Grade 9

CREST Mathematics Olympiad (CMO)

Sample Paper

Pattern and Marking Scheme				
Grade	**Topic/Section**	**No. of Questions**	**Marks per Question**	**Total Marks**
Grade 9	Practical Mathematics	40	1	40
	Achiever's Section	10	2	20
Grand Total		**50**		**60**

The total duration of the exam is 60 minutes.

Syllabus

Section 1: Number Systems, Polynomials, Coordinate Geometry, Linear Equations in Two Variables, Introduction to Euclid's Geometry, Lines and Angles, Triangles, Quadrilaterals, Areas of Parallelograms and Triangles, Circles, Constructions, Heron's Formula, Surface Areas and Volumes, Statistics, Probability.

Achievers Section: Higher Order Thinking Questions - Syllabus as per Section 1

For more details, visit https://www.crestolympiads.com/maths-olympiad-cmo

Practical Mathematics (Each Question is 1 Mark)

1. ABCD is a rectangle formed by the points A(-1, -1), B(-1, 4), C(5, 4) and D(5, -1). P, Q, R, and S are mid-points of AB, BC, CD and DA, respectively. The quadrilateral PQRS is a:

   a. Square
   b. Rectangle
   c. Rhombus
   d. None of these

2. The points A(2, 3), B(3, 5), C(7, 7) and D(5, 6) are such that:

   a. A, B, C and D are collinear
   b. ABCD is a parallelogram
   c. D lies inside triangle ABC
   d. D lies on the boundary of triangle ABC

3. A rectangular box has dimensions x, y and z units, where $x < y < z$. If one dimension is increased by one unit, then the increase in volume is:

   a. Greatest when x is increased.
   b. Greatest when y is increased.
   c. Greatest when z is increased.
   d. The same, regardless of whichever dimension is increased.

4. The polynomials $ax^2 + 3x^2 - 3$ and $2x^3 - 5x + a$ when divide by $(x - 4)$ leaves remainders R_1 and R_2, respectively, the value of a if $2R_1 - R_2 = 0$, is:

   a. -18/127
   b. 18/31
   c. 17/127
   d. -17/31

5. It is known that if $x + y = 10$, then $x + y + z = 10 + z$. The Euclid's axiom that illustrates this statement is:

   a. first axiom
   b. second axiom
   c. third axiom
   d. fourth axiom

6. Which of the following is/are correct?
   I. If two sides of a triangle are unequal, the larger side has the greater angle opposite to it.
   II. The sum of any two sides of a triangle is greater than its third side.
   III. If all the line segments can be drawn to a given line from an external point, the perpendicular line segment is the shortest.
   IV. If all the three sides of a triangle are equal, it is called a scalene triangle.

   a. I and III
   b. I, II and III
   c. I, III and IV
   d. Only III

7. ABCD is a parallelogram, if the two diagonals are equal, find the measure of angle ABC.

   a. 70°
   b. 80°
   c. 90°
   d. 100°

8. The ratio in which the point (2, y) divides the join of (-4, 3) and (6, 3) and hence the value of y is:

a. 2 : 3, y = 3
b. 3 : 2, y = 4
c. 3 : 2, y = 3
d. 3 : 2, y = 2

9. An urn contains 6 blue and 'P' green balls. If the probability of drawing a green ball is double that of drawing a blue ball, then 'P' is equal to:

a. 6
b. 18
c. 24
d. 12

10. Which of the following relationships is correct?

a. P(E) + P(E bar) = 1
b. P(E bar) - P(E) = 1
c. P(E) = 1 + P(E bar)
d. None of these

11. $1/2\ (a + b + c)\ \{(a - b)^2 + (b - c)^2 + (c - a)^2\} = ?$

a. $a^3 + b^3 + c^3 + 3abc$
b. $a^3 + b^3 + c^3 - 3abc$
c. $a^3 + b^3 + c^3 + 3abc(a + b + c)$
d. $3abc$

12. If $x = a(b - c)$, $y = b(c - a)$ and $z = c(a - b)$, then $(x/a)^3 + (y/b)^3 + (z/c)^3 = ?$

a. 3xyz/abc
b. xyz/abc
c. 3xyzabc
d. 3

13. A bag contains 5 red balls, 6 yellow balls and 3 green balls. If two balls are picked at random, what is the probability that either both are red or both are green in colour?

