

FE/MA/1119B 22/03/2020

# EEE CONSORTIUM

**FINAL EXAMINATION (2019-20)**

**Subject- MATHEMATICS (REEXAM)**

**Class- XI**

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

***General Instructions:-***

1. All questions are compulsory
2. This question paper contains **36** questions.
3. Question **1 – 20** in **Section A** are very short–answer type questions carrying **1** mark each.
4. Question **21-26** in **Section B** are short-answer type questions carrying **2** marks each.
5. Question **27-32** in **Section C** are long –answer-I type questions carrying **4** marks each.
6. Questions **33-36** in **Section D** are long-answer-II type questions carrying **6** marks each.

**Section- A**

**(*Question numbers 1 to 20 carry 1 mark each*)**

|  |
| --- |
| **Multiple Choice Questions**  Select the correct option out of the four possible options given after the statement of the Question: |

1. If A, B and C are nonempty subsets then (A-B) U(B-A) =

a) (AUB) – B b)A-(A∩B) c) (AUB) - (A∩B) d) (A∩B) U(AUB)

1. Domain of  is

a) R b) (1, 2) c) R – (1, 2) d) R-[1,2]

1. sin2 750 - sin2 150 =

a) b) c) 2 d) None of these

1. The value of tan 3A – tan 2A – tan A is

a) ) tan 3A tan 2A tan A b) – tan 3A tan 2A tan A

c) tan A tan 2A – tan 2A tan 3A – tan 3A tan A d) None of these

1. According to principle of mathematical induction, if P(k+1) = m(k+1) + 5 is true then which among the following must be true. a) P(k) = 3m(k) b) P(k) = m(k) + 5 c) P(k) = m(k+2) + 5 d) P(k) = m(k)
2. The Solution set of the in inequalities2*x* 13 and 3*x* 15 is a) b) (-2,2) c) (-2,2] d) [-2,2)
3. In an examination there are three multiple choice questions and each question has 4 choices. Number of ways in which a student can fail to get all answer correct is a) 11 b) 12 c)27 d) 63
4. The number of terms in *(x + y + z*)10 is a) 66 b) 11 c) 3 d) 4
5. If log 2, log (2x -1), log (2x + 3) are in A.P. then *x* = Which term of the following GP 3, 3, ……. Is 729

a) b) c) d)

1. If sum of an infinite geometric series is and its 1st term is , then its common ratio is

a) b) c) d)

|  |
| --- |
| **FILL IN THE BLANKS**  Complete the following statements with appropriate answer(s) in the blank space(s) : |

1. Distance between the parallel lines is -------

**(OR)**

Slope of a line perpendicular to the line through points (2, 5) and (-3, 6) is -----------

1. If P is any point on the ellipse 9x2 + 36y2 = 324 where foci are S and , then SP + P =------
2. The eccentricity of the hyperbola 3 is --------------
3. The image of (5,2,-7) in the *xy*plane is -----------
4. The ratio in which the line segment joining the points (2, -3, 4) and ( 3, 4, -1) is divided by the - plane is ---------------

|  |
| --- |
| **VERY SHORT ANSWER QUESTIONS**  Each of the following questions have to be answered in one word or one sentence or as per the exact requirement of the question : |

1. Evaluate 
2. Find the value of
3. Find the arithmetic mean if the coefficient of variation of a distribution is 75 and a standard deviation is 27.

What are the median class of the observation

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Wager | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 |
| No. of workers | 4 | 6 | 10 | 20 | 10 | 6 | 4 |

1. Three events A, B and C are mutually exclusive and exhaustive; if P(A)= and P(B)= , then find the value of P(C).
2. If P(AU B )=0.6 and P( A∩B)=0.2 , Find P()+ P()

**Section- B**

**(*Question numbers 21 to 26 carry 2 marks each*)**

1. Find the domain and range of f(x) = 

**(OR)**

Find the domain and range of

1. Show that is divisible by 64, whenever is a positive integer

**(OR)**

Find the term independent of in the expansion of .

1. Find the equation of the hyperbola satisfying the give conditions: Foci (±4, 0), the latus rectum is of length 12.
2. Find the value of
3. If 4-digit numbers greater than 5000 are randomly formed from the digits 0, 1, 3, 5 and 7, what is the probability of forming a number divisible by 5 when the repetition of digits is not allowed?.

**(OR)**

Out of 100 students, two sections of 40 and 60 are formed. If you and your friend are among the 100 students, what is the probability that you both enter the same section?

