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MATHEMATICS IMPORTANT QUESTIONS FOR HSLC EXAMINATION 2021

Chapter-1 –Number System

Q1. State any three field properties of real numbers.
Q2. By what prime numbers may 319 be divided so that the remainder is 4.
Q3.Show that the square of an odd integer is of the form 8k+1
Q4. Find the least multiple of 13 which when divided by 5, 8 and 12 leaves the same remainder 2 in each case.
Q5.Show that every integer is of the form 4k or 4k+1
Q6.If x,y,zϵR and ,x≠0 and xy = xz, prove that y = z.
Q7. If x,y, ϵR prove that $|x + y| \le |x| + |y|$
Q8. If x,y, ϵR prove that $|xy| \le |x|\ |y|$
Q9.If xyϵ R,and xy=0, then show that x=0 and y=0.
Q10.Define absolute value or modulus of areal number.Also prove that $|a^2|$ =a^2 for any aϵR.
Q11.If $a^2 > b^2$, prove that $|a| > |b|$
Q12.For any xϵR, x.0=0
Q13. If x,y, ϵR then prove that $|-x|$ = x
Q14.Find x if (i) $|x - 3|$ =$\sqrt{2}$ (ii) $|x - 2|$ = x
Q15.Give three values satisfying $|x - 3|$<1
Q16.Show that every integer is of the form 3q, 3q+1 and 3q-1.
Q17.Show that one of three consecutive odd integers is a multiple of 3.

Chapter-2 - Polynomials

Q1. State and prove factor theorem.
Q2. State and prove Remainder Theorem.
Q3.State the division algorithm for polynomials.
Q4. On dividing $x^3 - 3x^2 + x + 2$ by a polynomial f(x) the quotient and remainder are x-2 and 4-2x respectively. Find f(x)
Q5. If $x^2 + px + q$ and $x^2 + lx + m$ are both divisible by x+a, Show that a = $\frac{m-q}{l-p}$
Q6.Find the remainder when $x^4 + 2x^3 - 3x^2 - 5x + 4$ is divided by x – 3, without actual division.
Q7. Find the value of k, if x-1 is a factor of p(x) (i) p(x) = $kx^2 - \sqrt{2}x + 1$ (ii) p(x) = $\sqrt{2}x^2 + kx - 1$

Chapter-3 - Factorisation

Q1. When is an algebraic expression said to have cyclic factors.
Q2. What is cyclic expression?Write the steps for the factorization of cyclic expression.
Q3. Factorise:
(i) $a^3 + b^3 + c^3 - 3abc$. (ii) $(a + b + c)^3 - a^3 - b^3 - c^3$
(iii) $a^2(b-c) + b^2(c-a) + c^2(a-b)$ (iv) $a^2(b+c) + b^2(c+a) + c^2(a+b) + 3abc$
Q4. If $a^3 + b^3 + c^3 = 3abc$, prove that either $a + b + c = 0$ or $a = b = c$
Q5. Find the value of $xy(x+y) + yz(y+z) + zx(z+x) + 3xyz$ when $x = a(b-c)$, $y = b(c-a)$, $z = c(a-b)$
Q6. Prove that $(x-y)^3 + (y-z)^3 + (z-x)^3 - 3(x-y)(y-z)(z-x) = 0$

