CLASS TEST

S.No. : 01IGCE_O_27072024

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GENERAL APTITUDE

CIVIL ENGINEERING

Date of Test : 27/07/2024

ANSWER KEY ➤

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

DETAILED EXPLANATIONS

1. (b)

Assume the three number are $a - d$, a and $a + d$, where d is the difference between two consecutive number.

Then,

$$a - d + a + a + d = 15$$
$$3a = 15$$
$$a = 5$$

Also, $(5 - d)^2 + 5^2 + (5 + d)^2 = 83$

$$25 + d^2 - 10d + 25 + 25 + d^2 + 10d = 83$$
$$75 + 2d^2 = 83$$
$$2d^2 = 8$$
$$d = \pm 2$$

Then the possible smallest number $= 5 - 2 = 3$

2. (a)

Assume the current age of Shyam and Kavita are x and y years respectively.

then, $$\frac{x}{y} = \frac{2}{6}$$

$$\frac{x}{y} = \frac{1}{3} \quad \text{...(i)}$$

5 years after, the ratio of their ages

$$\frac{x+5}{y+5} = \frac{6}{8} = \frac{3}{4}$$

$$4x + 20 = 3y + 15$$
$$3y - 4x = 5$$

From eq. (i), $y = 32x$

$\therefore$ $3(3x) - 4x = 5$

$$5x = 5$$
$$x = 1 \text{ year}, y = 3 \text{ year}$$

After 10 years, the average of their ages

$$= \frac{10 + x + 10 + y}{2}$$

$$= 10 + \frac{x+y}{2} = 10 + \frac{1+3}{2} = 12 \text{ years}$$

3. (a)

$$\text{Average speed} = \frac{\text{Total distance}}{\text{Total time}} = \frac{8+6+40}{\frac{1}{4}+\frac{1}{4}+\frac{1}{4}} = 54 \times \frac{4}{3} = 72 \text{ km/hr}$$

4. (a)

Initial price of a cow and a calf was Rs. 2000 and Rs. 1400.

After increment the price becomes Rs. 2400 and Rs. 1820.

Then the total cost are = 2400 × 12 + 1820 × 24 = Rs. 72,480

5. (c)

Side of triangle ABC = 2 cm

Area of triangle ABC = $\frac{\sqrt{3}}{4}(2)^2 = \sqrt{3}$ cm^2

Sector Area = $\left[\frac{\theta}{360^\circ} \times \pi(1)^2\right] \times 3 = \frac{60^\circ}{360^\circ} \times \pi(1)^2 \times 3 = \frac{\pi}{2}$ cm^2

Hence, shaded area = $\left[\sqrt{3} - \frac{\pi}{2}\right]$ cm^2

6. (a)

$lb = 12$

$bh = 18$

$lh = 24$

Multiplying the three equations,

$(lbh)^2 = 12 \times 18 \times 24$

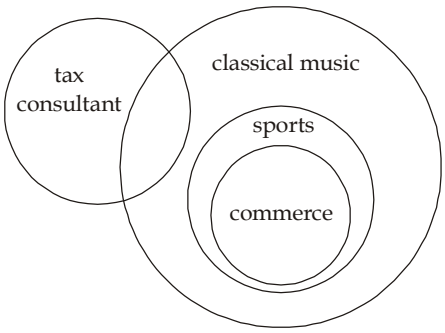
$= 2 \times 2 \times 3 \times 2 \times 3 \times 3 \times 2 \times 2 \times 2 \times 3$

$= (2)^6 \times (3)^4$

$lbh = (2)^3 \times (3)^2$

$= 8 \times 9 = \mathbf{72}$

7. (d)



From the Venn diagram, we can see that only option (d) is possible.

8. (b)

Each person out of 4 has 6 floors (options) to get out of (since no one gets out on the ground floor), hence total ways is $6 \times 6 \times 6 \times 6 = 6^4 = 1296$.

9. (a)

Since 96% of the 20 kg watermelon is water, 4% of the 20 kg is non-water : (0.04) (20) = 0.8 kg

Since 95% of the post-evaporation watermelon is water, the remaining 5% must be composed of the 0.8 kg of non-water : $0.05x = 0.8$

$$\Rightarrow \qquad x = \frac{0.8}{0.05} = \frac{80}{5} = 16\,\text{kg}$$

10. (b)

$$2^x = 4^y = 8^z \Rightarrow 2^x = 2^{2y} = 2^{3z}$$

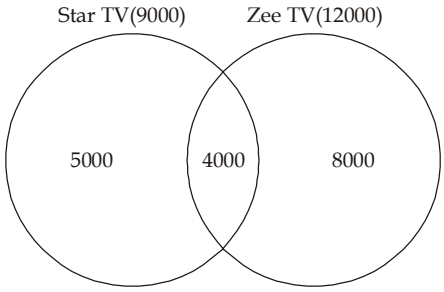
$$\Rightarrow \qquad x = 2y = 3z = k \text{ (say)}$$

