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IPMAT 2021

Question paper



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Quantitative Ability SA

1.

The number of positive integers which divide $(1890) \cdot (130) \cdot (170)$ and are not divisible by 45 is _____

2.

The sum up to 10 terms of the series $1.3 + 5.7 + 9.11 + \dots$ is _____

3.

It is given that the sequence $\{x_n\}$ satisfies $x_1 = 0, x_{n+1} = x_n + 1 + 2\sqrt{1 + x_n}$ for $n = 1, 2, \dots$. Then x_{31} is _____

4.

There are 5 parallel lines on the plane. On the same plane, there are n other lines which are perpendicular to the 5 parallel lines. If the number of distinct rectangles formed by these lines is 360, what is the value of n ?

5.

There are two taps, T1 and T2, at the bottom of a water tank, either or both of which may be opened to empty the water tank, each at a constant rate. If T1 is opened keeping T2 closed, the water tank (initially full) becomes empty in half an hour. If both T1 and T2 are kept open, the water tank (initially full) becomes empty in 20 minutes. Then, the time (in minutes) it takes for the water tank (initially full) to become empty if T2 is opened while T1 is closed is _____

6.

A class consists of 30 students. Each of them has registered for 5 courses. Each course instructor conducts an exam out of 200 marks. The average percentage marks of all 30 students across all courses they have registered for, is 80%. Two of them apply for revaluation in a course. If none of their marks reduce, and the average of all 30 students across all courses becomes 80.02%, the maximum possible increase in marks for either of the 2 students is _____

7.

What is the minimum number of weights which enable us to weigh any integer number of grams of gold from 1 to 100 on a standard balance with two pans? (Weights can be placed only on the left pan.)

8.

If one of the lines given by the equation $2x^2 + axy + 3y^2 = 0$ coincides with one of those given by $2x^2 + bxy - 3y^2 = 0$, and the other lines represented by them are perpendicular then $a^2 + b^2$ is _____.

9.

If a function $f(a) = \max(a, 0)$ then the smallest integer value of x for which the equation $f(x - 3) + 2f(x + 1) = 8$ holds true is _____

10.

In a class, 60% and 68% of students passed their Physics and Mathematics examinations respectively. Then at least _____ percentage of students passed both their Physics and Mathematics examinations.

Quantitative Ability MCQ

11.

Suppose that a real-valued function $f(x)$ of real numbers satisfies

$$f(x + xy) = f(x) + f(xy)$$

for all real x, y , and that $f(2020) = 1$. Compute $f(2021)$.

a) $\frac{2021}{2020}$

b) $\frac{2020}{2019}$

c) 1

d) $\frac{2020}{2021}$

12.

Suppose that

$$\log_2[\log_3(\log_4 a)] = \log_3[\log_4(\log_2 b)] = \log_4[\log_2(\log_3 c)] = 0$$

Then the value of $a + b + c$ is

a) 105

b) 71

c) 89

d) 37

13.

Let S_n be sum of the first n terms of an A.P. $\{a_n\}$. If $S_5 = S_9$, what is the ratio of $a_3 : a_5$

a) 9:5

b) 5:9

c) 3:5

d) 5:3

14.

If A, B and $A + B$ are non-singular matrices and $AB = BA$, then $2A - B - A(A + B)^{-1}A + B(A + B)^{-1}B$ equals

a) A

b) B

c) $A + B$

d) I

15.

If the angles A, B, C of a triangle are in arithmetic progression such that $\sin(2A + B) = 1/2$ then $\sin(B + 2C)$ is equal to

a) $-1/2$

b) $1/2$

c) $-1/\sqrt{2}$

d) $3/\sqrt{2}$

16.

The unit digit in $(743)^{85} - (525)^{37} + (987)^{96}$ is _____

a) 9

b) 3

c) 1

d) 5

17.

The set of all real values of p for which the equation $3 \sin^2 x + 12 \cos x - 3 = p$ has at least one solution is

- a) $[-12, 12]$
- b) $[-12, 9]$
- c) $[-15, 9]$
- d) $[-15, 12]$

18.

