

Mock CAT 2014 - 10*

Section I: QA & DI

1. Two chords AB and CD of a circle with centre O, intersect each other at P. If $\angle AOD = 80^\circ$ and $\angle BOC = 75^\circ$ then the value of $\angle APC$ is
 (a) 2.5° (b) 102.5° (c) 12.5° (d) Either (a) or (b)

1. d From the data given in the question the following two cases emerge:

Case I: The figure would be as shown below.

To find: $\angle APC$

Chord AD subtends 80° at centre O.

\therefore AD subtends $\frac{1}{2} \times 80^\circ = 40^\circ$ at the circumference of the circle.
 $\Rightarrow \angle ABD = \angle PBD = 40^\circ$

Similarly,

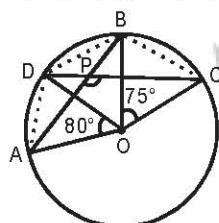
Chord BC subtends 75° at centre O.

\therefore BC subtends $\frac{1}{2} \times 75^\circ = 37.5^\circ$ at the circumference of the circle.
 $\Rightarrow \angle BDC = \angle BDP = 37.5^\circ$

In $\triangle BDP$, $\angle PBD = 40^\circ$ and $\angle BDP = 37.5^\circ$

$\therefore \angle BPD = 180^\circ - 40^\circ - 37.5^\circ = 102.5^\circ$

$\therefore \angle APC = \angle BPD = 102.5^\circ$ (vertically opposite angles)



Case II: The figure would be as shown below.

To find: $\angle APC$

Chord AD subtends 80° at centre O.

\therefore AD subtends $\frac{1}{2} \times 80^\circ = 40^\circ$ at the circumference of the circle.
 $\Rightarrow \angle AQD = 40^\circ$

AQDC is a cyclic quadrilateral.

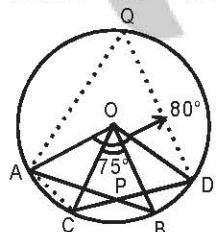
$\therefore \angle ACD = \angle ACP = 180^\circ - 40^\circ = 140^\circ$

Chord BC subtends 75° at centre O.

\therefore BC subtends $\frac{1}{2} \times 75^\circ = 37.5^\circ$ at the circumference of the circle.
 $\Rightarrow \angle CAB = \angle CAP = 37.5^\circ$

In $\triangle APC$, $\angle ACP = 140^\circ$ and $\angle CAP = 37.5^\circ$

$\therefore \angle APC = 180^\circ - 140^\circ - 37.5^\circ = 2.5^\circ$



2. The value of $\frac{1}{b^2 + by + y^2} - \frac{1}{b^2 - by + y^2} + \frac{2by}{b^4 + b^2y^2 + y^4}$ is
 (a) 2 (b) 1 (c) -1 (d) 0

$$\begin{aligned}
 & \frac{1}{b^2 + by + y^2} - \frac{1}{b^2 - by + y^2} + \frac{2by}{b^4 + b^2y^2 + y^4} \\
 &= \frac{b^2 - by + y^2 - b^2 - by - y^2}{\{(b^2 + y^2) + by\}\{(b^2 + y^2) - by\}} + \frac{2by}{b^4 + b^2y^2 + y^4} \\
 &= \frac{-2by}{(b^2 + y^2)^2 - b^2y^2} + \frac{2by}{b^4 + b^2y^2 + y^4} \\
 &= \frac{-2by}{b^4 + b^2y^2 + y^4} + \frac{2by}{b^4 + b^2y^2 + y^4} = 0.
 \end{aligned}$$

3. The sum of squares of three consecutive odd natural numbers is bbbb, which is a four-digit number. Find the value of b.
 (a) 1 (b) 2 (c) 5 (d) 8

3. c Assume that the three consecutive odd numbers are $(a - 2)$, a and $(a + 2)$, where a is an odd natural number. Thus, as per the condition given,

$$(a+2)^2 + (a)^2 + (a-2)^2 = 3a^2 + 8, \text{ which is odd.}$$

By the problem, $3a^2 + 8$ should be one of 1111, 3333, 5555, 7777 and 9999

$3a^2 + 8$ is of the form $3k + 2$, where k is a natural number.

However 1111, 3333, 7777, 9999 are not of that form

$$\therefore 3a^2 + 8 = 5555$$

$$\Rightarrow 3a^2 = 5547$$

$$\Rightarrow a^2 = 1849.$$

$$\Rightarrow a = 43.$$

$\therefore b = 5$ and the numbers are 41, 43 and 45.

4. Ramu had a pack of cards numbered from 1 to 1000 (not necessarily in any particular order). He shuffled this pack in two steps as given below:
 Step 1: Place the top most card to the bottom of the pack
 Step 2: Remove the top most card to make a new pack

He kept on repeating these two steps till he transferred all the cards into a new pack of cards. After the completion of the process, he realized that, in the new pack of cards, all the cards were automatically arranged from 1000 to 1, from top to bottom. Initially, what was the number on the top most card?

- (a) 937 (b) 875 (c) 125 (d) 63

4. a Initially Ramu has removed cards in the positions 2, 4, 6, 8 and so on till 1000 which have formed cards numbered from 1 to 500. Later, he moved cards positioned at 3, 7, 11, 15 and so on till 999 which were numbered from 501 to 750. After this, the first card will again come on the top and he will start remove cards positioned at 5, 13, 21 and so on till 997 which will be numbered from 751 to 875. Next he removes cards from the positions 9, 25, 41 and so till 985 which are numbered from 876 to 936. Finally, top most card, namely 993, will be put back to bottom and card to be removed will be the original top most card and this will be numbered 937.

5. If $f(x) = \frac{121^x}{121^x + 11}$, then find the value of the following expression:
- $$f\left(\frac{1}{2014}\right) + f\left(\frac{2}{2014}\right) + f\left(\frac{3}{2014}\right) + \dots + f\left(\frac{2012}{2014}\right) + f\left(\frac{2013}{2014}\right).$$
- (a) 1006 (b) **1006.5** (c) 1007 (d) None of these
5. b $f(x) = \frac{121^x}{121^x + 11}$
- $$f(1-x) = \frac{121^{1-x}}{121^{1-x} + 11} = \frac{11}{11+121^x}$$
- Thus, $f(x) + f(1-x) = \frac{121^x}{121^x + 11} + \frac{11}{121^x + 11} = 1$
- $$\Rightarrow f\left(\frac{1}{2014}\right) + f\left(\frac{2013}{2014}\right) = 1, f\left(\frac{2}{2014}\right) + f\left(\frac{2012}{2014}\right) = 1, f\left(\frac{3}{2014}\right) + f\left(\frac{2011}{2014}\right) = 1, \text{ and so on.....}$$
- Hence, sum of all the terms except $f\left(\frac{1007}{2014}\right)$ will be $\frac{2013 - 1}{2} = 1006$.
- And $f\left(\frac{1007}{2014}\right) = \frac{\frac{1}{121^2}}{\frac{1}{121^2} + 11} = \frac{1}{2}$
- Hence, required answer will be $1006 + \frac{1}{2} = 1006.5$.
6. There is a planet named M. On this planet, one day has 36 hours and they follow a 9-hour clock (like we follow 12-hour clock). In an hour, there are 100 minutes and in a minute, there are 200 seconds. Moreover, the hour hand and the second hand move in clockwise direction, while the minute hand moves in anticlockwise direction. How many times a day do the hour and minute hands meet on the planet?
- (a) 32 (b) 36 (c) **40** (d) None of these
6. c Every 9 hours, the minute hand moves $(360 \times 9)^\circ$, whereas the hour hand moves 360°
 (This is similar to our normal clock. Every 12 hours the minute hand moves $(360 \times 12)^\circ$, whereas the hour hand moves 360°)
- $$\therefore \frac{\text{Speed of minute hand}}{\text{Speed of hour hand}} = \frac{9}{1}$$
- By the question the minute and hour hands move in opposite directions.
 \therefore The tenth meeting of the minute and hour hands will be at the starting point i.e. every 9 hours the minute and hour hands meet 10 times
 \therefore Every 36 hours (= 1 day) the minute and hour hands meet 40 times.
- Alternate method:**
 The minute hand and the hour hand can be considered as two objects moving on a circular track in opposite directions. When two objects move in opposite directions, the number of times they meet is equal to the sum of the number of complete rounds made by each object.
- Here, in 36 hours, the minute hand completes 36 rounds whereas the hour hand completes $\frac{36}{4} = 9$ rounds. Together they completed $36 + 9 = 45$ rounds.
 Hence, they meet 45 times in a day.

Directions for question 7: A sequence of seven natural numbers is written in an increasing order from left to right such that:

- The numbers at the odd places form a geometric progression.
 - The numbers at the even places form an arithmetic progression.
 - The largest of the given numbers is 81.

7. If the ratio of the first term to the second term of the sequence is equal to the ratio of the third term to the fourth term of the sequence and it is also known that the second term of the sequence is a prime number, then what is the sum of the second, fourth and sixth terms of the sequence?

(a) 63 (b) 45 (c) 27 (d) 81

7. a Since, the last term is 81 and the terms at the odd places forms a geometric progression, the only possibility for first, third and fifth term are 3, 9 and 27 respectively.

Now, the second term is a prime number lying between 3 and 9. The possible values are 5 or 7.

Let the numbers at the second, fourth and the sixth place be x , y and z respectively.

Given that $\frac{3}{x} = \frac{9}{y}$

If $x = 5$ then $y = 15$ and $z = 25$ (as second, fourth and sixth term are in A.P.)

But this is not possible as the sixth term has to be greater than 27.

$$\therefore x = 7, y = 21 \text{ and } z = 35$$

∴ Sum of numbers in even positions = $7 + 21 + 35 = 63$.

8. Two numbers 'p' and 'q' are randomly chosen from the set $S = \{1, 3, 5, 6, 7, 9\}$. What is the product

of all the possible values of $\left(\frac{p}{q}\right)$?

- (a) 5670

$$(b) \frac{1}{5670}$$

- (c) $\frac{1}{2}$

- (d) 1

8. d If the 2 numbers picked are 1 and 3, then the possible values of $\frac{p}{q}$ are $\frac{1}{3}$ and $\frac{3}{1}$.

The product of the above two possible values of $\frac{p}{q}$ is 1.

Similarly, the product of every pair of values of $\frac{p}{q}$ is also 1.

\therefore The product of all possible values of $\frac{p}{q}$

5

9. PQRS is a field in the shape of a square. Three persons A, B and C are standing at points P, Q and R respectively. At time $t = 0$, A, B and C start walking towards point S along the lines PS, QS and RS respectively. The speed (in km/hr) of A, B and C is S_A , S_B and S_C respectively. It is also known that A reaches point S at time $t = 0.75$ hrs. If at time $t = 0.25$ hrs, the distances of each of A, B and

C from point S are in the ratio 4: 2: 3, in that order, then what is the value of $\frac{S_B}{S_A + S_C}$?

- (a) $\frac{2}{5}(3\sqrt{2}-1)$ (b) $\frac{3}{5}(2\sqrt{2}-1)$ (c) $\frac{1}{5}(3\sqrt{2}-1)$ (d) None of these

9. a Let the length of the side of the square field be 'a' kms.

$$\therefore 0.75S_A = a \Rightarrow S_A = \frac{4a}{3} \text{ km/hr}$$

Let the distance (in kms) from each of A, B and C to the point S, at $t = 0.25$ hrs be $4x$, $2x$ and $3x$ respectively.

$$\therefore a - 4x = S_A \times \frac{1}{4} = \frac{a}{3} \Rightarrow x = \frac{a}{6} \text{ kms}$$

Also,

$$(\sqrt{2}a - 2x) = S_B \times \frac{1}{4} \Rightarrow S_B = \frac{4a}{3}(3\sqrt{2} - 1) \text{ km/hr}$$

$$\text{Similarly, } (a - 3x) = S_C \times \frac{1}{4} \Rightarrow S_C = 2a \text{ km/hr}$$

$$\therefore \frac{S_B}{S_A + S_C} = \frac{\frac{4a}{3}(3\sqrt{2} - 1)}{\frac{4a}{3} + 2a} = \frac{2}{5}(3\sqrt{2} - 1).$$

10. What is the sum of all the possible integral values of x that satisfy the inequality $\frac{6x^2 - 17x + 5}{x^2 + x + 1} \leq 0$?

(a) 3 (b) 1 (c) 0 (d) More than 3

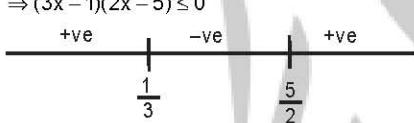
10. a Given that $\frac{6x^2 - 17x + 5}{x^2 + x + 1} \leq 0$

$$\Rightarrow \frac{(3x-1)(2x-5)}{x^2+x+1} \leq 0$$

(b) 1

(c) 0

(d) More than 3



$$\Rightarrow \frac{1}{3} \leq x \leq \frac{5}{2}.$$

∴ Integral values of x are 1 and 2.

\therefore Sum of integral values of $x = 3$.

11. Let $A = \{2, 2^2, 2^3, 2^4, 2^5, 2^6\}$ and $B = \{2, 4, 6, 8, 10, 12\}$. Find the number of elements in $(A \times B) \cap (B \times A)$.

