INTERNATIONAL MATHEMATICS OLYMPIAD 2012

Class IX

Questions : 50 Time: 60 Minutes

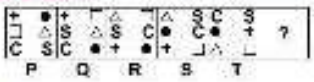
There are 3 sections, 20 questions in Section-1, 20 questions in Section-2, 10 questions in Section-3

SET A

Section-1 - Logical Reasoning

1. In the following question, the symbols @, ©, $ and '% are used with the following meanings as illustrated below :
'A $ B' means 'A is not smaller than B';
'A @ B' means 'A is neither smaller than nor equal to B';
'A © B' means 'A is neither smaller than nor greater than B';
'A % B' means 'A is neither greater than nor equal to B'.
Now in the following question, assuming the given statements to be true, find which of the three conclusions I, II and III given below them is/are definitely true and give your answer accordingly.
Statements : K © P, P @ Q, Q $ R
Conclusions : I. K @ R II. R % P III. Q '% K
(A) Only I and II are true (B) Only II and III are true
(C) Only III is true (D) All I, II and III are true

2. Select a figure from amongst the options which will continue the same series as established by the five Problem Figures P, Q, R, S and T.



(A)  (B)  (C)  (D) 

3. Study the following information carefully and answer the question given below.
P, Q, R, S, T, V and W are seven passengers and I, II, III are three different vehicles. There are atleast two passengers in each vehicle I, II and III and one of them is a lady. There are two engineers, two doctors and three teachers among them. R is lady doctor and she does not travel with the pair of sisters P and V. Q, a male engineer travels with only W, a teacher in vehicle I. S is a male doctor. Two persons belong to same profession do not travel in the same vehicle. P is not an engineer and travels in vehicle II.
How many lady members are there amongst them?
(A) Three (B) Four (C) Three or Four (D) Data inadequate

4. Inspector Jatin travelled from his police station for 400 metres. He then turned left and travelled 500 metres straight after which he turned left again and travelled for 400 metres straight. He then turned right and walked for another 600 metres straight. How far is he from the Police station?
(A) 1.0 km (B) 1.1 km (C) 1.4 km (D) 1.8 km

5. Read the following information carefully and answer the question given below it.

(i) There is a group of six persons A, B, C, D, E and F in a family. They are Psychologist, Manager, Lawyer, Jeweller, Doctor and Engineer.

(ii) The doctor is the grandfather of F who is a Psychologist.

(iii) The Manager D is married to A.

(iv) C, the Jeweller, is married to the Lawyer.

(v) B is the mother of F and E.

(vi) There are two married couples in the family.

How is A related to E?

(A) Brother (B) Uncle (C) Father (D) Grandfather

6. Vijay is fifteenth from the front in a column of boys. There were thrice as many behind him as there were in front. How many boys are there between Vijay and the seventh boy from the end of the column?

(A) 33 (B) 34 (C) 35 (D) Data inadequate

7. Which of the options will come next in the series?

JAZ, LEX, NIV, PDT, ?

(A) OUR (B) RUS (C) RUR (D) R5R

8. If the code of SENSITIVE is QHLVGWGYC then what will be the code of MICROSOFT?

(A) KCAPMCJMDT (B) CJKFTCJICHV (C) KIAUMVMIR (D) LKRTNUNHS

9. RUST = 9-6-8-7 and BOARD = 25-12-26-9-23, how will you code 'BEAT'?

(A) 25-23-24-7 (B) 25-21-25-7 (C) 25-22-25-7 (D) 25-22-25-7

10. If 12% people in a village are suffering from cancer and 13% from blood pressure, which of the following diagram best represents the sick population of the village?

(A)  (B)  (C)  (D) 

11. Look at the symbol-letter-number sequence given below.

J P J @ 8 S L B 1 V # Q 8 8 C W 9 K C D 3 © + F 5 F R 7 A Y 4

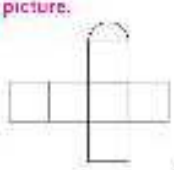
Three of the following four are similar in relation to their positions in the above sequence and hence form a group. Which one does not belong to that group?

(A) O K 5 (B) L 8 D (C) P L A (D) T G 6

12. A child went 90 m in the East to look for his father, then he turned right and went 20 m. After this he turned right and after going 30 m, he reached to his uncle's house. His father was not there. From there he went 100 m to his North and met his father in the shop. How far did he meet his father from the starting point?

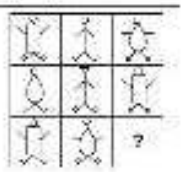
(A) 80 m (B) 100 m (C) 140 m (D) 260 m

13. Match the given net with the correct picture.



(A) 
(B) 
(C) 
(D) 

14. Find out which of the options completes the figure matrix?



(A) 
(B) 
(C) 
(D) 

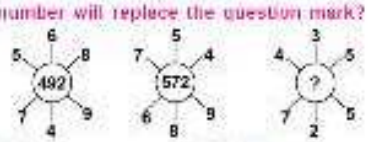
15. A goldsmith has five gold rings, each having a different weight :
Statement 1 : Ring D is weighing twice as much as ring E.
Statement 2 : Ring E is weighing four times as much as ring F.
Statement 3 : Ring F is weighing half as much as ring G.
Statement 4 : Ring G is weighing half as much as ring H.
Statement 5 : Ring H is weighing less than ring D but more than ring F.
Which of the following represents the descending order of weights of the rings ?
(A) D, E, G, H, F
(B) E, G, H, D, F
(C) D, E, F, G, H
(D) Data inadequate

16. In the following question from amongst the options, select the one which satisfies the same conditions of placement of the dot as in Fig. (X).