Chapter-4 - Pair of linear equations in two variables

Q1.Solve graphically :
(i) $2x - y = 2$, $3x + 2y = 17$ (ii) $4x + 6y = 18$, $9 - 2x - 3y = 0$ (iii) $3x + 2y = 4$, $6x + 4y = 13$
Q2. Examine whether the pair of linear equations $2x - 3y = 8$ and $4x - 6y = 9$ is inconsistent or not.
Q3. For what values of k will the following pair of linear equation have infinitely many solution.
$2x + 3y = 7$ and $(k-1)x + (k+1)y = 3k-1$
Q4.For what values of k for which the pair of linear equation $3x+y=1$ and $(2k-1)x + (k-1)y = 2k+1$ has no solution.
Q5.Solve by the method of cross-multiplication .
$a_1x + b_1y + c_1 = 0$ $a_2x + b_2y + c_2 = 0$
Q6. When is a pair of linear equation said to be (i) consistent (ii) inconsistent (iii) dependent
Q7. A chair and a table cost Rs 1200 . By selling the chair at a profit of 20% and the table at a loss of 5%, there is a profit of 4% on the whole . Find the cost price of the table and the chair.
Q8.90% and 95% pure mustard oils are mixed to obtain 20litres of a 92% pure mustard oil. How many litres of each kind of mustard oil are needed?
Q9. Two stations A and B on a highway are 90km apart. A car starts from A and another car starts from B at the same time. If they travel in the same direction they meet in 9 hours but if they travel towards each other, they meet in 1 hour after start. Find the speeds of the two cars , the cars from A moving faster.
Q10.The present age of a father exceeds that of his son by 20 years. Twenty years ago, the age of father was 5 times that of his son. Find their present ages.
Q11.An annual income of Rs 1,200 is derived from two sums invested, one at 4% and the other at 6% per annum simple interest. If the rates of interest are changed to 5% and 7% per annum simple interest respectively, the annual income derived from the investment is Rs 1,450. Find the sums invested.
Q12. A steamer goes 50km downstream and 45 km upstream in 5 hours. In 5 hr 8 min it can go 50 km upstream and 45 km downstream . Find the speed of the stream and that of the steamer in still water.
Q13. The sum of a two digit number and the number obtained by reversing the digits is 110. If the difference of the digits is 4, find the number. How many such numbers are there?
Q14. In a classroom there are a number of benches. If 4 students sit on each bench, five benches are left vacant; and if 3 students sit on each bench, 4 students are left standing. Find the number of benches and students in the classroom.
Q15. There are two numbers, when 1 is added to each of the numbers their ratio becomes 1:2 and when 5 is subtracted from each , their ratio becomes 5:11. Find the numbers.
Q16. Four years ago, a father was nine times as old as his son, and 8 years hence the father age will be three times the son's age. Find their present ages.
Q17. The ratio of incomes of two persons is 9:7 and the ratio of their expenditure is 4:3. If each of them saves Rs 2000 per month, Find their monthly incomes.
Q18. Two tables and three chairs cost Rs 3500 and three tables and two chairs cost Rs 4000. What is the cost of a table and that of a chair?

Q19. A farmer sold a cow and a calf for Rs 12750 thereby making a profit of 25% on the cow and 10% on the calf. By selling them for Rs 11925, he would have realized a profit of 10% on the cow and 25% on the calf. Find the price of the cow and the calf.

Chapter-5 - Quadratic Equation

Q1.Solve $ax^2 + bx + c = 0$, $a \neq 0$ by the method of completing the perfect square.
Q2. Form the quadratic equation whose roots are α and β
Q3. What is meant by the Discriminant of a quadratic equation?
Q4.Find the relation between roots and co-efficients of the quadratic equation $ax^2 + bx + c = 0$ whose roots are α and β .
"or' Show that α + β = sum of the roots $=\frac{-b}{a}$, α . β = product of the roots $=\frac{c}{a}$
Q5. If α and β are the roots of a quadratic equation $x^2 - px + q = 0$, $q \neq 0$. Find the value in terms of p and q.
(i) $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$ (ii) $\frac{1}{\alpha} + \frac{1}{\beta}$ (iii) $(\alpha + 2)(\beta + 2)$
Q6.If the sum of the roots of the equation $\frac{1}{x+a} + \frac{1}{x+b} = \frac{1}{c}$ is zero. Prove that the product of the roots is $-\frac{1}{2}(a^2 + b^2)$
Q7. If one root of the equation $x^2 + px + q = 0$ be the square of the other, then show that $p^3 + q^2 + q = 3pq$
Q8. One root of $x^2 + ax - 21 = 0$ is 3 while $x^2 + ax + b = 0$ has equal roots. Find b.
Q9. If the roots of the equation $x^2 - px + q = 0$ differ by 1, then show that $p^2 = 4q + 1$
Q10. When is a real number α called a root of the quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$.
Q11. Find the value of p so that the equation $3px^2 - 12x + p = 0$ has equal roots.
Q12. Find the quadratic equation whose roots are each less by 2 than those of $x^2 - 3x + 1 = 0$
Q13. Construct the quadratic equation whose roots are (i) $3+\sqrt{5}$, $3-\sqrt{5}$ (ii) $\frac{3+\sqrt{3}}{2}$, $\frac{3-\sqrt{3}}{2}$
Q14. If the roots of the equation $x^2 - px + q = 0$ be twice the other, show that $2p^2 = 9q$.

