Institute of Actuaries of India

ACET June 2018

Mathematics

1. If $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$, then

   A. $\vec{a}$ is parallel to $\vec{b}$
   B. $\vec{a}$ is perpendicular to $\vec{b}$
   C. $|\vec{a}| = |\vec{b}|$
   D. none of these.   1 mark

2. $f(x) = \sin\left(\frac{1}{x}\right)$, $x \neq 0$. $f(x)$ can be continuous at $x = 0$

   A. if $f(0) = 1$
   B. if $f(0) = 0$
   C. if $f(0) = -1$
   D. for no value of $f(0)$.   1 mark

3. Let f and g be two continuous functions. Then
$$\int_{-\pi/2}^{\pi/2} \{f(x) + f(-x)\}\{g(x) - g(-x)\}\, dx$$
   Is equal to

   A. π
   B. -1
   C. 1
   D. 0.   1 mark

4. The number of points at which the function $f(x) = |x - 1| + |x + 1| + \tan x$ does not have a derivative in $(-2, 2)$ is

   A. 4
   B. 1
   C. 2
   D. 3.   1 mark

5. For matrices X and Y, if $XY = X$ and $YX = Y$, then Y^2 must coincide with

   A. X
   B. Y
   C. identity matrix
   D. null matrix.   1 mark

6. The system of equations $ax + 2y - z = 1, (a - 1)y - 2z = 2$ and $(a + 2)z = 3$ has a unique solution if a equals to

    A. 0
    B. 1
    C. −2
    D. −1.   1 mark

7. Suppose $x > y$ $implies$ $\log x < \log y$ $\forall\ x, y > 0$. Then a possible value of base of the logarithm is

    A. e
    B. 10
    C. 1/3
    D. none of these.   1 mark

8. If $R = \{(x, y): x, y \in Z\ and\ x^2 + y^2 \leq 4\}$ is a relation on the set of integers Z, the domain of R is

    A. $\{0,1,2\}$
    B. $\{-2, -1, 1, 2\}$
    C. Z
    D. $\{-2, -1, 0, 1, 2\}$.   1 mark

9. The set of intelligent students in a class is

    A. a null set
    B. not a well defined collection
    C. a singleton set
    D. a finite set.   1 mark

10. If $x^3 - 1 = 0$ has complex roots α, β, then the value of $(1 + 2\alpha + \beta)^3 - (3 + 3\alpha + 5\beta)^3$ is

    A. −7
    B. 6
    C. −5
    D. 0.   1 mark

11. Suppose $n(X)$, the number of elements in the set X is 60, $n(Y) = 80, n(X - Y) = 45$. Then $n(X \cup Y)$ is equal to

    A. 125
    B. 135
    C. 120
    D. 115.   1 mark

12. The set $X = \{x \in R : f(2x) = 2f(x)\}, f(x) = x^2 + 3x$, then X is

    A. null set
    B. singleton set
    C. infinite set
    D. none of these.   1 mark

13. The smallest positive integer n, for which $\left(\frac{\sqrt{3}+i}{2}\right)^n = \left(\frac{\sqrt{3}-i}{2}\right)^n$, is

    A. 3
    B. 4
    C. 6
    D. none of these.   2 marks

14. The roots of the complex equation $1 - z - z^3 + z^4 = 0$ are represented by the vertices of

    A. a square
    B. an equilateral triangle
    C. a rhombus
    D. none of these.   2 marks

15. If $g = \{(1,1), (2,3), (3,5), (4,7)\}$ is a function described by the formula $g(x) = \alpha x + \beta$, then

    A. $\alpha = 1, \beta = 1$
    B. $\alpha = 2, \beta = -1$
    C. $\alpha = 1, \beta = -2$
    D. $\alpha = -2, \beta = -1$.   2 marks

16. If $f(x) = -1, 0, 1$ for $x < 0, x = 0, x > 0$ respectively and $g(x) = 1 + x - [x]$, where $[x]$ is the greatest integer less than or equal to x, then for all x, the value of $f(g(x))$ is

    A. 1
    B. x
    C. $f(x)$
    D. $g(x)$.   2 marks

17. The determinant $\begin{vmatrix} x^2 + 2x & 2x + 1 & 1 \\ 2x + 1 & x + 2 & 1 \\ 3 & 3 & 1 \end{vmatrix}$ is

    A. positive, if $x > 1$
    B. negative, if $x < 1$
    C. zero, if $x = 1$
    D. all of these.   2 marks

18. A college awarded 38 medals in Football, 15 in Basketball and 20 in Cricket. If these medals went to a total of 58 men and only 3 men got medals in all the three sports, then persons who received medals in exactly two of three sports are

