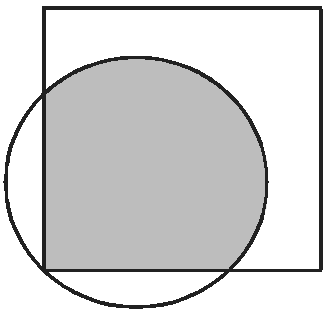
SECTION - I QA & DI

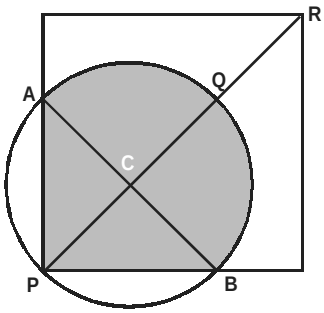
1. A punching machine is used to create a circular hole of diameter 2 unit from a square sheet of aluminum of width 2 unit, as shown in the figure. The hole is punched such that the circular hole touches one corner P of the square sheet and the diameter of the hole originating at P is in line with a diagonal of the square.



The area of the sheet that remains after punching is

(a) 10/7 square unit.
(b) 22/7 square unit.
(c) 5/7 square unit.
(d) 9/7 square unit.

Solution: (a)



Since angle APB is a right angle, AB is the diameter of the circle. Also, PQ is the diameter (given). Thus, C is the center of the circle.

PC = CB = AC = 1 unit (radius) and angle PCA = angle PCB = 90º.

Area of segment ACP = Area of Segment CPB = $\left(\frac{1}{4}\times\frac{22}{7}\times 1^2 - \frac{1}{2}\times 1\times 1\right)$.

Hence, the required area is (Area of square – (Area of circle – 2 (Area of segment ACP)))

Required Area = $4 - \left[\frac{22}{7}\times 1^2 - 2\left(\frac{1}{4}\times\frac{22}{7}\times 1^2 - \frac{1}{2}\times 1\times 1\right)\right] = \frac{10}{7}$ square units

2. A sphere with a diameter of 6 cm is dropped in a right circular cylindrical vessel that is partially filled with water. The diameter of the cylindrical vessel is 12 cm. If the sphere is completely submerged in water, how much will the level of water rise in the cylindrical vessel?
(a) 1 cm (b) 2 cm (c) 3 cm (d) 4 cm

Solution: (a)

Let the radius and the diameter (in cm) of the sphere be r and d respectively.

Volume of the sphere = $\frac{4}{3}\pi r^3 = \frac{4}{3}\pi\left(\frac{d}{2}\right)^3 = \frac{4}{3}\pi(3)^3 = 36\pi$ cm^3.

Let's assume that the level of water in the cylindrical vessel rises by h cm.
Let the diameter (in cm) of the cylindrical vessel be D.

Hence, $\pi\left(\frac{D}{2}\right)^2 h = \pi\left(\frac{12}{2}\right)^2 h = 36\pi h =$ Volume of the sphere $= 36\pi$

Hence, h = 1.

3. The profit and loss statement for the financial year of a company shows a sale of Rs 15200. The primary cost is 25% of sales and leading costs account for 20% of the gross profit. The gross profit is determined by deducting the primary cost plus the cost of miscellaneous expenses of Rs 1200. The managing director's salary of Rs 500 per annum plus 2% of annual sales is a minimum cost. What is the per cent profit on a capital investment of Rs 20000?
(a) 28% (b) 30% (c) 38% (d) 40%

Solution: (c)
Sale = Rs. 15200
Primary cost = Rs. 3800
GP = 15200 – 3800 – 1200 = Rs. 10200
Leading cost = Rs. 2040
Profit after deducting leading cost = Rs. 8160
Minimum cost = 500 + 304 = Rs. 804
Final profit = Rs. 7356
7356 of 20000 = 36.78% (approximately 38%)

4. The value of the product (1 + tan 1°)(1 + tan 2°)(1 + tan 3°)……(1 + tan 45°) is
(a) 45 (b) 2^{45} (c) 2^{23} (d) 2^{22}

Solution: (c)

We have $\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$

Hence, $\tan(A+B)(1-\tan A\tan B) = \tan A + \tan B$

Now if A + B = 45°, then

$\tan 45°(1-\tan A\tan B) = \tan A + \tan B$

$\Rightarrow 1 - \tan A\tan B = \tan A + \tan B$

$\Rightarrow \tan A + \tan B + \tan A\tan B = 1$

Hence, (1 + tan 1°)(1 + tan 44°) = 1 + tan 1°+ tan 44°+ tan1°tan 44° = 2
(1 + tan 2°)(1 + tan 43°) = 1 + tan 2°+ tan 43°+ tan 2°tan 43° = 2
and so on...
Hence,
the product (1 + tan 1°)(1 + tan 2°)(1 + tan 3°)…….(1 + tan 45°) is
$2\times2\times2\times\ldots\times2\times2$ (22 times)$\times(1 + \tan 45°) = 2^{22}\times2 = 2^{23}$.

