

Q.1 – Q.15: VERBAL ABILITY

Q 1. Each of the following four sentences has two words within brackets. The word which has been highlighted has been used as the most appropriate word for the sentence. In one of the sentences, the wrong word has been highlighted. Identify that sentence and indicate that option as your answer.

- (A) It is a nightmare driving in this city during (**peak**, peek) traffic hours.
- (B) You need to (ensure, **insure**) your belongings against theft and fire.
- (C) He distributed the document so as to (illicit, **elicit**) everyone's opinion.
- (D) You must understand the underlying (principle, **principal**) to prove the theorem.

Q 2. Each of the following four sentences has two words within brackets. The word which has been highlighted has been used as the most appropriate word for the sentence. In one of the sentences, the wrong word has been highlighted. Identify that sentence and indicate that option as your answer.

- (A) She was (complemented, **complimented**) for her excellent presentation.
- (B) Under his strict but (beneficent, **beneficial**) rule, the empire enjoyed a period of peace.
- (C) Due to his poor (**oversight**, oversite) during construction, the building had many flaws.
- (D) Since he took unauthorized leave, there was a (**break**, brake) in his service.

Q 3. Arrange the sentences in the most logical order to form a coherent paragraph. From the given options (A, B, C, D) choose the most appropriate option.

- (i) But state efforts to build up the data sector in rural areas have resulted in a plethora of under-used sites.
- (ii) At the same time, data centres in main cities are already running at capacity. In Beijing and Shanghai, demand outstrips supply by 20 and 25 per cent, respectively, according to the ministry.
- (iii) There are twice as many data centres in north-eastern China than required, according to figures from China's Ministry of Industry and Information Technology.
- (iv) Tech groups have been given incentives by Chinese regulators to set up their onshore data storage in poorer, more remote areas, with inducements such as free land and cheap power.

(A) (iv), (i), (iii), (ii)

(B) (iii), (i), (ii), (iv)

(C) (iv), (ii), (iii), (i)

(D) (iii), (i), (iv), (ii)

Q 4. Arrange the sentences in the most logical order to form a coherent paragraph. From the given options (A, B, C, D) choose the most appropriate sequence.

- (i) For almost a billion years, while its core churned and produced a protective magnetic field, Mars may have been among the friendlier places for life as we know it to set up and flourish.
- (ii) But that is what the \$2.4-billion 2020 rover will attempt to do.
- (iii) Though Mars is a parched, toxic desert today, the planet was once much warmer and covered in liquid seas.
- (iv) The trouble is, finding evidence for past life on an alien world, especially if that extinct life is microscopic, is not exactly easy.

(A) (i), (ii), (iii), (iv)

(B) (iv), (ii), (i), (iii)

(C) (i), (iii), (iv), (ii)

(D) (iii), (i), (iv), (ii)

Q 5. Arrange the sentences in the most logical order to form a coherent paragraph. From the given options (A, B, C, D) choose the most appropriate option.

- (i) Part of the rapid slowing reflected specific problems in the German car industry, where changes in emissions regulation have had a one-off impact on production.
- (ii) But even without that, growth would barely have been positive.
- (iii) Last week it was revealed that Germany, one of the few reliable engines of eurozone growth since the global financial crisis, had seen a 0.2 per cent fall in GDP in the third quarter.
- (iv) Moreover, indicators of business sentiment show that underlying growth momentum has slowed across the eurozone.

(A) (i), (ii), (iv), (iii)

(B) (iii), (i), (ii), (iv)

(C) (i), (iv), (iii), (ii)

(D) (iii), (i), (iv), (ii)

Instructions for Questions 6 to 10. Read the passage below and choose the most appropriate answer for the questions that follow.

One ad pictured a woman holding an hourglass next to the words: "Beauty has no age limit. Fertility does." Another portrayed a pair of baby shoes wrapped in a ribbon of the Italian flag. Yet another showed a man holding a half-burned cigarette: "Don't let your sperm go up in smoke," it read.

They were part of a government effort to promote "Fertility Day" on Sept. 22, a campaign intended to encourage Italians to have more babies. Instead, the ads set off a furore, were denounced as being offensive, and within days were withdrawn. What they did succeed in doing, however, was to ignite a deeper and lasting debate about why it is that Italy has one of the lowest birthrates in the world, and what can be done about it.

The problem is not a lack of desire to have children, critics of the campaign say, but rather the lack of meaningful support provided by the government and many employers in a country where the family remains the primary source of child care. Many working women, without an extended family to care for a child, face a dilemma, as private child care is expensive. Some

also worry that their job security may be undermined by missing workdays because of child care issues. Many companies do not offer flexible hours for working mothers.