Then $$xyz = \frac{k^3}{6} = 288 \Rightarrow k = 12$$

$$\therefore \qquad x = 12,\ y = 6,\ z = 4$$

$$\Rightarrow \qquad \frac{1}{2x} + \frac{1}{4y} + \frac{1}{8z} = \frac{11}{96}$$

11. (a)



Total number of people whose subscribe atleast one channel

= 5000 + 4000 + 8000 = 17000

Then, the people who do not subscribe any of the two channel

= 20000 – 17000 = 3000

12. (c)

The condition for both the roots of the equation $ax^2 + bx + c = 0$ are positive, if

$$\frac{-b}{a} > 0 \text{ and } \frac{c}{a} > 0$$

Given equation $x^2 - 2(k-1)x + (2k+1) = 0$ whose roots are positive,

$$\frac{-b}{a} = \frac{2(k-1)}{1} > 0$$

$$k > 1 \qquad \text{...(i)}$$

and $$\frac{c}{a} = \frac{2k+1}{1} > 0$$

$$k > \frac{-1}{2} \qquad \text{...(ii)}$$

From (i) and (ii) k > 1

Hence, from options least value of $k = 4$

13. (c)

Let α, β be the roots of the equation, $ax^2 + bx + c = 0$

$$\therefore \quad \text{Sum of roots } (\alpha + \beta) = \frac{-b}{a}$$

$$\text{and product of roots } (\alpha\beta) = \frac{c}{a}$$

By given condition,

$$\alpha + \beta = \alpha^2 + \beta^2$$
$$\alpha + \beta = (\alpha + \beta)^2 - 2\alpha\beta$$
$$\frac{-b}{a} = \left(\frac{-b}{a}\right)^2 - 2\left(\frac{c}{a}\right)$$
$$-ba = b^2 - 2ca$$
$$2ac = b^2 + ab$$

14. (a)

$$\text{Volume of each cube} = 216 \text{ m}^3$$
$$\text{Side of each cube} = \sqrt[3]{216} = 6 \text{ m}$$

By joining the cube end to end, it will be converted into cuboid, whose l = 18 m, b = 6 m, h = 6 m

then, the surface are of the cuboid $= 2(lb + bh + hl)$
$= 2(18 \times 6 + 6 \times 6 + 6 \times 18)$
$= 2(108 + 36 + 108) = 504 \text{ m}^2$

15. (a)

If L_f is the length of faster train and V_f and V_s are the speed of faster and slower train which are 40 kmph and 20 kmph respectively.

then, $$\frac{L_f}{V_f - V_s} = \frac{36}{3600}\text{hr}$$

$$\frac{L_f}{40 - 20} = \frac{1}{100}$$
$$L_f = \frac{20}{100}\text{km}$$
$$L_f = \frac{20}{100} \times 1000$$
$$L_f = 200 \text{ m}$$

16. (c)

$$\text{Distance between two poles} = 50 \text{ m},$$
$$\text{Distance covered by train} = 45 \times 4 = 180 \text{ km}$$

Number of poles counted by passenger $= \dfrac{180 \times 1000}{50} = 3600$

17. (b)

Time taken by both the pipes when they are opened simultaneously,

$$\Rightarrow \quad \frac{1}{14}+\frac{1}{16} = \frac{1}{t_1}$$

$$t_1 = \frac{112}{15}\text{hrs}$$

Let's assume to leakage it will take t_2 hr to fill the tank

then, $$t_2 = t_1+\frac{32}{60}\text{hr}$$

$$t_2 = \frac{112}{15}+\frac{8}{15}\text{hr}$$

$$t_2 = 8 \text{ hr}$$

If x is the rate of then leakage,

then

$$\Rightarrow \quad \frac{1}{14}+\frac{1}{16}-\frac{1}{x} = \frac{1}{8}$$

$$\Rightarrow \quad \frac{15}{112}-\frac{1}{x} = \frac{1}{8}$$

$$\Rightarrow \quad \frac{1}{x} = \frac{15}{112}-\frac{1}{8}$$

$$\Rightarrow \quad \frac{1}{x} = \frac{1}{112}$$

$$\Rightarrow \quad x = 112 \text{ hr}$$

18. (c)

Given:

A, B and C independently can finish the work in 24, 32 and 60 days respectively.