Chapter-6 - Arithmetic Progression

Q1. What is a sequence?
Q2. Define Arithmetic progression.
Q3. Find the n^{th} term of an A.P whose first term and common difference are 'a' and 'd' respectively.
"or" Prove that $a_n = a + (n-1)d$ where 'a' and 'd' are first term and C.D respectively.
Q4. The sum of the first n, 2n, 3n terms of an A.P are S_1, S_2, S_3 respectively. Show that $S_3 = 3(S_2 - S_1)$.
Q5. The nth term of a sequence is given by $a_n = 4n + 5$. Show that sequence is an AP.
Q6. If the p^{th} term of an AP is q and the q^{th} term is p. Prove that its nth term is (p + q – n).
Q7. Show that the sequence whose nth term is $2n^2 + 3$ is not an A.P.
Q8.If the m^{th} term of an AP be $\frac{1}{n}$ and the nth term be $\frac{1}{m}$, then show that $(mn)^{th}$ term is 1.
Q9.If a, b, c be the p^{th} , q^{th} and r^{th} terms of an AP. Prove that $a(q - r) + b(r - p) + c(p - q) = 0$.
Q10. Find the sum of the first n^{th} term of an AP whose first term and common difference are 'a' and 'd' respectively.Also Deduce the formula $S_n = \frac{n}{2}[a+l]$

"or"

Prove that $S_n = \frac{n}{2}[2a + (n-1)d]$ for finding the sum of the first n terms of an AP. Also Deduce the formula $S_n = \frac{n}{2}[a+l]$

Q11. In an A.P if the sum of the first m terms is equal to n and that of the first n terms is equal to m, then prove that the sum of the first (m+n) terms is –(m+n)
Q12. Find the first term and C.D of an AP if the sum of the first n terms is $\frac{n(5n+7)}{12}$
Q13. Show that the sequence whose nth term is given by $a_n = 5 - 3n$ is an AP. And find the sum of the first 15 terms of an AP.

Q14. Find the number of terms of the A.P 32, 28, 24, 20……. of which the sum is 132. Explain the double answer.

Q15.Show that the sequence whose n^{th} term is $2n^2+3$ is not an A.P.

Q16. The sum of the first 7 terms of an AP is 10 and that of the next 7 terms is 17. Find the first term and the common difference.

Chapter-7 - Triangles

Q1. When are two triangles said to be similar?

Q2. State and prove Pythagoras theorem.

Q3. State and prove Basic Proportionality theorem or Thale's theorem.

Q4. State and prove SAS Similarity.

Q5. If a line divides any two sides of a triangle in the same ratio, then the line is parallel to the third side.

Q6. Prove that the internal bisector of an angle of a triangle divide the opposite side internally in the ratio of the other two sides

Q7. State and prove AAA Similarity.

Chapter-8 - Circle

Q1. If a circle touches all the four sides of a quadrilateral ABCD, prove that AB + CD = BC + DA

Q2. What is a tangent? Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

Q3. If PA and PB are tangent segments drawn from an external point P to a circle with centre O. Prove that $\angle OAB = \frac{1}{2}\angle APB$

Q4. Prove that the length of tangent drawn from the external point of a circle are equal.

Q5. If PA and PB are tangent segments drawn from an external point P to a circle whose center is O. Prove that OP bisects AB and hence OP $\perp$ AB

Q6.If a circle touches all the four sides of a quadrilateral ABCD, Prove that AB+CD=BC+DA

Q7.What is a Secant? Prove that the opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

Q8.The incircle of a ΔABC touches the sides BC, CA and AB at D, E and F respectively. Show that AF + BD + CE = AE + BF + CD = $\frac{1}{2}$ $(perimeter\ of\ a\ \Delta ABC)$

Q9. Prove that the intercept of a tangent between two parallel tangents to a circle subtends a right angle at the centre.