Not surprisingly, Italy's long slowdown in childbirth has coincided with its recent economic slump. But Italian families have been shrinking for decades. In 2015, 488,000 babies were born in Italy, the fewest since the country first unified in 1861. It has one of the lowest birthrates in Europe, with 1.37 children per woman, compared with a European average of 1.6, according to Eurostat figures. By contrast, in France, the economy has been flat, too, but a family-oriented system provides a far more generous social safety net that includes day care and subsidies for families to have children. There, women have two children each on average.

The Ministry of Health began the fertility campaign on Aug. 31 with a group of online advertisements and a hashtag on Twitter. The goal was to publicize a series of public meetings on Fertility Day and encourage Italians to have more children. Even Prime Minister Matteo Renzi, whose own health minister started the campaign, distanced himself from the ads in a radio interview. Under Mr. Renzi, Italy's government has tried to help families with a so-called baby bonus of 80 to 160 euros, or about \$90 to \$180, for low- and middle-income households, and it has approved labor laws giving more flexibility on parental leave. But Italy allocates only 1 percent of its gross domestic product to social protection benefits — half the European average. One child out of three here is at risk of relative poverty.

Italy's health minister, Beatrice Lorenzin, responding on Facebook, wrote that the Fertility Day campaign was not a "call to reproduction" but a day to discuss "the fertility issues that 15 percent of Italians deal with." She promptly cancelled the campaign. "I am saddened that the launch of the advertising campaign misled many people," Ms. Lorenzin said. "I withdrew it to change it."

Q 6. Which one of the following sentences is inaccurate based on all the facts detailed in the passage?

- (A) A sizable proportion of Italian children are facing poor economic conditions.
- (B) The ad campaign was launched nationwide across television networks.
- (C) On average, a group of twenty-seven women give birth to thirty-seven children in Italy as opposed to fifty-four children in France.
- (D) Prime Minister Renzi has taken several steps in the right direction to address the core problem discussed here.

24
2137
27
9590

Q 7. According to the passage, what is the key reason for Italy's low fertility rate?

- (A) Couples are choosing to remain childless so that they focus on their career in an extremely competitive environment.
- (B) A reduction in overall wage rate across the country since the recent economic recession.
- (C) Absence of a support system for families with children.
- (D) High prevalence of smoking among men and women in the country.

Q 8. Which of the following words best captures Prime Minister Matteo Renzi's reaction to the fertility campaign?

- (A) Disassociation
- (B) Belligerence
- (C) Indifference ✗
- (D) Solidarity ✗

Q 9. Based on the passage, which of the following measures will not have a meaningful impact on Italy's fertility rate even if the government worked hard to implement them?

- (A) Making it mandatory for all private companies to allow flexible working hours for pregnant women and new moms.
- (B) Investing in a robust public child care system.
- (C) Persuading low income families to have children by providing them financial incentives.
- (D) Spending money on advertisements that encourage Italians to have more children.

Q 10. The passage mentions that the idea of "Fertility Day" was "denounced as being offensive." According to the campaign, what exactly did the Italians find "offensive"?

- (A) The message being conveyed was not appropriate for young children who also saw these advertisements.
- (B) The campaign offended the religious sensibilities of many Italians.
- (C) The government failed to recognize the real cause of the low fertility issue.
- (D) The advertisements offended men as it linked smoking with low fertility rates.

Instructions for Questions 11 to 15. Read the passage below and choose the most appropriate answer for the questions that follow.

The 'trolley problem' used to be an obscure question in philosophical ethics. It runs as follows: a trolley, or a train, is speeding down a track towards a junction. Some moustache-twirling evildoer has tied five people to the track ahead, and another person to the branch line. You are standing next to a lever that controls the junction. Do nothing, and the five people will be killed. Pull the lever, and only one person dies. What is the ethical course of action?

The excitement around self-driving cars, though, has made the problem famous. A truly self-driving car, after all, will have to be given ethical instructions of some sort by its human programmers. That has led to a miniature boom for the world's small band of professional ethicists, who suddenly find themselves in hot demand.

In a paper just published in *Nature*, a team of psychologists and computer scientists describe a different approach. Rather than asking said small band of philosophers for their thoughts, this team, led by Edmond Awad of the Massachusetts Institute of Technology (MIT), decided instead to ask the general public. They created the "Moral Machine", a website which presents visitors with a series of choices about whom to save and whom to kill. In one, for instance, a self-driving car experiences brake failure ahead of a pedestrian crossing. If it carries on in a straight line, a man, a woman and two homeless people of unspecified sex will be run down. If it swerves, the death count will be the same, but the victims will be two women and two male business executives. What should the car do?

