





## SECTION 1 - MATHEMATICS

**Important Note:** Read the questions carefully and comprehend them correctly before you answer. Questions from 1 to 45 have one or more options right. To score full marks for each question, bubbles for all the right answer options should be shaded. Shading one or more wrong bubble/s make the answer wrong. No marks are given for partial answers.

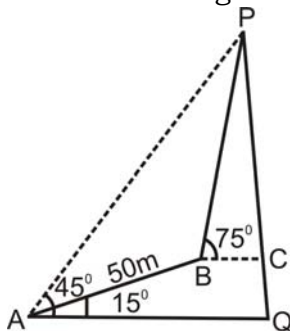
01. Wisden posed a question to Vidya. The virus population on a patient reduces to half every hour. But why the reduction in virus population cannot be represented by a linear equation? Vidya couldn't find the answer. What is your answer to help her?
- (a) The rate of decrease is not in arithmetic progression  
 (b) We do not know the initial population  
 (c) We do not know the time taken  
 (d) The rate of decrease is a variable
02. During the class on real numbers, Vidya noted the following points in her notebook. What is / are the point/s she has wrongly noted?
- (a) Factorize each of the given positive integers and express them as a product of powers of primes in ascending order of magnitudes of primes.  
 (b) To find the HCF, identify common prime factors and find the smallest exponent of these common factors. Raise these common prime factors to their exponents and multiply them to get the HCF.  
 (c) To find the LCM, list all prime factors once, occurring in the prime factorization of the given positive integers.  
 (d) For each of these factors, find the greatest exponent and raise each prime factor to the greatest exponent and multiply them to get the LCM.
03. If  $\alpha, \beta, \gamma$  are the zeros of the polynomial  $f(x) = x^3 - px^2 + qx - r$ , then  $\frac{1}{\alpha\beta} + \frac{1}{\beta\gamma} + \frac{1}{\gamma\alpha} =$
- (a)  $\frac{r}{p}$                       (b)  $\frac{p}{r}$                       (c)  $-\frac{p}{r}$                       (d)  $-\frac{r}{p}$
04. In each of the following system of equations determine whether the system has a unique solution, no solution or infinitely many solutions. Mark ' P ' for Unique solution, mark ' Q ' No solution and mark ' R ' for Infinitely many solutions.
- (a)  $x - 3y = 3$                       (b)  $2x + y = 5$   
 $3x - 9y = 2$                        $4x + 2y = 10$
- (c)  $3x - 5y = 20$                       (d)  $x + 2y = 3$   
 $2x - 3y = 12$                        $5x + ky + 7 = 0$
05. The angry Arjun carried some arrows for fighting with Bheeshm. With half the arrows, he cut down the arrows thrown by Bheeshm on him and with six other arrows he killed the rath driver of Bheeshm. With one arrow each he knocked down respectively the rath, flag and the bow of Bheeshm. Finally, with one more than four times the square root of arrows he laid Bheeshm unconscious on an arrow bed. Find the total number of arrows Arjun had.
- (a) 80                      (b) 90                      (c) 100                      (d) 110
06. If the equation  $ax^2 + 2x + a = 0$  has two distinct roots, then
- (a)  $a = \pm 1$                       (b)  $a = 0$                       (c)  $a = 0, 1$                       (d)  $a = -1, 0$

07. For some real number T, the first three terms of an arithmetic sequence are  $2T$ ,  $5T - 1$ , and  $6T + 2$ . What is the numerical value of the fourth term?  
 (a) 27 (b) 19 (c) 13 (d) 7
08. If the sum of first  $n$  even natural numbers is equal to  $k$  times the sum of first  $n$  odd natural numbers, then  $k$  is equal to  
 (a)  $\frac{1}{n}$  (b)  $\frac{n-1}{n}$  (c)  $\frac{n+1}{2n}$  (d)  $\frac{n+1}{n}$

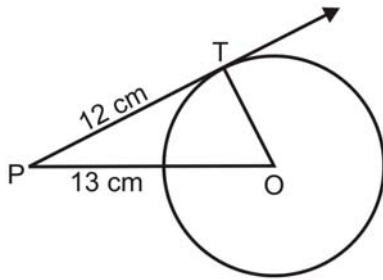
09.  $\cos \theta \sin \theta (90^\circ - \theta) + \sin \theta \cos(90^\circ - \theta)$  is equal to

- (a)  $\frac{\sin \theta \cos(90^\circ - \theta) \cos \theta}{\sin(90^\circ - \theta)} + \frac{\cos \theta \sin(90^\circ - \theta) \sin \theta}{\cos(90^\circ - \theta)}$   
 (b)  $(1 - \cos^2 \theta) \operatorname{cosec}^2 \theta$   
 (c)  $(1 + \cot^2 \theta) \sin^2 \theta$   
 (d)  $\sin^2 \theta + \frac{1}{1 + \tan^2 \theta}$

