3 \times 2 \times 1 = 5! = 120$

In half of the cases A will be to the left of B and in other half A will be to the right of B

$$\text{Hence, desired outcome} = \frac{120}{2} = 60.$$

10. (c)

$$\text{Speed of Sonam} = 60 \text{ km/hr}$$

$$\text{Speed of Ameesha} = 36 \text{ km/hr}$$

$$\text{Speed of Ankita} = 18 \text{ km/hr (since Ameesha's speed is twice of Ankita)}$$

Time taken to cover Agra to Kanpur by Ankita = 2 hours (since time is inversely proportional to speed)

Hence, distance between Agra and Kanpur = $2 \times 18 = 36 \text{ km}$ (since Ankita takes 2 hours to travel and her speed is 18 km/hr).

So, the distance between Agra and Delhi = 36 km

Sonam has to cover $36 \times 2 = 72 \text{ km}$

$$\text{Time taken by Sonam} = \frac{72}{60} \times 60 = 72 \text{ minutes}$$

11. (c)

At present,

Let the members be M, N, O and P

Where age of $P > O > N > M$

Since P died after 5 years at the age of 88. So, present age of $P = 88 - 5 = 83$

Youngest member = $M = 14 \text{ years}$

$$N + O + P = 54 \times 3$$

$$N + O = 162 - 83 = 79$$

$$\dots(i) \quad (O > N)$$

10 years after the death of P means 15 years hence from present, let Q be born.

20 years from present means at that time Q = 5 years and is youngest.

Eldest member at that time = O (age = O + 20)

$$(O + 20) - 5 = 57$$

$$O = 57 - 15 = 42 \text{ years}$$

$$\text{So, } N = 79 - 42 = 37 \text{ years}$$

After 5 years, members alive are = M, N, O

$$M = 14 + 5 = 19 \text{ years}$$

$$N = 37 + 5 = 42 \text{ years}$$

$$O = 42 + 5 = 47 \text{ years}$$

Required ages of N and O are 42 and 47.

12. (d)

Favourable events - (1,1), (1,2), (1,4), (2,3), (2,5), (5,6), (3,4), (1,6). Except the event (1,1) every other event must be counted twice due to the fact that the number might appear on either of the dice, so total number of favourable events is 15.

$$\text{Total events} = 6^2 = 36$$

$$\text{Probability} = \frac{15}{36} = \frac{5}{12}$$

13. (b)

For paper X:

$$\text{Area} = \text{Area of square} - 4 \times \text{Area of quadrant}$$

$$\text{Radius} = \frac{14}{2} = 7 \text{ mm}$$

$$\text{Required area} = (130 \times 130) - \text{Area of circle of radius 7 mm}$$

$$\text{Required area} = 16900 - \frac{22}{7} \times 7 \times 7$$

$$\text{Area} = 16746 \text{ mm}^2$$

For paper Y:

$$\text{Length of paper} = 150 \text{ mm}$$

$$\text{Breadth of paper} = \frac{150}{1.2} = 125 \text{ mm}$$

$$\text{Radius of semi circle} = \frac{125}{2} = 62.5 \text{ mm}$$

$$\text{Remaining area} = 150 \times 125 - 62.5 \times 62.5 \times \frac{22}{7}$$

$$= 18750 - 12276.8$$

$$= 6473.2 \text{ mm}^2$$

$$\text{Required percentage} = \frac{(16746 - 6473.2) \times 100}{16746}$$

$$= 61.3\% \text{ less}$$

14. (b)

Let the original speed of the train be 's' km/hour and the reduced speed will be (s - 50) km/hr. As per the question, a distance of 200 km is covered in 40 minutes more than the regular time taken to complete the journey. We can write the equation as

$$\frac{200}{s-50} - \frac{200}{s} = \frac{2}{3} \text{ or } 300 \times 50 = s(s-50) = 150 \times 100$$

which leads us to get $s = 150$ i.e. the original speed of the train is 150 km/hr i.e. option (b).

15. (c)

Since two typists can type two pages in two minutes, then one typist can type two pages in four minutes, which means that the rate of one typist is

$$= \frac{\text{job}}{\text{time}} = \frac{2}{4} = \frac{1}{2} \text{ page per minute.}$$

Now, (combined rate of x typists) \times (Time) = Job

$$\left(\frac{1}{2} \times x\right) \times 6 = 18$$

$$\Rightarrow x = 6$$

16. (c)

Probability of Sanjay hitting the strike, $P(S) = 0.5$ gives probability of Sanjay NOT hitting the strike = $P(\bar{S}) = 1 - P(S) = 0.5$.