Chapter-9 - Construction

Q1.What is Scale factor?

Q3. Draw a line segment and divide it in the ratio 3:7

Q4. Draw a circle of radius 3.5cm . Construct a pair of tangents to the circle, inclined to each other at 60^o. Find the distance of the point of intersection of the two tangents from the centre of the circle.

Q5. Construct a pair of tangents from an external point to a circle.

Q6. Draw a circle with a given line segment AB as a diameter. Then construct a tangent to the circle from a given external point P.

Chapter-10 -Trigonometry

Q1. What is Trigonometric identity?

Q2. What are angle of elevation and angle of depression?

Q3. In a right $\Delta\ ABC$, rt angled at B, Show that

(i) $1 + \tan^2 A = \sec^2 A$ (ii) $1 + \cot^2 A = \operatorname{cosec}^2 A$ (iii) $\sin^2 A + \cos^2 A = 1$

Q4. If $\sin(A+B) = \frac{\sqrt{3}}{2}$, $\cos(A-B) = \frac{\sqrt{3}}{2}$, $0^o < A + B \leq 90^o$. Find A and B

Q5. If cotA = $\frac{4}{3}$,find the value of $\cos^2 A - \sin^2 A$.

Q6. If tan tan θ = $\frac{a}{b}$, show that $\frac{a\sin\theta - b\cos\theta}{a\sin\theta + b\cos\theta} = \frac{a^2-b^2}{a^2+b^2}$

Q7.Find the trigonometric ratios of 30^o and 60^o

Q8.Prove the following identities.

(i) $\frac{\cos\theta}{\operatorname{cosec}\theta+1} + \frac{\cos\theta}{\operatorname{cosec}\theta-1} = 2\tan\theta$ (ii) $\frac{\cos\theta}{1+\sin\theta} + \frac{1+\sin\theta}{\cos\theta} = 2\sec\theta$ (iii) $\cos^2\theta - \sin^2\theta = \frac{1-\tan^2\theta}{1+\tan^2\theta}$

(iv) $\frac{1+\sin\theta}{1-\sin\theta} = (\sec\theta + \tan\theta)^2$ (v) $\tan^2 A + \cot^2 A + 2 = \sec^2\theta.\operatorname{cosec}^2\theta$ (vi) $\left(1+\frac{1}{\tan^2 A}\right)\left(1+\frac{1}{\cot^2 A}\right) = \frac{1}{\tan^4\theta - \tan^4\theta}$

(vii) $\frac{\cos A}{1-\tan\theta} + \frac{\sin A}{1-\cot A} = \sin A + \cos A$

Q9.The angle of elevation of bird from the eye of a man on the bank of a pond is 30^o and the angle of depression of its reflection in the pond is 60^o. Find the height of the bird above the pond if the distance of the eye from the foot of the man is 1.5metres.

Q10.As observes from the top of a light house 100m. above the water level, the angles of depression of two ships are 30^o and 45^o. If one ship is to the north and the other to the east of the light house, Find the distance between the two ships.

Q11.A tower subtends an angle α at a point on the same level as the foot of the tower and at a second point h metres above the first ,the depression of the foot of the tower is β. Show that the height of the tower is h tanα cotβ.

Q12. A vertical tower stands on a horizontal plane and is surmounted by a flagstaff of height h. At a point on the plane, the angle of the bottom of the flagstaff is α *and that of the top of the flagstaff is* β. Prove that the height of the tower is $\frac{h\tan\alpha}{\tan\beta - \tan\alpha}$

Q13.The angles of elevation of the top of a tower from two points at a distance a and b from the base and in the same straight line with it are complementary. Prove that height of the tower is $\sqrt{ab}$.

Q14.From a point on the ground 40m away from the foot of a tower, the angle of elevation of the top of the tower is 30^o.and the angle of elevation of the top of the water tank (on the top of the tower) is 45^o. Find the (i) height of the tower and (ii) depth of the tank.

Q15.From a light house the angles of depression of two ships on opposite sides of the light house are observed to be 30^o and 45^o .If the height of the light house be 100 metres, find the distance between the ships if the line joining them passes through the foot of the light house.

