



CREST Mathematics Olympiad (CMO)  
Previous Year Paper (2021-22)

**Class 10**

**Time Allowed: 1-hour**

**Maximum Marks: 60**

- Additional **10 minutes** will be allotted to fill up information on the OMR Sheet, before the start of the exam.
- Fill in all the mandatory fields clearly on the OMR Sheet.
- There are **2 sections** in the question paper namely the **Practical Mathematics & Achievers' Section** consisting of **40 questions (1 mark each) & 10 questions (2 marks each)**, respectively.
- There is no negative marking. The use of a calculator is not permitted.
- There is **only ONE correct option** to a given question.
- Use **HB Pencil or Blue / Black ball point pen only** for marking the correct choice of answers on the OMR Sheet.
- Rough work is to be done in the space provided in the test booklet. Extra plain sheet may be provided by the school for the rough work.
- The OMR Sheet is to be handed over to the invigilator at the end of the exam.
- No candidate is allowed to carry any textual material, printed or written, bits of paper, any electronic device, etc. inside the examination hall.
- The use of unfair means may result in the cancellation of the exam. Any such instances may be reported at **+91-98182-94134** or **info@crestolympiads.com**

**DO NOT OPEN THIS BOOKLET UNTIL ASKED TO DO SO**

**FILL IN THE DETAILS**

Student Name: \_\_\_\_\_

Class: \_\_\_\_\_ Section: \_\_\_\_\_

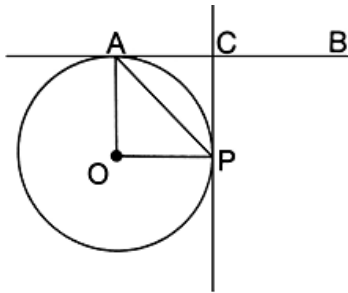
Enrollment No: \_\_\_\_\_

## Practical Mathematics (Each Question is 1 Mark)

- If H.C.F. (a, b) = 12 and  $a \times b = 1800$ , find L.C.M. (a, b):
  - 3600
  - 900
  - 150
  - 90
- If  $(x - 1)$  is a factor of  $Ax^3 + Bx^2 - 36x + 22$  and  $2^B = 64^A$ , find value of A and B:
  - 4 and 16
  - 6 and 24
  - 2 and 12
  - 8 and 16
- What are the respective values of the quotient and remainder when  $x^{2002} - 2001$  is divided by  $x^{91}$ ?
  - $x^{91 \times 22}, 2001$
  - $x^{91}, 2001$
  - $x^{91 \times 21}, -2001$
  - $x^9, -2001$
- If angles with measure x and y form a complementary pair, then angles with which of the following measures will form a supplementary pair?
  - 3
  - 4
  - 5
  - 6
- Which of the following is the equation of a straight line?
  - $y = 2x^2$
  - $x^2 + y^2 = a^2$
  - $(x/a) + (y/b) = 1$
  - $(x^2/a^2) + (y^2/b^2) = 1$
- Which is the smallest of all the chords of a circle passing through a given point in it?
  - Chord trisected at the point.
  - Chord bisected at the point.
  - Chord passing through the centre.
- The probability that A can solve a problem is  $\frac{2}{3}$  and the probability that B can solve the same problem is  $\frac{3}{5}$ . Find the probability that atleast one of A and B are able to solve the problem.
  - $\frac{12}{15}$
  - $\frac{13}{15}$
  - $\frac{19}{45}$
  - $\frac{17}{19}$
- A club holds an election for the post of chairperson. The probabilities that candidates Anthony and Joseph will be elected are 0.36 and 0.47 respectively. Find the probability that neither Anthony nor Joseph will be elected:
  - 0.83
  - 0.53
  - 0.37
  - 0.17
- If the coefficients of  $(2r + 4)^{\text{th}}$  term is equal to the coefficient of  $(r - 2)^{\text{th}}$  term in the expansion of  $(1 + x)^{18}$ , find the value of r:
  - 2
  - 4
  - 6
  - 8
- Evaluate  $\frac{1}{4}(\cot^4 30^\circ - \operatorname{cosec}^4 60^\circ) + \frac{3}{2}(\sec^2 45^\circ - \tan^2 30^\circ) - 5 \cos^2 60^\circ$ :
  - $\frac{55}{18}$
  - $\frac{11}{6}$
  - $\frac{7}{4}$
  - 0
- What is the value of  $\sin A \cos A \tan A + \cos A \sin A \cot A$ ?
  - $\sin^2 A + \cos A$
  - $\sin^2 A + \tan^2 A$
  - $\sin^2 A + \cot^2 A$
  - $\operatorname{cosec}^2 A - \cot^2 A$