Let's assume x days more are required to complete the whole work.

then, $$\left(\frac{1}{24}+\frac{1}{32}+\frac{1}{60}\right)\times 6+\left(\frac{1}{32}+\frac{1}{60}\right)\times 2+x\times\frac{1}{60} = 1$$

$$\Rightarrow \left(\frac{1}{2^3\times 3}+\frac{1}{2^5}+\frac{1}{2^2\times 3\times 5}\right)\times 6+\left(\frac{1}{2^5}+\frac{1}{2^2\times 3\times 5}\right)\times 2+\frac{x}{60} = 1$$

$$\Rightarrow \left(\frac{2^2\times 5+3\times 5+2^3}{2^5\times 3\times 5}\right)\times 6+\left(\frac{3\times 5+2^3}{2^5\times 3\times 5}\right)\times 2+\frac{x}{60} = 1$$

$$\left(\frac{43\times 6+23\times 2}{2^5\times 15}\right)+\frac{x}{60} = 1$$

$$\Rightarrow \quad \frac{19}{30}+\frac{x}{60} = 1$$

$$\Rightarrow \quad \frac{x}{60} = \frac{11}{30}$$

$$\Rightarrow \quad x = 22 \text{ days}$$

19. (b)

Let's assume Ashok, Mohan and Binod independently can finish the work in x days, y days and z days respectively.

Then, $$\frac{1}{x}+\frac{1}{y} = \frac{1}{12} \quad ...(i)$$

$$\frac{1}{y}+\frac{1}{z} = \frac{1}{15} \quad ...(ii)$$

$$\frac{1}{x} = 2\left(\frac{1}{z}\right) \quad ...(iii)$$

From (i), (ii) and (iii)

z = 60 days, x = 30 days, and y = 20 days

20. (b)

Let, the cost price of 50 mangoes = Rs. x = selling price of 40 mangoes

$\therefore$ Cost price of one mango = $\text{Rs.}\frac{x}{50}$

Selling price of one mango = $\text{Rs.}\frac{x}{40}$

$$\text{Profit\%} = \frac{S.P.-C.P}{C.P}\times 100$$

$$= \frac{\frac{x}{40}-\frac{x}{50}}{\frac{x}{50}}\times 100 = \left(\frac{5}{4}-1\right)\times 100 = 25\%$$

21. (b)

AB = 54 cm and ΔANM, ΔOCP, ΔOPX are equilateral triangles.

$\Rightarrow$ $MN = MR = NO = OP = PQ = QR = \frac{54}{3} = 18$ cm

Thus, MNOPQRM is regular hexagon with side 18 cm

$\therefore$ Area of MNOPQRM = $\frac{3\sqrt{3}}{2}(\text{side})^2$

$$\frac{3\sqrt{3}}{2}(18)^2 = 486\sqrt{3}\ \text{sq.cm.}$$

22. (b)

The series is an *A.P.* with common difference, d = –66 – (–64) = –2

First term, a = –64 and last terms a_n = –100

n^{th} term of the series, $a_n = a + (n-1)d$

$\Rightarrow$ $-100 = -64 + (n-1)(-2)$

$\Rightarrow$ $n - 1 = \frac{-36}{-2} = 18$

$\Rightarrow$ $n = 18 + 1 = 19$

$$\therefore \quad \text{Sum} = \frac{n}{2}(a + a_n)$$
$$= \frac{19}{2} \times (-64 - 100) = \frac{19}{2} \times (-164)$$
$$= 19 \times (-82) = -1558$$

23. (d)

Total books = 240

I. 80 books at the rate of ₹x per book

II. 78 books at the rate of ₹$(x + a)$ per book

III. [240 – (78 + 80)] = 82 books at the rate of ₹$(x - a)$ per book.

Total sale = ₹14384

Now, $80 \times x + 78(x + a) + 82(x - a) = 14384$

$$240x - 4a = 14384$$
$$60x - a = 3596 \quad \text{....(1)}$$

This equation has two variables and only one equation. So it can be solved by putting option value.

Putting, $x = 60$

$$60 \times 60 - a = 3596$$
$$a = 4$$

Hence,

Maximum price of book = 60 + 4 = ₹64/book

Minimum price of book = 60 – 4 = ₹56/book

Note : Reason behind putting $x = 60$ is that in any option a value is not more that 4. According to that nearest integer value of x should be 60.

24. (c)

An integer is divisible by 9 if the sum of its digits is divisible by 9.

Since the sum of first 9 natural number is $\frac{9(9+1)}{2} = 45$, which is divisible by 9, it must be the case that the sum of the two integers that we don't pick to form the seven digit number is divisible by 9.

