CLASS TEST

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GENERAL APTITUDE

MECHANICAL ENGINEERING

Date of Test : 02/07/2023

ANSWER KEY

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

1. (a)

Let the filling capacity of the pump = x m^3/min

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

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

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

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

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

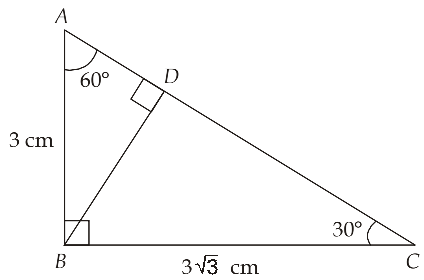
$$1800 = x^2 + 5x$$

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

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

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

2. (b)



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

then the triangle is a 30° – 60° – 90° triangle

$\Rightarrow$ $\angle BAC = 60°$

$\angle BCA = 30°$

Given: $BD \perp AC$

$\Rightarrow$ $\angle DBC = 60°$

and $\angle DAB = 60°$ and $\angle DBA = 30°$

Right Δs BAD and CBD are also 30° – 60° – 90° triangles.

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

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

Which enables us to compute

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

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

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

3. **(a)**

Sample space, S is {HHHH, HHHT, HHTH, HHTT, HTHH, HTHT, HTTH, HTTT, THHH, THHT, THTH, THTT, TTHH, TTHT, TTTH, TTTT} i.e. 16.

Favourable cases, P have been underlined above i.e. {HHHT, HHTH, HTHH, THHH} i.e. 4.

Required probability $= \frac{P}{S} = \frac{4}{16} = \frac{1}{4}$ i.e. (a)

4. **(d)**

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

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

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

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

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

$$\Rightarrow \quad n - 1 = 127$$

$$\therefore \quad n = 128$$

5. **(a)**

We are given 2 specific inputs:

(a) the four atheletes 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.

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

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

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

6. **(c)**

$$64 \times \frac{3}{2} = 96$$

$$96 \times \frac{5}{2} = 240$$

$$240 \times \frac{7}{2} = 840$$

$$840 \times \frac{9}{2} = 3780$$

$$3780 \times \frac{11}{2} = 20790$$

7. **(c)**

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

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.

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

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

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

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

$\Rightarrow \quad 40\text{ n} - 30\text{ n} = 300$

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

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

9. (d)

Sum of total age of 5 persons of group Alpha = 22 × 5 = 110 years

Sum of total age of 5 persons of group Beta = 19 × 5 = 95 years

Case 1:

Max joins group Beta

Resultant total age of persons of group Alpha = 24 × 4 = 96 years

Age of Max = 110 – 96 = 14 years

Case 2:

Ross joins group Beta from group Alpha

Sum of age of persons of group Beta = 20 × 7 = 140

Age of Ross = 140 – (95 + 40) = 31 years

Sum of age of persons of group Alpha = 96 – 31 = 65 years

Case 3:

Sum of total age of persons of group Alpha = 22 × 4 = 88 years

Age of John = 88 – 65 = 23 years

Required ratio = 23 : 14

10. (c)

Speed of Sonam = 60 km/hr

Speed of Ameesha = 36 km/hr

Speed of Ankita = 18 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 × 18 = 36 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 × 2 = 72 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 years

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

$$N + O = 162 - 83 = 79 \quad \text{...(i)} \quad (O > N)$$

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)

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

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

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. (a)

Let the defective car = D

Let the non defective car = D'

So, $$P\left(\frac{X}{D}\right) = \frac{200 \times (0.08)}{[200 \times 0.08 + 120 \times 0.03 + 80 \times 0.04]}$$

$$= \frac{16}{16 + 3.6 + 3.2} = 0.7$$

$$P\left(\frac{Y}{D}\right) = \frac{120 \times (0.03)}{[200 \times 0.08 + 120 \times 0.03 + 80 \times 0.04]}$$

$$= \frac{3.6}{16 + 3.6 + 3.2} = 0.158$$

$$\text{Ratio} = \frac{0.70}{0.158} = 4.430$$

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. **(d)**

$$\text{Let, } f(x) = ax^2 + bx + c$$

$$f(-4) = 16a - 4b + c = 8$$

$$f(1) = a + b + c = 8$$

$$f(3) = 9a + 3b + c = 15$$

Solving, we get $a = \frac{1}{2}, b = \frac{3}{2}, c = 6$

This gives $f(x) = \frac{x^2}{2} + \frac{3x}{2} + 6$. We have to find the value of $f(x)$ at x = 2

We can compute it as $f(2) = \frac{4}{2} + \frac{6}{2} + 6 = 11$ which leads us to get the desired point as (2, 11) i.e. (d).

16. **(c)**

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

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

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

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

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. **(d)**

Let the selling price of an article be = ₹ (SP)

Let the cost price of an article be = ₹ (CP)

$$\text{Profit} = 300\,SP = 500\,(SP - CP)$$

$$300\,SP = 500\,SP - 500\,CP$$

$$500\,CP = 200\,SP$$

$$\frac{5}{2} = \frac{SP}{CP}$$

$$\text{Profit percentage} = \left(\frac{SP}{CP} - 1\right) \times 100 = 150\%$$

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

$$\text{Time} \times \text{Combined rate} = \text{Job done}$$

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

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

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(not more than 1 out of 8) = p (0 defective out of 8) + p (1 defective out of 8)

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

$$= \frac{4^8}{5^8} + \frac{8.4^7}{5^8} = \frac{196608}{390625} = 0.5033$$

21. **(c)**

Jayesh covered 100 m – 0.25 m = 99.75 m and Karan covered 100 m – 5 m = 95 m (in the same time interval).

Initial distance between them was 5 m and final distance between Jayesh and Karan was 0.25 m.

Thus Jayesh gained 99.75 m – 95 m = 4.75 m over Karan in 99.75 m, hence Jayesh is gaining 1 m over Karan in every $\frac{99.75}{4.75} = 21$ m.

Hence, Jayesh in order to gain remaining 0.25 m over Karan should cover 21 × 0.25 = 5.25 m.

22. (b)

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

After evaporation, lets say the weight of tomatoes is x kg

$$x = \left(\frac{98}{100} \times x\right) \text{kg water} + 0.1 \text{ kg tomato matter}$$

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

$$ax = by$$

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

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

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

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

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

24. (a)

Let 'x' be the value of consignment

$$\Rightarrow \quad \text{Profit} = \frac{x}{3} \times \frac{10}{100} + \frac{2x}{3} \times \frac{4}{100} = 1200$$

$$\Rightarrow \quad x = ₹\ 20{,}000$$

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.

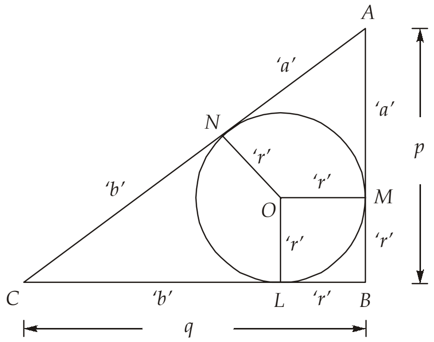
Now, the difference in the ages of Sachin and Ajinkya is greater than 5.

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 $AM = AN = a$ (say)

Similarly, $CN = CL = b$ (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 $r = 3$ 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 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 × third + 1 = second.
So 9 × 4 + 1 = 37

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