Similarly, Probability of Mahesh hitting the strike, $P(M) = 0.4$ gives probability of Mahesh NOT hitting the strike = $P(\bar{M}) = 1 - P(M) = 0.6$

In case of tie, Sanjay as well as Mahesh hit the strike OR both DO NOT hit the strike.

$$\text{Required probability} = P(S) \times P(M) + P(\bar{S}) \times P(\bar{M}) = 0.5 \times 0.4 + 0.5 \times 0.6 = 0.5$$

17. (a)

5! onwards every factorial will be a multiple of 120. As $5! = 120$

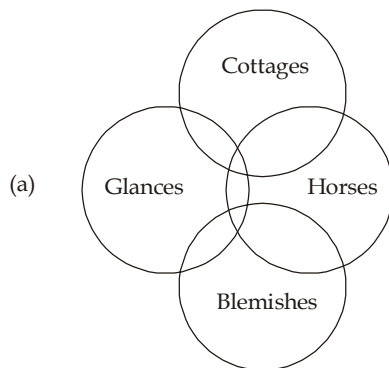
$$6! = 5! \times 6$$

$$7! = 5! \times 6 \times 7 \text{ and so on}$$

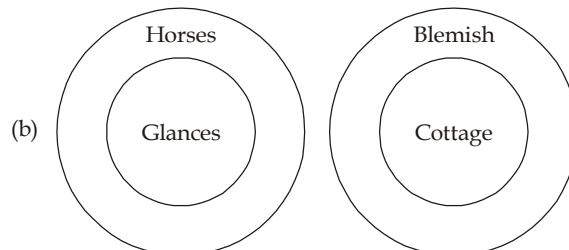
So, remainder will be $1! + 3! = 7$

18. (b)

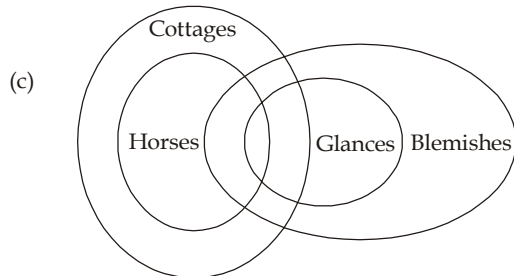
The statements given in option (b) lead to the required conclusions.



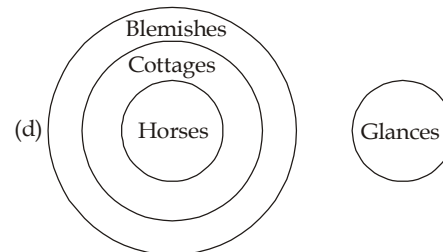
In this scenario conclusion II does not follow



In this scenario both the conclusions are true



In this case we see that neither of the conclusions is true



In this scenario conclusion I does not follow

19. (b)

First 2 days, all three of them worked together, thus they did $2 \times \left(\frac{1}{10} + \frac{1}{12} + \frac{1}{15} \right) = \frac{1}{2}$ of the work.

Last 3 days, only Chinmoy worked, thus he did $\frac{3}{15} = \frac{1}{5}$ of the work.

$1 - \frac{1}{2} - \frac{1}{5} = \frac{3}{10}$ of the work was done by Bhanu and Chinmoy

Time \times Combined rate = Job done

$$\Rightarrow t \times \left(\frac{1}{12} + \frac{1}{15} \right) = \frac{3}{10}$$

$$\Rightarrow t = 2 \text{ days}$$

So, Bhanu and Chinmoy worked together for 2 days.

$$\text{Total days} = 2 + 3 + 2 = 7$$

20. (a)

Probability of choosing a defective battery = $\frac{4}{20} = \frac{1}{5}$

Probability of choosing a non-defective battery = $1 - \frac{1}{5} = \frac{4}{5}$

$p(\text{not more than 1 out of 8}) = p(0 \text{ defective out of 8}) + p(1 \text{ defective out of 8})$

$$= {}^8C_0 \left(\frac{1}{5}\right)^0 \left(\frac{4}{5}\right)^8 + {}^8C_1 \left(\frac{1}{5}\right)^1 \left(\frac{4}{5}\right)^7$$

$$= \frac{4^8}{5^8} + \frac{8 \cdot 4^7}{5^8} = \frac{196608}{390625} = 0.5033$$

21. (d)

Let the letter boxes be named as A, B, C and D.

Now, there are 4 places (A, B, C, D) that need to be filled.

Letter 1 can be posted in either A, B, C, or D i.e. 4 ways.

Similarly, letters 2, 3 and 4 can be posted in either A, B, C, or D i.e. 4 ways each

So the total number of ways in which 5 letters can be posted in 4 boxes are

$$= 4 \times 4 \times 4 \times 4 \times 4 = 4^5$$

22. (b)

Before evaporation, 10 kg tomatoes = 9.9 kg water + 0.1 kg tomato matter

After evaporation, let's say the weight of tomatoes is x kg

$$x = \left(\frac{99}{100} \times x\right) \text{ kg water} + 0.1 \text{ kg tomato matter}$$

Solving for x gives 5 kg.

23. (b)

Let Ram have ' a ' number of Pen drives and the price be ₹ x /unit.