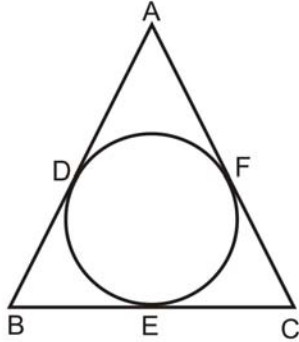
10. In the figure, PQ is a tower standing vertically on the horizontal ground. From A, the angle of elevation of the top P of the tower is found to be  $45^\circ$ . On moving 50 meter up a slope of  $15^\circ$ , the angle of elevation of P is found to be  $75^\circ$  from B. The horizontal through B is BC. Find the height of the tower.



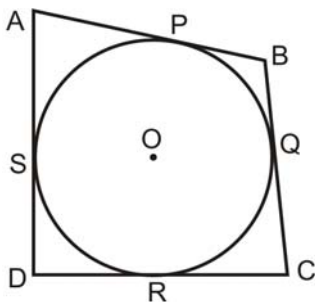
- (a) 72 m (b) 61 m (c) 57 m (d) 52 m
11. Which of the following can be proved?  
 (a) Diagonals of a trapezium divide each other proportionately  
 (b) Any line parallel to the parallel sides of a trapezium divides the non-parallel sides proportionally  
 (c) The diagonals of a trapezium can be perpendicular to each other  
 (d) Two sides of trapezium can have the same length
12. Below are four questions Vidya put to Wisden - (a), (b), (c) and (d), which were asked for various exams during the last few years. The task for Wisden was to choose the parameter on which each of the following questions are framed. The parameters P, Q, R and S, are given among the answer options. Match the questions with the parameters given.
- (a) A point P is 13 cm from the centre of the circle. The length of the tangent drawn from P to the circle is 12 cm. find the radius of the circle.



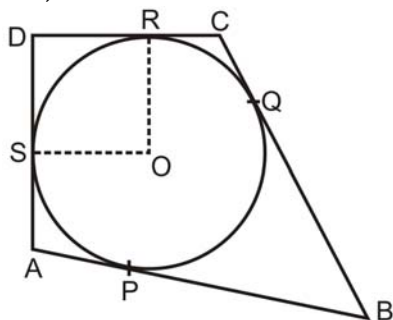
(b) In the figure below, if  $AB = AC$ , prove that  $BE = EC$ .



(c) A circle touches all the four sides of a quadrilateral ABCD. Prove that  $AB + CD = BC + DA$



(d) ABCD is a quadrilateral such that  $\angle D = 90^\circ$ . A circle  $C(O, r)$  touches the sides AB, BC, CD and DA at P, Q, R and S respectively. If  $BC = 38$  cm,  $CD = 25$  cm and  $BP = 27$  cm, find  $r$ .

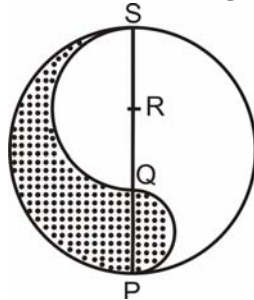


- (P) Tangents from an exterior point to a circle are equal in length
- (Q) Tangent lines at the end points of a diameter, of a circle are parallel
- (R) Tangent to a circle is perpendicular to the radius through the point of contact
- (S) Angles subtended at the centre by a pair opposite site are supplementary

13. What is the probability that a randomly selected two-digit number is a multiple of 14?

- (a)  $3/50$
- (b)  $2/13$
- (c)  $17/83$
- (d)  $7/90$

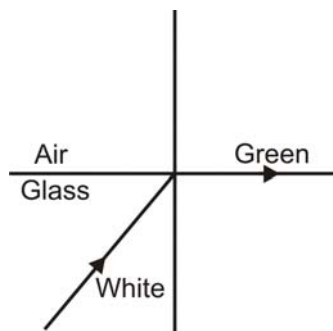
14.  $\frac{2 \tan 30^\circ}{1 + \tan^2 30^\circ}$  is equal to  
 (a)  $\sin 60^\circ$  (b)  $\cos 60^\circ$  (c)  $\tan 60^\circ$  (d)  $\sin 30^\circ$
15. If  $a \cot \theta + b \operatorname{cosec} \theta = p$  and  $b \cot \theta = q$ , then  $p^2 - q^2 =$   
 (a)  $a^2 - b^2$  (b)  $b^2 - a^2$  (c)  $a^2 + b^2$  (d)  $b - a$
16. If the centroid of the triangle formed by the points  $(a, b)$ ,  $(b, c)$  and  $(c, a)$  is at the origin, then  $a^3 + b^3 + c^3$  is equal to  
 (a)  $abc$  (b) 0 (c)  $a + b + c$  (d)  $3abc$
17. The height of a cone is 30 cm. A small cone is cut off at the top by a plane parallel to the base. If its volume be  $\frac{1}{27}$  of the volume of the given cone, then the height above the base at which the section has been made, is  
 (a) 10 cm (b) 15 cm (c) 20 cm (d) 25 cm
18. The mode of a frequency distribution can be determined graphically from  
 (a) Histogram (b) Frequency polygon  
 (c) Ogive (d) Frequency curve
19. PQRS is the diameter of a circle of radius 6 cm. the lengths PQ, QR and RS are equal. Semi-circles are drawn on PQ and QS as diameters as shown in the figure. Find the area of the shaded region.