ABCD is a quadrilateral whose diagonals AC and BD intersect at O. If triangles AOB and COD have areas 4 and 9 respectively, then the minimum area that ABCD can have is

- a) 26
- b) 25
- c) 21
- d) 16

19.

The highest possible value of the ratio of a four digit number and the sum of its four digits is:

- a) 1000
- b) 277.75
- c) 900.1
- d) 999

20.

Consider the polynomials $f(x) = ax^2 + bx + c$, where $a > 0$, b, c are real, and $g(x) = -2x$. If $f(x)$ cuts x -axis at $(-2, 0)$ and $g(x)$ passes through (a, b) , then the minimum value of $f(x) + 9a + 1$ is _____

- a) 0
- b) 1
- c) 2
- d) 3

21.

In a city, 50% of the population can speak in exactly one language among Hindi, English and Tamil, while 40% of the population can speak in at least two of these three languages.

Moreover, the number of people who cannot speak in any of these three languages is twice the number of people who can speak in all these three languages. If 52% of the population can speak in Hindi and 25% of the population can speak exactly in one language among English and Tamil, then the percentage of the population who can speak in Hindi and in exactly one more language among English and Tamil is _____

- a) 22%
- b) 25%
- c) 30%
- d) 38%

22.

A train left point A at 12 noon. Two hours later, another train started from point A in the same direction. It overtook the first train at 8 PM. It is known that the sum of the speeds of the two trains is 140 km/hr. Then, at what time would the second train overtake the first train, if instead the second train had started from point A in the same direction 5 hours after the first train? Assume that both the trains travel at constant speeds.

- a) 3 AM next day
- b) 4 AM next day
- c) 8 AM next day
- d) 11 PM the same day

23.

The number of 5-digit numbers consisting of distinct digits that can be formed such that only odd digits occur at odd places is

- a) 5250
- b) 6240
- c) 2520
- d) 3360

24.

There are 10 points in the plane, of which 5 points are collinear and no three among the remaining are collinear. Then the number of distinct straight lines that can be formed out of these 10 points is

- a) 10
- b) 25
- c) 35
- d) 36

25.

The x-intercept of the line that passes through the intersection of the lines $x + 2y = 4$ and $2x + 3y = 6$, and is perpendicular to the line $3x - y = 2$ is

- a) 2
- b) 0.5
- c) 4
- d) 6

26

In a football tournament six teams A, B, C, D, E and F participated. Every pair of teams had exactly one match among them. For any team, a win fetches 2 points, a draw fetches 1 point, and a loss fetches no points. Both the teams E and F ended with less than 5 points. At the end of the tournament points table is as follows (some of the entries are not shown):

Teams	Played	Wins	Losses	Draws	Points
A	5		0		8
B	5		2		6
C	5		2		5
D	5		1		5
E	5		1		
F	5				

It is known that: (1) Team B defeated Team C, and (2) Team C defeated Team D.

26.1

Total number of matches ending in draw is

- a) 12
- b) 4
- c) 5
- d) 6

26.2

Which team had highest number of draws?

- a) Team A

- b) Team C
- c) Team D
- d) Team E

26.3

Total points Team F got was

- a) 0
- b) 1
- c) 2
- d) 3

26.4

Which team was not defeated by Team A?

- a) Team B
- b) Team C
- c) Team D
- d) Team F

26.5

Team E was defeated by

- a) Teams A and B only
- b) Only Team A
- c) Only Team B
- d) Teams A, B and D only



Verbal Ability

27.

Read the following passage and choose the answer that is closest to each of the questions that are based on the passage.

From ancient Rome up to the Victorian era, a training in logic and rhetoric was meant to help privileged young men recognise spurious arguments and facts. Times have changed, but contemporary Italy is determined that its youth are prepared, as their ancient counterparts were, to engage meaningfully with the present-day version of the Forum — social media. At the end of October, 8,000 Italian schools will teach their students how to spot fake news through a programme developed with the help of journalists as well as tech giants Google and Facebook. In Israel, the University of Haifa is launching a course titled “Fake News”.