a. 3/7
b. 5/14
c. 1/7
d. 2/7

14. A bag contains 24 eggs, out of which 8 are rotten. The remaining eggs are not rotten. Two eggs are selected at random. What is the probability that one of the eggs is rotten?

a. 11/23
b. 17/23
c. 13/23
d. 32/69

15. Two years ago, the ratio of A's age to B's age at that time was 5:9. A's age three years ago was 13 years less than B's age six years ago. What is B's present age?

a. 38 years
b. 30 years
c. 34 years
d. 32 years

16. If $(4 + 3\sqrt{5})/(4 - 3\sqrt{5}) = a + b\sqrt{5}$, then (a, b) = ________

a. (61/29, -24/29)
b. (-61/29, 24/29)
c. (61/29, 24/29)
d. (-61/29, -24/29)

17. The square root of $5 + 2\sqrt{6}$ is:

a. $\sqrt{3} + 2$
b. $\sqrt{3} - \sqrt{2}$
c. $\sqrt{2} - \sqrt{3}$
d. $\sqrt{3} + \sqrt{2}$

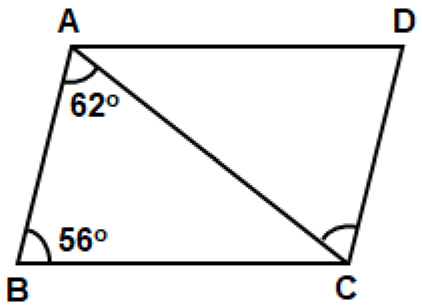
18. On simplifying $(a + b)^3 + (a - b)^3 + 6a(a^2 - b^2)$ we get:

a. $8a^2$
b. $8a^2b$
c. $8a^3b$
d. $8a^3$

19. If $(x + y + z) = 1$, $xy + yz + zx = -1$, $xyz = -1$, then the value of $x^3 + y^3 + z^3$ is:

a. -1
b. 1
c. 2
d. -2

20. ABCD is a rhombus with angle ABC = 56º, then angle ACD is equal to:



a. 90º
b. 60º
c. 56º
d. 62º

21. A speaks truth in 60% of cases and B speaks the truth in 70% of cases. The probability that they will say the same thing while describing a single event is:

a. 0.56
b. 0.54
c. 0.38
d. 0.94

22. If $x^3 + 5x^2 + 10k$ leaves remainder $-2x$ when divided by $x^2 + 2$, then the value of k is:

a. -2
b. -1
c. 1
d. 2

23. If G is the centroid and AD, BE, CF are three medians of the triangle ABC with an area of 72 cm^2, then the area of triangle BDG is:

a. 12 cm^2
b. 16 cm^2
c. 24 cm^2
d. 8 cm^2

24. From four corners of a square sheet of side 4 cm, four pieces, each in the shape of an arc of a circle with a radius of 2 cm are cut out. The area of the remaining portion is:

a. $(8 - \pi)$ sq. cm.
b. $(16 - 4\pi)$ sq. cm.
c. $(16 - 8\pi)$ sq. cm.
d. $(4 - 2\pi)$ sq. cm.

25. In measuring the sides of a rectangle, there is an excess of 5% on one side and 2% deficit on the other. Then the error per cent in the area is:

a. 3.3
b. 3.0
c. 2.9
d. 2.7

26. The difference between the squares of two consecutive even integers is always divisible by:

a. 3
b. 4
c. 6
d. 7

27. The area of a rectangular field is 460 m^2. If the length is 15% more than the breadth, then what is the breadth of the field?

a. 15 m
b. 34.5 m
c. 26 m
d. 20 m

28. The numerator of a fraction is 4 less than its denominator. If the numerator is decreased by 2 and the denominator is increased by 1, then the denominator becomes eight times the numerator, then find the fraction.