1. In a class of 60 students, 30 opted for NCC, 32 opted for NSS and 24 opted for both NCC and NSS. If one of these students is selected at random, find the probability that a) The student opted for NCC or NSS b) The student opted neither NCC nor NSS

**Section- C**

**(*Question numbers 27 to 32 carry 4 marks each*)**

1. Prove that =

(OR)

Find the value of

1. Prove that: 2.7n + 3.5n – 5 is divisible by 24, for all n N, by the method of induction
2. How many litres of water will have to be added to 1125 litres of the 45% solution of acid so that the resulting mixture will contain more than 25% but less than 30% acid content?
3. A boy has 3 library tickets and 8 books of his interest in the library. Of these 8, he does not want to borrow Mathematics Part II, unless Mathematics Part I is also borrowed. In how many ways can he choose the 3 books to be borrowed?

(OR)

Find the number of different signals that can be generated by arranging at least 2 flags in order (one below the other) on a vertical staff, if 5 different flags are available?

1. An arch is in the form of a semi ellipse. It is 8m wide and 2 m high at the center.Find the height of the arch at a point 1.5m from one end.
2. The mid-points of the sides of a triangle are (2, 5, -1), (0, 4, - 2) and (2,3,4). Find its vertices.

**Section- D**

**(*Question numbers 33 to 36 carry 6 marks each*)**

1. Find three numbers in GP whose sum is 13 and the sum of whose square is 91.
2. A triangle is formed by the lines , and , find the coordinates of its orthocenter.

**(OR)**

Find the image of the point (3,8) with respect to the line , assuming the line to be a plane mirror.

1. a) Find the differentiation of cot(2x + 3) by using first principle

b)Evaluate

(OR)

1. Find the derivative of 
2. 
3. The mean and standard deviation of 100 observations were calculated as 40 and 5.1, respectively by a student who took by mistake 50 instead of 40 for one observation. What are the correct mean and standard deviation?

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**ANSWER KEY**

|  |  |  |
| --- | --- | --- |
| Sl.No. | Value points/ Solutions/ Answer | M |
| 1 | **( Ans.- c)** | 1 |
| 2 | R- (1, 2) **( Ans.-c)** | 1 |
| 3 | **( Ans.-c)** | 1 |
| 4 | tan 3A tan 2A tan A ( **Ans. - a**) | 1 |
| 5 | P(k) = m(k) + 5( **Ans. -b**) | 1 |
| 6 | ( **Ans. - a**) | 1 |
| 7 | 63( **Ans. -d**) | 1 |
| 8 | 66 **( Ans.- a)** | 1 |
| 9 | **( Ans.- a)** | 1 |
| 10 | 🢧🢧🢧 **r= ( Ans.-a** | 1 |
| 11 | **(OR)** 5 | 1 |
| 12 | SP + P = 12 | 1 |
| 13 | e= | 1 |
| 14 | (5, 2, 7) | 1 |
| 15 | 0= 🢧 | 1 |
| 16 |  | 1 |
| 17 | = = 2 | 1 |
| 18 | 36 **OR** 40-50 | 1  1 |
| 19 | P( C ) = 1- P(A)- P(B)= | 1 |
| 20 | P( )+ P() = 1.2 | 1 |
| 21 | **Answer:**  **Domain**: in interval notation  **Range**: in interval notation:  **Explanation:**  , for domain under root should not be  negative quantity.  Domain:  Range: f(x) is maximum at  Range:  Domain: in interval notation:  Range: in interval notation : |  |