The purpose of these courses is to ensure that public debate, particularly during election campaigns, is not hijacked by vested interests. Since the US presidential election in 2016, the spectre of Russia and its use of online propaganda has loomed large over public discourse in the West. In other parts of the world too, doctored images and blatant lies have been published by “news” websites. Given the speed with which information is shared online, the damage is already done by the time a fake story is exposed. The voters of tomorrow certainly need to be armed with the ability to sift bare facts from motivated fiction. The effects of social media on the formation of opinion, however, go far beyond fake news.

Traditional or legacy media is ordered by a need for balance. A newspaper, for example, has sections that deal with politics, crime, sports, the arts *et al.* There is, at least in principle, an attempt to tell both sides of a story in each report. On social media, the only editor is the user herself. Algorithms ensure that people see more of what they “like”, that biases are reinforced rather than countered. Fake news is certainly a crucial aspect of online propaganda. But for young citizens to form opinions based on multiple viewpoints, they need to consciously seek out more than they are comfortable with.

27.1

The writer of the passage suggests that

- a) the purpose of education in early times was very different from what it is now.
- b) there are similarities in the aims of education in early times and those of today.
- c) the purpose of education in early times was to help students attain a position of privilege.
- d) as times have changed the basis of education has expanded.

27.2

The passage points out that an important difference between traditional media and social media is that

- a) social media reaches more people.
- b) traditional media tries to present different points of view.
- c) social media is more balanced in its reports.
- d) it is easier to spread fake stories through traditional media.

27.3

Social media is dangerous in its ability to influence opinion in readers through

- a) its choice of news items which are presented.
- b) its balanced reporting of wide-ranging stories.
- c) its ability to guide the reader to motivated conclusions.
- d) the creation of interest by using dubious facts.

27.4

'Vested interests' (Para 2) means

- a) hidden purposes.
- b) popular interests.
- c) self-serving intentions.
- d) profitable motives.

27.5

The antonym for 'spurious' (Para 1) is

- a) inferior.
- b) incisive.
- c) dubious.
- d) genuine.

27.6

The writer of the passage calls social media 'the present-day version of the Roman Forum' because it is a space for

- a) carrying out political propaganda.
- b) discussing ideas.
- c) nurturing political ambitions.
- d) spreading spurious arguments.

28.

Complete the following sentences by choosing the appropriate word/phrase from the options given below

28.1

The impatient and intolerant mother made every effort to

- a) domineer her children.
- b) dominate the child's lives.
- c) denominate her children.
- d) dominion her children.

28.2

To avoid the ecological issues, scientists and government agencies consider how sustainable development

- a) effects the citizen.
- b) affects the citizen.
- c) is affective to the citizen.
- d) is affectionate to the citizen.

28.3

I now have more productive time during the day because I keep the office gossips

- a) a foot away.
- b) at arm's length.
- c) at bay's length.
- d) out of harm's way.

28.4

We need to cut down on our expenses, so that we are able to

- a) make ends meet.
- b) tie up the loose ends.
- c) be more philanthropic.
- d) be tax compliant.

28.5

A portion of the house collapsed because the contractor _____ and built it with very poor quality materials.

- a) short-changed places
- b) cut corners
- c) bit the bullet
- d) made a fortune

28.6

Our team has won every single match that they have played since January. They seem to be

- a) rolling in luck.
- b) rolling in money.
- c) on a roll.
- d) on a roller coaster.

29.

Choose the alternative so that the underlined part of the sentence is rendered correct.

29.1

Other politicians may have claims to seniority over their peers, based upon their accomplishments and their ability to lead campaigns, but Alexandria Ocasio-Cortez, who is often described as merely being a junior member of the House of Representatives, has an unparalleled seniority over all of them by virtue of her prowess in social media management.