a. 3/7
b. 4/8
c. 2/7
d. 3/8

29. If $x = 3 + 2\sqrt{2}$, then what will be the value of $x^2 + 1/x^2$?

a. 35
b. 32
c. 36
d. 34

30. The polynomial $11a^2 - 12\sqrt{2}\,a + 2$ on factorization gives:

a. $(11a + \sqrt{2})(a - \sqrt{2})$
b. $(a - \sqrt{2})(11a - \sqrt{2})$
c. $(a + 11)(a + \sqrt{2})$
d. $(11a - \sqrt{2})(a + \sqrt{2})$

31. The solution set formed by the regions $x + y > 7$ and $x + y < 10$ in the first quadrant represents a __________.

a. triangle
b. rectangle
c. trapezium
d. rhombus

32. If we add 1 to the numerator and subtract 1 from the denominator the fraction becomes 1. It also becomes 1/2 if we add 1 to the denominator, then the sum of the numerator and the denominator of the fraction is:

a. 7
b. 8
c. 2
d. 11

33. The speed of Karolina is 5 km/h more than that of Andrea. Andrea reaches his home from office 2 hours earlier than Karolina. If Andrea and Karolina stay 12 km and 48 km from their respective offices, find the speed of Karolina:

a. 10 km/h
b. 4 km/h
c. 9 km/h
d. 8 km/h

34. The two lines 3x + 4y - 6 = 0 and 6x + ky - 7 = 0 are such that any line which is perpendicular to the first line is also perpendicular to the second line:
Then, k = ______.

a. -8
b. -6
c. 6
d. 8

35. The circum-centre of the triangle formed by points O(0, 0), A(6, 0) and B(0, 6) is ___________.

a. (3, 3)
b. (2, 2)
c. (1, 1)
d. (0, 0)

36. The ratio of the number of students in two classrooms, C1 and C2, is 2:3. It is observed that after shifting ten students from C1 to C2, the ratio is 3:7. Further, how many students have to be shifted from C2 to C1 for the new ratio to become 9:11?

a. 10
b. 15
c. 20
d. 8

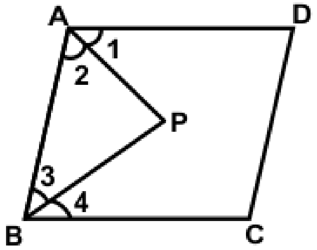
37. Train A can cross a 180 m long platform in 90 seconds. Train B has a speed which is twice that of A. A's length is 90% that of B. B can cross a 200 m long platform in x seconds. Find x.

a. 40
b. 45
c. 50
d. 60

38. The numerical expression 3/8 + (-5)/7 = -19/56 shows that:

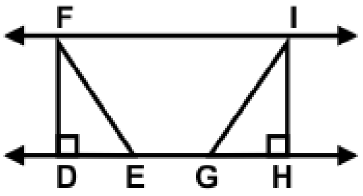
a. Rational numbers are closed under addition
b. Rational numbers are not closed under addition
c. Rational numbers are closed under multiplication
d. Addition of rational numbers is not commutative

39. In the given figure, AP and BP are angle bisectors of ∠A and ∠B, respectively which meets at P on the parallelogram ABCD. Then 2∠APB = ?



a. ∠C + ∠D
b. ∠A + ∠C
c. ∠B + ∠D
d. 2 x ∠C

40. In the following figure, two isosceles right triangles, DEF and HGI are on the same base DH and DH are parallel to FI. If DE = GH = 9 cm and DH = 20 cm, then the area of the quadrilateral FEGI is ________.



a. 99 cm^2
b. 40.5 cm^2
c. 81 cm^2
d. 180 cm^2

Achiever's Section (Each Question is 2 Marks)

41. If $(x^3 + ax^2 + bx + 4) / (x^2 + x - 2)$ is a polynomial of degree 1 in x, then what are the values of a and b, respectively?