Fig. (X)

(A) 
(B) 
(C) 
(D) 

17. In the given question, which number will replace the question mark?



(A) 115
(B) 130
(C) 135
(D) 140

18. Select a figure from amongst the options, which when placed in the blank space of fig. (X) would complete the pattern.

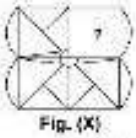
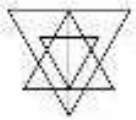


Fig. (X)

(A)  (B)  (C)  (D) 

19. Find the number of quadrilaterals in the given figure.



(A) 10
(B) 6
(C) 9
(D) None of these

20. Rita drives to the north of her place of stay at A and after travelling 25 km, finds that she has driven in the wrong direction. She then turns to her right and travels 2 km, and then she again turns to the right and drives straight another 25 km. How much distance has she now to cover to go back to the starting point ?

(A) 25 km (B) 2 km (C) 4 km (D) 40 km

Section-2 – Mathematical Reasoning

21. The expression $2x^3 + ax^2 - bx + 3$, where a and b are constants, has a factor of $x - 1$ and leaves a remainder of 15 when divided by $x + 2$. Find the value of a and b respectively.

(A) −3, 8 (B) 3, −8 (C) −3, −8 (D) 3, 8

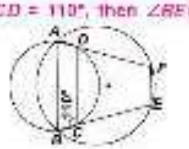
22. If 'l', 'b' and 'h' of a cuboid are increased, decreased and increased by 1%, 3% and 2% respectively, then the volume of the cuboid _____.

(A) Increases
(B) Decreases
(C) Increases or decreases depending on original dimensions
(D) Can't be calculated with given data

23. A box of chocolates contain 5 chocolates with hard centres and 4 with soft centres.
Amit takes a chocolate, selected at random, from the box and eats it.
Ajay then takes a chocolate, selected at random, from the box.
Find the probability that Amit and Ajay both choose a chocolate with a hard centre.

(A) $\frac{5}{9}$ (B) $\frac{4}{9}$ (C) $\frac{3}{10}$ (D) $\frac{5}{18}$

24. In given figure, $ABCD$ and $ABEF$ are two cyclic quadrilaterals. If $\angle BCD = 110°$, then $\angle BEF = ?$



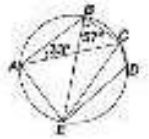
(A) 55°
(B) 70°
(C) 90°
(D) 110°

25. The value of $3\begin{bmatrix} (a^2-b^2)^3+(b^2-c^2)^3-(c^2-a^2)^3 \\ (a-b)^3+(b-c)^3+(c-a)^3 \end{bmatrix}-7$

(A) $3(a-b)(b+c)(c-a)$ (B) $3(a-b)(b-c)(c-a)$
(C) $(a-b)(b-c)(c-a)$ (D) 1

26. How many planes can be made to pass through three distinct points?
(A) One if they are collinear (B) Infinite if they are collinear
(C) Only one if they are non collinear (D) Both (B) and (C)

27. The line BF is a diameter of the given circle. If $\angle BAC = 33°$ and $\angle EBC = 57°$. Then $\angle CAE =$



(A) 57°
(B) 33°
(C) 46°
(D) 90°

28. The term containing the highest power of x in the polynomial $f(x)$ is $2x^3$. Two of the roots of the equation $f(x) = 0$ are -1 and 2. Given that $x^2 - 3x + 1$ is a quadratic factor of $f(x)$, find the remainder when $f(x)$ is divided by $2x - 1$.

(A) $1\frac{1}{8}$ (B) 2 (C) 0 (D) $-1/3$

29. The sum of a number and its reciprocal is thrice the difference of the number and its reciprocal. The number is _____.

(A) $\pm\sqrt{2}$ (B) $\pm\frac{1}{\sqrt{2}}$ (C) $\pm\sqrt{3}$ (D) Both (A) and (B)

30. Solve for x: $\frac{2^{x-5}}{8^{-3}} = \frac{32}{4^{(1/2)x}}$.

(A) $2\frac{3}{5}$ (B) $1\frac{1}{5}$ (C) $3\frac{1}{5}$ (D) $1\frac{3}{5}$

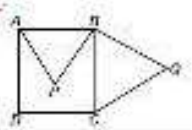
31. $2.6\ \overline{0.82} =$ _____

(A) $\frac{192}{99}$ (B) $\frac{180}{999}$ (C) $\frac{175}{99}$ (D) $\frac{184}{999}$

32. The base of an isosceles triangle is 4 cm and its area is 16 cm^2. If one of the two equal sides of the triangle is k cm, the approximate value of $k - 1.24$ is _____.