   A. 9
   B. 3
   C. 18
   D. 12.   3 marks

19. For which value of the constant k does the function $f(x) = kx^2 - k^2x + 3$ have a minimum at $x = -2$?

   A. -4
   B. 0
   C. -2
   D. No value of k.   1 mark

Statistics

20. There are two samples, the first of the two samples has 100 items with mean 15 and standard deviation 3. If the whole group has 250 items with mean 15.6 and standard deviation $\sqrt{13.44}$, then the standard deviation of the second group is

    A. 2   B. 3   C. 4   D. 5.   3 marks

21. For a group of 300 candidates, the mean of scores was found to be 50. Later it was discovered that the scores 84 and 53 were misread as 48 and 35, respectively. The correct mean is

    A. 50.16   B. 50.18   C. 50.20   D. 50.22.   1 mark

22. From a city population, the probability of selecting (i) a male smoker is 2/5, and (ii) a male among the smokers is 2/3. The probability of selecting a non-smoker is

    A. 4/5   B. 2/5   C. 1/5   D. 3/5   1 mark

23. A pair of fair dice is thrown. If the two numbers appearing are different, the probability that the sum is 4 or less is

    A. 2/15   B. 1/15   C. 4/15   D. 7/15.   1 mark

24. The coefficient of correlation between X and Y is 0.6. Their covariance is 4.8. The variance of X is 9. Then the standard deviation of Y is

    A. $\dfrac{4.8}{3\times0.6}$ B. $\dfrac{0.6}{4.8\times3}$ C. $\dfrac{3}{4.8\times0.6}$ D. $\dfrac{4.8}{9\times0.6}$.   1 mark

25. Let X be normally distributed with mean 0 and variance σ_1^2 and Y be normally distributed with mean 0 and variance σ_2^2. Let ρ be the correlation coefficient between X and Y, then the correlation coefficient of $(X/\sigma_1 + Y/\sigma_2)$ and $(X/\sigma_1 - Y/\sigma_2)$ is

    A. ρ B. $-\rho$ C. $1 - \rho^2$ D. 0.   1 mark

26. If X and Y are two independent log- normal variates, then XY and X/Y follow the following two distributions, respectively

    A. Normal and Log Normal
    B. Normal and Normal
    C. Log Normal and Log Normal
    D. None of the above   1 mark

27. If X has exponential distribution with mean 2, then $P(X < 1 \mid X < 2)$ is

    A. $(1{-}e^{-2})/(1 - e^{-4})$
    B. $(1{-}e^{-0.5})/(1 - e^{-1})$
    C. $(1{-}e^{-1})/(1 - e^{-2})$
    D. $(1{-}e^{-0.5})/(1 - e^{-4})$ 2 marks

28. In a partially destroyed laboratory, only the following results on the record of a regression analysis are legible:
Regression equations of Y on X: $8X - 10Y + 66 = 0$.
Regression equation of X on Y: $40X - 18Y = 214$.
The correlation coefficient between X and Y is

   A. 0.5   B. 0.7   C. 0.6   D. 0.4   2 marks

29. Given that $X = 4Y + 5$ and $Y = kX + 4$, are the lines of regression of X on Y and Y on X, respectively. Identify which one of the following statements is true.

   A. $0 \le 4k \le 1$ B. $4k > 1$ C. $-1 \le 4k \le 0$ D. $4k < -1$
      1 mark

30. A box contains k white balls and m black balls. Out of these, x balls are drawn at random with replacement (i.e., drawn one at a time and put back in the box each time). The expected value of the number of white balls drawn is

   A. $\dfrac{xk}{k+m}$ B.$\dfrac{xm}{k+m}$ C. $\dfrac{km}{k+x}$ D.$\dfrac{km}{m+x}$ 2 marks

31. In a Poisson distribution, the probability of observing 3 is 2/3 times that of observing 4. The mean of the distribution is

   A. 5   B. 6   C. 7   D. 8   2 marks

32. The sample space consists of integers from 1 to $2n$ which are assigned probabilities proportional to their logarithms. Then the conditional probability of the integer 2, given that an even integer occurs, is

   A. $\dfrac{\log 2}{\log 2 + \log(n!)}$

   B. $\dfrac{\log 2}{\log(2n) + \log(n!)}$

   C. $\dfrac{\log 2}{n \log 2 + \log(n!)}$

   D. $\dfrac{\log 2}{\log(2n!)}$ 2 marks

Data Interpretation

Distribution of Students in different courses and faculty at a Premier Institute is as given in the table below. Use this information to answer the questions 33 and 34.