|  |  |  |
| --- | --- | --- |
| 22 | By Binomial theorem, we have  = [n+1C0 + n+1C1+ n+1C2 + n+1C3 +…… + n+1Cn+1]- 8  = [ 1+  n+1C2 + n+1C3 +…… + n+1Cn+1]--9  = [n+1C2 +n+1C3 +…… + n+1Cn+1] = 64, where is some integer.  Hence, is divisible by 64, whenever is a positive integer.  **(OR)**  The expansion is We have 6Cr=6Cr= 6Cr. The term will be independent of if the index of is zero, i.e. = 0. Thus, = 4. Hence 5th term is independent of and is given by 6Cr. |  |
| 23 | Given, Foci = (±4, 0) and the latus rectum is of length 12.  Here, the foci are on the x-axis.  Therefore, the equation of the hyperbola is of the form - =1  Since the foci are (±4, 0), c = 4  Length of latus rectum = 12  => 2b2/a = 12  => b2/a = 6  => b2 = 6a  We know that a2 + b2 = c2  => a2 + 6a = 42  => a2 + 6a = 16  => a2 + 6a – 16 = 0  => (a + 8)(a - 2) = 0  => a = -8, 2  Since a is non-negative, a = 2  So, b2 = 6a = 6 x 2 = 12  Thus, the equation of the hyperbola is - =1 |  |
| 24 |  |  |
| 25 | When the repetition of digits is not allowed   |  |  |  |  | | --- | --- | --- | --- | | Th | H | T | U | | 2 ways | 4 Ways | 3 ways | 2 ways |   As the number to be formed is more than 5000, leftmost place(i.e. thousand’s place) can be filled in two ways as 5 or 7 can be placed there. The remaining three places can be filled in with remaining four digits in 4P3 ways.  Number of numbers (>5000) that can be formed = 24P3  = 2 = 48.  The numbers which are divisible by 5 have either 0 or 5 in the units place  **Case-1**:   |  |  |  |  | | --- | --- | --- | --- | | Th | H | T | U | | 7 fixed | 2 ways | 1 way | 5 fixed |   In this case 5 is in units place, 7 is fixed in thousands place and the remaining two places can be filled in with remaining 3 digits in 3P2 = 3 = 6 ways  **Case- 2:**   |  |  |  |  | | --- | --- | --- | --- | | Th | H | T | U | | 2 Ways | 3ways | 2 ways | 0 fixed |   In this case 0 is fixed in unit’s place. Thousand’s place can be filled in two ways as either 5 or 7 can be placed there. He remaining two places can be filled in with three digits in 3P2 ways = 3 = 6 ways. Number of numbers of this kind = 2 6 = 12  Therefore Number of numbers divisible by 5 = 6 +12 = 18’  Therefore required probability= =  **(OR)**  Two sections 40 and 60 can be formed out of 100 in 100C60 or 100C40 ways.  Both you and your friend can go either to one section containing 40 students or to the other section containing 60 students, which can happen in 98C38 + 98C40 ways Therefore P(both enter the same section) = = |  |
| 26 | Let A = event of student opting for NCC and B = event of student opting for NSS  Then, n(S)=60,n(A)=30,n(B)=32,n(A∩B)=24  P(A)= ½, P(B)= 8/15 and P(A∩B) =2/5   1. Probability that the student opted for NCC or NSS= P(A∪B)   =P(A)+P(B)−P(A∩B)  =+−=   1. Probability that the student opted neither NCC nor NSS =P(A'∩B')   =1−P(A∪B)  =1−= |  |
| 27) | cos2x + cos2+ cos2  = [ 1 + cos 2x + 1 + cos 2() + 1 + cos 2]  = [ 3 + cos 2x + 2 cos 2x cos ]  = [ 3 + cos 2x – 2 cos 2x cos ]  =  **OR**  Now,  Hence |  |
| 28) | is divisible by 24  Then which is divisible by 24  p(1) is true  Let p (m) : 2.7m + 3.5m - 5 is divisible by 24 be true  2.7m + 3.5m - 5 = 24 ; N  3.5m = 24 + 5 - 2.7m …(1)  Now  p(m+1) : 2.7m+1 + 3.5m+1 - 5  = 2.7m+1 + (3.5m) 5 - 5  =2.7m+1 + (24 + 5 - 2.7m) 5 - 5 (from (1))  =2.7m+1 + 120 + 25 - 10.7m - 5  =(2.7m+1 - 10.7m) + 120 + 20  = (2 x 77m-10 x 7m) + 120 + 24 - 4  =(14 - 10)7m - 4 + 24 (5 + 1)  = 4 x 6 + 24 (5 + 1) (7m - 1 is a multiple of 6 for all mN 7m - 1 = 6, N)  = 24 ( + 5 + 1) which is divisible by 24  p (m + 1) is true.  Hence by principle of mathematical induction p(n) is true for all n N |  |
| 29) | If x litres of water is added then  🢧25 << 30 🢧>>🢧 2025 > 1125 > 1687.5  🢧900 >🢧  This means that volume of water to be added lies between 562.5 litres and 900 litres |  |