Number of ways of choosing two integers from 9 integers : ${}^9C_2 = 36$

Number of two digit pairs whose sum is divisible by 9 : {(1, 8), (2, 7), (3, 6), (4, 5)} = 4

Simply take the ratio to get the probability that the seven digit number so formed is divisible by 9 : $\frac{4}{36} = \frac{1}{9}$

25. (d)

Let us assume the amount of work to be finished = LCM of {10, 12, 15, 18} = 180 units.

The amount of work which A can complete in a day = $\frac{180}{10}$ = 18 units.

The amount of work which B can complete in a day = $\frac{180}{12}$ = 15 units.

The amount of work which C can complete in a day = $\frac{180}{15}$ =12 units.

The amount of work which D can complete in a day = $\frac{180}{18}$ =10 units.

It is given that 50 percent of the total work gets completed after 3 days. Therefore, we can say that 90 units of work was completed in 3 days.
Let us check options.
Option (a) : Each of them worked for exactly 2 days.
In this case amount of work completed = 2 × (10 + 15 + 12 + 18) = 110 units.
Option (b) : B and D worked for 1 day each, C worked for 2 days and A worked for all 3 days. In this case amount of work completed = 1 × (10 + 15) + 2 × (12) + 3 × (18) = 103 units.
Option (c) : A and C worked for 2 days each, D worked for 1 day and B worked for all 3 days. In this case amount of work completed = 2 × (18 + 12) + 1 × (10) + 3 × (15) = 115 units.
Option (d) : A and C worked for 1 day each, B worked for 2 days and D worked for all 3 days. In this case amount of work completed = 1 × (18 + 12) + 2 × (15) + 3 × (10) = 90 units.
Therefore, we can say that option (d) is the correct answer.

26. (b)
The possible ways are
i. (25 × 4)
ii. (22 × 4 + 2 × 6)
iii. (19 × 4 + 4 × 6)
iv. (16 × 4 + 6 × 6)
v. (13 × 4 + 8 × 6)
vi. (10 × 4 + 10 × 6)
vii. (7 × 4 + 12 × 6)
viii. (4 × 4 + 14 × 6)
ix. (1 × 4 + 16 × 6)
Hence there are total 9 ways.

27. (a)
The terms x, 17, $3x - y^2 - 2$ and $3x + y^2 - 30$ are in A.P.
Common difference : $d = 17 - x$ .....(i)
$d = 3x - y^2 - 19$ .....(ii)
$d = 2y^2 - 28$ .....(iii)
From equation (i) & (ii),
$17 - x = 3x - y^2 - 19$
$\Rightarrow 4x - y^2 = 36$ .....(iv)
From equation (ii) & (iii),
$3x - y^2 - 19 = 2y^2 - 28$
$\Rightarrow x - y^2 = -3$ .....(v)
Solving equation (iv) & (v), we get :
$x = 13, y^2 = 16$
$\Rightarrow$ Terms are = 13, 17, 21, 25
$\therefore$ Sum = 13 + 17 + 21 + 25 = 76
Which is divisible by 2. (among the given options)

28. (d)

Let Manufacturing Cost of the product = ₹100

$\Rightarrow$ Maximum Retail Price (MRP) = $100 + \frac{55}{100} \times 100 = ₹\,155$

Retailer gives 10% discount on MRP

$\Rightarrow$ Retailer's selling price = $155 - \frac{10}{100} \times 155 = ₹\,139.5$

It is given that the Retailer earned 23% profit on his purchase price, say ₹x

$$\Rightarrow \quad \frac{123x}{100} = 139.5$$

$$\Rightarrow \quad x = \frac{13950}{123} = 113.41$$

Now, the purchase price of Retailer = x = selling price of Manufacturer
$\therefore$ Profit earned by Manufacturer = 113.41 – 100 = ₹13.41 $\approx$ 13%

29. (a)

Point $A(-1, 7)$ does not lie outside the circle. So, point can lie on the circle or inside the circle. Distance of A from center = 5 units. So, for the points to lie inside the circle, the distance of given points from center has to be less than 5 units.

Point (i) – Distance between (0, 7) and (2, 3) = $\sqrt{20}$, which is less than 5
Point (ii) – Distance between (5, –1) and (2, 3) = 5

Point (iii) – Distance between (–2, 7) and (2, 3) = $4\sqrt{2}$, which is more than 5
So, option (a).

30. (d)

At least 3 out of 4 throws means 3 or 4 throws

So, $$P = {}^4C_3 \times \left(\frac{1}{5}\right)^3 \times \frac{4}{5} + \left(\frac{1}{5}\right)^4 = \frac{17}{5^4}.$$

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