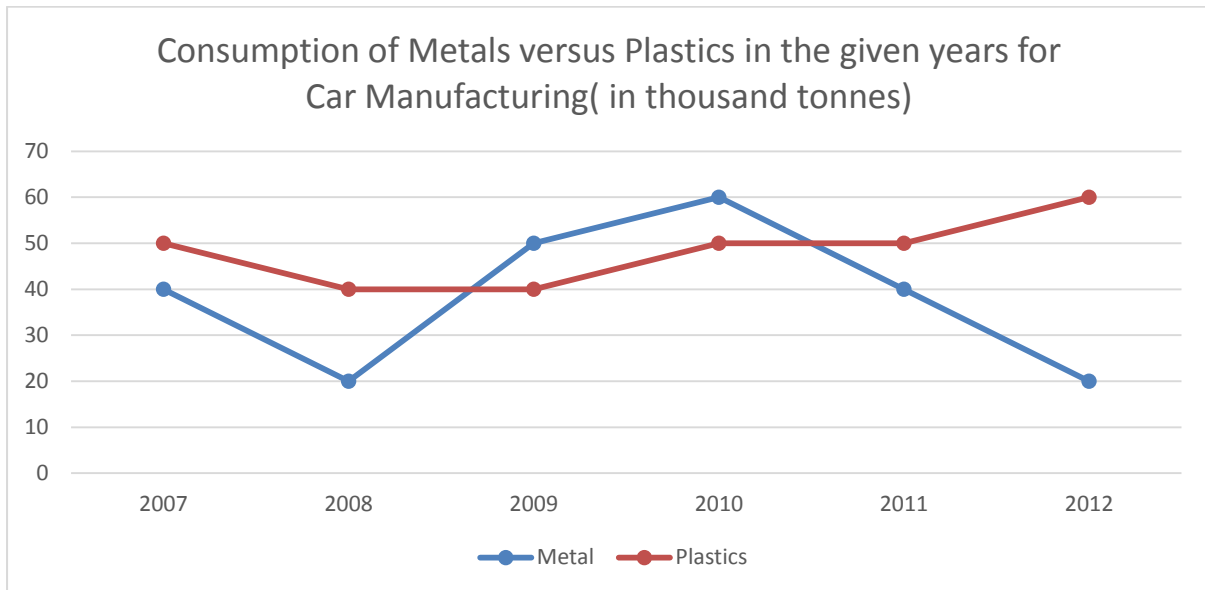| Sr. No.	Course	Faculty Engineering		Faculty Non-Engineering	
		Girls	Boys	Girls	Boys
1	Business Management	50	90	50	130
2	Computers	46	372	40	64
3	Finance	50	240	24	116
4	Others	24	200	6	10
	Total	170	902	120	320

33. If 60% of the boys and 70% of the girls pass the courses taken by them, then what is the combined pass percentage?

A. 60   B. 62   C. 65   D. 69   1 mark

34. The percentage of girl engineers doing Business management is

A. 10.2   B. 11. 2   C. 12.2   D. None of these   1 mark

The following graph shows the trend of consumption of metals and plastics in the production of cars between 2007-12. Consider the graph and answer Questions 35 and 36 based on that.

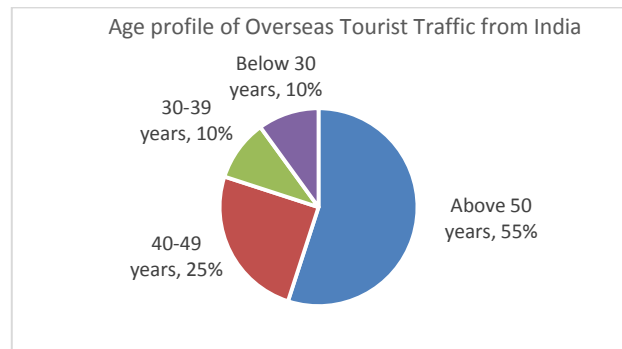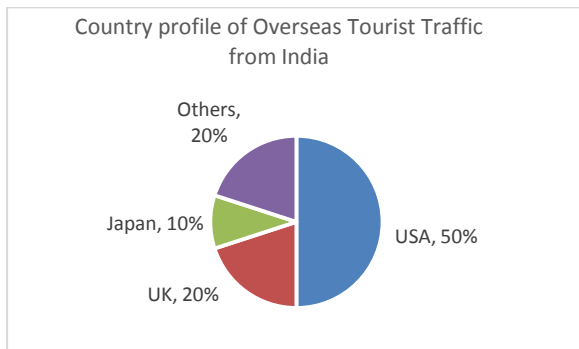Consumption of Metals versus Plastics in the given years for Car Manufacturing(in thousand tonnes)