- (a)  $16 \text{ cm}^2$  (b)  $216 \text{ cm}^2$  (c)  $38 \text{ cm}^2$  (d)  $264 \text{ cm}^2$
20. A square sheet of paper is converted into a cylinder by rolling it along its length. What is the ratio of the base radius to the side of the square?  
 (a)  $\frac{1}{2x}$  (b)  $\frac{\sqrt{2}}{x}$  (c)  $\frac{1}{\sqrt{2}x}$  (d)  $\frac{1}{x}$

### SECTION 2 – SCIENCE

21. Wisden has gifted a diamond to Vidya on her birthday. The same evening, they had discussions on the brilliance of the diamond. Vidya said brilliance of the diamond is due to two reasons. What are they?  
 (a) Shape on which it is cut (b) Total refraction from its surface  
 (c) Total external reflection (d) Total Internal reflection
22. Wisden has come up with the next question to consolidate his position. He asked Vidya : “White light is incident on the interface of glass and air as shown in the figure. If green light is just totally internally reflected then, what is / are the colour/s you can see in the emerging ray in air?” What is your answer to Wisden?



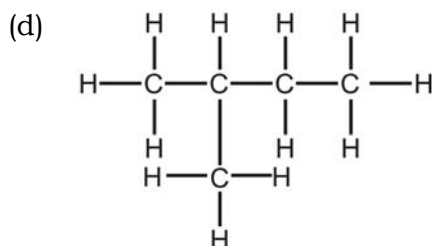
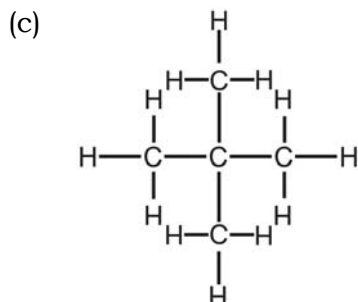
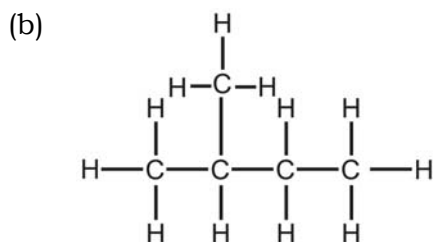
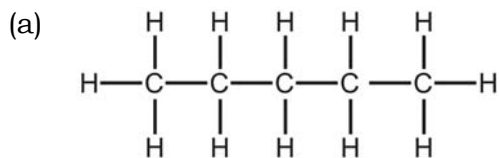
- (a) Yellow, orange, red  
(b) Violet, indigo, blue  
(c) All colours  
(d) Only green
23. A person using a lens as a simple microscope sees an  
(a) Inverted virtual image  
(b) Inverted real magnified image  
(c) Upright virtual image  
(d) Upright real magnified image
24. Which of the following correctly describes the magnetic field near a long straight wire?  
(a) The field consists of straight lines perpendicular to the wire.  
(b) The field consists of straight lines parallel to the wire  
(c) The field consists of radial lines originating from the wire  
(d) The field consists of concentric circles centred on the wire
25. In an electric motor, the direction of current in the coil changes once in each:  
(a) Two rotations (b) One rotation (c) Half rotation (d) One-fourth rotation
26. The essential difference between an AC generator and a DC generator is that:  
(a) AC generator has an electromagnet while a DC generator has permanent magnet  
(b) DC generator will generate a higher voltage  
(c) AC generator will generate a higher voltage  
(d) AC generator has slip rings while the DC generator has a commutator
27. At the time of short circuit, the current in the circuit:  
(a) Reduces substantially (b) Does not change  
(c) Increases heavily (d) Varies continuously
28. Match the right reaction with the following equations

Column I	Column II
(a) $CaO + CO_2 \rightarrow CaCO_3$ (b) $2Na + 2H_2O \rightarrow 2NaOH + H_2$ (c) $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$ (d) $NH_4NO_2 \rightarrow N_2 + 2H_2O$ (e) $CuSO_4 + 2NaOH \rightarrow Cu(OH)_2 + Na_2SO_4$	(P) Displacement Reaction (Q) Double Displacement Reaction (R) Decomposition Reaction (S) Combination Reaction