11. c $A \times B$ is the set of all ordered pairs (a, b) such that $a \in A$ and $b \in B$.

Similarly, $B \times A$ is the set of all ordered pairs (b, a) such that $b \in B$ and $a \in A$.

Only nine ordered pairs $(2, 2)$, $(2, 4)$, $(2, 8)$, $(4, 2)$, $(4, 4)$, $(4, 8)$, $(8, 2)$, $(8, 4)$ and $(8, 8)$ are the elements of both the sets $A \times B$ and $B \times A$.

Alternative:

The elements in set A are of the form 2^n , $n \leq 6$, $n \in \mathbb{N}$

The elements in set B are of the form $2k$, $k \leq 6$, $k \in \mathbb{N}$

∴ Common elements in A and B are 2, 4, 8

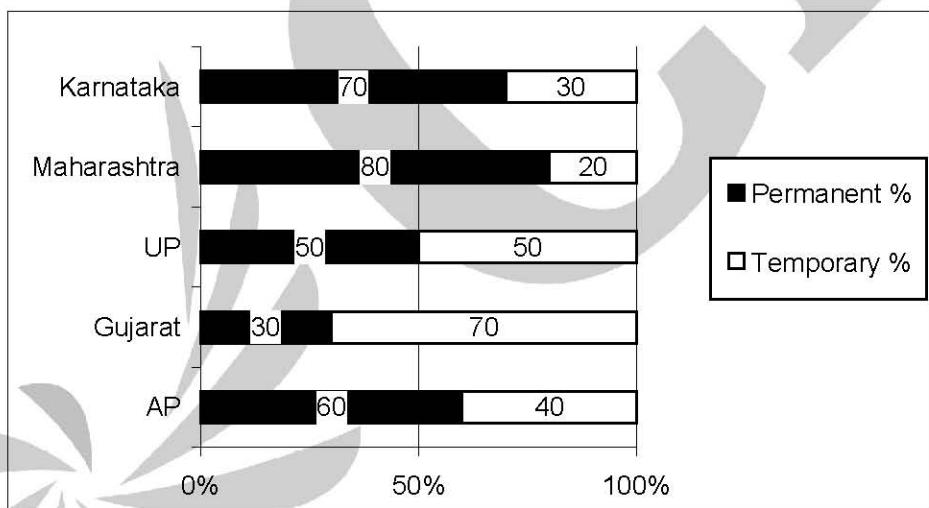
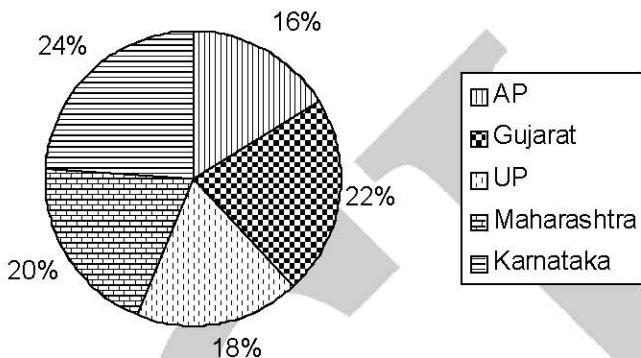
The only common ordered pairs in $(A \times B)$ and $(B \times A)$ will be formed by these elements among themselves.

∴ Total number of common ordered pairs = $3 \times 3 = 9$.

Directions for questions 12 to 15: Answer the questions on the basis of the information given below.

The break-up of the total number of state government employees in five different states of India – Andhra Pradesh (AP), Gujarat, Uttar Pradesh (UP), Maharashtra and Karnataka – in 2003 is depicted in the pie-chart below. The bar graph shows the percentage break-up of permanent and temporary government employees for each state in the same year (2003).

Number of employees



In 2003, the total number of state government employees in Maharashtra is 900.

12. How many permanent state government employees were there from Andhra Pradesh in 2003?
(a) 288 (b) 432 (c) 506 (d) 324
13. How many temporary state government employees were there from Gujarat in 2003?
(a) 693 (b) 297 (c) 649 (d) 748

For questions 12 to 15:

Number of employees in Maharashtra = 900

= 20% of the total number of state government employees.

	States				
	AP	Gujarat	UP	Maharashtra	Karnataka
Permanent %	60	30	50	80	70
Temporary %	40	70	50	20	30
Number of employees	720	990	810	900	1080
Permanent	432	297	405	720	756
Temporary	288	693	405	180	324

12. b State government employees in AP = $\frac{900}{20} \times 16 = 720$.

Out of these, 60% are permanent

⇒ 432 are permanent.

13. a State government employees in Gujarat = $\frac{900}{20} \times 22 = 990$

Out of these, 70% are temporary.

⇒ 693 are temporary.

14. c Permanent (UP) = 50% and Temporary (UP) = 50%

Thus, number of permanent government employees of UP = number of temporary government employees of UP.

15. b In Maharashtra, number of temporary employees (20%) is one-fourth the number of permanent employees (80%) and each of them gets four times the salary of a permanent employee. Thus, their wage bills are same.

16. In $\triangle ABC$, $\angle B = \frac{\pi}{6}$ and $\angle C = \frac{\pi}{4}$, and D divides BC internally in the ratio 1 : 3, then $\frac{\sin \angle BAD}{\sin \angle CAD}$ is equal to

$$(2) \frac{1}{\sqrt{2}}$$

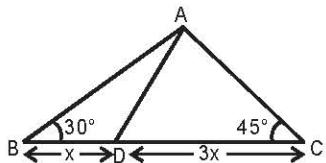
✓2

$$(b) \frac{1}{\sqrt{3}}$$

$$(c) \frac{1}{\sqrt{18}}$$

(d) $\sqrt{6}$

16. c



$$\text{In } \triangle ABD, \frac{\sin \angle BAD}{BD} = \frac{\sin \angle ABD}{AD} = \frac{\sin \frac{\pi}{6}}{AD} = \frac{1}{2AD} \Rightarrow \sin \angle BAD = \frac{x}{2AD}$$

$$\text{In } \triangle ADC, \frac{\sin \angle CAD}{CD} = \frac{\sin \angle ACD}{AD} = \frac{\sin \frac{\pi}{4}}{AD} = \frac{1}{\sqrt{2}AD} \Rightarrow \sin \angle CAD = \frac{3x}{\sqrt{2}AD}$$

$$\therefore \frac{\sin \angle BAD}{\sin \angle CAD} = \frac{\frac{x}{2AD}}{\frac{3x}{\sqrt{2}AD}} = \frac{1}{3\sqrt{2}} = \frac{1}{\sqrt{18}}.$$

17. a Given, $xy + yz + zx = 0$

$$\Rightarrow yz = -xy - zx$$

Similarly, $xy = -yz - zx$ and $zx = -xy - yz$

Substituting these values in the original equation,

$$\begin{aligned} & \frac{1}{x^2 - (-xy - zx)} + \frac{1}{y^2 - (-xy - yz)} + \frac{1}{z^2 - (-yz - zx)} \\ \Rightarrow & \frac{1}{x(x+y+z)} + \frac{1}{y(x+y+z)} + \frac{1}{z(x+y+z)} \Rightarrow \frac{yz + xz + xy}{xyz(x+y+z)} = 0 \end{aligned}$$

Alternate method:

Substituting $x = z = 2$

$$\Rightarrow y = -1$$

On substituting the value of x, y and z we get $\frac{1}{x^2 - yz} + \frac{1}{y^2 - zx} + \frac{1}{z^2 - xy} = \frac{1}{6} - \frac{1}{3} + \frac{1}{6} = 0$

The result would be the same for all values of x, y and z.

18. A large solid sphere is melted and molded to form identical right circular cones with base radius and height same as the radius of the sphere. One of these cones is melted and molded to form a smaller solid sphere. The ratio of the radius of the smaller to that of the larger sphere is
 (a) $1 : 3^{4/3}$ (b) $1 : 2^{3/2}$ (c) $1 : 3^{2/3}$ (d) $1 : 2^{2/3}$

18. d Let R, r be the radii of the large and small sphere respectively.

$$\text{Volume of large sphere} = \frac{4}{3}\pi R^3$$

$$\text{Volume of each cone} = \frac{1}{3}\pi R^2(R) = \frac{1}{3}\pi R^3$$

Volume of cone = Volume of small sphere

$$\Rightarrow \frac{4}{3}\pi r^3 = \frac{1}{3}\pi R^3 \Rightarrow \frac{r}{R} = \frac{1}{\sqrt[3]{2^3}}.$$

21. Find the number of two-digit natural numbers with the following characteristics:
- Number should be even.
 - Number should have exactly four factors including 1 and the number itself.
 - One of the digits of the number should be a perfect square.
 - The new number formed by reversing the digits of the number is prime.
 - The sum of digits of the number should be a prime number.

(a) 0

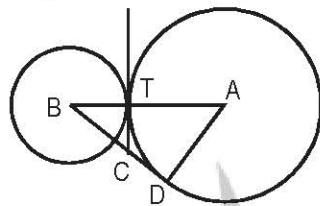
(b) 1

(c) 2

(d) 3

21. d If the number is an even number with exactly four factors, it has to be either 2^3 or some product of 2 and one other prime number. Since, 2^3 is a single digit number, number has to be product of 2 and one other prime number. Thus, looking at all such possible products, we have 10, 14, 22, 26, 34, 38, 46, 58, 62, 74, 82, 86, 94. One of the digits in the number will be one of 1, 4, 9. Thus, the possible numbers are 10, 14, 34, 46, 74, 94. Since the sum of the digits should be a prime number, possible numbers are 14, 34, 74, 94. On reversing the digits, we should receive a prime number. So, possible options are 14, 34, 74. Hence, there are only three possible numbers, namely, 14, 34 and 74.

22. Two circles, with centers A and B, touch each other at T. BD is the tangent at D and TC is a common tangent. AT has length 3 cm and BT has length 2 cm. The length of CD (in cm) is



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

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

(c) $\frac{5}{3}$

(d) $\frac{7}{4}$

22. b Consider $\triangle BTC$ and $\triangle BDA$

$$\angle TBC = \angle DBA.$$

$$\angle BTC = \angle BDA = 90^\circ.$$

Thus, $\triangle BTC$ and $\triangle BDA$ are similar to each other. Hence,

$$\frac{BC}{BA} = \frac{BT}{BD} = \frac{TC}{DA} \quad \dots (i)$$

Assume, $TC = x$ cm, hence, $CD = x$ cm (length of tangents drawn to a circle from the same point is equal)

$$AB = AT + BT = 2 + 3 = 5 \text{ cm}$$

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

$$TC = CD = x \text{ cm}$$

$$BD = \sqrt{5^2 - 3^2} = 4 \text{ cm}$$

Since, $TC = CD = x$ cm, $BC = (4 - x)$ cm.

Substituting the above in (i), we get

$$\frac{BC}{BA} = \frac{BT}{BD} = \frac{TC}{DA} = \frac{4-x}{5} = \frac{2}{4} = \frac{x}{3}$$

$$\Rightarrow \frac{x}{3} = \frac{2}{4} \Rightarrow x = \frac{3}{2}.$$

23. Raju went to a shop to buy a certain number of pens and pencils. He calculated the amount payable to the shopkeeper and gave that amount to him. Raju was surprised when the shopkeeper returned Rs. 24, to him, as balance. When he came back home, he realized that the shopkeeper had actually transposed the number of pens with the number of pencils. Which of the following is certainly an invalid statement?

- (a) The number of pencils that Raju wanted to buy was 8 more than the number of pens.
- (b) The number of pens that Raju wanted to buy was 6 less than the number of pencils.
- (c) A pen cost Rs. 4 more than a pencil.

(d) None of these

23. d x = Price of a Pen and

y = Price of a Pencil

a = Number of pens Raju wanted to purchase

b = Number of pencils Raju wanted to purchase

s = Bill amount calculated by Raju

We have two equations:

$$ax + by = s \quad \dots(i)$$

$$bx + ay = s - 24 \quad \dots(ii)$$

Subtracting (ii) from (i), we get

$$\Rightarrow (a - b)(x - y) = 24$$

Clearly, all the statements can be valid.

24. The distance penetrated by a missile is directly proportional to its penetrative power and inversely proportional to the thickness of the concrete wall it has to pass through. The penetration power 'P' of a missile is just enough to reach the inner side of the spherical shell of a bunker of outer radius 'R' and inner radius 'r'. The missile is always aimed at the center of the spherical bunker. If the penetration power of the missile becomes four times and the bunker's inner radius remains constant, then by how much should the thickness of the outer surface of the bunker be increased so as to just stop the missile from entering the inner shell?

