**SS 3/TEC 3 Further Mathematics**

1. Given that (-5)(+)= P +q, find q . A 4 B. -4 C -5 D. -7
2. Simplify ×÷ . A. B C. D.
3. The root of a quadratic equation are -3 and 1, find its equation. . A. -3x+1=0 B.-2x+1=0 C +2x-3=0 D. +x-3=0
4. Change 1000=3 into index form. . A B. 10 C. D. .
5. Which of the following is used to calculate the nth term of an arithmetic progression? . A. a+d B. +d C. a+ (n-1)d D. a+2d
6. Express 2/ (3-√7) in the form a+√b, where a and b are integers. . A 6+√7 B. 3+√7 C. 3-√7 D. 6-√7.
7. + 6√5 - 4√10) (B) (2 - 3√2 - 4√5 - 6√(10)) (C) (3√2 + 4√5 - 6√(10 ) - 2 (D) 14(2 + 3√2 - 6√5 + 4√10)
8. Solve 2 cos x – 1 = 0, for 0 ≤ x ≤ 2π. (A) ( , ) (B) ( , ) (C) ( , ) (D) ( , )
9. Solve: 4 ( = 8x. (A) 1 and 2 (B) 1 and -2 (C) -1 and 2 (D) -1 and -2
10. If log3x = log93 , find the value of x. (A) 32  (B) (C) (D)
11. Find the third term of (8 in descending order of x. ( A) (B) (C) (D) x4
12. Given that f: x → and g: x →x+3 where x find fog(2). (A) 25 (B) 9 (C) 7 (D) 5
13. Which of the following is a factor of the polynomial: 6x4 + 2x3 + 15x + 5. (A) 3x + 1 (B) x + 1 (C) 2x + 1 (D) x + 2
14. Find the minimum value of y = x2 + 6x – 12. (A) -21 (B) -12 (C) -6 (D) -3
15. In how many ways can a committee of five be selected from eight students if two particular students are to be included? (A) 20 (B) 28 (C) 54 (D) 58
16. If x = i – 3j and y = 6i + j, calculate the angle between x and y (A) 600 (B) 750 (C) 810 (D) 850
17. If y = (, find the value of at x =1 (A) 57 (B) 27 (C) -6 (D) -54
18. If and are the roots of x2 + x – 2 = 0, find the value of ( +) (A) (B) (C) (D)
19. Given that x2 + 4x + k = ( x + r )2 + 1, find the values of k and r (A) k = 5, r = -1 (B) k = 5, r = 2 (C) k= 2, r = 5 (D) k =-1, r = 5
20. Given that **r** = 2i – j, **s** = 3i + 5j, and **t** = 6i – 2j, find the magnitude of ( 2**r** + **s** – **t** ) (A) (B) 4 (C) (D)
21. A mass of 75kg is placed on a lift. Find the force exerted by the floor of the lift on the mass when the lift is moving up with a constant velocity. [ Take g = 9.8 ms-2 ](A) 750N (B) 745N (C) 735N (D) 98N
22. **Each** of the 90 students in a class speak **at least** Igbo and Hausa. If 56 students speak Igbo and 50 speak Hausa, find the probability that a student selected at random from the class speak Igbo only. (A) (B) (C) (D)
23. Given that y = 4 – 9x and = 0.1, Calculate. (A) 9.0 (B) 0.9 (C) -0.3 (D) -0.9
24. Four fair coins are tossed once. Calculate the probability of obtaining equal number of heads and tails. (A) (B) (C) (D)
25. In calculating the mean of 8 numbers, a boy mistakenly used 17 instead of 25 as one of the numbers. If he obtained 20 as the mean, find the correct mean. (A) 24 (B) 23 (C) 21 (D) 19