(A) 9 cm (B) 7 cm (C) 10 cm (D) 8 cm

33. $ABCD$ is a rectangle. If ABP and BCQ are equilateral triangles, $\angle PBQ =$ ____.



(A) 65°
(B) 75°
(C) 60°
(D) 90°

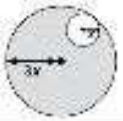
34. A certain distance is covered at a certain speed (s_1). If half of this distance is covered in double the time at speed (s_2). Find the ratio of the two speeds.
Also, if s_1 is 60 km/hr, find s_2.

(A) 1 : 16, 3.75 km/hr (B) 4 : 1, 15 km/hr (C) 2 : 1, 30 km/hr (D) 2 : 8, 240 km/hr

35. If product of abscissa and ordinate of a point is positive, then the point lies in

(A) I quadrant (B) III quadrant (C) IV quadrant (D) Both (A) And (B)

36. The two circles have radii x and 3x. A point is chosen, at random, inside the larger circle. Find, in its simplest fractional form, the probability that this point is in the shaded area.



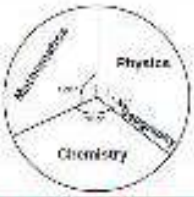
(A) 7/9 (B) 6/9

(C) 1/9 (D) 1/3

37. Find the missing value. $\frac{(13)^2 + 7^2}{(13)^2 + ?^2} = 29$

(A) 6 (B) 20 (C) 91 (D) 19

38. The students in a college were asked to vote for their favourite subject. The pie chart represents the number of votes for each subject. Mathematics obtained 25 more votes than Chemistry. Calculate the number of students who took part in the survey.



(A) 250 (B) 500

(C) 450 (D) 600

39. A cuboidal metal block of dimensions 20 cm × 16 cm × 12 cm weighs 6 kg. Find the weight of block of the same metal of size 10 cm × 8 cm × 8 cm.

(A) 3 kg (B) 6 kg (C) 7 kg (D) 1 kg

40. What percentage of a day is six hours and 45 minutes?

(A) 7.218% (B) 8.3% (C) 28.125% (D) None of these

Section-3 – Everyday Mathematics

41. The population of a town was 160000 three years ago. If it had increased by 3%, 2.5% and 5% in the last three years, find its present population.

(A) 167356 (B) 177465 (C) 177356 (D) 177366

42. The taxi charges in a city comprise of a fixed charge, together with the charge of the distance covered. For a journey of 15 km, the charges paid are Rs. 156 and for a journey of 24 km, the charge paid are Rs. 204. What will a person have to pay for travelling a distance of 30 km?

(A) Rs. 236 (B) Rs. 240 (C) Rs. 246 (D) Rs. 252

43. Savita has Rs. 27 in the form of fifty paise and twenty-five paise coins. She has twice as many twenty-five paise coins as she has 50 paise coins. How many coins of each kind does she have?

(A) 27, 54 (D) 30, 60 (C) 25, 50 (D) 40, 80

44. A trader purchases 70 kg of tea at Rs. 15 per kg and 30 kg of tea at Rs. 18.50 per kg. If the packing charges are 2 percent, then at what price he must sell the mixture of two to gain 15%?

(A) Rs. 19.92 per kg (B) Rs. 19 per kg (C) Rs. 18.00 per kg (D) Rs 17.90 per kg

45. The average age of a family of 6 members 4 years ago was 25 years. Meanwhile a child was born in this family and still the average age of the whole family is same today. The present age of child is _____.

(A) 2 years (B) $1\frac{1}{2}$ years (C) 1 year (D) Data insufficient

46. 2 men and 3 women finish 25% of the work in 1 day, while 6 men and 14 women can finish the whole work in 5 days. In how many days will 20 women finish it?

(A) 20 (B) 25 (C) 24 (D) None of these

47. Two pipes *X* and *Y* can fill a cistern in 24 min. and 32 min. respectively. If both the pipes are opened together, then after how much time *Y* should be closed so that the tank is full in 18 minutes?

(A) 6 mins (B) 8 mins (C) 10 mins (D) None of these

48. Suresh travelled 1200 km by air which formed (2/5) of his trip. One third of the whole trip, he travelled by car and the rest of the journey he performed by train. Find the distance travelled by train. Also, find the speed of the train if the time taken for the train to travel the whole distance is 8 hrs.

(A) 1600 km, 350 km/hr (B) 900 km, 375 km/hr
(C) 1600 km, 300 km/hr (D) 480 km, 360 km/hr

49. Three lightships flash simultaneously at 6:00 a.m. The first lightship flashes every 12 seconds, the second lightship every 30 seconds and the third lightship every 66 seconds. At what time will the three lightships next flash together?

(A) 6:09 a.m. (B) 6:10 a.m. (C) 6:11 a.m. (D) 6:12 a.m.

50. A fruit seller has 24 kg of apples. He sells a part of these at a gain of 20% and the balance at a loss of 5%. If on the whole he earns a profit of 10%, the amount of apples sold at a loss is ___.

(A) 1.6 kg (B) 6 kg (C) 9.6 kg (D) 11.4 kg