29. What is the best test to distinguish between ionic compounds and covalent compounds?  
(a) Heat them as covalent compounds have low melting points  
(b) Pass electricity as covalent compounds do not conduct electricity

- (c) Dissolve small amount of the compound in water as ionic compounds are soluble in water
- (d) Dissolve small amount of the compound in alcohol as ionic compounds are insoluble in alcohol

30. Match the each Structural formula with the name of the compounds given:



(P) Pentane

(R) 2 methylbutane

(Q) 2,2 - dimethylpropane

(S) 2 methylpropane

31. The autotrophic mode of nutrition requires:

(a) Carbon dioxide

(b) Chlorophyll

(c) Sunlight

(d) Water

32. Which of the following is/are not associated with anaerobic respiration?

(a) Carbon dioxide

(b) Oxygen

(c) Ethanol

(d) Glucose

33. The main organs of human respiratory system are Nose, Nasal passage, Trachea, Bronchi, Lungs and Diaphragm. Which of the following organs is/are not associated with animal respiratory system?

(a) Gills

(b) Skin

(c) Cell membrane

(d) Petiole



34. Vidya's uncle had renal failure and is admitted in the hospital for Dialysis. Dialysis is a process
- (a) That removes platelets from blood
  - (b) That removes waste from blood
  - (c) That strengthens the functioning of lungs
  - (d) That removes blood sugar
35. The directional growth movement of a plant part in response to the touch of an object is called thigmotropism. Which of the following is/are positively thigmotropic?
- (a) Stem
  - (b) Tendrils
  - (c) Root
  - (d) Leaf
36. Auxins, Gibberellins, Cytokinins and Abscisic Acid are for major types of plant hormones that are involved in the control and coordination of plants. Which among them promotes wilting and falling of leaves?
- (a) Auxins
  - (b) Gibberellins
  - (c) Cytokinins
  - (d) Abscisic Acid
37. Which of the following are the function/s of blood?
- (a) It carries oxygen to different parts of the body
  - (b) It kills bacteria and other germs
  - (c) It help to keep our body temperature constant
  - (d) It removes nitrogenous waste through urine
38. Name the metal which can be extracted by heating?
- (a) Copper
  - (b) Iron
  - (c) Manganese
  - (d) Zinc
39. Choose the properties that metals have?
- (a) They are solids
  - (b) They conduct electricity
  - (c) They react with hydrogen
  - (d) They react with oxygen
40. Wisden's mother complaints about milk turning sour for the last two days. She had heated arguments the milkman this morning. The milkman asked her to add a small amount of baking soda to fresh milk to avoid it souring fast. She did so and kept the milk for observation. Choose the right results she had.
- (a) The milk took a long time to set as curd
  - (b) The pH of fresh milk changes
  - (c) Presence of Lactic acid in milk
  - (d) Presence of hydrochloric acid in milk

### SECTION 3 – GENERAL KNOWLEDGE

41. Vidya learned from her Physics class that human beings cannot hear sounds of frequencies above 20,000Hz. She also learnt from her teacher that dogs can hear sounds as high as 48,000Hz. She tried to develop a whistle that produces more than 25,000Hz to train her dog Sumo not to bark. While doing this, Wisden told her that even human beings below the age of 25 can hear slightly higher frequencies than that is usually audible to people in the middle age and above. Vidya immediately struck with another idea of developing a ring tone of little higher frequency for her phone. Why should she do this? Choose all the relevant reasons.
- (a) Sumo can bring her the phone every time it rings
  - (b) She can present it to her mother on her birthday
  - (c) She can carry it to her classroom and the teacher won't hear when it rings

- (d) She can exhibit it in the forthcoming School science exhibition
42. Why Koodankulam is in the news for quite long?  
(a) Generation of electricity (b) Extraction of nuclear fuels  
(c) Anti nuclear protest (d) Nuclear energy conservation
43. Indian scientist Satyendra Nath Bose worked with Albert Einstein in the 1920s made discoveries that led to a kind of particle being named for him.  
It was Peter Higgs, a British physicist, who in the 1960s made advances in the field, resulting the naming of Higgs Boson.  
Do you know what is it popularly called?  
(a) Higgs particle (b) God particle (c) Bose particle (d) Good particle
44. Where did the concept of carbon credit originated?  
(a) Kyoto Protocol (b) Earth Summit, Rio de Janeiro  
(c) Montreal Protocol (d) G-8 Summit, Heiligendamm
45. Which of the following Mr. Sam Pitroda is / was associated with?  
(a) Telecom Revolution (b) National Knowledge Commission  
(c) National Innovation Council (d) Center for Mathematical Biology

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