| 30) | Case-I: Mathematics Part II is borrowed. In this case Mathematics Part I is also borrowed. Number of ways of selecting 1 book from 6 books = 6C1 = 6  Case-II: Mathematics Part II is not borrowed. In this case Mathematics Part I may or may not be borrowed. Number of ways of selecting 3 books from 7 books = 7C3 = 35. Hence, required number of ways = 6 +35 = 41  **(OR)**  Case-I: We arrange 5 distinct flags, taken 2 at a time. So, number of 2-flags signals = 5P2 = 20  Case-II: We arrange 5 distinct flags, taken 3 at a time. So, number of 3-flags signals = 5P3 = 60  Case-III: We arrange 5 distinct flags, taken 4 at a time. So, number of 4-flags signals = 5P4 = 120  Case- IV: We arrange 5 distinct flags, taken 5 at a time. So, number of 5-flags signals = 5P5 = 120.  Hence , required number of signals= 20+ 60+ 120+120 = 320 |  |
| 31) | http://clay6.com/mpaimg/misc4.jpg  a= 4 and b = 2  The eqn of ellipse is + = 1  x2 +4y2 =16  Let k meters be the height of the arch at distance of 1.5m from one end, the OB = 4-1.5=2.5  So the point C is (2.5,k)  As C lies on the ellipse , we get k=√39/4=1.56  Therefore, the required length of the arch is 1.56m |  |
| 32) | x1 + x2 = 4, y1 + y2 = 6, z1 + z2 = 8  Adding first three equations in (i), (ii) and (iii), we obtain  2(x1 + x2 + x3) = 2 + 0 + 4 x1 + x2 + x3 = 3.  Solving first three equations in (i), (ii) and (iii) with x1 + x2 + x3 = 3, we obtain x1 =1, x2 =3, x3 = -1.  Adding next three equations in (i), (ii) and (iii), we obtain  2(y1 + y2 + y3) = 10 + 8 + 6 y1 + y2 + y3 = 12.  Solving first three equations in (i), (ii) and (iii) with y1 + y2 + y3 = 12, we obtain y1 =2, y2 =4, y3 = 6.  Adding last three equations in (i), (ii) and (iii), we obtain  2(z1 + z2 + z3) = -2 - 4 + 8 z1 + z2 + z3 = 1.  Solving first three equations in (i), (ii) and (iii) with z1 + z2 + z3 = 1, we obtain z1 =3, z2 =5, z3 = -7.  Thus, the vertices of the triangle area A(1, 2, 3), B (3, 4, 5) and C (-1,6,-7) |  |
| 33) | Let the required numbers in G.P. be and  and ………..(2)  From (2), we get 🢧  🢧=91 🢧  🢧🢧  Dividing (1) by (3), we get 🢧7  🢧3🢧. Putting the value of in (1), we get and 9 respectively. The numbers are 1, 3 and 9 |  |
| 34) | Let ABC be the triangle formed by the given lines .  x+y-6=0 -------------- (1)  3y-x+2=0 ---------------(2)  3y=5x+2 ----------------(3)  Solving (2) and (3) , A are (-1,-1)  Slope of BC = -1 →slope of AL =1  The equation of AL is x-y=0    Solving (1) and (3) , B are (2,4).  Slope of CA =1/3 → slope of BM = -3  The equation of BM is 3x+y-10=0  Solving , the coordinates of orthocenter is ( 5/2, 5/2)  **OR**  Let B(a,b) be the image of the point A(3,8) in the line x+3y=7 and N be the foot of perpendicular from A.  Slope of the line = -1/3    Therefore , slope of the AN = 3  The equation of AN is y-8=3(x-3)  3x-y-1=0  Solving the equations, x=1, y=2.  The point N is (1,2)  Since N is the midpoint of AB , we get ,a=-1 and B= -4  Therefore, the image is (-1,-4). |  |
| 35) | Let f(x) = cot (2x + 1). Then, f(x + h) = cot (2 (x + h)+ 1) = cot (2x + 2h + 1)  f(x) =  =  =  = [using : sin (A-B) = sin A cos B - cos A sin B]  = = -  = .  = -2 x 1 x  = -2 cosec2 (2x + 1)  b)  =  =  =  = x  = . . .  = 4 x 1 x 1 x 1 x 1  = 4  OR  a)  =  =  =  =  =  b)  Evaluate  =  = = |  |
| 36) | Given that the number of observations,  Incorrect mean = 40 and incorrect standard deviation = 5.1  So, Incorrect  Since, the student took by mistake 50 instead of 40 for one observation.  Correct Incorrect = 4000-50+40 = 3990.  So, correct mean =  Now, incorrect standard deviation =  5.1= 🢧 26.01=  🢧. Since , the student by mistake 50 instead of 40 for one observation. = 162601- 2500+1600 = 161701.  So, Correct standard deviation = = = 5. Hence, correct mean = 39.9 and correct standard deviation = 5. |  |

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