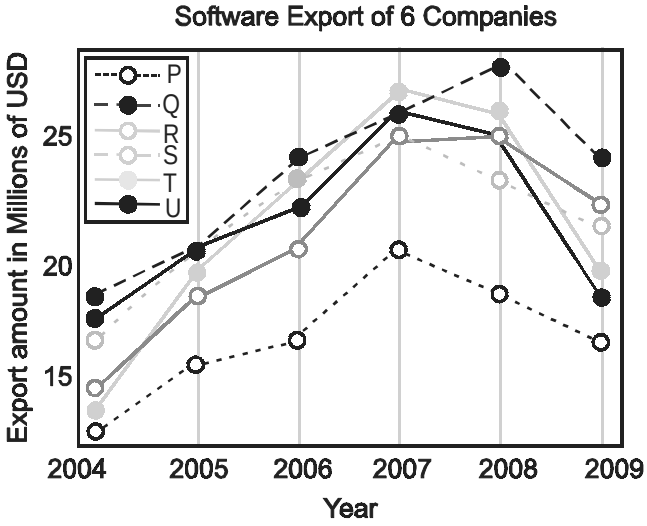
5. The following table gives the functional relationship between x and y.

x	0	1	2	3	4	5	6
y	0	10	40	90	160	250	360

If x = 2.5, what will be the value of y?
(a) 45 (b) 62.5 (c) 65 (d) 67.5

Solution: (b)
Through observation we can say that the functional relationship between x and y must be:
$y = 10(x)^2$
Hence, for x = 2.5, $y = 10(2.5)^2 = 62.5$

6. The line graph gives the annual software export amount of six IT companies P, Q, R, S, T, and U in millions of US dollars (USD), for the last six calendar years from 2004 to 2009.
In 2008, which company was unaffected by the global economic slowdown?



(a) Q (b) P (c) T (d) U

Solution: (a)
The company Q was unaffected by the global economic slowdown as it continued to show an increase in export amount over 2007.

SECTION-II: VA & LR

1. In each of the options, the following word is used in sentences in four different ways. Choose the option corresponding to the sentence in which the usage of the word is incorrect or inappropriate.
   (a) I faxed the first draft of the article to him.
   (b) He was drafted into the army during World War 2.
   (c) Ten days later, She received a 1000 pound cheque drafted to her from the embassy.
   (d) Extra police has been drafted into the town after the violence.

Solution: Correct answer is option (c).
Option (a) uses the word 'draft' correctly. Here, draft means 'a preliminary outline.' 'Draft into' means to select from a group for some usually compulsory service. Thus, option (b) is correct. In option (d), 'drafted into the town' is correct. Here it means to detach (military personnel) from one unit to another.
Option (c) incorrectly uses 'draft' as a verb. The correct expression is 'cheque made out to.'

2. The sentences given in this question, when properly sequenced, form a coherent paragraph. Each sentence is labelled with a number. Choose the most logical order of sentences from among the choices given to construct a coherent paragraph.

   1. These instructions are read from the computer's memory and are generally carried out (executed) in the order they were given.
   2. However, there are usually specialised instructions to tell the computer to jump ahead or backwards to some other place in the program and to carry on executing from there.
   3. Many computers directly support subroutines by providing a type of jump that 'remembers' the location it jumped from and another instruction to return to the instruction following that jump instruction.
   4. These are called 'jump' instructions (or branches), and may be made to happen conditionally so that different sequences of instructions may be used depending on the result of some previous calculation or some external event.
   5. In most cases, computer instructions are simple: add one number to another, move some data from one location to another, send a message to some external device, etc.

   (a) 12354 (b) 24135 (c) 51243 (d) 43521

Solution: Correct answer is option (c).
Statement 5 and 1 form a mandatory pair. Statement 1 is a continuation of statement 5. 'These instructions' in 1 refers to the computer instructions in 5. Statement 2 creates a contrast with the idea presented in 51.

Reading Comprehension

To discover the relation between rules, paradigms, and normal science, consider first how the historian isolates the particular "loci of commitment" that have been described as accepted rules. Close historical investigation of a given specialty at a given time discloses a set of recurrent and quasi-standard illustrations of various theories in their conceptual, observational, and instrumental applications. These are the community's paradigms, revealed in the textbooks, lectures, and laboratory exercises. By studying them and by practising with them, the members of the corresponding community learn their trade. The historian, of course, will discover in addition a penumbral area occupied by achievements whose status is still in doubt, but the core of solved problems and techniques will usually be clear. Despite occasional ambiguities, the paradigms of a mature scientific community can be determined with relative ease.