- a) as merely being a junior member of the House of Representatives
- b) as being a merely junior member of the House of Representatives
- c) for merely being a junior member of the House of Representatives
- d) as a mere junior member of the House of Representatives

29.2

Although the coastal city of Kundapur was once home to a flourishing maritime trade, their economy has been dependent in more recent years on the cotton textile and sugar industries.

- a) it's economy had depended in more recent years
- b) its economy has in more recent years depended
- c) the economy having in more recent years depended
- d) their economy has depended in more recent years

29.3

Due to the progress in the field of modern medicine and advances in nutrition and hygiene, less people die every year from infectious diseases than ever before.

- a) fewer people die every year from infectious diseases than ever before.
- b) less people die every year from infectious diseases than ever before.
- c) fewer people die every year from infectious diseases than ever before.
- d) every year, fewer people die from infectious diseases than have ever before.

30.

Each of the paragraphs given below has a sentence missing which is indicated by a blank. From the choices given below each paragraph, choose the sentence that seems most logically appropriate to complete the paragraph.

30.1

Captive breeding has helped revive wildlife such as the Eurasian beaver, the cheetah and the Arabian Onyx. Several species have been reintroduced into locations in order that the ecological balance is restored. When herbivorous bandicoots were set free in the wild, they dug the ground and redistributed dry leaves and branches, reducing the chance of bush fires. But some predators may overhunt or threaten other vulnerable species.

- a) Hence, wildlife conservationists should revive more of herbivorous animals and enrich the ecosystems.
- b) Conservation of carnivorous animals is complex and could be dangerous to so many other vulnerable species.
- c) The revival of the ecosystem therefore, depends on the eating habits of the animals introduced therein.
- d) Therefore, all species must be revived and allowed to live in forests regardless of their being carnivorous.

30.2

Postponed from last year, the Tokyo Olympics are set to begin this year. The locals are wary, the athletes are anxious, training sessions are truncated, and restrictions are extensive.

Yet Japan, in many ways is seen as a safe choice, because of its past experience of hosting big events. It has an impeccable reputation for discipline and the ability to deliver the goods.

- (a) The Japanese are anxious but ready to welcome the athletes.
- (b) The shadow of the pandemic looms large over the Tokyo Olympics.
- (c) The International Olympic Committee has fully supported the Tokyo games.
- (d) Japan is going through an economic recession and could run out of funds.

31.

The sentences below have words that are missing. Choose the best option from those given below to complete the sentence.

31.1

When we think about listening, we tend to assume that it is basically the same as hearing; this is a _____ because it leads us to believe that effective listening is _____. As a result, we make little effort to learn, or develop listening skills and thereby _____ a vital communication function.

- a) blunder, spontaneous, forget
- b) fallacy, impulsive, ignore
- c) mistake, natural, reject
- d) misconception, instinctive, neglect

31.2

As vaccination rates rise and governments relax their pandemic _____, the recovery of the event ecosystem is happening faster than expected. Event management _____ see the number of events and event attendance reaching and potentially _____ pre-pandemic levels in 2019.

- (a) regulations, professionals, surpassing
- (b) monitoring, experts, confounding
- (c) resolutions, practitioners, reducing
- (d) systems, masters, exceeding

31.3

This _____, _____ man was actually the _____ manager the company ever had.

- a) assiduous, ludicrous, most able
- b) assiduous, analytical, best
- c) well-groomed, assertive, compassionate
- d) kind-hearted, thoughtful, friendly

31.4

The best strategy to give an _____ is to deliver it orally as well as in _____. It is also important to _____ the employee's achievements in the same manner.

- a) approval, awards, promote
- b) indictment, memos, realise
- c) appraisal, writing, recognise
- d) appreciation, increments, advertise

31.5

The Aravalli range is the oldest _____ geological feature anywhere in the world. These were once tall mountains, possibly as high as the Himalayas. Over hundreds of millions of years these tall mountains have been _____ to low hills and ridges. Yet, these diminutive hills have been _____ to many important events in Indian history.