The strongest preferences, expressed by respondents from all over the world, were for saving human lives over animal ones, preferring to save many rather than few and prioritising children over the old. There were weaker preferences for saving women over men, pedestrians over

passengers in the car and for taking action rather than doing nothing. Criminals were seen as literally subhuman—ranking below dogs in the public’s priority list, but above cats.

Preferences differed between countries. The preference for saving women, for instance, was stronger in places with higher levels of gender equality. The researchers found that the world’s countries clustered into three broad categories, which they dubbed “Western”, covering North America and the culturally Christian countries of Europe, “Eastern”, including the Middle East, India and China, and “Southern”, covering Latin America and many of France’s former colonial possessions. Countries in the Eastern cluster, for instance, showed a weaker preference for sparing the young over the elderly, while the preference for humans over animals was less pronounced in Southern nations. Self-driving cars, it seems, may need the ability to download new moralities when they cross national borders.

Q 11. Among the following, who would be the equivalent of the person pulling the lever in the ‘trolley problem’?

- (A) Professional ethicists working for car manufacturing firms.
- (B) CEOs of multinational car manufacturing firms.
- (C) Driverless-car owners who use their cars to travel abroad.
- (D) Software-programmers who design software for driverless cars.

Q 12. The statement “self-driving cars...may need the ability to download new moralities when they cross national borders” implies that,

- (A) Car manufacturing firms face difficult choices in developing car navigation software which will be acceptable to regulators in different countries
- (B) Different countries have different regulations for self-driving cars which need to be downloaded by cars when they cross national boundaries.
- (C) National preferences differ with regard to whom self-driving cars should kill in an accident and navigation software needs to be modified accordingly.
- (D) Car manufacturing firms need to train local software programmes in ethics or train local professional ethicists to develop software in countries where they sell cars.

Q 13. Which of the following preferences in driverless-car navigation software is likely to get acceptance from the largest number of countries?

- (A) Saving three children and their two young female teachers crossing the road as opposed to five old men also crossing the road.
- (B) Saving three children and their two young female teachers each carrying a puppy as opposed to five criminals also crossing the road.
- (C) Saving three children and their two young female teachers travelling in a school bus as opposed to five old women traveling in a car.
- (D) Saving five young female teachers travelling in a school bus as opposed to five old women traveling in a car.

Q 14. Regulatory approval of which of the following preferences of car-navigation software is likely to face most uncertainty in a 'Southern' country with high levels of gender in-equality?

- (A) Save older women as opposed to older men.
- (B) Save older women as opposed to young male animals.
- (C) Save older male animals as opposed to younger female animals.
- (D) Saving older women as opposed to young female animals.

Q 15. Which of the following, if achieved, might solve the ethical dilemmas faced by those designing navigation software for driverless cars?

- (A) An international agreement to develop a separate signalling system for driverless cars.
- (B) A solution to the 'trolley problem' and an international agreement that cars should run on rails instead of roads.
- (C) Formation of an international panel of professional ethicists to solve the 'trolley problem'.
- (D) An international agreement on guidelines for development of navigation software for self-driving cars.

Q 20. If Q and S have at least two brands in common, then what is the maximum number of handsets that Q and S together can own?

(A) 5

(B) 6

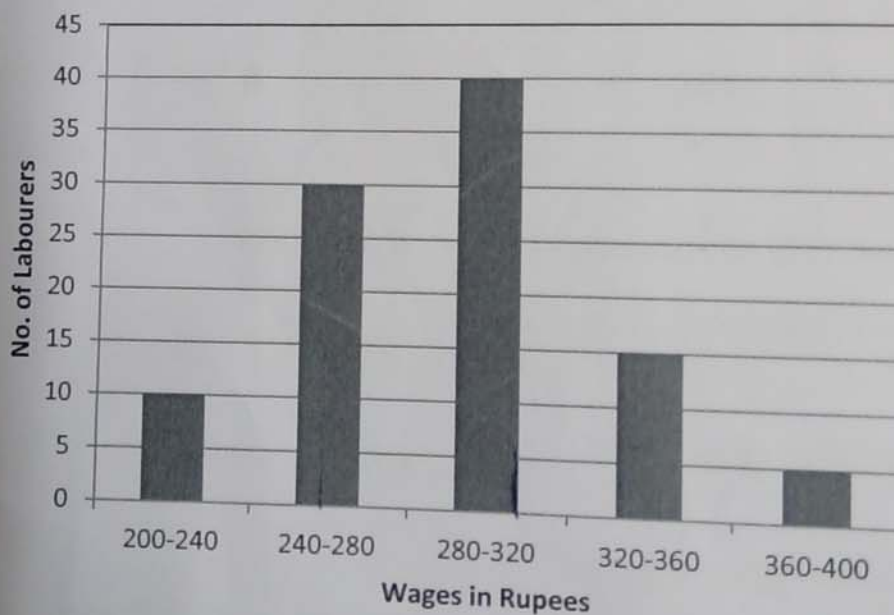
(C) 7

(D) 8

Q. 21 – Q.25: DATA INTERPRETATION AND DATA VISUALIZATION

Instructions for Questions 21 to 23: Answer the questions based on the following information.