(a) $2R - r$

(b) $R - r$

(c) $\frac{R+r}{2}$

(d) $\frac{R-r}{2}$

24. b Let L and L' be the distances the missile penetrates in the first and the second case.

$$L \propto \frac{P}{(R-r)}, \text{ i.e. } L = k \times \frac{P}{(R-r)}, \text{ where } k \text{ is a constant.}$$

Here $L = R - r$

$$\therefore R - r = k \times \frac{P}{(R-r)} \quad \dots(i)$$

The inner radius, r remains constant. Let the new outer radius be R' .

$$\text{So, } L' = k \times \frac{4P}{(R'-r)}, \text{ i.e. } L' = k \times \frac{P}{(R'-r)}, \text{ where } k \text{ is a constant.}$$

Here $L' = R' - r$

$$\therefore R' - r = k \times \frac{4P}{(R'-r)} \quad \dots(ii)$$

Dividing (ii) by (i), we get:

$$\frac{(R'-r)^2}{(R-r)^2} = 4$$

or $R' - r = 2(R - r)$

or $R' = 2R - r$

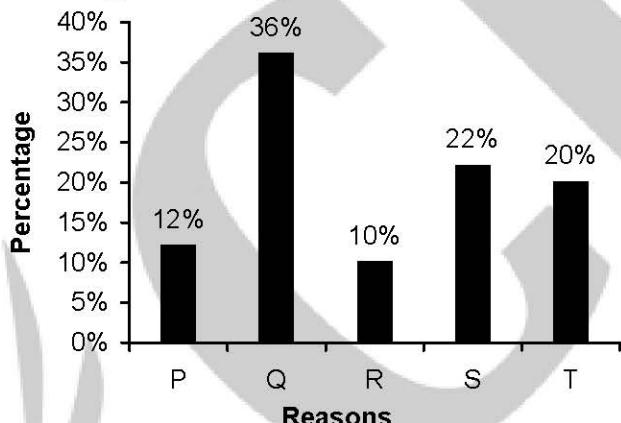
So increase in the thickness of the wall = $R' - R = 2R - r - R = R - r$.

Directions for questions 25 to 27: Answer the questions on the basis of the information given below.

Aseem, Ayaan and Samantha appeared for the board examinations in March 2013. Each of the three students appeared for tests in six different subjects namely Maths, Social Studies, Science, English, Hindi and Commerce. The following table provides information about the marks obtained by each student in every subject as a percentage of the aggregate marks obtained by that student in all the six subjects put together.

	Maths	Social Studies	Science	English	Hindi	Commerce
Aseem	12%	20%	18%	10%	24%	16%
Ayaan	10%	10%	36%	24%	5%	15%
Samantha	20%	20%	10%	16%	10%	24%

The marks lost by each of the three students in each of the six subjects were due to five different reasons namely P, Q, R, S and T. The following bar graph provides information about the marks lost by each student due to each of the mentioned reasons as a percentage of the aggregate marks lost by that student in that subject. This holds true for all the given six subjects.



The marks lost by Aseem, Ayaan and Samantha in each subject as a percentage of the marks obtained by each one of them in that subject was 40%, 25% and 20% respectively.

25. If the marks lost by Aseem, Samantha and Ayaan in English were the same, then the marks lost by Ayaan in Science due to reason R as the percentage of the total marks obtained by Aseem in all the subjects together was

(a) 2% (b) 0.6% (c) 1% (d) 1.5%

Let the total marks obtained by Aseem, Ayaan and Samantha be x , y and z respectively.
 \therefore Marks obtained by Aseem, Ayaan and Samantha in English is $\frac{x}{5}$, $\frac{6y}{5}$ and $\frac{4z}{5}$ respectively.

$$\text{Marks lost by Aseem in English} = 40\% \text{ of } \frac{x}{10} = \frac{x}{25}$$

Similarly, marks lost by Ayaan and Samantha in English is $\frac{3y}{50}$ and $\frac{4z}{125}$ respectively.

$$\text{As per the question, } \frac{x}{25} = \frac{3y}{50} = \frac{4z}{125} \Rightarrow 10x = 15y = 8z$$

$$\text{Marks lost by Ayaan in Science due to reason R} = \left(\frac{36}{100} \times \frac{1}{4} \times \frac{1}{10} \times y \right) = \frac{9y}{1000}$$

$$\text{Required Percentage} = \left(\frac{\frac{9}{1000} \times \frac{y}{x} \times 100 \right) = \left(\frac{\frac{9}{1000} \times \frac{10}{15} \times 100 \right) = 0.6\%$$

26. Given that the marks obtained by Aseem in Maths were not less than the marks obtained by Ayaan in Social Studies and the marks obtained by Ayaan in English were not less than the marks obtained by Samantha in Hindi.
 If the marks obtained by Samantha in Commerce were 144, then what could be the minimum marks obtained by Aseem in Science?

(a) $25\frac{1}{4}$

(b) $40\frac{1}{4}$

(c) $48\frac{3}{4}$

(d) $37\frac{1}{2}$

27. Given that the marks obtained by Aseem in Maths were not less than the marks obtained by Ayaan in Social Studies and the marks obtained by Ayaan in English were not less than the marks obtained by Samantha in Hindi.

If the marks lost by Ayaan in English due to reason Q were 45, then the marks lost by Samantha in Maths due to reason T could not be more than

(a) 50

(b) 32

(c) 36

(d) 40

For questions 26 and 27:

$$\text{Marks obtained by Aseem in Maths} = \frac{3x}{25}$$

$$\text{Marks obtained by Ayaan in Social Studies} = \frac{y}{10}$$

$$\text{Marks obtained by Ayaan in English} = \frac{6y}{25}$$

$$\text{Marks obtained by Samantha in Hindi} = \frac{z}{10}$$

$$\text{Now as per the information given } \frac{3x}{25} \geq \frac{y}{10} \text{ and } \frac{6y}{25} \geq \frac{z}{10}$$

26. d Given that $\frac{6z}{25} = 144$, therefore $z = 24 \times 25$.

$$\text{Marks obtained by Aseem in Science} = \frac{9x}{50}$$

$$\text{Since, } \frac{3x}{25} \geq \frac{y}{10} \text{ and } \frac{6y}{25} \geq \frac{z}{10} \Rightarrow \frac{x}{z} \geq \frac{25}{72}$$

$$\text{Therefore, the marks obtained by Aseem in Science is at least } \frac{9}{50} \times \frac{25}{72} \times 24 \times 25 = 37\frac{1}{2}.$$

27. d Marks lost by Ayaan in English due to reason Q = $\frac{36}{100} \times \frac{1}{4} \times \frac{24}{100} y$

$$\text{Therefore, } \frac{36}{100} \times \frac{1}{4} \times \frac{24}{100} y = 45$$

$$\Rightarrow y = \frac{125 \times 50}{3}$$

$$\text{Marks lost by Samantha in Maths due to reason T} = \frac{z}{5} \times \frac{1}{5} \times \frac{1}{5} = \frac{z}{125}$$

$$\text{Also, } \frac{y}{z} \geq \frac{5}{12}$$

Maximum possible value of 'z' = 5000

Maximum possible marks lost by Samantha in Maths due to reason T is 40.

28. If $A = \sum_{i=198}^{201} \text{Rem}\left(\frac{3^i}{8}\right)$ and $B = \prod_{j=1}^n \text{Rem}\left(\frac{(A/4)^j}{15}\right)$, where i, j and $n \in \mathbb{N}$, then find the value of $1^3 + 2^3 + 3^3 + \dots + n^3$. It's given that n is the least possible number that allows B to attain the value of 1.

Where, $\prod_{j=1}^n j = 1 \times 2 \times 3 \times \dots \times j$

(a) 28

(b) 16

(c) 784

(d) 256

28. c For $i = 198$, $3^{198} = (3^2)^{99} = 9^{99}$, which gives 1 as remainder when divided by 8. Similarly, for $i = 199, 200$ and 201 , the remainders obtained will be 3, 1 and 3 respectively.

Thus $A = 1 + 3 + 1 + 3 = 8$

So, $A/4 = 2$

$$B = \text{Rem}\left(\frac{2^1}{15}\right) \times \text{Rem}\left(\frac{2^2}{15}\right) \times \text{Rem}\left(\frac{2^3}{15}\right) \times \dots \times \text{Rem}\left(\frac{2^n}{15}\right) = \text{Rem}\left(\frac{2^1 \times 2^2 \times 2^3 \times \dots \times 2^n}{15}\right) = \text{Rem}\left(\frac{2^{\frac{n(n+1)}{2}}}{15}\right)$$

For $B = 1$, $n(n + 1)/2$ should attain one of the following values: 4, 8, 12, 16...

But for smallest $n \in \mathbb{N}$, n should acquire a value of 7.

$$\therefore 1^3 + 2^3 + 3^3 + \dots + n^3 = [n(n + 1)/2]^2 = [7 \times 8/2]^2 = 28^2 = 784.$$

29. Which of the following is incorrect regarding a regular pentagon inscribed in a circle of radius r ?

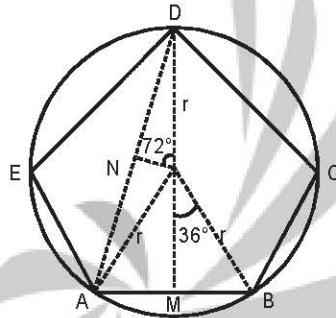
(a) Side of pentagon = $2r \sin 36^\circ$

(b) Area of Pentagon = $\frac{5}{2} r^2 \sin 72^\circ$

(c) Length of diagonal = $2r \sin 36^\circ$

(d) Side of the pentagon = $2r \cos 54^\circ$

29. c



Sum of the interior angles of a pentagon = $(n - 2) \times 180^\circ = 540^\circ$.

So each interior angle of a pentagon = 108° .

Let O be the center of the circle. $OA = OB = r$ and $\angle AOB = 72^\circ$.

Side of the pentagon, $AB = 2r \sin 36^\circ = 2r \cos 54^\circ$

$$\text{Area of pentagon} = 5 \times \text{AOB} = 5 \times \frac{1}{2}(2r \sin 36^\circ)(r \cos 36^\circ) = \frac{5}{2}r^2 \sin 72^\circ$$

Length of the diagonal, $AD = 2 \times DN = 2r \sin 72^\circ$.

30. The angle between the two sides of a plot measuring 32 m and 24 m is a right angle. The other two sides measure 25 m each and the other three angles are not right angles. The area of the plot (in m^2) is

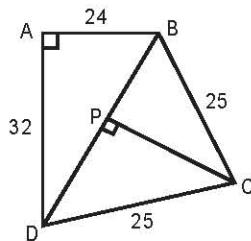
(a) 768

(b) 534

(c) 96.5

(d) 684

30. d



In the above figure,

$$BD = \sqrt{24^2 + 32^2} = 40 \text{ cm}$$

CP \perp BD and BC = DC $\Rightarrow \Delta BPC \cong \Delta CPD$ $\therefore PB = PD = 20 \text{ cm.}$

$$\Rightarrow CP = \sqrt{25^2 - 20^2} = 15 \text{ cm.}$$

$$\therefore \text{Area of } ABCD = \text{Area of } \triangle ABD + \text{Area of } \triangle BCD = \left(\frac{1}{2} \times 32 \times 24\right) + \left(\frac{1}{2} \times 40 \times 15\right) = 684 \text{ cm}^2.$$

31. If $x = 12$, then the value of $x^5 - 13x^4 + 13x^3 - 13x^2 + 13x - 1$ is

(a) 5

(b) 11

(c) 15

(d) 20

31. b Given $x = 12$,

$$\begin{aligned} & x^5 - 13x^4 + 13x^3 - 13x^2 + 13x - 1 \\ &= 12^5 - (12+1)12^4 + (12+1)12^3 - (12+1)12^2 + (12+1)12 - 1 \\ &= 12 - 1 = 11. \end{aligned}$$

32. If $x \sin^3 a + y \cos^3 a = \sin a \cos a$ and $x \sin a = y \cos a$, where $0 < a < 90^\circ$, then find the value of $(x^2 + y^2)$.

(a) 2

(b) 1

(c) 5

(d) Cannot be determined

32. b By the problem, $x \sin a = y \cos a$

$$\Rightarrow \frac{y}{x} = \tan a \quad \dots \text{(i)}$$

$$\text{Given, } x \sin^3 a + y \cos^3 a = \sin a \cos a \quad \dots \text{(ii)}$$

Substituting (i) in (ii),

$$x \sin^3 a + x \tan a \cos^3 a = \sin a \cos a$$

$$\Rightarrow x \sin^3 a + x \sin a \cos^2 a - \sin a \cos a = 0$$

$$\Rightarrow \sin a(x \sin^2 a + x \cos^2 a - \cos a) = 0$$

$$\Rightarrow \sin a(x - \cos a) = 0.$$

However, $\sin a \neq 0$ since, $0 < a < 90^\circ$.

$$\Rightarrow x - \cos a = 0$$

$$\Rightarrow x = \cos a \quad \dots \text{(iii)}$$

Substituting (iii) in (i), $y = \sin a$.

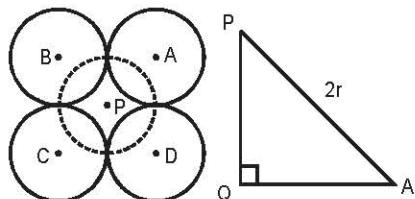
$$\therefore x^2 + y^2 = \cos^2 a + \sin^2 a = 1.$$

33. In a cuboidal box, 8 identical spherical balls are kept in two rows, with 4 balls in each row. Above this, three balls, identical to the previous 8 balls, are kept in the space between the balls, such that each ball touches 4 balls below it. Now water is filled in the box up to a height equal to the radius of the sphere. What is the minimum distance (in units) between the sphere in the second layer and the water?

(a) r

(b) $\sqrt{2}r$ (c) $(\sqrt{2} - 1)r$ (d) $\sqrt{3}r$

33. c



Let A, B, C and D be the centers of the spheres in the lower layer and P be the center of the sphere in the upper layer. The distance between the two centers, A and P, $AP = 2r$, since the spheres are touching. Let Q be a point directly below P and in the same plane as the centers of the spheres of the lower layer.

