***ST. JOSEPH'S SENIOR SECONDARY SCHOOL NAGGALAMA***

***S. 6 PURE MATHEMATICS REVISION QUESTIONS 2020.***

***EQUATIONS***

1. *(a) If , show that .*

*(b)Eliminate from the equation:.*

*(c)Show that if and .*

*(d)If , show that .*

1. *Resolve the following into partial fractions.*
3. *(a) Solve the set of the simultaneous equations below.*
4. *, .*

*(b). Solve completely the equation: .*

*(c). By putting , solve for x in*

*(d) Solve the equations.*

*(i)*

*(ii)*

1. *(a) Find the range of values of x for which .*

*(b) For what values of x is true?*

*(c) Solve the inequality. .*

1. *(a) Solve the equation for x. .*

*(b) Solve the equation for x.*

1. *If and find the values of and hence solve the equations.*
2. *Solve the equations:*

*(a)*

*(b)*

1. *If and show that*
2. *Solve the equation: .*

***SERIES***

1. *The sum of the squares of three positive numbers in an arithmetic progression (A.P) is 155. The sum of the numbers is 21. Find the numbers,*
2. *If the tenth term of a geometric progression (G.P) is 2 and the twentieth term is , find the first term of the progression.*
3. *If and are both positive, prove that the series,*

*is an arithmetic series and find the sum of the terms.*

1. *Find how many terms of the series Must be added so that the sum to infinity will be less than .*
2. *A ball when dropped from any height loses 20% of its previous height at each rebound. If it is dropped from a height of 40ft, find how often it will rise to a height over 8 ft. How far does the ball travel before coming to rest?*
3. *For what values of x do both series given below*
4. *converge?*

***BINOMIAL THEOREM AND EXPANSION***

1. *Obtain the expansions in ascending powers of x of : .*
2. *Show that , for what values of x is the expansion valid?*
3. *Show that: for what values of x is the expansion valid?*
4. *Show that if x is so small that and higher powers of x can be neglected,*

*, by putting show that .*

1. *Use the Binomial theorem to evaluate , correct to 5 significant figures.*
2. *Use the method of induction to show that.*
3. *Evaluate the term independent of x in the binomial expansion .*
4. *Prove by induction that is a multiple of 6.*
5. *Prove by the method of mathematical induction that if n is a positive integer,*

*(i).*

*(ii).*

1. *Show that is always divisible exactly by 120 when n is a positive integer.*

***COMPLEX NUMBERS***

1. *Express the following in the form*

*(i). (ii). (iii).*

1. *If find the modulus of if*
2. *P represents the complex number z. Q represents a complex number, show that if P moves on the circle , Q moves on the ellipse .*
3. *Find the locus of a point Z which moves so that .*
4. *Solve the equation.*
5. *Show that if are real, then , hence show that if*

*and is real, the point represented by Z lies on the real axis or on a Cartesian circle.*

1. *If , show that .*

***ROOTS OF QUADRATIC EQUATION***

1. *Given the quadratic equation derive the conditions for which the equation has real, equal or repeated or complex roots.*
2. *If the equation has equal roots, find p.*
3. *Find the greatest values of λ for which the equation has real roots.*
4. *Show that the equation cannot have real roots if a and b are both real.*
5. *The roots to the equation are and. Form a quadratic equation whose roots are and .*
6. *If and are the roots to the equation , find the values of;*

*(i). (ii). (iii)*

1. *If and are the roots to the equation , form the equations whose roots are;(i). and . (ii). and .*
2. *(i) One of the roots of the equation is twice the other. Show that;*
3. *.*

*(ii). One root of the equation is the square of the other. Show that;*

*provided .*

1. *If one of the root p is four times the other, show that;*

*.*

1. *Form a quadratic equation for which the sum of the roots is 5 and the sum of the squares of the roots is 33.*
2. *Find the condition that the roots of the equation should be*

*(i) equal in magnitude but opposite in sign. (ii) reciprocals*

1. *If are the roots to the equation, , show that is independent of p and q.*

***TRIGONOMETRY***

1. *(a) (i) If , show that*

*(ii). If show that*

*(b). If A, B and C are angles of a triangle, show that;*

*(i).*

*(ii).*

1. *Show that;*

*(i)*

*(ii).*

*(iii).*

*(iv). .*

*(v).*

*(vi).*

*(vii).*

*(viii).*

1. *(i) Express in the form hence state the maximum value of the expression.*

*(ii) Express in the form .*

*(iii) By expressing in the form , calculate the maximum value of this expression. Find the acute angle for which this maximum value is attained.*

1. *If A, B and C are angles of a triangle, show that;*

*(i)*

*(ii)*

1. *(a) Show that: .*

*(b) Given that , prove that;*

*, prove also that;*

*(c) Prove that;*

*(i)*

*(ii)*

*(d) If , show that .*

1. *(a). Given that , evaluate without using tables,*

*(b) If , show that .*

*(c) If ,show that;*

*(i) (ii)*

1. *(a) Starting from the sine formula of a triangle ABC or otherwise, prove that*

*(b) Prove that in ant triangle ABC, .*

*(c)Show that in any triangle, ABC, . Use this formula rather than the cosine formula to the triangle in which*

*and .*

1. *(a)Prove that for a triangle of area ,*

*(b). If in any triangle ABC, , prove that , if . Find the value of and hence the value of a.*