Let Laxman have ' b ' number of pen drives and the price be ₹ y /unit.

$$ax = by$$

$$\Rightarrow \frac{x}{y} = \frac{b}{a}$$

$$ay = 16875 \text{ and } bx = 1452$$

$$\Rightarrow \left(\frac{b}{a}\right) \left(\frac{x}{y}\right) = \frac{1452}{16875} = \left(\frac{22}{75}\right)^2$$

$$\Rightarrow \left(\frac{b}{a}\right)^2 = \left(\frac{22}{75}\right)^2 \quad (\text{Given } a + b = 194)$$

$$\Rightarrow b = 44, a = 150$$

24. (c)

Bike A = 5 km/hour

$$\Rightarrow \frac{5}{60} = \frac{1}{12} \text{ km in 1 minute}$$

Bike B = 10 km/hour

$$\Rightarrow \frac{10}{60} = \frac{1}{6} \text{ km in 1 minute}$$

One minute before they collide, distance = $\frac{1}{12} + \frac{1}{6} = \frac{3}{12} = \frac{1}{4}$ km apart

25. (c)

Suppose the ages of Sachin, Shikhar, Ajinkya and Mahendra be a , b , c and d respectively.

$$a : b = 6 : 5$$

$$c - a > 5;$$

d = prime number between the ages of Sachin and Ajinkya

Also,

$$b : c = 2 : 3$$

So,

$$a : b : c = 12 : 10 : 15$$

To satisfy the condition required, multiply the ratio by 2.

Thus,

$$a : b : c = 24 : 20 : 30$$

Let Sachin's age be 24 years, Shikhar's age be 20 years and Ajinkya's age be 30 years.

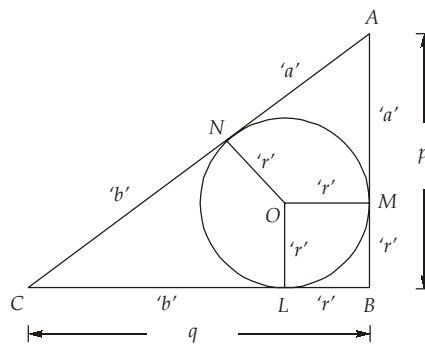
Now, the difference in the ages of Sachin and Ajinkya is greater than 5.

Now, the age of Mahendra is a prime number between the ages of Sachin ($a = 24$) and Ajinkya ($c = 30$)

It means, $d = 29$

Hence, required difference between c and $d = 30 - 29 = 1$ year

26. (b)



The largest possible circle that can be inscribed in the triangle is the one which touches the 3 sides.

Since A is an external point from where AN and AM are tangents to this circle, we have

$$AM = AN = a \text{ (say)}$$

Similarly,

$$CN = CL = b \text{ (say)}$$

If O is the centre of the circle, then $OM = OL = r$ (radius of this circle)

$$BC = q = b + r \text{ and } AB = p = a + r$$

We are given the hypotenuse $CA = AN + NC$

$$= p + q - 6 = a + b$$

Or using the values of p and q ,

$$b + r + a + r - 6 = a + b$$

We get

$$r = 3 \text{ cm}$$

27. (b)

We can have three possible scenarios:

- (I) : Reena and Seema are in the same row. Since Reena is the shortest person in the row, Seema is taller than Reena.
- (II) : Reena and Seema are in the same column; once again Seema is taller than Reena since Seema is tallest in the column.
- (III) : Reena and Seema are neither in the same row nor in the same column. In this case, there has to be a person 'X' who is in the same row as Reena and in the same column as Seema. Now, Reena is shorter than 'X' who is shorter than Seema; which again leads us to conclude that Seema is taller than Reena.

28. (b)

We will start with one student each being recipient of one prize value. This implies that $31250 + 6250 + 1250 + 250 = ₹ 39000$ has been used up leaving a sum of ₹ 6,000 to be distributed among NOT more than $18 - 4 = 14$ students. Since the amount remaining is less than ₹ 6250, this amount has to be distributed as prizes of denomination ₹ 1250 and/or ₹ 250 only.

We can start with four students receiving ₹ 250 each and the remaining ₹ 5,000 can be given to four more students @ ₹ 1250 leading to total number of 12 students receiving the prizes.

Alternately, we can have $4 + 5 = 9$ students receiving ₹ 250 each and the remaining ₹ 3750 can be given to three more students @ ₹ 1250 leading to total number of 16 students receiving the prizes. Any more options are ruled out since we have to increase in steps of $5 - 1 = 4$ students only which means that the next option will lead to 20 students getting the prize money which is not possible since there are only 18 students in all.

29. (d)

We will be required to get the value of n such that $\frac{n(n+1)}{2} = 100$. If $n = 13$, $\frac{n(n+1)}{2} = 91$ which means that 100^{th} digit will be occupied by 14^{th} set of digits or it will be equal to 4.

30. (b)

Because in each row first \times third + 1 = second.

So $9 \times 4 + 1 = 37$