It can be seen that ABCD form a square of side $2r$, with center Q.

$$\text{So, } AC = 2AQ = 2\sqrt{2}r \Rightarrow AQ = \sqrt{2}r$$

$$\text{The required answer} = \sqrt{2}r - r = (\sqrt{2} - 1)r.$$

34. $A = \log_{10}(1 + 2 + 3 + \dots + n) + \log_{10}2$, where n is a natural number. Find the number of possible values of n for which $1 < A < 3$.

(a) 28

(b) 31

(c) 29

(d) 38

$$34. c \quad A = \log_{10}(1 + 2 + 3 + \dots + n) + \log_{10}2 = \log_{10}[2 \times (1 + 2 + 3 + \dots + n)] = \log_{10}\left[2 \times \frac{n(n+1)}{2}\right] = \log_{10}n(n+1).$$

By the question, $1 < A < 3 \Rightarrow 10 < n(n+1) < 1000$.

It is possible only for values of n from 3 to 31, i.e. there are $(31 - 3) + 1 = 29$ possible values of n.

35. Find the number of real solutions of the equation $x = \left(x - \frac{1}{x}\right)^{\frac{1}{2}} + \left(1 - \frac{1}{x}\right)^{\frac{1}{2}}$.

(a) 0

(b) 1

(c) 2

(d) 3

35. b For real solutions, both $\left(x - \frac{1}{x}\right)^{\frac{1}{2}}$ and $\left(1 - \frac{1}{x}\right)^{\frac{1}{2}}$ are positive numbers and $\frac{1}{x}$ is defined.

$$\Rightarrow \left(x - \frac{1}{x}\right)^{\frac{1}{2}} + \left(1 - \frac{1}{x}\right)^{\frac{1}{2}} > 0 \text{ and hence } x > 0.$$

$$\text{By the problem, } x = \left(x - \frac{1}{x}\right)^{\frac{1}{2}} + \left(1 - \frac{1}{x}\right)^{\frac{1}{2}}$$

Squaring both sides, we get

$$x^2 = x - \frac{1}{x} + 1 - \frac{1}{x} + 2 \times \sqrt{\left(x - \frac{1}{x}\right)\left(1 - \frac{1}{x}\right)} = x + 1 - \frac{2}{x} + 2\sqrt{x - 1 - \frac{1}{x} + \frac{1}{x^2}}$$

Multiplying both sides by x, we get

$$x^3 - x^2 - x + 2 = 2\sqrt{x^3 - x^2 - x + 1}$$

$$\text{So, } (x^3 - x^2 - x + 1) - 2\sqrt{x^3 - x^2 - x + 1} + 1 = 0$$

$$\text{So, } \left(\sqrt{x^3 - x^2 - x + 1} - 1\right) = 0$$

$$x^3 - x^2 - x + 1 = 1$$

$$x^3 - x^2 - x = 0$$

$$x(x^2 - x - 1) = 0$$

$$\text{So, } x = 0, \frac{1 \pm \sqrt{5}}{2}$$

Since, $x > 0$, only possible value for x is $\frac{1 + \sqrt{5}}{2}$

36. Four cards are picked from a pack of well-shuffled bridge cards and arranged on a table in such a way that no two adjacent cards are of same suit. If this can be done in n ways, then n is divisible by which of the following numbers?

(a) 24×13^3 (b) 96×13^2 (c) 24×13^2 (d) 48×13^2

36. c By the problem, no two adjacent cards are of the same suit.
Thus, there will be four cases.

Case I: All 4 cards are of different suits.

Total number of ways = $(4 \times 13)(3 \times 13)(2 \times 13)(1 \times 13)$

Case II: First 3 cards are of different suits while the fourth card is of the same suit as either the first or the second card.

Total number of ways = $(4 \times 13)(3 \times 13)(2 \times 13)({}^2C_1 \times 13)$

Case III: First 2 cards are of different suits while the third card is of the same suit as the first card and the fourth card is of one of the remaining two suits.

Total number of ways = $(4 \times 13)(3 \times 13)(12)({}^2C_1 \times 13)$

Case IV: First and third cards are of the same suit while the second and fourth cards are of the same suit.

Total number of ways = $(4 \times 13)(3 \times 13)(12)(12)$

By the question, n = sum of ways in the four cases

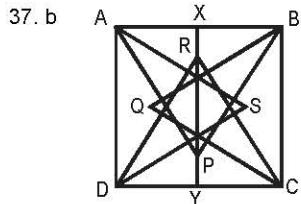
$\therefore n$ is divisible by $4 \times 13 \times 3 \times 13 \times 2 = 24 \times 13^2$.

The other factor of n is odd, since case I contributes 13^2 , which is odd, whereas other cases contribute an even number.

Thus, none of the other options is a permissible factor.

37. ABCD is a square of side 10 units. There are four points P, Q, R, S inside the square such that ΔABP , ΔBCQ , ΔCDR and ΔDAS are equilateral triangles. Find the area (in sq. units) of quadrilateral PQRS.

(a) $100(\sqrt{3} - 1)$ (b) $100(2 - \sqrt{3})$ (c) $100(2\sqrt{3} - 1)$ (d) $50(2 - \sqrt{3})$



Refer to the given figure, $AB = AP = PB = 10$ units. Length of perpendicular PX from P on AB will $\sqrt{10^2 - 5^2} = \sqrt{75}$ units.

Similarly, length of perpendicular RY from R on CD will be $\sqrt{75}$ units.

Hence, $PR = PX + RY - PR$

$$\Rightarrow PR = \sqrt{75} + \sqrt{75} - 10 = 5\sqrt{3} + 5\sqrt{3} - 10 = 10(\sqrt{3} - 1).$$

$$\text{Area of a square} = (\text{side})^2 = \frac{1}{2} \times (\text{Diagonal})^2 = \frac{1}{2} (10(\sqrt{3} - 1))^2 = 50(4 - 2\sqrt{3}) = 100(2 - \sqrt{3}).$$

38. If $4x^2 - y^2 + 4y = c$ represents a pair of lines, then find the value of 'c'?

(a) 2 (b) 8 (c) 4 (d) 6

38. c $4x^2 - y^2 + 4y = c$

$$\Rightarrow (2x - y + c_1)(2x + y + c_2) = 0$$

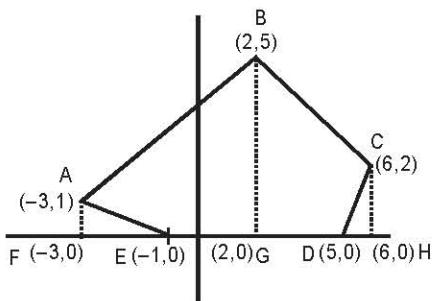
$$\Rightarrow 2x(c_1 + c_2) = 0 \text{ and } y(c_1 - c_2) = 4y$$

From above $c_1 = 2$, $c_2 = -2$

$$\therefore c = -c_1 c_2 = 4.$$

42. Find the area of the pentagon whose vertices are $(-1, 0)$, $(5, 0)$, $(6, 2)$, $(2, 5)$ and $(-3, 1)$.
 (a) 27.5 (b) 28 (c) **27** (d) 24.5

42. c



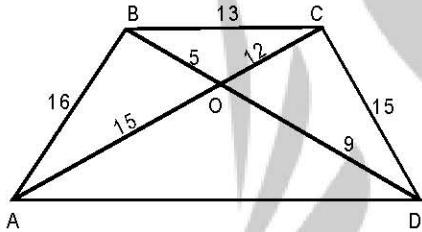
Area of pentagon ABCDE

$$\begin{aligned} &= (\text{Area of trapezium ABGF} - \text{Area of } \triangle AFE) + (\text{Area of trapezium BCHG} - \text{Area of } \triangle CHD) \\ &= \left[\left\{ \frac{1}{2} \times (5+1) \times 5 \right\} - \left(\frac{1}{2} \times 1 \times 2 \right) \right] + \left[\left\{ \frac{1}{2} \times (5+2) \times 4 \right\} - \left(\frac{1}{2} \times 2 \times 1 \right) \right] = 27. \end{aligned}$$

43. In a quadrilateral ABCD, AC and BD intersect at O, where $AB = 16$ cm, $AO = 15$ cm, $OB = 5$ cm, $BC = 13$ cm, $OC = 12$ cm, $OD = 9$ cm and $CD = 15$ cm. If it is given that one of the dimensions out of AB, BC and CD is incorrect while all the other dimensions are correct, then the incorrect dimension is of side

- (a) **AB** (b) BC (c) CD (d) Cannot be determined

43. a



Note that $12^2 + 5^2 = 13^2$ and $12^2 + 9^2 = 15^2$

\therefore At least one of the triangles BOC and COD will be a right angled triangle with the right angle at O. But if one of them is a right angled triangle, then all the other triangles must also be right angled triangles.

However, in $\triangle ABO$, $5^2 + 15^2 \neq 16^2$

\therefore AB is written incorrectly.

44. If $5x + 2y + z = 81$, where x, y and z are distinct positive integers, then find the absolute difference between the maximum and the minimum possible value of $(x + y + z)$.
 (a) 44 (b) 48 (c) **55** (d) 60

44. c Minimum possible value of $x + y + z$ will be when we maximize the value of 'x'. Maximum possible value of x will be 15 and since x, y and z are distinct positive integers, $y = 1$ and $z = 4$.
 \therefore Minimum possible value of $x + y + z = 15 + 1 + 4 = 20$.

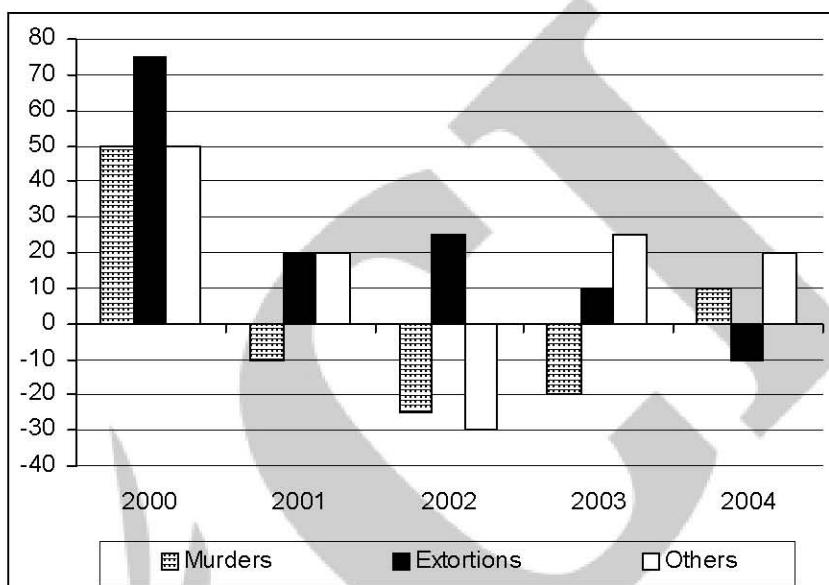
Maximum possible value of $x + y + z$ will be when the value of z is maximized. Maximum possible value of z will be when $y = 2$ and $x = 1$, i.e. $z = 72$.

\therefore Maximum possible value of $x + y + z = 1 + 2 + 72 = 75$

Required difference is $75 - 20 = 55$.

Directions for questions 45 to 47: Answer the questions on the basis of information given below.

In the city of Gotham, crime has been a major problem that is affecting the growth of the city. The two major gangs that are responsible for most of the crimes are Gangnam and Kitkat. The following chart shows the percentage increase/decrease in crime over the previous year. In year 1999, the number of murders was 8000, the number of extortions was 4000 and the number of other crimes was 6000. In each year from 2000 to 2004, the total number of crimes committed by Gangnam and Kitkat put together was the same. The ratio of the number of crimes committed by these two gangs, in the aforementioned order, for the years 2000 to 2004 was 5 : 6, 3 : 4, 7 : 3, 2 : 3 and 9 : 8 respectively.



45. What was the total number of crimes committed by the other gangs for the given 5 years, i.e. from 2000 to 2004, collectively?
(a) 75053 (b) 86143 (c) 48143 (d) Cannot be determined

46. For which year, was the percentage of crimes committed by other gangs as a percentage of crimes committed by Gangnam minimum?
(a) 2000 **(b) 2002** (c) 2003 (d) 2004

47. In 2001, had the ratio of crimes committed by Gangnam and Kitkat been 1:1, what would have been the approximate ratio of crimes committed by other gangs to that of Gangnam for the same year?
(a) 4 : 1 (b) 9 : 2 (c) 3 : 1 **(d) Cannot be determined**

For questions 45 to 47:

Year	Murders	Extortions	Others	Total	Crimes by G + K	Crimes by Others	Crimes by Gangnam
1999	8000	4000	6000	18000			
2000	12000	7000	9000	28000	13090	14910	5950
2001	10800	8400	10800	30000	13090	16910	5610
2002	8100	10500	7560	26160	13090	13070	9163
2003	6480	11550	9450	27480	13090	14390	5236
2004	7128	10395	11340	28863	13090	15773	6930
Total crimes(2000 to 2004)				140503			

Ratio of crimes committed by Gangnam and Kitkat over the years 2000 - 2004 is 5 : 6, 3 : 4, 7 : 3, 2 : 3 & 9 : 8.