12. Let PS be the median of the triangle with vertices P (2, 2), Q (6, -1) and R (7, 3). The equation of the line passing through (1, -1) and parallel to PS is:
- $2x - 9y - 11 = 0$
  - $2x - 9y - 7 = 0$
  - $2x + 9y - 11 = 0$
  - $2x + 9y + 7 = 0$
13. The rational number of the form  $\frac{p}{q}$ ,  $q \neq 0$ , p and q are positive integers, which represents 0.134 bar i.e., (0.1343434.....) is:
- $\frac{134}{999}$
  - $\frac{134}{990}$
  - $\frac{133}{999}$
  - $\frac{133}{990}$
14. If the roots of the equation  $px^2 + 2qx + r = 0$  and  $qx^2 - 2\sqrt{pr}x + q = 0$  be real, then which of the following option is correct?
- $p = q$
  - $q^2 = pr$
  - $p^2 = qr$
  - $r^2 = pq$
15. If  $\tan \theta = a \sin \phi / (1 - a \cos \phi)$  and  $\tan \phi = b \sin \theta / (1 - b \cos \theta)$ , then find the value of a/b:
- $\sin \theta / (1 - \cos \theta)$
  - $\sin \theta / (1 - \cos \phi)$
  - $\sin \phi / \sin \theta$
  - $\sin \theta / \sin \phi$
16. The median of a set of 9 distinct observations is 20.5. If each of the largest 4 observation of the set is increased by 2, then the median of the new set:
- Is increased by 2
  - Is decreased by 2
  - Is two times the original median
  - Remains the same as that of the original set
17. If the  $r^{\text{th}}$  term in the expansion of  $(x/3 - 2/x^2)^{10}$  contains  $x^4$ , then r is equal to:
- 2
  - 3
  - 4
  - 5
18. If  $\alpha$  and  $\beta$  are the roots of the equation  $x^2 - 5x + 6 = 0$ , then the value of  $(\alpha^2 - \beta^2)$  is equal to:
- 5
  - 5
  - $\pm 5$
  - +6
19. If the length and breadth of a rectangular plot are increased by 50% and 20% respectively, then the new area is how many times the original area?
- $\frac{5}{9}$
  - 10
  - $\frac{9}{5}$
  - $\frac{1}{2}$
20. If  $a + b + c = 10$  and  $ab + bc + ac = 31$ , find the value of  $a^2 + b^2 + c^2$ :
- 69
  - 162
  - 131
  - 38
21. A bag A contains 4 green and 6 red balls. Another bag B contains 3 green and 4 red balls. If one ball is drawn from each bag, find the probability that both are green:
- $\frac{13}{20}$
  - $\frac{1}{4}$
  - $\frac{6}{35}$
  - $\frac{8}{35}$
22. Feder was married 8 years ago. Today her age is  $1\frac{2}{7}$  times that at the time of marriage. At present her daughter's age is  $\frac{1}{6}$  of her age. What was her daughter's age 3 years ago?
- 6 years
  - 7 years
  - 3 years
  - 2 years

23. In the given figure (not to scale), 'O' is the centre of the circle, and AB and PC are the tangents to the circle at A and P, respectively. If  $\angle PAB = 40^\circ$ , then find the measure of  $\angle PCA$ :



- a.  $100^\circ$                       b.  $80^\circ$   
c.  $60^\circ$                         d.  $70^\circ$
24. The number of common solution(s) for the system of linear equations  $2x + 3y + 5 = 0$  and  $4x + 6y - 10 = 0$  is:
- a. 0                                b. 1  
c. 1                                d. 2
25. If  $\frac{a}{b}$ ,  $\frac{b}{c}$ , and  $\frac{c}{a}$  are in AP, then which of the following is true?
- a.  $ca^2$ ,  $ab^2$  and  $bc^2$  are in AP.  
b.  $ab^2$ ,  $bc^2$  and  $ca^2$  are in AP.  
c.  $a^2b$ ,  $b^2c$  and  $c^2a$  are in AP.  
d. a, b, and c are in AP.

