MODEL EXAMINATION

Class 10 - Mathematics

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

1. This Question Paper has 5 Sections A, B, C, D, and E.
2. Section A has 20 Multiple Choice Questions (MCQs) carrying 1 mark each.
3. Section B has 5 Short Answer-I (SA-I) type questions carrying 2 marks each.
4. Section C has 6 Short Answer-II (SA-II) type questions carrying 3 marks each.
5. Section D has 4 Long Answer (LA) type questions carrying 5 marks each.
6. Section E has 3 Case Based integrated units of assessment (4 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 2 marks, 2 Qs of 3 marks and 2 Questions of 5 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E.
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

SECTION A.

1. If $a = 2^3 \times 3, b = 2 \times 3 \times 5, c = 3^n \times 5$ and LCM (a, b, c) $= 2^3 \times 3^2 \times 5$, then n = **[1]**

   a) 1 b) 4

   c) 3 d) 2

2. For what least value of **n** a natural number, $(24)^n$ is divisible by 8? **[1]**

   a) 1 b) 0

   c) 2 d) No value of n is possible

3. If (x + 1) is a factor of $2x^3 + ax^2 + 2bx + 1$, then the values of a and b, given that 2a - 3b = 4 are **[1]**

   a) a = -5 and b = -2 b) a = 5 and b = 2

   c) a = -5 and b = 2 d) a = 5 and b = -2

4. If α, β are the zeros of polynomial $f(x) = x^2 - p(x + 1) - c$, then (α + 1) (β + 1) = **[1]**

   a) 1 + c b) c

   c) c − 1 d) 1 − c

5. If the product of the roots of the equation x^2 - 3x + k = 10 is -2 then the value of k is **[1]**

   a) -8 b) 12

   c) -2 d) 8

6. If the point C(k, 4) divides the join of the points .4(2, 6) and B(5,1) in the ratio 2:3 then the value of k is **[1]**

   a) 16 b) $\frac{28}{5}$

c) $\frac{8}{5}$ d) $\frac{16}{5}$

7. The distance between the points (a cosθ + b sinθ, 0) and (0, a sinθ - b cosθ) is **[1]**

a) $\sqrt{a^2+b^2}$ b) a + b

c) $a^2 + b^2$ d) $a^2 - b^2$

8. If sin$\alpha = \frac{1}{\sqrt{2}}$ and tanβ = 1, then the value of $\cos(\alpha+\beta)$ is **[1]**

a) 3 b) 1

c) 2 d) 0

9. If x cos A = 1 and tan A = y, then the value of $x^2 - y^2$ is **[1]**

a) -1 b) 0

c) 1 d) 2

10. If sin A + 2 cos A = 1, then the value of 2 sin A - cos A is **[1]**

a) 2 b) 0

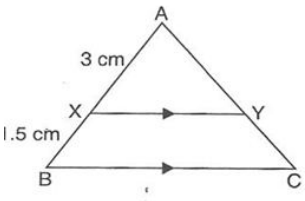
c) -2 d) 1

11. In a $\triangle$ABC, AD is the bisector of $\angle$BAC. If AB = 8cm, BD = 6cm and DC = 3 cm. Find AC **[1]**

a) 6 cm b) 4 cm

c) 3 cm d) 8 cm

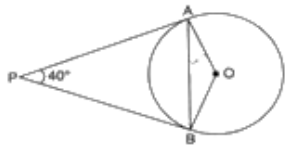
12. In the given figure $XY||BC$. If AX = 3cm, XB = 1.5 cm and BC = 6cm, then XY is equal to **[1]**



a) 6 cm. b) 4.5 cm

c) 3 cm. d) 4 cm.