Also, total number of crimes committed by Gangnam and Kitkat each year is constant

∴ Total crimes committed per year by Gangnam and Kitkat must be divisible by 11, 7, 10, 5 and 17 i.e. must be divisible by 13,090.

Also, the total crimes committed by the 2 gangs must be ≥ minimum of total crimes committed from 2000 to 2004

Now, $13090 \times 2 = 26180 > 26160$ (total crimes committed in 2002)

∴ Total crimes committed by Gangnam and Kitkat each year is 13090

45. a Number of total crimes committed by other gangs in the given 5 years = $140503 - (13090 \times 5) = 75053$.
46. b By the table above the ratio of crimes committed by others and crimes committed by Gangnam is least for the year 2002.
47. d In this case the total crimes committed by Gangnam and Kitkat per year is divisible by 11, 2, 10, 5 and 17 i.e. divisible by 1870. Thus, the value could be any of the multiples of 1870 below 26160.
Hence, cannot be determined.
48. If $f(x) = x^4 + 1$, and $x \neq 0$, then which of the following options is correct?

$$(a) \frac{f(x)}{f\left(\frac{1}{x}\right)} = f(x) - f\left(\frac{1}{x}\right)$$

$$(b) f(x) \cdot f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right)$$

(c) Both (a) and (b) are correct

(d) None of these

48. b Check the option (a)

$$\text{LHS} = \frac{x^4 + 1}{\frac{1}{x^4} + 1}$$

$$\text{RHS} = x^4 + 1 - \frac{1}{x^4} - 1 = \frac{x^8 - 1}{x^4}$$

So the option (a) is incorrect

Now check option (b)

$$\text{LHS} = f(x) \cdot f\left(\frac{1}{x}\right) = (x^4 + 1) \left(\frac{1}{x^4} + 1 \right) = x^4 + \frac{1}{x^4} + 2$$

$$\text{RHS} = (x^4 + 1) + \left(\frac{1}{x^4} + 1 \right) = x^4 + \frac{1}{x^4} + 2$$

Hence, option (b) is correct.

49. All the positive integers in which sum of digits is equal to the number of digits in the number are said to be 'pure numbers'. For example, 1, 11 and 20 are pure numbers. How many pure numbers have more than one digit and all the digits are distinct?

(a) 2

(b) 3

(c) 5

(d) Infinite

49. c For two digit pure numbers the sum of digits = 2

∴ Only 20 is permissible since digits have to be different

For three digit pure numbers the sum of digits = 3

Thus, the permissible digits are 0, 1, 2 hence, number of numbers = $3! - 2! = 4$.

For four digit pure numbers the sum of digits = 4

This is not possible since the smallest digits are 0, 1, 2, 3 and their sum = 6 (>4).

Hence, only (1 + 4 =) 5 such numbers exist.

50. If angles of a triangle are integers x, y and z and $\log(x \times y \times z) = 3 \log x + 3 \log 2 + 2 \log 3$, then the respective values of angles x, y and z are

(a) $30^\circ, 80^\circ$ and 70° **(b) $10^\circ, 80^\circ$ and 90°** (c) $40^\circ, 60^\circ$ and 80° (d) Cannot be determined

50. b $3 \log x + 2 \log 3 + 3 \log 2 = \log x^3 + \log 9 + \log 8 = \log(x^3 \times 9 \times 8)$

By the problem $\log(x^3 \times 9 \times 8) = \log xyz$

∴ $72x^3 = xyz$

⇒ $yz = 72x^2$

Also, $x + y + z = 180^\circ$

$x = 10^\circ, y = 80^\circ$ and $z = 90^\circ$ satisfies the above equation.

Section II: VA & LR

51. Given below are four sentences or parts of sentences that form a paragraph. Identify the sentence(s) or part(s) of sentence(s) that is/are incorrect in terms of grammar and usage. Then, choose the most appropriate option.

- A. I think we've chosen to invest our money in the wrong option since
- B. the view from this apartment is not nearly as
- C. spectacular as that mountain lodge.
- D. I hadn't expected to forego any pleasure
- E. after paying through the nose for this vacation.

(a) Only A **(b) Only C** (c) A and C (d) B, C and E

51. b The only error in the text is in sentence C, where the change should be, 'as spectacular as the view from that mountain lodge'. The original sentence actually compares the lodge to the view from the apartment, while the comparison should be between the view from the apartment and the view from the lodge. Thus, option (b) is the correct answer.

52. Given below is a sentence, part of which is underlined. Beneath the sentence you will find four ways of phrasing the underlined part. Select the correct answer in terms of grammar and usage.

The whining noises that dogs make, although most people think that dogs whine because they are not content, is actually involuntary and is not directly related with the emotion of the dog.

- (a) The whining noise of a dog, although most people think that dogs whine because they are not content, is actually involuntary and is not directly related with the emotion of the cat.
- (b) Although most people think that dogs whine because they are not content, the whining noise of a dog is actually involuntary and is not directly related with the emotion of the dog.
- (c) Although most people think that dogs whine because they are not content, the whining noise of a dog is actually involuntary and is not directly related to the emotion of the dog.**
- (d) Although most people think that dogs whine because they are not content, is actually involuntary and is not directly related to the emotion of the dog.

52. c In the given sentence, the placement of 'although' is incorrect. It should be placed at the beginning of the sentence. 'Related with' is not the correct phrase. The correct phrase should be 'related to'. Thus, the correct answer is option (c).

53. A paragraph is given below from which the last sentence has been deleted. From the given options, choose the one that completes the paragraph in the most appropriate way.

Basically, birds' wings are not flat but are shaped like an aerofoil, - concave. Air passes over or under the wing as the bird moves forward, or as the wind blows. The air that moves over the top of the wing has further to travel to get across the wing, thus it speeds up. This causes the pressure to drop because the same amount of air is exerting its pressure over a greater area. Therefore, any given point experiences less pressure. This effectively sucks the wing up. Meanwhile the air going below the wing experiences the opposite effect. _____

-
1. aerofoil (noun) : a device that provides reactive force when in motion relative to the surrounding air; can lift or control a plane in flight

- (a) Hence, a bird with air moving over its wings is pulled up from above and pushed up from below.
(b) The more curved the aerofoil the greater the lift providing the degree of curve does not impede the flow of air.
(c) It slows down, generates more pressure and effectively pushes the wing up.
(d) This is the resistance the air gives to anything passing through it.

53. c The last sentence of the given paragraph talks about the opposite effect. Option (c) describes this effect in detail. Thus, option (c) should immediately follow the given paragraph and is the correct answer. Option (a) is close but it should ideally follow option (c).

Directions for questions 54 and 55: Answer the questions on the basis of the information given below.

Five aspiring ministers: Mr. Kallu Yadav, Mr. Laxman Vilas, Mr. Tamambaran, Mr. S.M. Iyer and Mr. Tamalnath went to Mrs. Sona Chandi to lobby for important ministerial berths in the cabinet. Mrs. Sona Chandi asks these people to submit their individual preferences. Each of them submitted their two preferred ministerial berths as given in the table below.

Name of the aspirant	Preference 1	Preference 2
Kallu Yadav	Railways	Petroleum
Laxman Vilas	Railways	Steel
Tamambaram	Finance	Commerce
S.M. Iyer	Commerce	Petroleum
Tamalnath	Finance	Steel

A ministry can be assigned to only one aspirant.

Directions for question 56 to 59: The passage given below is followed by a set of four questions. Choose the most appropriate answer to each question.

For 10 years or longer, my weekday routine as a psychiatrist had been constant: write mornings, see patients afternoons. With the publication of my book *Listening to Prozac*,² in 1993, new elements were added: travel and public appearances.

One question followed me from lecture to lecture, from talk show to talk show, bookstore to bookstore. Because the question was so automatic, so predictable, it took me months to appreciate how peculiar it was.

At a book signing, I might give a short introduction to this or that aspect of *Listening to Prozac*, discussing workplace pressures to remain upbeat, say, and the ethics of using medications in response. What I spoke about seemed not to matter. Inevitably someone would ask: "What if so-and-so had taken Prozac?" The candidates for drug treatment were drawn from a short roster of tortured 19th-century artists and writers. Friedrich Nietzsche and Edgar Allan Poe made frequent appearances.

My response was perfunctory,³ — a quick review of theories of art and neurosis. I resented the joking distraction from issues I had raised. I did not treat the *what if* question as I did others. I did not attend to it, puzzle over it, take it to heart.

And then one day I did. The setting was a professional meeting in Copenhagen, in 1995. At home, as the Prozac book's popularity grew, my standing among my colleagues fell — or so I feared. With a few thousand copies sold, a man is all right. With hundreds of thousands of sales, it is another matter. I was a popularizer, an opportunist who had made his way on the backs of others, the real researchers. This apprehension was a matter of hypersensitivity, of mild paranoia — although when a book succeeds, there are always belated "debunking" reviews, to feed an author's insecurity. Speaking invitations poured in, and still I thought I heard snickering from the back row.

But in Scandinavia! There I was a prophet with honour, like Jerry Lewis in France. The Finns were among the first to translate *Listening to Prozac*. Now it was being put into Swedish, with an introduction by the most eminent biological psychiatrist in Northern Europe, Marie Åsgard. The Swedes had persuaded the Scandinavian Society for Psychopharmacology to invite me as the keynote speaker at their annual meeting.

My hosts had proposed the topic "Myths and Realities" about antidepressants. The core of the talk would concern an orthodoxy I considered mythical, the one that said antidepressants treat only depression. I wanted to review evidence that the drugs might influence personality traits in people with no mental illness at all.

I spent a pleasant afternoon in Copenhagen on my own. The morning of my presentation arrived. I was in serious company — laboratory and clinical researchers. The practising doctors had seen effects similar to the ones I had described in my book, dramatic responses to medication. I felt myself on solid ground, the honoured guest.

I launched into my talk. The audience was attentive, applause polite. A hearty fellow stood up to ask the first question. He had a smile that was familiar to me, from other audiences. His question was: "So, Dr. Kramer, what would have happened if Kierkegaard had taken Prozac?"

-
2. Prozac (noun) : fluoxetine; a drug used as an antidepressant
3. perfunctory (adj.) : acting with indifference; showing little interest or care.
-

Of course, in Copenhagen the suffering artist would be Søren Kierkegaard. Who else? He is the most famous Dane, give or take Hans Christian Andersen. Certainly Kierkegaard is the Dane best known for his melancholy, if you understand Hamlet to be fiction. Danes know Kierkegaard the way we know Mark Twain or Henry David Thoreau — perhaps more intimately. I was once told that when Danish children are sullen, parents will scold them, "Don't be such a Søren!"

Kierkegaard is part of what had brought me to Copenhagen, what had made the invitation appealing. I read Kierkegaard when I was young. My college roommate and I plowed through *Either/Or* together, after my roommate's mother died. She had lived with Hodgkin's disease for almost the whole of her son's life and had never told him, for fear of blighting his childhood. That was like something out of Kierkegaard — self-sacrifice so radical as to be disturbing.

On the flight across the Atlantic, I had browsed in a paperback version of Kierkegaard's *Diaries*. How grim they are. Kierkegaard describes self-loathing, pessimism, dread, isolation, guilt, and anomie. He writes of wanting to shoot himself. Kierkegaard complains of a "primitive melancholy ... a huge dowry of distress." He writes, "My whole past life was in any case so altogether cloaked in the darkest melancholy, and in the most profoundly brooding of misery's fogs, that it is no wonder I was as I was." And then: "How terrible to have to buy each day, each hour — and the price varies so!" And again: "The sad thing with me is that the crumb of joy and reassurance I slowly distill in the painstakingly dyspeptic process of my thought-life I use up straightaway in just one despairing step."

On my arrival in Copenhagen, I had taken a walk to the Kierkegaard statue, in the garden of the Danish Royal Library. For good measure, I sought out Kierkegaard's grave in the old central churchyard. The walks gave time and occasion to take the measure of the man. So when I heard Kierkegaard in the usual question, I was aware of a particular person. What if effective treatment had been available to *this man*, the one who pays a terrible price for each day and each hour?

That was how, standing before a group of friendly faces in a standard hotel conference room, I caught a glimmer of the problem with the *what if* challenge: The question had nothing to do with my talk and not much to do with my book. I had asked my listeners to consider medication's effects on people who meet no criteria for any illness. How did that presentation suggest Kierkegaard?

56. It can be inferred from the passage that the victim(s) of the 'mild paranoia' was/were
 - (a) The researchers who claimed him to be a popularizer
 - (b) His publishers
 - (c) The author**
 - (d) The reviewers
56. c The fifth paragraph of the passage makes this quite clear – "or so I feared", "of mild paranoia". Option (c) is the correct answer.
57. Which of the following can most likely be inferred from the passage?
 - (a) The 'what if' question posed by the man from the audience in Sweden was an indicator that the man had doubts about the author's expertise.
 - (b) His interest in Kierkegaard was one of the reasons for the author's acceptance of the invitation to speak in Sweden.**
 - (c) Jerry Lewis is a famous soothsayer from France.
 - (d) The author was prone to challenge orthodoxies and expose them as popular myths.
57. b Option (b) is the correct answer - the author mentions this in the eleventh paragraph. The other options are not supported by the passage.