26. A 24N force acts on a body such that it changes its velocity from 5m/s to 9m/s in 2 seconds. If he body is travelling in a straight line, calculate the distance covered during the period. (A) 22m (B) 18m (C) 14m (D) 10m
27. The sum, Sn = 2n2 – 5. Find the 6th term. (A) 112 (B) 67 (C) 45 (D) 22
28. Two forces **F1** =( 7i + 8j)N and **F2** = (3i + 4j)N act on a particle. Find the magnitude of (**F1** – **F2**). (A) 4N (B) 5N (C) 6N (D) 3N
29. Given that 2x = 0.125, find the value of x. (A) 0 (B) -1 (C) -2 (D) -3
30. Find the area of the circle whose equation is x2 + y2 – 4x + 8y + 11 = 0. (A) 3 (B) 6 (C) 9 (D) 12
31. Which of the following is the same as sin (270 + x)? (A) sin x (B) tan x (C) - sin x (D) - cos x
32. Given that and are the roots of an equation such that + = 3 and = 2, find the equation. (A) x2 – 3x + 2 = 0 (B) x2 – 2x + 3 = 0 (C) x2 – 3x - 2 = 0 (D) x2 – 2x - 3 = 0
33. How many ways can 12 people be divided into three groups of 2, 7, and 3 in that order? (A) 7920 (B) 792 (C) 187 (D) 42
34. A binary operation \*, is defined on the set R, of real numbers by a \* b = a2 + b +ab. Find the value of x for which 5 \* x = 37 . (A) 7 (B) 2 (C) -2 (D) -7
35. Find the derivative of: 3x2 + . (A) 6x + 2x2 (B) 6x + (C) 6x - (D) 6x -
36. If = 32, find the value of x. (A) 4 (B) 2 (C) -2 (D) -4
37. If events A and B are independent and P(A) = and P(AB) = , find P(B). (A) (B) (C) (D)
38. The remainder x3 – 2x + m is divided by x – 1 is equal to the remainder when 2x3 + x – m is divided by 2x + 1. Find the value of m. (A) (B) (C) (D)
39. Express radians is degrees. (A) 3150 (B) 2100 (C) 1050 (D) 750
40. Given that **AB** = 5i + 3j and **AC** = 2i + 5j, find **BC**. (A) -7i – 8j (B) -3i + 2j (C) 3i – 2j (D) 3i + 8j
41. If (2t + 3s)(t – s) = 0, find (A) or 1 (B) or - 1 (C) or -1 (D) - or 1
42. A body starts from rest and moves in a straight line with a uniform acceleration of 5ms-2. How far, in m , does it go in 10 seconds? (A) 50 (B) 250 (C) 350 (D) 500
43. Simplify: (A) 3 (B) 5 (C) 5 (D) 3
44. A rectangle has a perimeter of 24m. If its area is to be a maximum, find its dimension. (A) 12, 12 (B) 6, 6 (C) 4, 8 (D) 9,3
45. If = 6, find the value of x. (A) 1 (B) 2 (C) 3 (D) 6
46. The first term of a geometric series is 350. If the sum to infinity is 250, find the common ratio. . A. -5/7 B. -2/5 C. 2/5 D. 5/7
47. Find the common ratio in 1, -1/2, ¼ /-1/8 . A -1/4 B. 1/2 C. -1 D. -1/2
48. Solve │x-1│>│3-x│. A. x<2 B. 1>3 C. x>3 D. x>2
49. The eleventh term of an A.P is 25 and its first term is −5. Find its common difference. A. 4 B. 5 C. 3 D. 7
50. The operation \* is defined by x\*y = , find −2\*3 A. −6 B. −5 C. 7 D. −7