*(c). If p is the altitude from A to BC of a triangle ABC, prove that;*

*and .*

*Hence or otherwise given that calculate b and c.*

1. *(a) In any triangle ABC, assuming that; , prove that;*

*. Calculate the values of c for the triangle in which , A = 72, B = .*

*(b)If the area of the triangle ABC is and , prove that;*

*(c)Prove that; .*

1. *The side BC of the triangle ABC is divided internally a point such that , where . Show that where and are taken on CA and AB such that and respectively. Show that angle and prove that is the area of the triangle , . Deduce that if is the area of triangle ABC,*

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1. *If , then .*

***DIFFERENTIATION***

1. *(i) Find if and .*

*(ii). Find and for the curve , .*

*(iii) Find*

*(iv) Find*

1. *(i)If , prove that;.*

*(ii)If , prove that .*

1. *(a). Water is running out of a certain funnel at a rate of . The radius of the base of the funnel is 5cm and its height is 10cm. Find the rate at which water level is falling when it is 4cm from the top?*

*(b) The radius of a sphere is r cm after t sec. Find the radius when the rate of increase of r and the rate of increase of the surface area are numerically equal.*

*(c). A gas is escaping from a spherical balloon at the rate of How fast is the radius decreasing when the radius is 3m?*

*(d). The value of g, the acceleration due to gravity is determined by means of a simple pendulum of length lcm. The period T sec of the pendulum is measured and g is calculated from the formula . The experimenter feels that he is able to measure length l accurately but realizes that his measurement of T is subjected to an error of 1%. What is the percentage error in the calculated value of g?*

*(e). The volume of water in a hemispherical bowl of radius 12cm is given by where x cm is the greatest depth of the water. Find the approximate volume of water necessary to raise the depth from 2 cm to 2.1 cm. If the water is poured at the rate of , at what rate is the water rising when the depth is 3 cm?*

*(f). The strength of a magnetic field due to a current I (A) in a wire in the form of a circle of radius r cm, at a point x cm from the circle is given by;*

*gauss. If I = 10A, and r = 4 cm, find the approximate change in H when x changes from 3 cm to 2.9 cm?*

1. *(a).If , find .*

*(b). Differentiate with respect to x; (i) .(ii)*

*(c). If , show that*

*(d). If , show that .*

*(e). If , show that .*

*(f). Show that if , where q and p are constants, then V is maximum when .*

***INTEGRATION***

1. *Integrate the following.*

*(i).*

*(ii).*

*(iii).*

*(iv).*

*(v).*

*(vi)*

*(vii).*

*(viii).*

*(ix).*

*(x)*

*(xi).*

*(xii).*

*(xiii).*

*(xiv).*

*(xv).*

*(xvi).*

*(xvii).*

*(xviii).*

*(xix).*

*(xx).*

*(xxi).*

*(xxii).*

*(xxiii).*

*(xxiv).*

*(xxv).*

*(xxvi).*

*(xxvii).*

*(xxviii).*

*(xxix).*

*(xxx).*

*(xxxi).*

*(xxxii).*

*(xxxiii).*

*(xxxiv).*

*(xxxv).*

*(xxxvi).*

*(xxxvii).*

*(xxxviii).*

*(xxxiv).*

*(xxxv).*

*(xxxvi).*

*(xxxvii).*

*(xxxviii).*

*(xxxix).*

*(xl).*

*(xli).*

*(xlii).*

1. *Integrate the following with respect to x.*

*(i).*

*(ii).*

*(iii).*

*(iv).*

*(v).*

*(vi).*

*(vii). Hint: put x = cos 2*

1. *(i). Find the area under the curve between and .*

*(ii).Find the area contained between the two parabolas and*

*.*

*(iii). Find the area between the curve , the axis of y and the lines;*

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*(iv). Find the area included between the curve and the*

*x – axis.*

*(v). Find the area of the curve .*

*(vi). Find the area enclosed between the parabolas and .*

*(vii). Find the area enclosed between the curve , the y – axis, the line y= 4 and the line x =1.*

1. *Find the area of each of the curves;*

*(a). 2*

*(b).*

*(c).*

1. *Find the area of the loop of the curve .*

***DIFFERENTIAL EQUATIONS***

1. *Solve the differential equations*

*(i)*

*(ii).*

*(iii).*

*(iv).*

*(v). Show that the general solution of the equation can be written as where k is the arbitrary constant. Hence find the particular solution for which .*

1. *(i) Show that the equation represents a family of parabolas with a common axis and a common tangent at the vertex.*

*(ii) Find a function whose rate of change is proportional to the square of its value and whose value is 1 when x = o and 3 when x =1.*

*(iii) A particle moves in a straight line in a resisting medium so that its acceleration is given by . If the particle passes through the origin with a velocity u, find an expression for its distance s from the origin in terms of u and v.*

*(iv).Given that a particle moves so that its distance (s) from a fixed point at a time t is given by where are constants. Find the original differential equation governing the motion of the particle.*

*(v) A beaker containing water at 100is placed in a room which has a constant temperature of 20. The rate of cooling at any moment is proportional to the difference between the temperature of the room and the liquid. If after 5 minutes the temperature of water is 60, what will be the temperature after 10 min?*

*(vi). In a certain chemical reaction, the amount x of one substance at any time t is related to the velocity of reaction, where a, b and k are constants. Show that at time t; + c, c is a constant.*

*(vii). In a reservoir which is discharging over a weir, it is known that where H ft. is the height of the surface above the sill of the weir at time min, if initially H = 1ft., find the expression for H?.*