That demands a second step and one of a somewhat different kind. When undertaking it, the historian must compare the community's paradigms with each other and with its current research reports. In doing so, the historian's object is to discover what isolable elements, explicit or implicit, the members of that community may have abstracted from their more global paradigms and deploy them as rules in their research. Anyone who has attempted to describe or analyse the evolution of a particular scientific tradition will necessarily have sought accepted principles and rules of this sort. Almost certainly, he would have met with at least partial success. But, if his experience has been at all like my own, he will have found the search for rules both more difficult and less satisfying than the search for paradigms. Some of the generalisations he employs to describe the community's shared beliefs will present more problems. Others, however, will seem a shade too strong. Phrased in just that way, or in any other way he can imagine, they would almost certainly have been rejected by some members of the group he studies. Nevertheless, if the coherence of the research tradition is to be understood in terms of rules, some specification of common ground in the corresponding area is needed. As a result, the search for a body of rules competent to constitute a normal research tradition, becomes a source of continual and deep frustrations.

Recognising that frustration, however, makes it possible to diagnose its source. Scientists can agree that a Newton, Lavoisier, Maxwell, or Einstein has produced an apparently permanent solution to a group of outstanding problems and still disagree, sometimes without being aware of it, about the particular abstract characteristics that make those solutions permanent. They can, that is, agree in their identification of a paradigm without agreeing on, or even attempting to produce, a full interpretation or rationalisation of it. Lack of a standard interpretation or of an agreed reduction to rules will not prevent a paradigm from guiding research. Normal science can be determined in part by the direct inspection of paradigms, a process that is often aided by but does not depend upon the formulation of rules and assumption. Indeed, the existence of a paradigm need not even imply that any full set of rules exists.

3. What is the author attempting to illustrate through this passage?
   (a) Relationship between rules, paradigms and normal science.
   (b) How a set of shared belief evolve into a paradigm.
   (c) Ways of understanding a scientific tradition.
   (d) The frustrations of attempting to define a paradigm of a tradition.

Solution : Correct answer is option (c).
The author first tries to elaborate on the relations between rules, paradigms and normal science and discusses on determining the paradigms. He them moves on to discuss the evolution of a particular scientific tradition and the difficulties one faces while searching for rules. He then elaborates on the reason for the difficulty. Option (c) is the most appropriate choice as it covers the scope of the passage and brings out the purpose effectively. Option (a) and (b) are limited in scope and deal with a part of the purpose of the author. Option (d) is incorrect as the author expresses his frustration while searching for rules and not for paradigms.

4. The term 'loci of commitment', as used in the passage, would most likely correspond with which of the following?
   (a) Loyalty between a group of scientists in research lab.
   (b) Loyalty to a certain paradigm of scientific enquiry
   (c) Loyalty to scientific patterns of scientific enquiry
   (d) Loyalty to evolving need of scientific enquiry

Solution: Correct answer is option (b).
Refer to the lines ""loci of commitment" that have been described as accepted rules. Close historical investigation of a given specialty at a given time discloses a set of recurrent and quasi-standard illustrations of various theories in their conceptual, observational, and instrumental applications."

5. With which of the following is the author of this passage likely to agree?
   (a) Paradigms almost entire define a scientific tradition
   (b) A group of scientists inventing a phenomenon would benefit by defining a set of rules.
   (c) Choice of isolation mechanism determines the type of paradigm that may emerge from a scientific enquiry.
   (d) Paradigms are a general representation of rules and beliefs of scientific tradition

Solution : Correct answer is option (d).
Correct answer is (d). Refer to the lines "Close historical investigation of a given specialty at a given time discloses a set of recurrent and quasi-standard illustrations of various theories in their conceptual, observational, and instrumental applications. These are the community's paradigms, revealed in the textbooks, lectures, and laboratory exercises. By studying them and by practising with them, the members of the corresponding community learn their trade." Option (b) is incorrect. Refer to the line "Lack of a standard interpretation or of an agreed reduction to rules will not prevent a paradigm from guiding research….". Hence, it is not necessary for a group of scientists to agree on a set of rules. Option (c) is incorrect as the author has stressed on the importance of "isolable elements" but not on the process of isolation.

6. Five girls took part in a race. Rashmi finished before Mandakini but behind Gauri. Astha finished before Suhana but behind Mandakini. Who won the race?
   (a) Rashmi (b) Gauri (c) Mandakini (d) Astha

Solution: Correct answer is option (b).
Let the average speed of Rashmi, Mandakini, Gauri, Astha and Suhana be R, M, G, A and S respectively.
Hence, G > R > M and M > A > S.
Thus, G > R > M > A > S.
The average speed of Gauri was the highest among the five and hence she won the race.