58. The phrase "... if you understand Hamlet to be fiction" is used to mean
(a) Hamlet was a creation of Kierkegaard who was a melancholic
(b) Hamlet is also a well-known melancholic but he is fictitious
(c) Hamlet is a semi-fictitious figure who is well known for melancholia
(d) The author realized that the Danes were big fans of Shakespeare

58. b The author mentions this in the tenth paragraph when he talks about how popular Søren was. The phrase is used to convey that Søren, after Hamlet, is the one who is best known for his melancholy; but Hamlet is a fictitious character. So among real people, Søren is the one who is best known for his melancholy. This makes option (b) correct.

59. According to the passage, which of the following statements about Kierkegaard is/are true?
(a) Kierkegaard was plagued by chronic depression, a bane passed on to him by his ancestors.
(b) Kierkegaard paid a terrible price for keeping his sanity intact, each day and each hour.
(c) Kierkegaard's depressing works had the potential to affect the reader's mind to the extent that they started behaving as Kierkegaard would.
(d) None of the above.

59. d Option (a) cannot be inferred from the passage – it is not mentioned that Kierkegaard's depression was passed on to him by his ancestors. Option (b) is also not supported as the passage does not imply that Kierkegaard had to pay a price for keeping himself sane. Option (c) also cannot be inferred from the passage. Thus, option (d) is the correct answer.

Directions for questions 60 to 64: Fill up the blanks, numbered [60], [61] ... up to [64], in the passage below with the most appropriate word from the options given for each blank.

The narrow creek was like a/an [60]: tortuous, fairly deep, filled with gloom under the thin strip of pure and shining blue of the heaven. Immense trees soared up, invisible behind the [61] draperies of creepers. The short words of the paddlers [62] loud and clear between the thick and somber walls of vegetation. Darkness [63] out from between the trees, through the tangled maze of the creepers, from behind the great fantastic and unstirring leaves, the darkness, mysterious and invincible, the darkness, scented and poisonous, of the [64] forests.

64. d Option (d) is the correct answer as the passage describes the forest as thick, somber, mysterious, dark and invincible.

Directions for question 65 to 68: The passage given below is followed by a set of four questions. Choose the most appropriate answer to each question.

With the prospect of dwindling state funds, the leaders of Oxford and Cambridge face a question that many people living beneath this city's dreaming spires may consider beneath their dignity: How do you market an 800-year-old university?

American universities have whole departments devoted to fund-raising and marketing, but these have remained foreign to schools here. Both Oxford and Cambridge, however, have new fund-raising efforts under way.

"Fund-raising is a topic we have to approach very carefully because it is not ingrained in the culture of these universities like it is in the United States," said Frances Cairncross, rector of Exeter College in Oxford. "There is a shift taking place, but it will take time."

Oxford has hired a fund-raiser from a North American university who will start work in October, and later this year the University of Cambridge will hold a public kickoff of its largest capital campaign ever, pegged to its 800th anniversary in 2009.

For all their prestige and fame, cashing in on their brand names will take more than a simple campaign, according to John Birnsteel, a director of the London consulting firm Enterprise IG.

"While they are both among the most prestigious educational establishments in the world, their amateur communications efforts give totally mixed messages to alumni," said Mr. Birnsteel, a graduate of Queen's College, Cambridge. "As it stands, I can never understand who is asking for money or for what."

To eliminate confusion, both universities should establish a "master brand," Mr. Birnsteel said.

"The key brand weakness is that there is very little identifying the universities as a single entity," he said. "Sports unite universities in the US, but the only events that unite Oxford and Cambridge as a whole are a rugby game and a rowing race."

The result, Mr. Birnsteel says, is that he receives requests for money from his college, the university and from individual faculties. "There is no streamlined message or economy of scale in this setup. Strong brands stand out from the clutter, but this does the opposite."

Officials from both universities agree that fund-raising efforts must somehow overcome the decentralized manner in which the universities have always been run. Individual colleges - where students spend much of their time, and to which they hold strong allegiances⁴ — seem to compete in fund-raising against the university itself. The university raises money for services, like the faculty of English or the department of chemistry.

"Alumni confusion about whether to give to their college or the university is something we are actively addressing now," said Aniela Shuckburgh, fund-raising campaign manager of the University of Cambridge. "Our message is that giving to your college or the university as a whole is great, and both count towards our capital campaign."

4. allegiance (noun) : loyalty or the obligation of loyalty, as to a nation, sovereign, or cause.

"The university is working closely with the colleges to simplify our message," Ms. Shuckburgh said. "This is unprecedented, and we hope it will bring unprecedented results."

Traditionally, colleges will raise money for buildings, scholarships and perhaps the restoration of a chapel, and the university will raise money for such things as a new law department building, a new chair of chemistry and scholarships.

"Now we have narrowed it all down to four objectives," Ms. Shuckburgh said. "We want money for investing in students, investing in staff, investing in discovering creativity and investing in our great collections."

Over at Oxford, fund-raising has also become a higher priority. Formerly undertaken by the director of development, who answered to the college registrar, fund-raising has been raised to the level of a pro vice chancellor answering directly to the university's top executive, the vice chancellor.

Directions for questions 69 to 71: Answer the questions on the basis of the information given below.

The Israel defense forces (IDF) have 4 types of guns – A, B, C and D – at their disposal. No two types of guns either have the magazine of the same capacity i.e. the number of bullets loaded in a magzine or bullets of the same caliber (in units). M_1 , M_2 , M_3 and M_4 are the capacities, in descending order, of the magzine used in the gunes, and C_1 , C_2 , C_3 and C_4 are caliber of bullets, in ascending order, loaded in the four magazines. The higher the caliber, the lower is the magazine capacity. The capacity of the magazine multiplied by the caliber of the bullets that are loaded into it gives the destructive power of the gun. It is also known that:

For questions 69 to 71:

By the problem,

C_1 is loaded in M_1

C_3^4 is loaded in M_3^4

C_1 is loaded in M_2

C_1 is loaded in M_1

Also, $C_4 > C_3 > C_2 > C_1$ and $M_4 < M_3 < M_2 < M_1$

By statement (ii) and the inequality of C's

$$C_4 = 144 \text{ and } C_1 = 8$$

By statement (iv), M_3 has one 0 at the end

$$\Rightarrow M_3 = 10, 20, 30, \dots, 90$$

$$\Rightarrow C_2 + C_3 = 110, 220, 330, \dots, 990$$

But, $C_2, C_3 < 144$

$$\Rightarrow C_2 + C_3 = 110$$

$\rightarrow C = 21$ and C'

$$\therefore C_2 = 21 \text{ and } C_1 = 10$$

$$\therefore M_3 = 10$$

By statement (iii),

$$\overline{M}_1 \times \overline{M}_4 = \overline{N}$$

By statement (v),

$$M_1 = M_2 \times M_3 \times M_4$$

Combining the ab

$$\therefore M_4 = 1 \text{ and } M_3 = 10$$

$$\Rightarrow M_2 = 100 \text{ and } M_1 =$$

ANSWER **1**

By statement (viii), (M_1, C_1) is loaded in gun C, (M_4, C_4) is loaded in gun B, (M_3, C_3) is loaded in gun D and that leaves (M_2, C_2) to be loaded into gun A.

- 69. c M₁ is the magazine of gun C.
- 70. c Gun C possesses the most destructive power.
- 71. c There are four odd factors.

Directions for question 72 to 74: The passage given below is followed by a set of three questions. Choose the most appropriate answer to each question.

The title of Ian Stewart's book (he has written more than 60 others) is, of course, taken from the enigmatic last two lines of John Keats's "Ode on a Grecian Urn".

"Beauty is truth, truth beauty, "— that is all Ye know on earth, and all ye need to know.

But what on earth did Keats mean? T. S. Eliot called the lines "meaningless" and "a serious blemish on a beautiful poem." John Simon opened a movie review with "one of the greatest problems of art—perhaps the greatest—is that truth is not beauty, beauty not truth. Nor is it all we need to know." Stewart, a distinguished mathematician at the University of Warwick in England and a former author of this magazine's Mathematical Recreations column, is concerned with how Keats's lines apply to mathematics. "Euclid alone has looked on Beauty bare," Edna St. Vincent Millay wrote. To mathematicians, theorems and great proofs such as Euclid's elegant proof of the infinity of primes, have about them what Bertrand Russell described as "a beauty cold and austere," akin to the beauty of great works of sculpture.

Stewart's first 10 chapters, written in his usual easygoing style, constitute a veritable history of mathematics, with an emphasis on the concept of symmetry. When you perform an operation on a mathematical object, such that after the operation it looks the same, you have uncovered a symmetry. A simple operation is rotation. No matter how you turn a tennis ball, it does not alter the ball's appearance. It is said to have rotational symmetry. Capital "H" has 180-degree rotational symmetry because it is unchanged when turned upside down. It also has mirror reflection symmetry because it looks the same in a mirror. A swastika has 90-degree rotational symmetry but lacks mirror reflection symmetry because its mirror image whirls the other way.

Associated with every kind of symmetry is a "group." Stewart explains the group concept in a simple way by considering operations on an equilateral triangle. Rotate it 60 degree in either direction, and it looks the same. Every operation has an "inverse." That cancels the operation. Imagine the corners of the triangle labeled A, B and C. A 60-degree clockwise rotation alters the corners positions. If this is followed by a similar rotation the other way, the original positions are restored. If you do nothing to the triangle, this is called the "identity" operation. The set of all symmetry transformations of the triangle constitutes its group.

Stewart's history begins with Babylonian and Greek mathematics, introducing their basic concepts in ways a junior high school student can understand. As his history proceeds, the math slowly becomes more technical, especially when he gets to complex numbers and their offspring, the quaternions and octonions. The history ends with the discoveries of Sophus Lie, for whom Lie groups are named, and the work of a little-known German mathematician, Joseph Killing, who classified Lie groups. Through this historical section, Stewart skillfully interweaves the math with colorful sketches of the lives of the mathematicians involved.

Not until the book's second half does Stewart turn to physics and explain how symmetry and group theory became necessary tools. A chapter on Albert Einstein is a wonderful blend of elementary relativity and details

of Einstein's life. Next come quantum mechanics and particle theory, with several pages on super strings, the hottest topic in today's theoretical physics. Stewart is a bit skeptical of string theory, which sees all fundamental particles as inconceivably tiny filaments of vibrating energy that can be open-ended or closed like a rubber band. He does not mention two recent books that give string theory a severe bashing. Lee Smolin's *The Trouble with Physics* denounces string theory as "not a theory at all, "only a mishmash of bizarre speculations in search of a viable theory. Peter Woit's book is entitled *Not even wrong*, a quote from the great Austrian Physicist Wolfgang Pauli. He once described a theory as so bad it was "not even wrong."

"Is string theory beautiful?" Its promoters think so. But, Smolin and Woit believe that its recent absorption into a richer conjecture called M-theory has turned the former beauty of strings into mathematical structures as ugly as the epicycles Ptolemy invented to explain the orbits of planets as they circle the earth.

We are back to the mystery of Keats's notorious lines. In my opinion, John Simon is right. Even beautiful mathematical proofs can be wrong. In 1879 Sir Alfred Kempe published a proof of the four-color map theorem. It was so elegant that for 10 years it was accepted as sound. Alas, it was not. Henry Dudeney, England's great puzzle maker, publishing a much shorter and even prettier false proof.

Directions for questions 75 and 76: Answer the questions on the basis of the information given below.

A, B, C, D and E are five persons. Each of them has exactly one car and cars with no two of them are of the same colour. The colours of the cars are Grey, Black, Blue, Red and Green. The colour of the A's car is not grey. The colour of D's car is not blue. The colour of C's car is red and the colour of E's car is neither black nor blue.

For questions 75 and 76:

As per the information given in the question, we get the following table.

	Grey	Black	Blue	Red	Green
A	X			X	
B				X	
C	X	X	X	✓	X
D			X	X	
E		X	X	X	

75. c Given that the colour of B's car is not blue and the colour of E's car is not green, we get the following table:

	Grey	Black	Blue	Red	Green
A	X	X	✓	X	X
B	X		X	X	
C	X	X	X	✓	X
D	X		X	X	
E	✓	X	X	X	X

Thus, if we know that the colour of B's car is not green, it implies that the colour of B's car is Black and the colour of D's car is green.

Hence, option (c) is the correct choice.

76. b Option (a): If the colour of A's car is blue, then the colour of B's car could be either grey or green. D's and E's cars would also change accordingly. Hence, the statement is not sufficient.

Option (b): If the colour of A's car is green, then the colour of E's car is grey and the colour of D's car is black. So, the colour of B's car is blue.

Hence, this statement is sufficient to determine the exact colour of the car with each of the mentioned persons.

Option (c): If the colour of A's car is black, then the colour of B's car is blue and the colour of D's car could be either grey or green and the colour of E's car could be either green or grey. Hence, the statement is not sufficient.

77. In these times of fiscal correctness, it is heresy to call for expansionary fiscal policy to revive the economy. However, sound economics underpins such a prescription even if it sounds like the wild cry of a slump struck corporate bothered only about its own bottom line.

Which of the following if true would lend support to the author's view on fiscal policy?