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

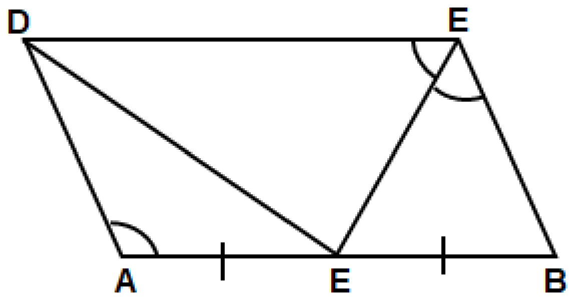
42. In the triangle ABC, AB = 2 cm, BC = 3 cm and AC = 4 cm. D is the middle-point of AC. If a square is constructed with BD as one of its sides, what is the area of the square?

a. 4.5 cm^2
b. 2.5 cm^2
c. 6.35 cm^2
d. None of these

43. A right triangular prism of height 18 cm and of base sides 5 cm, 12 cm and 13 cm is transformed into another right triangular prism on a base of sides 9 cm, 12 cm and 15 cm. Find the height of the new prism and the change in the whole surface area:

a. 10 cm, 120 cm^2
b. 8 cm, 132 cm^2
c. 10 cm, 132 cm^2
d. 8 cm, 120 cm^2

44. ABCD is a parallelogram, E is the mid-point of AB and CE bisects angle BCD. The value of angle DEC is:



a. 60º
b. 90º
c. 100º
d. 120º

45. 20 people are invited for a party. If two particular persons be seated on either side of the host, then find the number of ways in which they and the host can be seated at a circular table:

a. 2 (18)!
b. 18! 3!
c. 19! 2!
d. None of these

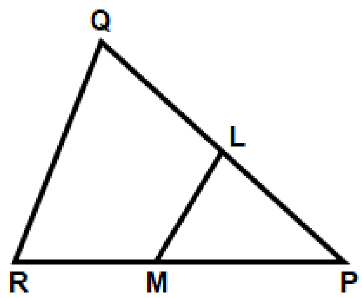
46. A person invested \$5,000 at the rate of 6% per annum for two years at SI. At the end of two years, he took the entire amount along with interest and invested in another scheme offering 10% CI for two years. What is the total amount received at the end of four years?

a. \$6,560
b. \$6,686
c. \$6,600
d. \$6,776

47. The cost of a precious stone varies as the cube of its weight. The stone broke into 3 pieces whose weights are in the ratio 1:2:3. As a result, its cost is reduced. If the cost of the unbroken stone is \$96,336, then find the loss incurred due to breakage.

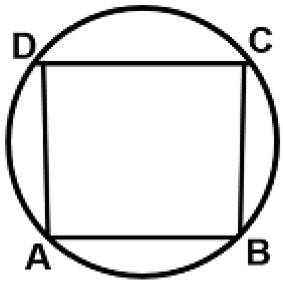
a. \$80,280
b. \$16,056
c. \$40,140
d. \$8,028

48. In the given figure, LM is parallel to QR. If LM divides the triangle PQR such that the area of trapezium LMRQ is two times the area of triangle PLM, then what is PL/PQ equal to?



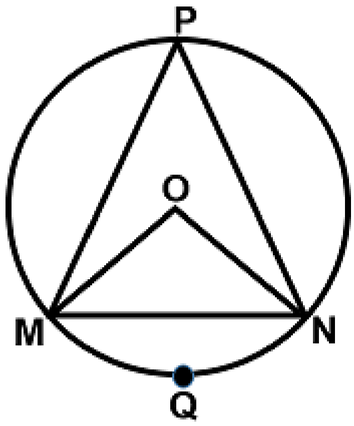
a. $1/\sqrt{2}$
b. $1/\sqrt{3}$
c. 1/2
d. 1/3

49. ABCD is a square of side 'a' cm. AB, BC, CD and AD are all chords of circles with equal radii. If the chords subtend an angle of 120º at the centre of their respective circles, find the total area of the given figure, where arcs are a part of the circle:



a. $[a^2 + 4 (\pi a^2/9 - a^2/3\sqrt{2})]$
b. $[a^2 + 4 (\pi a^2/9 - a^2/4\sqrt{3})]$
c. $[9a^2 - 4\pi + 3\sqrt{3} a^2]$
d. None of these

50. In the following figure, O is the centre of the circle. If ∠MPN = 55°, then find the value of: ∠MON + ∠OMN + 1/2 ∠MNO



a. 145°

b. $162\ ^{1}/_{2}$°

c. $158\ ^{1}/_{2}$°

d. 180°

Answer Key

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