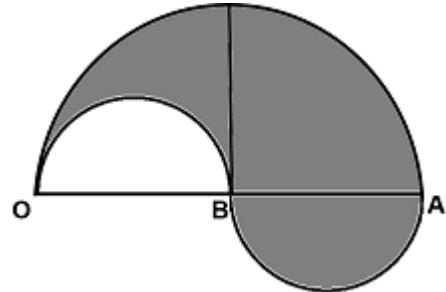
26. If  $\alpha + \beta = 90^\circ$ ,  $\alpha = 2\beta$ , then find the value of  $\cos^2\alpha + \sin^2\beta$ :

- a.  $\frac{1}{2}$                                 b.  $\frac{3}{4}$   
c.  $\frac{3}{2}$                                 d. 1

27. If  $\sec \theta = A$ ,  $\operatorname{cosec} \theta = B$ , then which of the following options is correct?

- a.  $A^2 + B^2 = AB$   
b.  $A^2 + B^2 = A^2B^2$   
c.  $A^2 - B^2 = A^2B^2$   
d.  $A^2 + B^2 = -A^2B^2$

28. The boundary of the shaded region in the given diagram consists of three semi-circular arcs, the smaller ones being equal. If the diameter of the larger arc is 10 cm, the area of the shaded region is ( $\pi = 3.14$ ):



- a.  $39.25 \text{ cm}^2$                       b.  $46.45 \text{ cm}^2$   
c.  $35.60 \text{ cm}^2$                       d.  $37.95 \text{ cm}^2$

29. In a class, there are two sections A and B. If 10 students of section B shift over to section A, the strength of A becomes three times the strength of B. But, if 10 students shift over from A to B, both A and B are equal in strength. How many students are there in A and B?

- a. 50 and 30                      b. 45 and 15  
c. 90 and 40                      d. 80 and 40

30. A man sold  $\frac{3}{5}$ th of his article at a gain of 20% and the remaining at cost price. Find the gain earned in the transaction:

- a. 8%                                b. 10%  
c. 12%                                d. 14%

31. An item is marked at a mark-up of x%. It is discounted by y% while being sold to a customer. If the shopkeeper does not gain or loss anything, which of the following is definitely true?

- a.  $x = y$   
b.  $x > y$   
c.  $x < y$   
d. No definite relation exists

32. X men and Y women work together for n days. The wages per day of a man and woman are in the ratio 5: 4. If the total wages of all the men for n days to the ratio of the total wages of all the women for n days is 40: 32, then find the ratio of X to Y:

- a. 25 : 16                      b. 5 : 4  
c. 1 : 1                          d. 3 : 5

33. A jar has 75 L of milk. 15 L is drawn out and replaced with 15 L of water. This operation is done once every day. On which day, will the amount of milk in the container become less than 15 L?

- a. 5th day                      b. 7th day  
c. 6th day                      d. 8th day

34. In a group of people where each one likes at least one fruit out of apple or banana, 40% like apple 80% like banana while 20% like both apple and banana. Find the percentage of people who like only apple:

- a. 30%                          b. 40%  
c. 20%                          d. 60%

35. If the quadratic expression  $x^2 + (a - 4)x + (a + 4)$  is a perfect square, then find the value of a:

- a. 0 and -4                      b. 0 and 6  
c. 0 and 12                      d. 6 and 12

36. In a bag, there are 2 red balls, 3 green balls and 4 brown balls. Find the probability of drawing a ball at random being red or green:

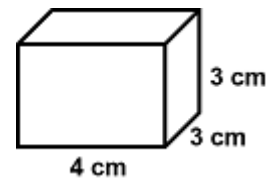
- a.  $\frac{5}{9}$                               b.  $\frac{1}{4}$

- c.  $\frac{1}{5}$                               d.  $\frac{4}{9}$

37. If  $3 \tan A = 4$ , then find the value of  $(2 \sin A - 7 \cos A) / (3 \cos A + 4)$ :

- a.  $-\frac{13}{29}$                           b.  $\frac{13}{11}$   
c.  $\infty$                               d.  $\frac{29}{13}$

38. How many 1 cm x 1 cm x 1 cm blocks are needed to build the solid rectangular prism shown in the figure given below?



- a. 10                              b. 12  
c. 33                              d. 36

39. Given a triangle with side  $AB = 8\text{cm}$ . To get a line segment  $AB' = \frac{3}{4}$  of  $AB$ , it is required to divide the line segment  $AB$  in the ratio:

- a. 3 : 4                          b. 4 : 3  
c. 1 : 3                          d. 3 : 1

40. The sum of the ages of a father and son is 45 years. Five years ago, the product of their ages was four times the father's age at that time. The present ages of the father and son respectively are:

- a. 25 years, 10 years  
b. 36 years, 9 years  
c. 39 years, 6 years  
d. 35 years, 10 years

## Achiever's Section (Each Question is 2 Marks)

**41.** What is the possibility of getting at least 6 heads if eight coins are tossed simultaneously?

- a.  $\frac{37}{256}$                       b.  $\frac{25}{57}$   
 c.  $\frac{1}{13}$                         d.  $\frac{5}{27}$

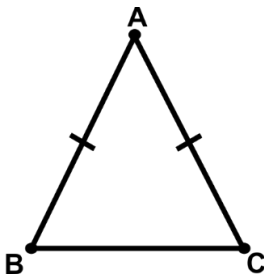
**42.** Find the value of the following:  
 $\sin 5\theta / \sin \theta$