The following bar diagram represents the number of daily wages (in rupees) of 100 labourers in different wage classes on a construction site. Here the class interval $a-b$ includes all wages (in rupees) greater than or equal to a and less than b except for the interval 360-400, where both the end points are included.



Q 21. The number of labourers receiving at least Rs. 320 is

(A) 5

(B) 15

(C) 20

(D) more than 20

Q 22. The number of labourers receiving less than Rs. 250 is

- (A) less than 10 (B) at least 10 but not more than 40
 (C) more than 40 but not more than 50 (D) more than 50

Q 23. The maximum wage (in Rupees), such that at least 50% of the labourers definitely earn more than that, is

- (A) 240 (B) 280 (C) 290 (D) 300

Handwritten calculations for Q 23:

$$\begin{array}{r} 984 \\ 875 \\ \hline 109 \end{array} \times 100$$

$$\begin{array}{r} 875 \\ 35 \\ \hline 840 \end{array}$$

Instructions for Questions 24 and 25: Answer the questions based on the following information.

The following table gives month-wise arrivals of foreign tourists in India in the years 2016 & 2017.

Table: Month-wise Arrivals of Foreign Tourists (in Thousands) in India (2016-2017)

Month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2016	400	500	600	500	400	500	600	600	700	800	900	1000
2017	560	570	720	590	580	610	660	696	875	984	1170	1090

Q 24. In which month of 2017 is the percentage increase over the corresponding month of the previous year the minimum?

- (A) FEB (B) JUL (C) SEP (D) DEC

Handwritten calculations for Q 24:
 For FEB: $\frac{160}{400} \times 100 = 40\%$
 For JUL: $\frac{60}{600} \times 100 = 10\%$
 For SEP: $\frac{175}{700} \times 100 = 25\%$
 For DEC: $\frac{90}{1000} \times 100 = 9\%$

Q 25. In which month of 2017 is the percentage increase over the previous month the maximum?

- (A) MAR (B) SEP (C) OCT (D) NOV

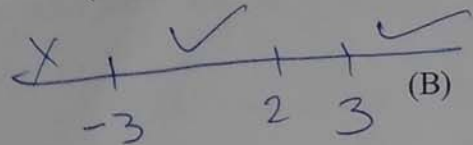
Handwritten calculations for Q 25:
 For MAR: $\frac{150}{570} \times 100 = 26.3\%$
 For SEP: $\frac{179}{696} \times 100 = 25.7\%$
 For OCT: $\frac{109}{875} \times 100 = 12.5\%$
 For NOV: $\frac{186}{984} \times 100 = 18.9\%$

Q. 26 - Q. 50: QUANTITATIVE APTITUDE

$x \neq -3, 3$

Q 26. If $f(x) = \log_e \left(\frac{2-x}{9-x^2} \right)$, then the domain of the function f is

$\frac{2-x}{9-x^2} > 0$

(A) $(-2, 3)$  (B) $(2, 3)$

$\frac{2-x}{(3-x)(3+x)}$

(C) $(-2, 2) \cup (9, \infty)$ (D) $(-3, 2) \cup (3, \infty)$

$\begin{vmatrix} 2 & 1 & a \\ 6 & -2 & b \\ 2 & -1 & c \end{vmatrix}$

Q 27. If the system of linear equations

$\begin{vmatrix} 1 & a \\ -2 & b \\ -1 & c \end{vmatrix}$

$2x + y + 7z = a$
 $6x - 2y + 11z = b$
 $2x - y + 3z = c$

$\begin{vmatrix} 2 & 1 & 7 \\ 6 & -2 & 11 \\ 2 & -1 & 3 \end{vmatrix} = 2 \begin{bmatrix} -6+11 \\ -1[18-22] \end{bmatrix}$
 $-2a - 4c + 2b$
 $-6c + 24 + 7[-6+4]$

has infinite number of solutions, then a, b, c must satisfy

$-2c + b$

$6c - 2b$

$(-6+4)$

$+2b - 6c + 2b - 2a$

(A) $5a - 2b + c = 0$

(B) $5a - b + c = 0$

$10 + 4 - 14$

(C) $a - 5b + 2c = 0$

(D) $a - 2b + 5c = 0$

Q 28. If α, β are the roots of the equation $x^2 + 3x - 3 = 0$, then the value of