35. The ratio of the highest total consumption (of the two items taken together) in any single year to the lowest total consumption in any single year was equal to:

    A. 5:3   B. 11:6   C. 7:4   D. 11:7   1 mark

36. What is the highest percentage by which the consumption of Metal has exceeded the consumption of Plastics in any year during 2007 to 2012? :

    A. 18%   B. 20%   C. 25%   D. 30%   2 marks

The following two pie charts exhibit distribution of the overseas tourist traffic from India. The two charts show the tourist distribution by country and the age profile of the tourists respectively. Study the charts carefully and answer the questions 37 and 38 which follow.

Country profile of Overseas Tourist Traffic from India

Others, 20%
Japan, 10%
UK, 20%
USA, 50%

Age profile of Overseas Tourist Traffic from India

Below 30 years, 10%
30-39 years, 10%
40-49 years, 25%
Above 50 years, 55%

37. If amongst the "Others" country category, Switzerland accounted for 15% of the Indian tourist traffic, and it is known from official Swiss records that a total of 30 lakh Indian tourists had gone to Switzerland during the year, then find the number of 40-49 years old Indian tourists who went abroad in that year

A. 250 lakh   B. 200 lakh   C. 300 lakh   D. 350 lakh   3 marks

38. Going by the Swiss records mentioned in the previous question, what is the number of 50+ year olds who visited UK during the year assuming that the age distribution of overseas Indian tourists was uniform for all the countries?

A. 100 lakh   B. 110 lakh   C. 120 lakh   D. 130 lakh   2 marks

English

39. The antonym of the word 'Calm' is:
    A. Music
    B. Pain
    C. Lull
    D. Troubled   1 mark

40. The antonym of the word 'Dreary' is:
    A. Surprise
    B. Calm
    C. Cheerful
    D. Composed   1 mark

41. The synonym of the word 'Amused' is:
    A. Glad
    B. Confused
    C. Bewildered
    D. Bleared   1 mark

42. The synonym of the word 'Mammoth' is:
    A. Large
    B. Big
    C. Gigantic
    D. Hefty   1 mark

43. One word for "a person with identity concealed" is:
    A. Hidden
    B. Incognito
    C. Spy
    D. Concealed   1 mark

44. One word for "a thing kept as a reminder of a place or event" is:
    A. Nostalgic
    B. Remembrance
    C. Memorial
    D. Souvenir   1 mark

45. The alternative which replaces '?' in "Rural : Hut :: Urban : ?" is:
    A. Concrete
    B. Apartment
    C. Office
    D. House   1 mark

46. The meaning of 'Truant' is:
    A. one who does not fulfil her/his responsibilities
    B. one who is notorious by nature
    C. one who makes deceitful pretences
    D. one who is absents herself/himself from school or work without permission   1 mark

47. The alternative which replaces '?' in "Pleasure : Happy :: Pain : ?" is:
    A. sad
    B. sorry
    C. pitiful
    D. pathetic   1 mark

48. Meaning of the phrase "to call it a day" is:
    A. to go home late after work
    B. to enjoy with friends
    C. to take leave for a day
    D. to quit work and go home   1 mark

49. Meaning of the phrase "to throw in the towel" is:
    A. to become a participant in a contest
    B. to admit failure
    C. to go for swimming
    D. to sweat a lot in some sports or exercise   1 mark

50. Meaning of the phrase "Couch potato" is:
    A. a lazy and inactive person who watches a lot of television
    B. a person who eats lot of potato chips while watching the television
    C. a person who has a big belly
    D. a person who watches television   1 mark

51. Rearrange the following parts (1, 2, 3 and 4) in proper sequence to obtain a correct sentence:
    I. that juniors would not
    II. the management meeting
    III. be allowed to attend
    IV. the manager was certain