- (a) In the past, most governments have adopted a conservative attitude in the face of an economic slump.
- (b) Expansionary fiscal policy would be welcomed by business houses that have been overwhelmed by the slump.
- (c) Expansionary fiscal policy leading to more expenditure would revive a depressed economy and help achieve fiscal goals.**
- (d) Sound economics suggests that increasing fiscal expenditure during a depression would raise the import bill and adversely affect the trade deficit.

77. c Option (a) does not support expansionary fiscal policy. Option (b) merely restates the information given in the paragraph. Option (d) negates the author's suggestion. Option (c) is the right answer since it addresses the issue of how expansionary fiscal policy would help the economy and, at the same time, help achieve fiscal goals.

78. Easy import of goods and services spurred by free trade policies introduce goods of various types and quality into the domestic economy. The consumer, instead of the government, gets the right to choose or reject a foreign product. By treating imports and domestic goods at the same level, the government encourages competition which is essential to improve productivity and lower costs, both in turn being essential to improve the plight of the poor.

Which of the following, if true, would most strengthen the case for free trade?

- (a) Consumers are likely to opt for imported products as they are of superior quality.
- (b) Domestic producers, who enjoy lower costs of production, have an edge over producers of imported products in terms of price.
- (c) Countries that have implemented free trade policies have seen massive decline in poverty and overall improvement in living conditions for all citizens.**
- (d) Consumers are unlikely to increase their level of expenditure because of the introduction of a wide variety of imported goods.

78. c Option (a) does not indicate any positive consequence for the economy and can be eliminated. Option (b) indicates an advantage for domestic producers over foreign producers in terms of price. But it does not tell us whether domestic producers are comparable to foreign producers in terms of quality. Option (b) is therefore insufficient. Option (c) is the correct answer since it implies that such policies will definitely be beneficial for the country. Option (d) is irrelevant.

79. In the performance appraisal report of a company, six parameters p₁, p₂, p₃, p₄, p₅ and p₆ are considered for evaluation. The report for the performance appraisal is given below:

Parameters in which Employees qualified	Number of employees
p ₁ , p ₂ , p ₃ , p ₄ , p ₅	10
p ₂ , p ₃ , p ₄ , p ₅ , p ₆	15
p ₃ , p ₄ , p ₅ , p ₆ , p ₁	20
p ₄ , p ₅ , p ₆ , p ₁ , p ₂	10
p ₅ , p ₆ , p ₁ , p ₂ , p ₃	15
p ₆ , p ₁ , p ₂ , p ₃ , p ₄	10

If the number of employees who qualified in all the six parameters is 10, find the number of employees who qualified in exactly five parameters.

79. a The number of employees who passed in exactly five factors
= [Total number of employees passed in all possible sets of 5 factors at a time] — [6 × employees passing in all six].
= $(10 + 15 + 20 + 10 + 15 + 10) - 6 \times 10 = 80 - 60 = 20$.

80. The TV entertainment industry is evolving and with it its attitudes towards research. The industry is moving away from its chaotic roots in the direction of increased professionalism. TV software companies that once consisted of no more than scripts, studios and salesmanship are now proper corporate entities with access to formal sources of funding. Instead of entrepreneurs leading by instinct, you are getting professionals with MBA degrees and experience in established companies.

Which of the following statements, if true, would weaken the author's claims of increased professionalism in the Television industry?

- (a) The artists working on TV shows are paid on a contractual basis and are not very loyal to their producers.
 - (b) Banks and financial institutions are wary of lending money to TV producers as these producers are unable to furnish necessary documents.**
 - (c) Many management graduates who have opted for a career in television are satisfied with their jobs.
 - (d) Quite a few television producers see the industry as an avenue for making quick money.

80. b The author cites "access to formal sources of funding" as one of the points that support his claim of increased professionalism in the TV entertainment industry. Option (b) attacks this point - if TV producers cannot obtain loans or find it difficult to obtain loans, the author's claim of increased professionalism is weakened. Thus, option (b) is the right answer. Options (a), (c) and (d) do not imply unprofessionalism and can be negated.

81. With the advent of mobile phones last year, the number of automobile accidents has increased. Talking on the mobile phone distracts drivers and hence causes accidents.

All of the following could be used to weaken the above argument EXCEPT

- (a) The number of cars on the road has increased drastically during the last year.
 - (b) Radio stations have aired some very interesting programmes during the last year and many drivers report that they often get distracted due to such programmes.
 - (c) Due to poor maintenance, road conditions have worsened significantly over the last year.
 - (d) Most of the mobile phones were sold to people who drive for at least 4 hours every day.**

81. d Options (a), (b) and (c) provide alternative explanations for the increase in the number of accidents. Hence, they weaken the argument that mobile phones are the cause of the increase in the number of accidents. Option (d) has no bearing on the argument and thus, is the correct answer.

82. Granted we all need self-confidence and a good self-image. However, when confidence turns to conceit, people invite the proverbial downfall. Some ideologists train their pupils to develop an unjustified adulation of their own personal judgment, causing whole societies to collapse from ideologies that nurture internal thought conceit.

Which of the following statements best captures the problem mentioned in the paragraph given above?

- (a) We can be impartial in one area of our lives and plagued by prejudice in another.
- (b) It takes wrenching experiences to tear us away from our own thought conceit.
- (c) People have difficulty recognizing thought conceit in themselves.
- (d) Not all educators teach respect for self-discipline and humility.**

82. d It is mentioned in the paragraph that some ideologists are responsible for propounding thought conceit. Among the given options, option (d) comes closest to conveying this idea. Hence, option (d) is the right answer.

Directions for questions 83 to 86: The passage given below is followed by a set of four questions. Choose the most appropriate answer to each question.

Jawaharlal Nehru had once described agriculture as "India's greatest living industry". Yet, 60 years after Independence, the country is slowly coming to grips₅ with the effects of having neglected agriculture all these years. Addressing a recent seminar on agriculture, Prime Minister Manmohan Singh said the situation was alarming. The Tenth Five-Year Plan (2002-07) had assumed that Indian agricultural production would grow by 4 per cent every year. "But the reality is that in the first three years of the Plan, we have not been able to ensure even 1.5 per cent rate of growth," he said.

As Singh and his top team see it, if India has to grow by 7-8 per cent every year, agriculture has to grow faster. After all, despite all the industrial development and India's hi-tech image, the economy remains overwhelmingly agrarian. Unlike the West, where agriculture provides just 3 per cent of the jobs, two out of three Indians earn their livelihood directly or indirectly from agriculture.

The situation on the ground is alarming. Around 10 per cent of India's farming households are landless. Another 67 per cent own less than one hectare of land each. Eleven per cent have 1-2 hectares of land. Yields have been stagnant. Irrigation facilities remain inadequate. Mechanisation is low. So is the use of farm inputs.

Fixing all this is not easy. But in the last one year, Manmohan Singh's government has put comprehensive reform of Indian agriculture on top of its agenda. Managing such a systemic change on such a huge scale is daunting - especially when agriculture is a state subject.

The changes are far too many and far too complex to be addressed in one go.

One big factor hobbling₆ Indian farmers is the 7,000-strong mandi system — the large agricultural produce markets that have aggregated and dispatched grains, fruits, vegetables and the rest from farms to towns for ages now. A big effort is on to develop an alternative mechanism that will connect farmers more efficiently to markets. Competition, it is hoped, will discipline the old mandi system and also give farmers their due share.

But mere efficiency won't help. Today, most Indian farmers don't think enough about what the market wants before they choose their crop. The government is, therefore, trying to also bring in a new market orientation. Its new National Horticulture Mission — and its focus on high-value agriculture — is part of this drive. Opening up foreign direct investment in retail could also allow big retailers to deal directly with the farms.

5. coming to grips (idiom) : to face and cope with.

6. hobbling (verb) : to walk or move along haltingly or with difficulty; limp.

All these big shifts require huge investments in building hard and soft infrastructure - something that the government alone is in no position to bear. The Prime Minister has already talked about replacing publicly funded R&D in agriculture and rural infrastructure with a new private participation model. But the private sector will not step in till the larger environment itself is conducive for it to function smoothly. That is why a more favourable environment is being created — largely through an overhaul of several antiquated⁷ laws.

Today, there is renewed optimism among private sector firms. In the next two to three years, most people reckon a lot of these changes will begin to fall into place. And it could once again kick-start a new cycle of investment and growth in "India's greatest living industry".

83. Why is agriculture being a state subject mentioned in the passage?
- (a) To showcase one of the many problems agriculture faces since state subjects are usually considered an unimportant part of the economy.
 - (b) To show how the lack of a national agenda has forced the Prime Minister to find local issues within various states.
 - (c) To indicate some of the practical problems related to the implementation of the Manmohan Singh government's agenda.**
 - (d) To ensure that the reader understands the depth of the problem.
83. c The author mentions this in the fourth paragraph while mentioning the problems associated with implementing the government's agenda. The correct answer is option (c).
84. It can be inferred that the National Horticulture Mission intends to
- (a) encourage farmers to produce high-value crops**
 - (b) help farmers sell high-value crops
 - (c) remove the mandi system from the buying and selling of high-value crops
 - (d) encourage farmers to use the mandi system in an efficient and productive manner
84. a The author mentions this entity in the seventh paragraph. The author mentions that farmers choose their crop without thinking about the market and hence, the government has launched the National Horticulture Mission which is set to focus on high-value agriculture. Option (a) follows from this.
85. Which of the following can be inferred from the passage?
- (a) The private sector is very keen to enter the agriculture sector and has made rapid inroads in this sector during the last few years.
 - (b) The mandi system is not very efficient and adds to the problems faced by farmers.**
 - (c) Governments over the last 60 years have completely neglected agriculture and this has led to the grim situation prevalent today.
 - (d) None of the above
85. b The author talks about the mandi system in the sixth paragraph. Option (b) clearly follows from this.
86. What is the author trying to convey by using the word 'systemic' in the passage?
- (a) Dominated by the governmental system
 - (b) Integrated network of processes**
 - (c) Slow moving and gradual
 - (d) Related closely to manufacturing
86. b The author uses this word while talking about the problems associated with reforming Indian agriculture. Systemic means "of or relating to an entire system". This makes option (b) correct.

7. antiquated (adj.) : too old to be fashionable, suitable, or useful; outmoded.

87. There is a button inside an elevator in a complex with 20 floors marked 1 to 20. The elevator either goes 8 floors down or 13 floors up when the button is pressed, depending on the availability of enough floors to go up or down. A person has to go to the 8th floor from the 13th floor. What is the minimum number of times the button is required to be pressed?

(a) 22

(b) 19

(c) 7

(d) 13

87. b

Initially
Floor No.13

The table below provides the solution.

Number of times button is pressed	Resulting Floor No.
I	5
II	18
III	10
IV	2
V	15
VI	7
VII	20
VIII	12
IX	4
X	17
XI	9
XII	1
XIII	14
XIV	6
XV	19
XVI	11
XVII	3
XVIII	16
XIX	8

The button required to be pressed = 19 times.

Directions for questions 88 to 91: The passage given below is followed by a set of four questions. Choose the most appropriate answer to each question.

Chess has always been a simulacrum for political and military confrontation, with its gambits and endgames, stalemate and checkmate. We imagine diplomats or generals facing each other across a board. The game has been internationally popular for more than two centuries, but, like the literary genre of the spy thriller, it came into its own in the cold war. To take one of many examples: the opening scene of one of the first James Bond films, From Russia with Love, is a chess match between two grandmasters. And in real life, it was the Fischer-Spassky match of 1972—when an eccentric American genius smashed 25 years of Soviet chess hegemony⁸—that marked the beginning of the end of the cold war.

8. hegemony (noun) : the predominant influence, as of a state, region, or group, over another or others.

Chess provided a mega-metaphor for this psychological war, one that derived added significance from the game's important role in Soviet communist society. The Russians might have lagged behind in military technology or economic competition, but over the chessboard they reigned supreme. A battlefield that for the first time in history was genuinely global could be metaphorically translated on to the 64 squares.

Chess provided one of the safety valves that kept the lid on the cold war. But how did chess come to play this role: both symbol of the war and its antithesis? And how does chess illuminate the process by which the west triumphed over communism?

The place of chess in European culture closely reflects the rise and fall of the educated elite, for whom it was the recreation of choice. The story begins with an image that records one of the great encounters of modernity: a group portrait, painted in 1856 by Moritz Daniel Oppenheim, which depicts three major figures of 18th-century thought—the dramatist Gotthold Ephraim Lessing, the Swiss divine Johann Caspar Lavater and the Jewish philosopher Moses Mendelssohn. The focus of the picture, around which these ornaments of the Enlightenment are stationed, is a chessboard.

Lessing and Mendelssohn first met in 1754 after a mutual friend had recommended the latter to the already celebrated Lessing as a chess partner. It was a fateful meeting of two remarkable men, but also of two cultures. In *Nathan the Wise*, the play which proved to be its author's most popular work, Lessing, the Christian, depicted an idealised Mendelssohn as Nathan: wise, enlightened and Jewish.

The progress of chess from pastime to artistic or scientific maturity was accelerated by Jewish assimilation, which transformed the German-speaking Bildungsbürgertum, or educated middle class, of Mitteleuropa into agents of modernist reform. That German-Jewish symbiosis—doomed by anti-semitism though it proved to be—provided the cultural context in which chess could become the intellectual recreation par excellence. And from the mid-19th century onwards, an extraordinarily high proportion of chess masters, including most of the great world champions, have been Jews.