$+4b - 2a = 0$

$c + 2b - a = 0$

$(\alpha+1)^{-1} + (\beta+1)^{-1}$ is equal to

(A) $\frac{2-2\sqrt{3}}{3}$

$\begin{vmatrix} 2 & a & 7 \\ 6 & b & 11 \\ 2 & c & 3 \end{vmatrix}$

(B) $\frac{2}{3}$

(C) $\frac{\sqrt{21}}{5}$

(D) $\frac{1}{5}$

$(3b - 11c) - a(18 - 22) + 7(6c - 2b)$
 $\frac{42c - 14b}{\alpha + 1} + \frac{1}{\beta + 1}$
 $\frac{22c - 18a + 22a + 42c - 14b}{\alpha + 1} + \frac{1}{\beta + 1}$
 $\frac{22c - 18a + 22a + 42c - 14b}{\alpha + 1} + \frac{1}{\beta + 1}$

$\frac{1}{\alpha+1} + \frac{1}{\beta+1}$

$\frac{\alpha+1+\beta+1}{(\alpha+1)(\beta+1)}$
 $\frac{-3+2-1}{-3-3+1}$
 $\frac{-2}{-5}$

$\frac{2-3}{1-3-3} = \frac{1}{-5}$

16

$$y^2 + 4y + 7 = 0$$

$$y = \frac{-4 \pm \sqrt{16 - 28}}{2} = \frac{-4 \pm \sqrt{-12}}{2} = -2 \pm i\sqrt{3}$$

Q 29. The number of real roots of the equation

$$3(e^x + e^{-x})^3 + 3(e^x + e^{-x})^2 + 3(e^x + e^{-x}) = 7$$

is

$$(y+1)^3 = 3y^3 + 3y^2 + 3y - 7 = 0 \quad \ln(x + e^{-3/4}x)$$

(A) 0

(B) 1

(C) 2

(D) more than 2

$$y+1 = \sqrt[3]{3y^3 + 3y^2 + 3y - 7}$$

$$y = -1 + \sqrt[3]{3y^3 + 3y^2 + 3y - 7}$$

$$x = -\frac{3/4}{1!} + \frac{(3/4)^2}{2!} - \frac{(3/4)^3}{3!} + \dots$$

$$\begin{matrix} 0 & 2 & 4 & 7 \\ 2 & 4 & 6 & + \\ 4 & 6 & 8 & \checkmark \\ 6 & 8 & 10 & \checkmark \\ 8 & 10 & & \checkmark \end{matrix}$$

Q 30. Let $x = -\frac{1}{1!} \cdot \frac{3}{4} + \frac{1}{2!} \cdot \left(\frac{3}{4}\right)^2 - \frac{1}{3!} \cdot \left(\frac{3}{4}\right)^3 + \dots$, and $y = x - \frac{x^2}{2} + \frac{x^3}{3} - \dots$. Then the value of y

is

$$e^{-3/4} - 1 \quad \ln(1+x)$$

(A) $-\frac{3}{4}$

(B) $\frac{3}{4}$

(C) $-\frac{4}{3}$

(D) $\frac{4}{3}$

$$P = \{1, 2, 3\}$$

$$Q = \{2, 3\}$$

$$2n-2 < n+2$$

$$n < 4$$

$$n-2 + n + n+2$$

$$3n$$

Q 31. If P, Q, R are subsets of some universal set, then the conditions $P^c \cap Q \subseteq R^c \cap Q$ and $P^c \cap Q^c \subseteq R^c \cap Q^c$ imply

$$R = (P \cup Q)^c \subseteq (R \cup Q)^c \subseteq (P \cup Q^c)^c \subseteq (R \cup Q^c)^c$$

(A) $R \subseteq P$

(B) $P \subseteq R$

(C) $Q = R$

(D) $P = Q$

$$(P \cup Q)^c \subseteq (R \cup Q)^c$$

$$(R \cup Q)^c \subseteq (P \cup Q)$$

$$R \subseteq P$$

$$\frac{\sqrt{2}+1}{2\sqrt{2}}$$

$$R \cup Q^c \subseteq P \cup Q$$

$$P \subseteq P$$

Q 32. The sides of triangle are 3 consecutive even integers with the largest side being less than 13. What is the total number of such triangles?