- a) existing, reduced, sentinel
- b) prevailing, destroyed, testament
- c) surviving, eroded, witness
- d) continuing, broken down, observers

32.

One of the statements below contains a word used incorrectly. Choose the option which has the incorrect or inappropriate usage of the word.

32.1

One of the statements below contains a word used incorrectly. Choose the option which has the incorrect or inappropriate usage of the word.

- a) Naturally, the fauna of the region varies with climatic changes.
- b) Some plants adapt themselves to a variety of climatic conditions.

- c) When the last tree dies in the climactic scene, the message in the movie becomes clear.
- d) The climactic changes from summer to winter affected the moods of the hero of the film.

32.2

One of the statements below contains a word used incorrectly. Choose the option which has the incorrect or inappropriate usage of the word.

- a) The lives of the little princes in the large castle in the rich city were luxurious.
- b) The rooms were adorned with luxuriant trimmings of gold, silk and velvet.
- c) They were handsome men who were distinguished by their luxuriant, golden tresses.
- d) The cruise ship was of medium size, but the suites were very luxurious.

32.3

One of the statements below contains a word used incorrectly. Choose the option which has the incorrect or inappropriate usage of the word.

- a) The king was under intensive pressure to protect the borders of his vast empire.
- b) The subject's loathing of the cruel emperor was intense.
- c) Without intensive study, it is difficult for most students to get admitted into any course.
- d) The intense debate between states led to the resolution of issues across the border.

32.4

One of the statements below contains a word used incorrectly. Choose the option which has the incorrect or inappropriate usage of the word.

- a) We called a mechanic to appraise the car before we bought it.
- b) The principal called a meeting to apprise the school's governing board of the progress made by all the students in the past year.
- c) At the end of each practice session, the teacher trainees are expected to appraise their own performance.
- d) The soldiers returned to the camp to appraise the commanding officer of the enemy's location.

32.5

One of the statements below contains a word used incorrectly. Choose the option which has the incorrect or inappropriate usage of the word.

- a) The young girl said, "I now request our chief guest to come forward for the lighting of the lamp."
- b) I just read that two men who took shelter under a tall tree during a thunderstorm were struck by lightning.
- c) I believe that skin lightning products have a lot of undesirable side effects.
- d) The young girl helped her mother carry some of the groceries home, thereby lightening her heavy load.

33.

The sentences given below, when properly sequenced, form a coherent paragraph. Each sentence is labelled with a number. Decide on the most logical order and enter the sequence of numbers in the space provided, for e.g., 1234.

- a) In the past, companies with international aspirations simply familiarised themselves with any differences in the legal system or in the procedures used in the day-to-day business of import and export.
- b) Modern trade, however, demands more from companies.
- c) Today, the company seeking international success must also understand the people who live and work in countries they deal with, how they think, behave and do business.
- d) To succeed in today's global market place, it is essential to learn as much as possible about the conditions in overseas markets.

34.

The sentences given below, when properly sequenced, form a coherent paragraph. Each sentence is labelled with a number. Decide on the most logical order and enter the sequence of numbers in the space provided, for e.g., 1234.

- a) It mentions a video on TikTok that questioned an influencer's possible views on the Israel-Palestine crisis.
- b) Social media has given us the expectation that every video, every tweet needs to be irreproachable and encompass the lived experiences of the audience.
- c) Should celebs always have a take, asks an article in a magazine.
- d) "Do you guys even care about the issue or do you care about influencers caring about the issue?"

35.

The sentences given below, when properly sequenced, form a coherent paragraph. Each sentence is labelled with a number. Decide on the most logical order and enter the sequence of numbers in the space provided, for e.g., 1234.

- a) In a recent incident, villagers in a tea estate were shocked to find a leopard cub in a trench.
- b) The cub was then taken to the area where she was discovered and reunited with her mother.
- c) The 12,500 leopards in India stray into villages due to their shrinking habitat.
- d) The wildlife vet examined and declared it to be uninjured but dehydrated.