13. If PA and PB are tangents to the circle with centre O such that $\angle$APB = 40°, then $\angle$OAB is equal to **[1]**



a) 40° b) 30°

c) 20° d) 25°

14. If the area of a circle is equal to the area of a square, then the ratio of their perimeters is **[1]**

a) $2 : \pi$ b) 1 : 2

c) $\sqrt{\pi} : 2$ d) $\pi : 2$

15. In making 1000 revolutions, a wheel covers 88 km. The diameter of the wheel is **[1]**

a) 40 m b) 28 m

c) 24 m d) 14 m

16. The radii of the base of a cylinder and a cone are in the ratio 3 :4. If they have their heights in the ratio 2 : 3, the ratio between their volumes is **[1]**

a) 9 : 8 b) 3 : 4

c) 8 : 9 d) 4 : 3

17. The wickets taken by a bowler in 10 cricket matches are 2, 6, 4, 5, 0, 3, 1, 3, 2, 3. The mode of the data is **[1]**

a) 1 b) 2

c) 4 d) 3

18. If the median of the data 4, 7, x - 1, x - 3, 16, 25, written in ascending order, is 13 then x is equal to **[1]**

a) 15 b) 14

c) 13 d) 16

19. **Read the statements one labelled as Assertion and other as Reason and choose the correct option** **[1]**

Assertion (A): If a die is thrown, the probability of getting a number less than 3 and greater than 2 is zero.

Reason (R): Probability of an impossible event is zero.

a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

20. **Read the statements one labelled as Assertion and other as Reason and choose the correct option** **[1]**

Assertion (A): The HCF of two numbers is 18 and their product is 3072. Then their LCM = 169.

Reason (R): If a, b are two positive integers, then HCF $\times$ LCM = a $\times$ b.

a) Both A and R are true and R is the correct explanation of A. b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false. d) A is false but R is true.

SECTION B

21. For what value of k the following system of equations will be inconsistent? **[2]**

4x + 6y = 11

2x + ky = 7

22. Prove the trigonometric identity: **[2]**

$(\sin\theta + \text{cosec}\theta)^2 + (\cos\theta + \sec\theta)^2 = 7 + \tan^2\theta + \cot^2\theta$

OR

Verify: sin 60° cos 30° - cos 60° sin 30° = sin 30°

23. In a $\triangle ABC$, AD is the bisector of $\angle A$, meeting side BC at D. If BD = 2.5 cm, AB = 5 cm and AC = 4.2 cm, find DC. **[2]**

24. Prove that in two concentric circles, the chord of the larger circle, which touches the smaller circle is bisected at the point of contact. **[2]**

25. A horse is placed for grazing inside a rectangular field 70 m by 52 m and is tethered to one corner by a rope 21 m long. On how much area can it graze? **[2]**

OR

In a circle of radius 10.5 cm, the minor arc is one-fifth of the major arc. Find the area of the sector corresponding to the major arc.

SECTION C

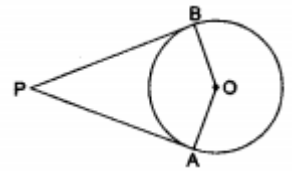
26. One card is drawn from a well-shuffled deck of 52 cards. Find the probability of drawing: **[3]**

i. an ace

ii. '2' of spades

iii. '10' of a black suit.

27. In the given figure, PA and PB are the tangent segments to a circle with centre O. Show that the points A, O, B and P are concyclic. **[3]**



28. In a △ABC, ∠C = 90° and tan A = $\frac{1}{\sqrt{3}}$. Find the values of: **[3]**

i. (sin A cosB + cos A sin B)

ii. (cos A cos B - sin A sin B)

29. If α, β are the zeroes of the $x^2 + 7x + 7$, find the value of $\frac{1}{\alpha} + \frac{1}{\beta} - 2\alpha\beta$. **[3]**

OR

Find the zeroes of the polynomial $4x^2 + 5\sqrt{2}x - 3$ by factorisation method and verify the relationship between the zeroes and coefficient of the polynomial.

30. Solve the system of equations by using the method of substitution: **[3]**

$\frac{2x}{a} + \frac{y}{b} = 2$

$\frac{x}{a} - \frac{y}{b} = 4$

31. The traffic lights at three different road crossings change after every 48 seconds, 72 seconds and 108 seconds respectively. If they all change simultaneously at 8 a.m. then at what time will they again change simultaneously? **[3]**

SECTION D

32. Solve the quadratic equation **[5]**

$\frac{1}{2a+b+2x} = \frac{1}{2a} + \frac{1}{b} + \frac{1}{2x}; x \neq 0, x \neq \frac{-2a-b}{2}, a, b \neq 0$