(A) 1

(B) 2

(C) 3

(D) 4

$$n-2, n, n+2$$

$$n < 6$$

$$2n + 2ny' = 0$$

$$m = -\frac{2}{4} = -\frac{1}{2}$$

Q 33. The circle $x^2 + y^2 = 9$ intersects with the parabola $y^2 = 8x$ at a point P in the first quadrant. The acute angle between the tangents to the circle and the parabola at the point P is

(A) $\tan^{-1}\left(\frac{5}{2\sqrt{2}}\right)$

(B) $\tan^{-1}\left(\frac{3}{\sqrt{2}}\right)$

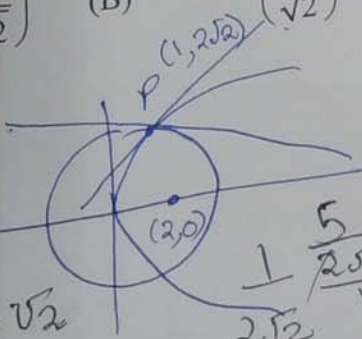
(C) $\tan^{-1}\left(\frac{5}{\sqrt{2}}\right)$

(D) $\tan^{-1}\left(\frac{7}{2\sqrt{2}}\right)$

$$y = -\frac{x}{y}$$

$$= -\frac{1}{2\sqrt{2}}$$

$$y = \frac{4}{2\sqrt{2}} = \sqrt{2}$$



$$x^2 + 8x - 9 = 0$$

$$x^2 + 9x - x - 9 = 0$$

$$x = 1, \dots$$

$$xy = 2\sqrt{2}$$

$$\left(2\sqrt{2} + \frac{1}{\sqrt{2}}\right)$$

$$\frac{5}{\sqrt{2}}$$

Q 34. The interior angles of a convex polygon are in arithmetic progression. The smallest angle is 120° and the common difference is 5° . Then the number of its sides is

- (A) 5 (B) 9 (C) 12 (D) 16

$$y = \sqrt{32} \sqrt{32} \dots$$

Q 35. Assuming that

is a real number, its value is

- (A) 16 (B) 32 (C) 64 (D) 128

$$\sqrt{32 \sqrt{32 \sqrt{32 \dots}}}$$

$$y = \sqrt{32y}$$

$$y = \sqrt{32y}$$

$$y^2 = 32y$$

$$y = 0 \text{ or } 32$$

Q 36. The total number of onto functions from $\{1, 2, \dots, 10\}$ to $\{1, 2, \dots, 9\}$ is

- (A) ${}^{10}C_2 \times 9!$ (B) ${}^{10}P_2 \times 9!$ (C) $9 \times 10!$ (D) 10^9

$${}^{10}C_1 \times 9 \times 9! \rightarrow 9 \times 10!$$

Q 37. All words formed by permutations of the word 'WARE' are arranged in a list according to the dictionary ordering. The position of the word 'WEAR' in this list is at number

- (A) 20 (B) 21 (C) 22 (D) 23

Q 38. The number of integers between 300 and 1100 which are divisible by either 7 or 13 but not both is

- (A) 149 (B) 158 (C) 167 (D) 176

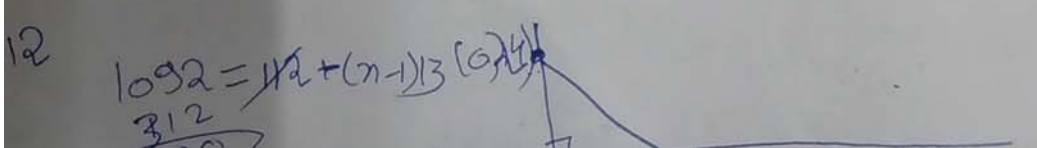
Q 39. The diameter of the circumcircle of the triangle formed by the line $24x + 7y = 168$ and the coordinate axes is

- (A) $15\sqrt{2}$ (B) 24 (C) 25 (D) $12\sqrt{3}$

$$\frac{x}{7} + \frac{y}{24} = 1$$

$$364 + (n-1)9$$

$$n=9$$



$$1092 = 12 + (n-1)13$$

Q 40. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ be an even function that is differentiable everywhere except exactly at 10 distinct points. Then which of the following statements is TRUE ?

- (A) $f'(0)$ does not exist
- (B) $f'(0) > 0$
- (C) $f'(0) = 0$
- (D) $f'(0) < 0$



Q 41. Let the function f be defined on the set of real numbers by

$$f(x) = \begin{cases} 2x-1 & \text{if } x < 1 \\ \frac{x^2-1}{3} & \text{if } x \geq 1 \end{cases}$$

Then which of the following statements is TRUE ?