**PAPER 2** (ESSAY)  **(48 Marks)**

 Answer **all** the questions in this section; **al**l question carry equal marks

1. The functions **f** : x x2 + 1 and **g** : x 5 – 3x are defined on the set of real numbers, R.

 (i) State the domain of **f-1**, the inverse of **f**; (ii) Find **g-1** (2)

 2. If are the roots of the equation 2x2 - 7x + 4 = 0, find the equation whose roots are and .

3. (a) White down the binomial expansion of (2 – x)5 in ascending powers of x.

 (b) Use your expansion in 3(a) to evaluate (1.98)5, correct to four decimal places.

4. Find the gradient of xy2 + x2y = 4xy at the point (1, 3).

5. Solve: 2(2y + 2) – 9(2y) = -2.

6. (a) Write the following as column vectors: r = (10N, 090o*);* q = (8N, 135o). (b) Use your answer in 6(a) to find (r + q).

7. (a) Evaluate + , correct to two decimal places. (b) A committee of 2 tutors and 5 pupils is to be formed among 6 tutors and 10 pupils. In how many ways can this be done?

8. A particle of mass 400g is moving under the action of two forces; F1 = (35N, 210o), F2 = (35 N, 300o) and a resistance of 40N. Find the magnitude of the: (a) resultant of F1 and F2; (b) resultant force acting on the particle.

**SECTION C (52 Marks)**

 Answer **four** questions only from this section**, all** questions carry equal marks

9. (a) If the quadratic equation (x + 1)(x + 2) = k(3x + 7) has equal roots, find the possible values of the constant k. (b)(i) Evaluate , (ii) Using the answer in 9(i), solve the simultaneous equations: 2x – 3y + z = 10, y – 2z = - 7, x + 2y – 3z = - 9

10. The images of (3, 2) and (-1, 4) under the linear transformation **T** are (-1, 4) and (7, 11) respectively. **P** is another transformation where **P**: (x, y) (x + y, x + 2y). (a) Find the matrices T and P of the linear transformations **T** and **P**.(b) Calculate **TP**. (c) Find the image of the point X (4, 3) under **TP .**

11. (a) The probability that a man wins a race is 0.8. In four different races, what is the probability that he wins: (i) all races (ii) no race **(ii**i) at most 3 races? (b) A class consists of 5 girls and 10 boys. If a committee of 5 is chosen at random from the class, find the probability that: (i) 3 boys are selected; (ii) at least one girl is selected.

12. The table gives the distribution of heights in metres of 100 students

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| heights | 1.40 -1.42 | 1.43 -1.45 | 1.46 -1.48 | 1.49 -1.51 | 1.52-1.54 | 1.55 -1.57 | 1.58-1.60 | 1.61 -1.63 |
| Freq. |  2 |  4 |  19 |  30 |  24 |  14 |  6 |  1 |

(a)  Calculate **the**: (i) mean height; (ii) mean deviation of the distribution. (b) What is the probability that the height of a student selected at random is greater than the mean height of the distribution?

13. (a) The position vector of a body, with respect to the origin, is given by r = 4t **i** + (12 – 3t)**j** at any time t seconds.(i) Find the velocity of the body. (ii) Calculate the magnitude of the displacement between . t = 0 and t = 5.

 (b) Express in the form m + n where m and n are rational numbers.

 14. One out of a thousand people reacted to a newly manufactured vaccine against an epidemic disease. If 3000 people were treated with this vaccine, find the probability that: (i) exactly two people react to the vaccine; (ii) at most two people react to the vaccine; (iii) at least three people react to the vaccine; (iv) no one react to the vaccine; (v) not less than one person reacts to the vaccine.

15. The following table shows the weights losses, X, of 10 persons and the number of months, Y, they have been on a special weight reducing diet:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Months on diet |  4 |  17 |  14 |  1 |  11 |  22 |  9 |  12 |  4 |  7 |
| Weight loss kg |  7 |  32 |  26 |  1 |  20 |  34 |  17 |  21 |  5 |  12 |

(a) Draw a scatter diagram of the data and indicate on your diagram a line of regression of y on x. (b) Find the equation of this line, and obtain from it, the coefficient of regression of y on x. (c) Predict the weight loss if a person stays on this diet for 16 months.

16. A particle is projected vertically upwards from the ground with speed 30ms-1. Calculate the: (a) maximum height reached by the particle; (b) time taken by the particle to return to the ground; (c) time(s) taken for the particle to attain a height of 40 m above the ground. [ Take g = 10 ms-2]IOLEF