Q16. From a top of a tower 9m high, the angle of elevation of the top of a building are respectively 45^o and60^o, What is the height of the building?

Q17. A pole is broken by the wing and its top touches the ground at an angle of 30o and at a distance of 8m from the foot of the pole. Find the whole length of the pole.

Q18. A pole 5m high is fixed on the top of a tower. The angle of elevation of the top of the pole observed from a point A on the ground is 60^o and the angle of depression of the point A from the top of the tower is 45^o. Find the height of the tower.

Chapter-11 -Co-ordinate Geometry

Q1.Find the co-ordinates of the point R which divides the line joining P(x_1, y_1) and Q(x_2, y_2) internally in the ratio m:n

Q2. Find the coordinates of the point which divides the line joining (1, -2) and (4, 7) internally in the ratio 1:2

Q3. Let A(-1,5) and B(6,-2) be two given points. Find the coordinates of the point P such that AP = $\frac{3}{7}AB$ and P lies on AB

Q4.Find the coordinates of the points where the diagonals of the parallelogram ABCD formed by joining A(-2,-1), B(1,0), C(4,3) and D(1,2) meet

Q5. Find the ratio in which the line segment joining (-2, -3) and (3, 7) is divided by y-axis. Also find the co-ordinates of the point of division.

Q6. Find the area of a quadrilateral whose vertices are (1,1), (7,-3) and (7,21) taken in order.

Q7.Find the co-ordinates of the centroid of a Δ ABC whose vertices are A(x_1, y_1), B(x_2, y_2) and C(x_3, y_3).

Q8. Determine the ratio in which the point P(10,m) divides the join of A(5,2) and B(17, 14). Also find the value of m.

Q9.Find the ratio in which the line segment joining (-2, -3) and (5, 6) is divided by x-axis. Also find the co-ordinates of the point of division.

Q10. Find the co-ordinates of the point which divides internally the line joining the points (p, q) and (q, p) in the ratio p-q : p+q

Q11. The mid-point of the line segment A(2a, 4) and B(-2, 3b) is M (1, 2a+1).Find the values of a and b.

Q12.Show that the four points (1, 2), (3, 0), (7, 4) and (5, 6) taken in order are the angular points of a rectangle.

Q13. Three vertices of a rectangle are the points (3,4), (-1,2) and (2, -4); what are the coordinates of the fourth vertex.

Chapter-12 -Mensuration

Q1.The sum of the radii of two circles is 35cm and the difference of their areas is 770cm^2. Find the circumferences.

Q2.The difference between the perimeter and the radius of a circle is 37cm. Find the area of a circle.

Q3. Water is flowing at the rate of 5 Km/hr through a pipe of diameter 14cm into a rectangular tank of base 30cm x 22cm. Find the time during which the level of water in the tank rises by 35cm.

Q4.A geyser (water boiler) is in the form of a cylinder with hemispherical ends. If the length of the cylinder is 56cm and the diameter of each end is 18cm. Find the capacity of the geyser in litres.

Q5. The minute hand of a wall clock is 4,2 cm long. Find the area swept by it in 20 minutes.

Q6. Find the sectorial angle and area of the sector of a circle if the arc length of the corresponding sector is 8.8cm and the radius of the circle is 5.6cm.

Q7.A Chord of a circle of radius 12cm subtends a right angle at the centre. Find the area of the corresponding (i) minor sector (ii) major segment (use $\pi = 3.14$ and $\sqrt{3} = 1.73$

Q8. A solid is in the form of a cylinder surmounted by a cone of the radius. If the radius of the base and the height of the cone are ‘r’ cm and ‘h’cm respectively and the total height of the solid is 3h, prove that the volume of the solid is $\frac{7}{3}\pi \mathrm{h} r^2$

Q9. An ice cream is in the form of an inverted cone surmounted by a hemisphere of the same radius. If the radius and the height of the cone are respectively 2.1cm and 8 cm . Find the volume of the ice-cream.

Q10.A right triangle, with legs 9cm ,is made to revolve about its hypotenuse. Find the volume and the surface area of the double cone so formed.

Q11.Find the volume of the largest sphere that can be carved out of a cube of side 4.2cm. Also find the ratio of the volume of the cube to that of the sphere.