OR

If the roots of the quadratic equation (x - a) (x - b) + (x - b)(x - c) + (x - c)(x - a) = 0 are equal. Then show that a = b = c

33. In the figure, OB is the perpendicular bisector of the line segment DE, FA ⊥ OB and F E intersect OB at point C. Prove that $\frac{1}{OA} + \frac{1}{OB} = \frac{2}{OC}$. **[5]**

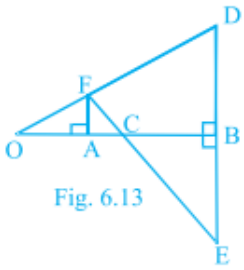


Fig. 6.13

34. A tent is of the shape of a right circular cylinder upto a height of 3 metres and then becomes a right circular cone with a maximum height of 13.5 metres above the ground. Calculate the cost of painting the inner side of the tent at the rate of ₹2 per square metre, if the radius of the base is 14 metres. **[5]**

OR

From a cubical piece of wood of side 21 cm, a hemisphere is carved out in such a way that the diameter of the hemisphere is equal to the side of the cubical piece. Find the surface area and volume of the remaining piece.

35. The table below gives the percentage distribution of female teachers in the primary schools of rural areas of various states and union territories of India. Find the mean percentage of female teachers by assumed mean method. **[5]**

Percentage of female teachers	15 - 25	25 - 35	35 - 45	45 - 55	55 - 65	65 - 75	75 - 85
Number of states/ U.T.	6	11	7	4	4	2	1

SECTION E-CASE BASED QUESTIONS

36. Akshat's father is planning some construction work in his terrace area. He ordered 360 bricks and instructed the supplier to keep the bricks in such as way that the bottom row has 30 bricks and next is one less than that and so on. **[4]**

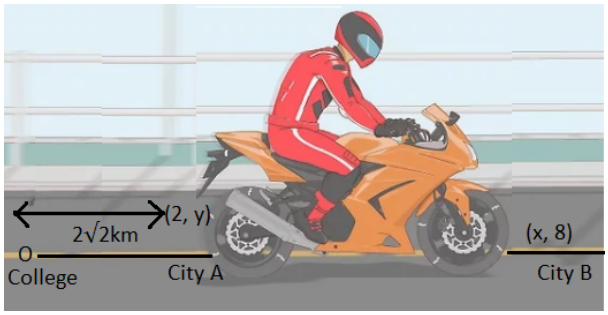
The supplier stacked these 360 bricks in the following manner, 30 bricks in the bottom row, 29 bricks in the next row, 28 bricks in the row next to it, and so on.

i. In how many rows, 360 bricks are placed?

ii. How many bricks are there in the top row?

37. **Read the case study based questions carefully and answer any four out of the following:** **[4]**

A person is riding his bike on a straight road towards East from his college to city A and then to city B. At some point in between city A and city B, he suddenly realises that there is not enough petrol for the journey. Also, there is no petrol pump on the road between these two cities.

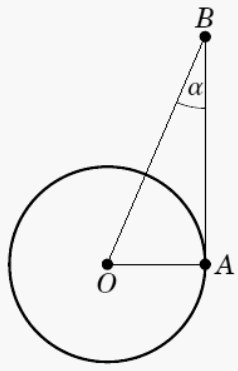


i. Find the value of x and y.

ii. M is any point exactly in between city A and city B, then find the coordinates of M a

iii. Find the ratio in which A divides the line segment joining the points O and M

38. Let O be the center of the earth. Let A be a point on the equator, and let B represent an object (e.g. a star) in space, as shown in the figure. If the earth is positioned in such a way that the angle $\angle OAB = 90^o$, then we say that the angle $\alpha = \angle OBA$ is the equatorial parallax of the object. **[4]**



The equatorial parallax of the sun has been observed to be approximately $\alpha = 0.00244^{o}$. The radius of the earth is 3958.8 miles. Given: $\sin \alpha = 4.26 \times 10^{-5}$ and $\tan \alpha = 4.25 \times 10^{-5}$

i. Estimate the distance from the center of the earth to the sun.

ii. Can we say in this problem points O and A are approximately the same points? If yes, how?