    A. I, II, III, IV
    B. I, II, IV, III
    C. IV, II, III, I
    D. IV, I, III, II   1 mark

52. Rearrange the following parts (1, 2, 3 and 4) in proper sequence to obtain a correct sentence:
   I. to make amends
   II. Mira saw her opportunity
   III. when Karan came to her home
   IV. to borrow her car

   A. III, I, II, IV
   B. III, II, IV, I
   C. II, III, I, IV
   D. II, I, III, IV   1 mark

53. Rearrange the given parts (1, 2, 3 and 4) in proper sequence to obtain the correct part of the sentence "An eighteenth century Asian painting ....":
   I. as would a
   II. does not
   III. represent an actual view
   IV. classical Western painting

   A. I, II, III, IV
   B. II, III, I, IV
   C. III, I, IV, II
   D. II, III, IV, I   1 mark

54. Select the most logical order of sentences from among the given choices to construct a coherent paragraph:

   P: They can even perform transplants.
   Q: Nowadays, doctors stops a patient's heart and carry out major operations.
   R: If heart stops we die in about five minutes.
   S: A few years ago, it was impossible to operate on a patient whose heart was not working properly.

   A. RSQP
   B. QSPR
   C. SPRQ
   D. SRPQ   2 marks

55. Select the most logical order of sentences from among the given choices to construct a coherent paragraph:

P: Metals are being replaced by polymers in many applications.
Q: They are cheaper and easier to process making them a viable alternative to metals.
R: Today polymers as strong as metals have been developed.
S: For example, they have replaced the traditional chromium-plated metallic bumpers in cars.

A. PQRS
B. RQPS
C. SPQR
D. RSPQ   2 marks

56. Fill the blanks in the sentence "One should not .... people with ....":
A. decide, bias
B. blame, discretion
C. judge, prejudice
D. praise, qualities   2 marks

57. Fill the blanks in the sentence "Doubt is .... not the end of ....":
A. killer, tolerance
B. hope, knowledge
C. important, dumbness
D. beginning, wisdom   2 marks

58. Fill the blanks in both sentences by a single word:

The .... of the cab was arrested two days after the accident.
Women's safety was the main.......... behind the decision on Pink cabs.

A. Issue
B. Owner
C. Driver
D. Passenger   2 marks

59. Choose the correct sentence:
A. When the car was searched, it was found.
B. When the car was searched for, it was found.
C. When the car was searched about, it was found.
D. When they searched for the car, they found.   2 marks

60. Choose the correct sentence:
A. Work expands so fill the time available.
B. Work expands so that fill the time available.
C. Work expands as much as fill the time available.
D. Work expands so as to fill the time available.   2 marks

Read the passage below and answer Question No. 61:

Taking a picture with a camera is making a decision about composition. It means how you choose to frame the picture you're about to make. Many books have been written about composition, and while no two people are likely to frame the same scene the same way, there are some general guidelines that can help you improve your photos and make them better. First you need to decide, while composing a picture, what your subject is. Of all the things you see in front of you, which one is the reason for your taking the photo? Once you've answered that question you can begin to work on how best to show that subject. The rule of thirds is a guide to help you do just that. When you look through your viewfinder or at the LCD screen, imagine a tic-tac-toe grid over the scene. These gridlines are a guide to help you frame your image and won't show up in your final picture. Notice where the lines intersect. The rule of thirds suggests that these points are the best places to position your subject. Doing so will generally result in a pleasant and balanced composition. Try moving your camera so your subject appears where two of the lines meet. The subject doesn't have to be directly on the intersection but somewhere close to it. Try a couple of different compositions to find the one you like best. These same gridlines can help you to keep your horizons level and the vertical elements in your photo straight.

    I.   Using the rule of thirds, you can compose your picture:
    i.   as you wish
    ii.   similar to others
    iii.   that looks better

    II.   While composing a picture, first of all you decide:
    i.   the subject
    ii.   the composition
    iii.   the points of intersection on a tic-tac-toe grid

    III.   How many points are suggested by the rule of thirds to place your subject?
    i.   Nine
    ii.   Three
    iii.   Four

61. The correct answers to I, II and III are:
    A. iii, iii, ii, respectively
    B. i, ii, iii, respectively
    C. iii, i, iii, respectively
    D. ii, i, i, respectively   3 marks

Read the passage below and answer Question No. 62:

Over the last thirty years, there has been increasing scientific evidence that pets can help to keep us fit and well. Pets can even help speed up recovery after major illness. A study found that owning a pet produced improvements in general health in as little as one month. This continued over the 10-month study. Pet owners were found to suffer fewer ailments, such as headaches, colds and hay fever. Stroking a pet or simply watching a fish swim in an aquarium helps us to relax. Indeed, the mere presence of a pet seems to have the same effect, reducing heart beat rate and lowering blood pressure. Research has shown that this effect is particularly marked in people suffering from high blood pressure. The reduction in blood pressure is equivalent to that gained by eating a low salt diet or cutting down on alcohol consumption. Heart disease is one of the UK's biggest killers, yet it is another area where pets provide health benefits. One study showed that keeping a pet significantly reduced levels of cholesterol and blood triglyceride. This fact, combined with the reduction in blood pressure from being with a pet, may make pet owners less prone to heart attacks than non-pet-owners. Pet ownership proved to be one of the best predictors of survival from a heart attack, according to an American study. The study showed that those patients who owned a pet had a much better chance of surviving for more than a year after a heart attack - a difference which could not be explained by the extra exercise the pet owners enjoyed. Children who own pets are often less self-centred than those who do not. Psychiatrically ill people were happier as a result of looking after a pet. Pets provide companionship and promote a general feeling of well-being. For example, pets in residential homes improve both patient and staff morale. Pets can lessen the feelings of isolation and loneliness and provide a sense of purpose among elderly people. Having to make the effort to care for a pet on a regular basis provides a feeling of fulfilment.

    I.   Owning a pet helps in ……..:
    i.   learning mathematics
    ii.   recovering from various disease
    iii.   making friends

    II.   Pet owners were found to suffer from ……..:
    i.   headache
    ii.   allergies
    iii.   don't know

    III.   Pets can provide ……….:
    i.   lesser feeling of loneliness
    ii.   improved muscle mass
    iii.   both (i) and (ii)

62. The correct answers to I, II and III are:
    A.   iii, iii, i, respectively
    B.   ii, iii, i, respectively
    C.   ii, i, iii, respectively
    D.   ii, iii, iii, respectively   3 marks

Logical Reasoning

63. Neena and Veena were Darshan's wives. He had no other wife. Deepika is Veena's step-daughter. How was Neena related to Deepika?

    A. Sister
    B. Mother-in-law
    C. Mother
    D. Step-daughter   1 mark

64. The six faces of a cube are coloured black, brown, green, red, white and blue.
    I.   Red is opposite to black,
    II. Green in between red and black,
    III. Blue is adjacent to white,
    IV. Brown is adjacent to blue,
    V.   Red is at the bottom.

    Which colour is opposite to brown?

    A. White
    B. Red
    C. Green
    D. Blue   1 mark

65. It was Sunday on Jan 1, 2006. What was the day of the week Jan 1, 2010?

    A. Sunday
    B. Saturday
    C. Friday
    D. Wednesday   1 mark

66. If in a certain code, 'DAUGHTER' is written as 'TERDAUGH', how will 'APTITUDE' be written in that code?

    A. DEUAPTIT
    B. UDEAPTIT
    C. DUEAPTIT
    D. DAUEPTIT   1 mark

67. Arrange the words given below in a meaningful sequence.

   1. Probation. 2. Interview 3. Selection 4. Appointment 5. Advertisement 6. Application

   A. 5, 6, 3, 2, 4, 1
   B. 5, 6, 4, 2, 3, 1
   C. 5, 6, 2, 3, 4, 1
   D. 6, 5, 4, 2, 3, 1   1 mark

68. Which word does not belong with the others?

   A. dodge
   B. flee
   C. duck
   D. avoid   1 mark

69. A college has 60 students studying Political Science, Chemistry and Botany. 33 students study Political Science, 25 Chemistry and 26 Botany. 10 study Political Science and Chemistry, 9 study Botany and Chemistry while 8 study both Political Science and Botany.

   How many students study all the three subjects?

   A. 2
   B. 3
   C. 5
   D. 7   2 marks

70. In the following question, two statements are given followed by four conclusions numbered I, II, III and IV. You have to take the given statements to be true even if they seem to be at variance from the commonly known facts and then decide which of the given conclusions logically follows from the given statements disregarding commonly known facts.

   Statements

   All politicians are honest.
   All honest are fair.

   Conclusions:

     I. Some honest are politicians.
    II. No honest is politician.
   III. Some fair are politicians.
   IV. All fair are politicians.

   A. None follows.
   B. Only I follows.
   C. Only I and II follow.
   D. Only I and III follow.   2 marks