Q12.A conical flask of radius x units and height 2x units, is full of water. The water is poured into a cylindrical flask of radius $\frac{2x}{3}$ units. Find the height of water in the cylindrical flask.

Q13.A solid metallic sphere of diameter 28cm is melted and recast into a number of cones, each of diameter 7cm and height 4cm. Find the number of cones so formed.

Q14.A circus tent is in the shape of a cylinder of diameter 24m and height 4m surmounted by a cone of the same radius and height 5m. Find the capacity of the tent and the cost of the canvas at the rate of Rs 120 per square metre.

Q15.A solid metallic cylinder and another solid metallic cone have the same height h and the same radius r. If the two solids are melted together and recast into a cylinder of radius $\frac{1}{2}r$,prove that the height of the new cylinder is $\frac{16}{3}$ h.

Q16. The internal and external radii of a hollow sphere are 3cm and 5cm respectively. If the sphere is melted and recast into solid cylinder of height $2\frac{2}{3}$. Find the curved surface area of the cylinder.

Q17. A cylindrical vessel of radius 7cm and height 30cm is full of ice-cream. How many ice cream cones of each of radius 3cm and height 8cm with hemispherical tops can be formed with ice-cream from the vessel.

Q18. The radii of the bases of two solid metallic cones of same height h are x1 and x2. If the two cones are melted together and recast into a cylinder of height h, then show that the radius of the base of the cylinder is $\sqrt{\frac{1}{3}(x_1^2 + x_2^2)}$

Chapter-13 –Statistics

Q1.Define Arithmetic mean of a grouped frequency distribution.
Q2.What are median and mode of a data?
Q3. What are the 5 most important parameters indicating the state of being of the population in respect of a characteristic or characteristics?
Q4.What are the three measures of central tendency?
Q5.Write the Karl Pearson's empirical formula. If the mean and median of an ungrouped data is differ by 1.25 , then find the difference of mean and mode.
Q6.The expenditure for the consumption of water per month 100 families is given below.

Expenditure on water(in Rs.)	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-110	110-120
No. of families	12	18	20	15	12	11	6	4	2

Find the mean monthly expenditure of the families on water.
Q7Find the median and mode of the following distribution.

Marks below	10	20	30	40	50	60	70	80
No.of students	15	35	60	84	96	127	198	250

Q8.Find the median and mode of the following distribution of 245 workers.

Daily Savings	1-2.99	3-4.99	5-6.99	7-8.99	9-10.99	11-12.99	13-14.99	15-16.99
No.of workers	6	53	85	56	21	16	4	4

Q9.The following is the data of marks and number of students

Marks	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50
No. of students	10	15	30	40	60	25	20	15	5

Calculate Mean ,Median and mode marks.
Q10. In the following distribution, the frequencies of two classes were missing. However, the mean of the data is given to be 50 and N=120 . Find the missing frequencies.

Class	0-20	20-40	40-60	60-80	80-100
Frequency	14	……..	32	………..	19

Chapter-14 –Probability

Q1.When is an event said to be (i) independent (ii) equally likely (iii) mutually exclusive (iv)favourable outcomes
Q2. Define (i) Sample Space (ii) Exhaustive set of events
Q2. What is Random or non-deterministic experiment?
Q3. State Classical or Mathematical or a Priori definition of Probability due to Laplace.
Q4.In a 20-20 cricket match, a batsman hits a boundary 5 times out of 24 balls he faced. Find the probability that he did not hit a boundary in a ball he faced.
Q5. From a pack of cards, two cards are drawn at random after a thorough suffle. Find the probability that both are kings.
Q6. From a pack of cards, two cards are drawn at random after a thorough suffle. Find the probability that both are Diamonds.
Q6.There are four men and three ladies in a council. If two council members are elected at random for a committee, how likely is that both are ladies.

Q7.From an urn containing 4 white and 5 red balls, two balls are drawn at random. Find the probability that at least one is white.

Q8.A , B, C are three events which are equally likely but not forming an exhaustive system of events. Then show that P(A) = P(B) = P(C) $\neq \frac{1}{3}$

Q9.Two fair dice are thrown and points on them are added together. Find which is more likely to happen that the sum is 7 and that the sum is 8.