- a.  $16 \cos^4 \theta - 12 \cos^2 \theta - 1$   
 b.  $16 \cos^4 \theta - 12 \cos^2 \theta + 1$   
 c.  $16 \cos^4 \theta + 12 \cos^2 \theta - 1$   
 d.  $16 \cos^4 \theta + 12 \cos^2 \theta + 1$

**43.** Find the equation of the line which passes through the point of intersection of the lines  $2x - y + 5 = 0$  and  $5x + 3y - 4 = 0$  and is perpendicular to the line  $x - 3y + 21 = 0$ :

- a.  $2x + y + 10 = 0$   
 b.  $3x + y + 21 = 0$   
 c.  $3x + y = 0$   
 d.  $3y - x + 21 = 0$

**44.** A cow is tethered at corner A by a rope. Neither the cow nor the rope is allowed to enter  $\triangle ABC$ .  $\angle A = 30^\circ$ ,  $AB = AC = 10$  m and  $BC = 6$  cm. What is the area that can be grazed by the cow if the length of the rope is 8 m?



- a.  $133 \frac{1}{6} \pi$  sq. m                      b.  $121 \pi$  sq. m  
 c.  $132 \pi$  sq. m                        d.  $\frac{176}{3} \pi$  sq. m

**45.** Let  $T_r$  be the  $r^{\text{th}}$  term of an A.P. for  $r = 1, 2, 3, \dots$ . If for some positive integers  $m, n$  we have  $T_m = 1/n$  and  $T_n = 1/m$ , then  $T_{mn}$  equals:

- a.  $\frac{1}{mn}$                                   b.  $\frac{1}{m} + \frac{1}{n}$   
 c. 1                                        d. 0

**46.** Read the following statements carefully and choose the correct option:

- (i) Two figures having the same shape but not necessarily the same size are called similar figures.  
 (ii) All the congruent figures are similar but the converse is not true.  
 (iii) If in a triangle, the square of one side is equal to the sum of the squares of the other two sides, then the angle opposite the first side is a right angle.  
 (iv) A tangent is a straight line that touches the circle at only one point.

- a. (i), (iii) is true and (ii), (iv) is false  
 b. (i), (ii) is true and (iii), (iv) is false  
 c. All statements are correct  
 d. (i), (ii) and (iv) is correct and (iii) is incorrect

**47.** If  $\alpha$  and  $\beta$  are the roots of the equation  $x^2 + x + 1 = 0$ , then the equation whose roots are  $\alpha^{19}$  and  $\beta^7$  is:

- a.  $x^2 - x - 1 = 0$   
 b.  $x^2 - x + 1 = 0$   
 c.  $x^2 + x - 1 = 0$   
 d.  $x^2 + x + 1 = 0$

**48.** How many three-digit numbers less than 300 will give respective remainders of 2, 3 and 4 when divided by 3, 4 and 5?

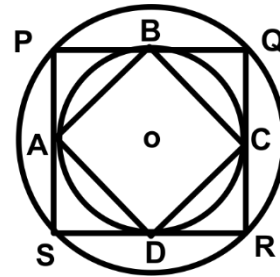
- a. 6                                        b. 7  
 c. 5                                        d. 4

49. Yon spent  $0.5x\%$  of his monthly salary on rent. He spent  $x\%$  of the remaining salary on food,  $2x\%$  of the remaining salary on transport and  $4x\%$  of the remaining salary on various bills. If these expenditures are denoted by R, F, T, and S, respectively, and if  $x$  is 20, then find the ascending order of these expenditures:

- |               |               |
|---------------|---------------|
| a. R, S, F, T | b. R, F, T, S |
| c. R, T, F, S | d. R, F, S, T |

50. The figure below shows two concentric circles with centre O. PQRS is a

square inscribed in the outer circle. It also circumscribes the inner circle, touching it at point B, C, D and A. The ratio of the perimeter of the outer circle to that of polygon ABCD is:



- |            |            |
|------------|------------|
| a. 33 days | b. 31 days |
| c. 39 days | d. 35 days |

## Answer Key

1. c    2. c    3. c    4. b    5. c    6. b    7. b    8. d    9. c    10. a  
11. d    12. d    13. d    14. b    15. d    16. d    17. b    18. c    19. c    20. d  
21. c    22. c    23. a    24. a    25. a    26. a    27. b    28. a    29. a    30. c  
31. b    32. c    33. d    34. c    35. c    36. a    37. a    38. d    39. d    40. b  
41. a    42. b    43. c    44. d    45. c    46. c    47. d    48. d    49. b    50. c