Chess is a special case of a more general phenomenon—the higher than average IQ of “Ashkenazic Jews of European origin”—which begs many questions and still defies simple explanation. We do not know whether Jews had an inherent disposition to excel at chess, or were attracted to the game because this intellectually demanding, competitive, sedentary sport fitted the prevailing Jewish stereotype in 19th-century Europe. What we do know is that what Gerald Abrahams identified as “the chess mind”—a combination of memory, logic and imagination—has much in common with skills that were and are characteristic of Jewish intellectual life. Above all, the study of sacred texts is conducive to a game on which more books have been written than on all others put together. The game of the book seems to have had a very special appeal to the people of the book.

In Lessing's *Nathan*, chess is also depicted as the private passion of Saladin, the enlightened Muslim sultan, who is checkmated by his sister Sittah. For Lessing's cosmopolitan intellectuals, chess was a means to overcome prejudice—religious, racial, national or sexual. Excluding chance and hence discouraging gambling, chess was the only game worthy of the gentleman. (Until 1987 it was the only game permitted within the Palace of Westminster.)

88. The word "simulacrum" used in the first paragraph can be best substituted by
(a) genesis (b) dearth (c) **representation** (d) ratiocination

88. c The author uses this word to convey that Chess is used to represent political and military confrontation. This makes option (c) correct.

89. The author uses the example of Oppenheim's painting to highlight the fact that
- (a) paintings for the rich always featured a chessboard
 - (b) chess was the common meeting ground for elites**
 - (c) the elite always wanted to portray themselves as playing chess
 - (d) chess was the only game that represented the politics of war and society in European art
89. b The author mentions in the second paragraph – “The place of chess in European culture closely reflects the rise and fall of the educated elite, for whom it was the recreation of choice.” The painting shows a set of educated elite brought together over a game of chess. This makes option (b) correct.
90. As regards Jewish dominance of Chess, the author believes that it occurred because
- (a) the Jews possessed the skills needed to master it
 - (b) the lifestyle of the Jews fitted a game such as chess
 - (c) Jews had an inherent gift for chess as proved by the ‘chess mind’ theory
 - (d) None of the above**
90. d The author writes in the seventh paragraph about the various explanations offered regarding the Jewish domination of Chess. He points out that we do not know which of these explanations is correct. The ‘chess mind’ theory states that the skills needed for chess were similar to the skills needed for Jewish intellectual life. This does not mean that all Jews had the ‘chess mind’ or an inherent gift for chess. This makes option (d) the correct answer.
91. The instance of Saladin being checkmated by Sittah shows
- (a) chess overcoming sexual prejudice**
 - (b) men played chess with family members
 - (c) chess was the chosen method to settle arguments
 - (d) women chess players were exceptionally good
91. a The author mentions in the fifth paragraph that “For Lessing’s cosmopolitan intellectuals, chess was a means to overcome prejudice...”. The case of a man being beaten by a woman would be an instance of sexual prejudice being overcome, making option (a) the correct answer.
92. In the following question, a main statement is followed by four statements: A, B, C and D. Choose the ordered pair of statements where the first statement implies the second and the two statements are logically consistent with the main statement.

She wears red and blue only if she wears them together.

- A. She did not wear red.
- B. She wore red.
- C. She did not wear blue.
- D. She wore pink.

(a) AC

(b) AB

(c) AD

(d) CD

92. a Option (a) gives us a pair which is consistent with the main statement since we can be sure that if she did not wear red, she also did not wear blue. Option (b) offers contradictory statements and thus, can be eliminated. Both options (c) and (d) are not supported by the main statement and thus, can be negated.

93. In the following question, four sets of three sentences are given. You have to identify whether the three sentences in each of these sets are logically related.

- A. Scientists are eccentric. Some scientists are not friends. Some eccentric are friends.
- B. A platypus lays eggs. A platypus is a mammal. All mammals lay eggs.
- C. A platypus is a mammal. Some mammals can swim. A platypus cannot swim.
- D. ACs are used by everyone in summer. Our skin needs to be cold in summer. ACs are used to provide cold.

(a) A, C and D

(b) B and D

(c) D only

(d) None of the above

93. d The conclusion in statement A does not follow since it is possible that there are no scientists or eccentrics who are friends. In statement B, a platypus cannot be used to draw a conclusion about all mammals. In statement C, the final part cannot be concluded since a platypus maybe one of those mammals that swim. Similarly, the conclusion in statement D does not follow logically since ACs might be used for some purpose other than providing cold. Thus, none of the statements follow and the correct option is (d).

94. In the following question a set of six statements is given, followed by four answer choices. Each of the answer choices has a combination of three statements from the given set of six statements. Identify the answer choice in which the statements are logically related.

- A. Some captains are not dopers.
- B. Some dopers are honest.
- C. All captains are not honest.
- D. Some honest are not captains.
- E. All dopers may be captains.
- F. Some dopers are captains.

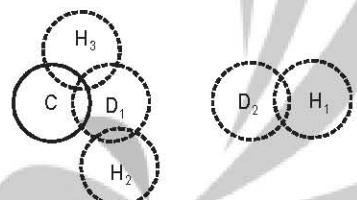
(a) ABC

(b) BCE

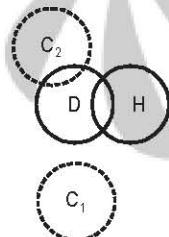
(c) ABD

(d) FCB

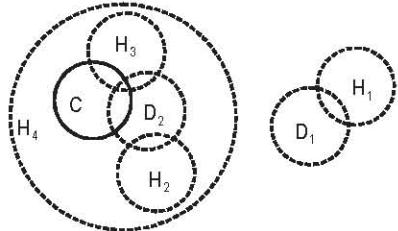
94. c



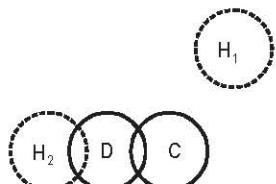
Hence, option (a) is incorrect.



Hence, option (b) is incorrect.



Hence, option (c) is correct.



Hence, option (d) is incorrect.

95. In the communication of input with the machine, it is possible that at most one bit-reversal happens due to errors in the communication channel. Bit-reversal refers to **1** changing into **0** or **0** changing into **1**. To check at most one such bit-reversal, a parity bit is appended at the rightmost end of the input. Parity bit is not an instruction to the machine to do anything but just a check if the input has been read appropriately by the machine or not. The following algorithm should be followed for the check.

Step 1: Compute the parity bit for the input using a defined procedure.

Step 2: Append it at the end of the input and send it to the machine.

Step 3: Machine reads the input and computes parity bit using the same defined procedure.

Step 4: If parity bit supplied is equal to the parity bit computed, execute the input.

Step 5: If parity bit supplied is different from the parity bit computed, request a re-sending of the input.

Which of the following defined procedures of setting up the value of parity bit is in accordance with the machine's behaviour?

- (a) Set the parity bit to **0**. Reverse the parity bit for each occurrence of bit **1** in the input.
- (b) Set the parity bit to **1**. Reverse the parity bit for each occurrence of bit **1** in the input.
- (c) Set the parity bit to **1**. Reverse the parity bit if the number of times bit **1** occurs in the input is even.
- (d) All of these**

95. d Take an example.

Input = **01101**.

Checking option (a), parity bit is initially '**0**'. Then, it gets reversed 3 times (because of three occurrences of **1**) to become '**1**' ultimately. Now, since at most 1 bit-reversal can happen, it may happen that one of the '**0**' becomes '**1**' (total number of **1** = 4) or one of the '**1**' becomes '**0**' (total number of **1** = 2). In either of the case, recomputation of the parity would not yield the same result. Thus, error would get caught.

Same is true for each of the other options (b) and (c).

96. Four sentences are given below, labeled (a), (b), (c) and (d). Of these, three sentences need to be arranged in a logical order to form a coherent paragraph/ passage. From the given options, choose the one that does not fit the sequence.

(a) As it approaches 67P/C-G, Philae will fire a set of harpoons, and tether₁₀ itself to the frozen surface.

- (b) Launched ten years ago, Rosetta took a serpentine path through the solar system as it raced to catch its speeding target, comet 67P/Churyumov-Gerasimenko, moving at up to 135,000 kilometers per hour.
(c) The Rosetta is the European Space Agency's interplanetary explorer tasked with unlocking secrets hidden in comets.
(d) After a 6.4-billion-kilometer journey, the probe pulled into orbit around the oddly shaped 67P/C-G in early August, and will stick around through the end of 2015.

96. a Option (a) talks of the Philae, while the other options talk of the Rosetta. Thus, option (a) is the odd one out.

97. Four sentences are given below, labeled (a), (b), (c) and (d). Of these, three sentences need to be arranged in a logical order to form a coherent paragraph/passage. From the given options, choose the one that does not fit the sequence.

(a) We envisioned a foggy scene with a dinosaur towering over trees and lights.

(b) We found out very quickly that it's not easy to transport a 50-foot long awkwardly-shaped creature, even if it is in 8 pieces.

(c) After many weeks of searching for exactly the right combination of elements, Mike found the perfect parking lot at a golf course outside Chicago.

(d) Should it be a small bank parking lot or that of a big box store?

97. b Options (d), (c) and (a) form a sequence. Option (d) poses a question about which location to choose and (c) tells us about the perfect parking lot. (a) then describes what people imagined the location would look like. Option (b) is the only sentence that speaks of transporting a 50-foot long creature. Thus, option (b) is the odd sentence.

98. The following text is followed by four alternative summaries. Choose the option that best captures the essence of the text.

"That all sounds good enough, but people are easy to deceive," says Ernie Davis, a computer scientist at New York University. "We're used to the safe assumption that whoever is talking to us is actually an intelligent person." So human officiants will likely give the computer the benefit of the doubt. Additionally, chatbots often mask their lack of reasoning by coming across as merely scatterbrained. For example, futurist Ray Kurzweil once asked Eugene, "If I have two marbles in a bowl and I add two more, how many marbles are in the bowl now?" "Not too many," wrote Eugene. "I can't tell you the exact number; I forgot it. If I'm not mistaken, you still didn't tell me where you live." In this way, the Turing Test doesn't foster the development of machines with adaptive, human-level smarts. Instead, it exposes our own gullibility, and spawns programs whose greatest innovation is the tactical use of snarky non-sequiturs and manipulative charm.

- (a) The fact that chatbots like Eugene are smart and can guile officiants into believing they are merely scatterbrained in order to mask their lack of reasoning leads us to believe that the Turing Test lacks the capability to foster development of machines.

9. harpoons (noun) : a spearlike weapon with a barbed head used in hunting whales and large fish.

10. tether (verb) : to fasten or restrict with or as if with a tether.

- (b) The Turing test has been shown to be completely useless given that computers who have been put to the test try and play on our gullibility by acting scatterbrained when not able to answer logical questions.
- (c) There is a need to replace the Turing Test since it fails to fulfill its agenda of fostering the development of adaptive machines and instead only serves to expose the gullibility of humans by way of their assuming that they're talking to an intelligent human.
- (d) Eugene is an example of how easy it is to deceive people and how machines take advantage of this fact to wiggle their way out of the Turing Test by acting absent-minded.**

98. d Option (d) takes into account the important aspects mentioned in the given paragraph – the fact that people are easy to deceive, how machines capitalize on this fact by acting dumb, and how the Turing test fails at times. Option (a) is incorrect as it states that chatbots are “smart” – this contradicts what the author implies in the paragraph. Option (b) is incorrect as it is too extreme in its usage of the words - “has been shown to be completely useless”. Option (c) can be easily ruled out as the given paragraph nowhere suggests that there is any need to “replace the Turing Test”.
99. The sentences given below, when properly sequenced, form a coherent paragraph. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph.
- A. Now a new study has identified the tissue and chemical changes that stir up the problem, a finding that could lead to novel drug treatments.
B. It can be life threatening, too, when it is a part of sleep apnea.
C. This disorder, in which breathing stops many times a night, can detonate dangerous cardiovascular stress.
D. But scientists have long puzzled over why we should respond so fiercely to dips in the oxygen supply.
E. Snoring is not just a recipe for marital discord.
- (a) EADBC (b) **EBCDA** (c) AEDCB (d) CDEAB
99. b The passage talks about the medical complications arising out of a sleep disorder. The first sentence is E which introduces snoring (a common habit). B talks about the more serious impact of the same and follows next. C describes the serious impact in detail while D talks about scientists' puzzlement at this and A talks about the latest developments. This makes option (b) correct.
100. The sentences given below, when properly sequenced, form a coherent paragraph. Choose the most logical order of sentences from among the given choices to construct a coherent paragraph.
- A. Wonder is marvellous, but it is also cruel, cruel, cruel.
B. We have paid a terrible price for our education, such as it is.
C. Of course, wonder is costly because it is the antithesis of anxiously worshipped security.
D. The Magian World View forms the core of our contemporary education system.
E. We have educated ourselves into a world view from which wonder has been banished.
- (a) **BDECA** (b) EDACB (c) ACBDE (d) DCBAE

100. a B makes the opening statement as it is the most general statement of the lot, talking about ‘price of education’. D goes on to describe the current status of education. E then describes the implication of this. C explains the problem with wonder and A comments on the same. The correct answer thus, is option (a).

11. sleep apnea (noun) : a brief suspension of breathing occurring repeatedly during sleep.