- (A) f is decreasing for $x < 1$ and increasing for $x \geq 1$
- (B) f is not continuous at $x = 1$
- (C) f is continuous but not differentiable at $x = 1$
- (D) f is differentiable at $x = 1$

Handwritten calculations for Q41:

$$\frac{(1-h)^2 + h - 1}{-h} = \frac{1 - 2h + h^2 + h - 1}{-h} = \frac{-h + h^2}{-h} = 1 - h$$

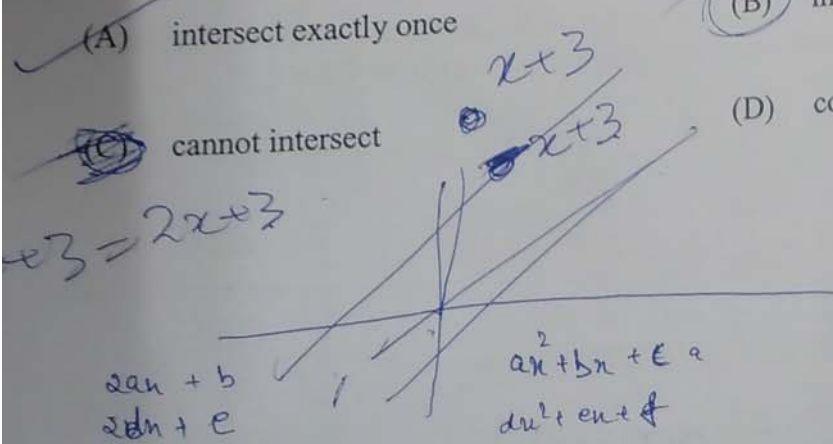
$$\frac{(1+h)^2 - 1}{3h} = \frac{1 + 2h + h^2 - 1}{3h} = \frac{2h + h^2}{3h} = \frac{2 + h}{3}$$

Since $1 - h \neq \frac{2 + h}{3}$, the function is not differentiable at $x = 1$.

Q 42. If $f'(x)$ and $g'(x)$ exist for all $x \in \mathbb{R}$, and if $f'(x) > g'(x)$ for all $x \in \mathbb{R}$, then the curves $y = f(x)$ and $y = g(x)$ in the xy -plane

- (A) intersect exactly once
- (B) intersect at most once

(D) could intersect more than once



Handwritten notes for Q42:

$$2^2 + x$$

$$\frac{e^{-x}}{-e^{-x}}$$

W A R E A E R W

- A → 6
- E → 6
- R → 6

W.A → 2
E.A.R

$$2 \int_0^1 \frac{x^2+1}{1+x^2} dx$$

Q 43. The value of the integral $\int_{-1/\sqrt{3}}^{1/\sqrt{3}} \left(\frac{x^2 - \tan x}{1+x^2} \right) dx$ is equal to

(A) $2 \left(\frac{1}{\sqrt{3}} - \frac{\pi}{6} \right)$

Handwritten: $2x \int_0^{\sqrt{3}} \dots$

(B) $2 \left(\frac{1}{\sqrt{3}} + \frac{\pi}{6} \right)$

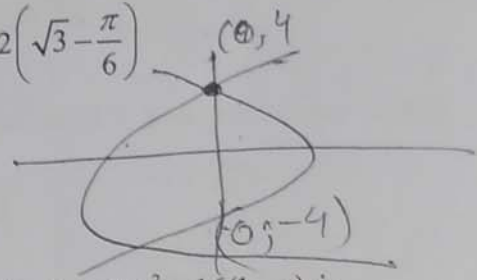
Handwritten: $-\int_0^{\sqrt{3}} \frac{1}{1+d^2} dd - \tan^{-1} x \Big|_0^{\sqrt{3}}$

(C) $\frac{2\pi}{3}$

Handwritten: $\int_{-1/\sqrt{3}}^{1/\sqrt{3}} \frac{x^2}{1+x^2} dx$

Handwritten: $-\int_{-1/\sqrt{3}}^{1/\sqrt{3}} \frac{\tan x}{1+x^2} dx$

(D) $2 \left(\sqrt{3} - \frac{\pi}{6} \right)$



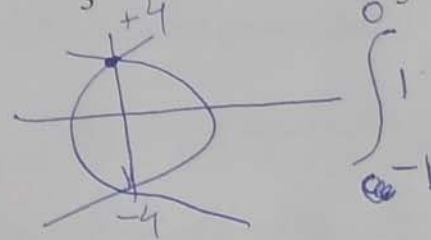
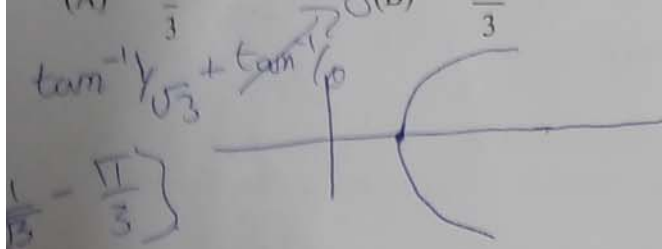
Q 44. The area enclosed between the parabolas $y^2 = 16(1+x)$ and $y^2 = 16(1-x)$ is

(A) $\frac{8}{3}$

(B) $\frac{16}{3}$

(C) $\frac{32}{3}$

(D) $\frac{64}{3}$



Q 45. Let $[x]$ denote the greatest integer less than or equal to x . The value of the integral $\int_0^{\sqrt{2}} [x^2] e^x dx$ is equal to

Handwritten: $\int_0^{\sqrt{2}} [x^2] e^x dx$



(A) 0

(B) $\sqrt{2}e - 1$

(C) $e^{\sqrt{2}} - e$

(D) $e^2 - e$

Handwritten: $\int_0^1 0 e^x dx + \int_1^{\sqrt{2}} 1 e^x dx$

Handwritten: $f(x) - x < 0, (b-1)^2 < 4ac, a < 0, ax^2 + (b-1)x + c < 0$

Q 46. A function $f(x) = ax^2 + bx + c$, where $a, b, c \in \mathbb{R}$, satisfies the property $f(x) < x$ for all $x \in \mathbb{R}$. Then which of the following statements must always be TRUE?

(A) $a \leq 0$

(B) $b \leq 1$

(C) $c = 0$

(D) $b > 1$

Handwritten: $ax^2 + bx = 0 \Rightarrow x = -b/a$

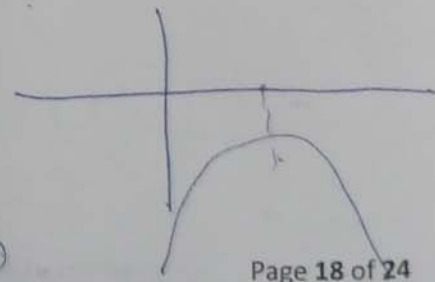
Handwritten: $ax^2 + bx + c < x$

Handwritten: $ax^2 + (b-1)x + c < 0$

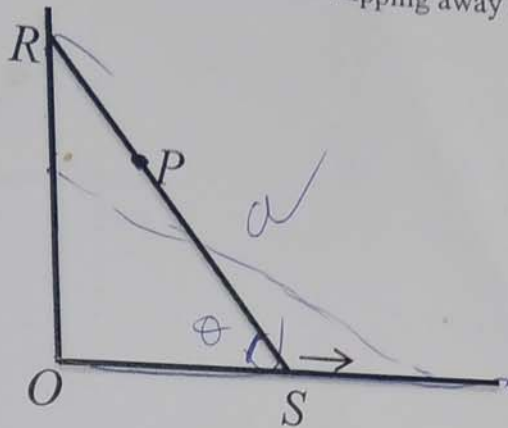
Handwritten: $x = \frac{-(b-1)}{2a}$

Handwritten: $(b-1)^2 - 4ac < 0$

Handwritten: $16 < 4ac$



Q47. The foot of the ladder RS in the following figure is slipping away from the wall RO .



$$\tan \theta = \frac{2k}{2h}$$

$$\sec^2 \theta \frac{d\theta}{dt} =$$

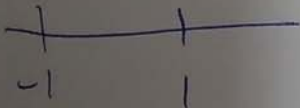
$$P(x) = 2ax > 0$$

$$a < 0$$

Then the point P (a fixed point on the ladder) lies on

- (A) a straight line (B) a parabola (C) a hyperbola (D) an ellipse

Q48. Given that



Then the value of ab is

- (A) 0 (B) $\frac{1}{6}$ (C) $\frac{1}{4}$

Q49. If $\left| \frac{x+1}{x-1} \right| > \frac{x+1}{x-1}$, then

- (A) $-1 \leq x \leq 1$ (B) $-1 < x < 1$ (C) $x > 1$ (D) $x < -1$

Q50. How many 6×7 matrices are there with entries in $\{0, 1\}$ such that all the row totals and column totals are odd numbers?

- (A) $\frac{2^{42}}{2}$ (B) $\frac{42^2}{2}$ (C) 42

END OF THE QUESTION PAPER

