Competitive Entrance 2013 **Session**

Department: Civil Engineering

and Forestry Techniques, Electrical and Power Engineering & Computer science

1^{st} **cycle** **Option: ALL** **Paper 2: Mathematics** **Duration: 3 hours**

1. The value of x given that $3 \times 2^x = 0.25$ is:

   $A : \frac{2}{5}$ $B : \frac{5}{2}$ $C : -\frac{2}{5}$ $D : 4$

2. The eighth term of a geometric sequence is 256. If the first member of the sequence is 2 then common ratio is:

   $A : 2$ $B : 7$ $C : 128$ $D : 8$

3. Given the function $f : x \longmapsto \frac{2x}{4-3x}$; $x \in \mathbb{R} - \{\frac{4}{3}\}$. The range is:

   $\mathbb{R} - \{\frac{4}{3}\}$ $B : \mathbb{R} - \{\frac{2}{3}\}$ $C : \mathbb{R} - \{-\frac{3}{2}\}$ $D : x \in \mathbb{R}$.

4. The set of values of x for which $(x-3)(x-4) < x-3$ is:

   $A : x < 4$ $B : x > 4$ $C : 5 < x < 3$ $D : 3 < x < 5$

5. The complex number z where $z = \frac{2-i}{1-i}$ can be reduced to form $x + iy$ where x and y are real numbers. Then the values of x and y are:

   $A : \frac{3}{2}$ and $\frac{1}{2}$ $B : \frac{1}{2}$ and $-\frac{3}{2}$ $C : -\frac{1}{2}$ and $-\frac{3}{2}$ $D : -\frac{1}{2}$ and $-\frac{3}{2}$

6. $\int_0^2 \frac{x}{1+x} dx$ is:

   $A : \ln(\frac{1}{5})$ $B : \ln(\frac{5}{2})$ $C : \ln(\sqrt{5})$ $D : \ln 5^2$.

7. The sequence whose n^{th} sum is given by $s_n = n(2n+1)$ is:

   A : a G.P B : an A.P C : an infinite sequence D : a finite sequence

8. The coordinates of the point on inflexion of the curve $f(x) = x^4 - x^3$ are:

   $A : (3, -27)$ $B : (0, 0)$ $C : (-27, 3)$ $D : (3, 27)$

9. i^{1003} is:

   $A : 1$ $B : i$ $C : -i$ $D : -1$

10. If $log_5 3 = x$, then the value 625^x is:

    $A : 12$ $B : 81$ $C : 64$ $D : 60$

11. $\lim_{x\to 1} \frac{x^3-1}{x-1}$ where $x \neq 1$ gives:

    $A: 0 \quad B: 3 \quad C: \infty \quad D: -3$

12. Given the cartesian equation of a line as $\frac{x-5}{3} = \frac{y+4}{7} = \frac{x-6}{2}$ then the line passes through the point:

    $A: (5,-4,6) \quad B: (3,7,2) \quad C: (-5,4,-6) \quad D: (\frac{5}{3},-\frac{4}{3},3)$

13. The equation $x^2 - 12x + k + 3 = 0$ has real roots, the range of values of k are:

    $A: -2 \leq k \leq 6 \quad B: k \leq 2 \cup k \geq 6 \quad C: -2 < k < 6 \quad D: k < -2 \cap k > 6$

14. If $\frac{dy}{dx} + 5 = 6x$ at $A(2,1)$, then the expression of y in terms of x will be:

    $A: y = 3x^2 - 5x - 1 \quad B: y = 6x - 5 \quad C: y = \frac{12}{5} \quad D: y = 6x^2 - 5$

15. Given that the parametric equation of a curve are $x = \frac{1}{t-1}$ and $y = \frac{1}{t+1}$ then the gradient of the curve at the point where $t = 2s$ is:

    $A: -1 \quad B: \frac{1}{9} \quad C: 1 \quad D: \frac{1}{3}$

16. The number of ways in which we can arrange the letters of the word "NDOMBOLO" is:

    $A: 40\,320 \quad B: 33 \quad C: 6\,720 \quad D: 8$

17. The term independent of x in the expansion of $(2x - \frac{1}{x^2})^6$ is:

    $A: 2 \quad B: 15 \quad C: 16 \quad D: 240$

18. How many 4 digit numbers can be formed from the numbers 1, 2, 3, 4 and 5 if repetition is not allowed?

    $A: 625 \quad B: 256 \quad C: 120 \quad D: 24$

19. The oblique (skew) asymptote of the curve $y = \frac{2x^3+x^2-2x+1}{2(x^2-1)}$ is

    $A: y = x + 2 \quad B: y = x \quad C: y = x + \frac{1}{2} \quad D: y = 2x + 1$

20. The value of $\sum_{r=1}^{\infty} 4\left(\frac{1}{3}\right)$ is:

    $A: 2 \quad B: 4 \quad C: 3 \quad D: \frac{4}{3}$

21. If $y = \ln x^7$ then $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$ is:

    $A: \frac{7}{x} \quad B: -\frac{7}{x^2} \quad C: -\frac{7}{x} \quad D: \frac{7}{x^2}$

22. Given the geometric series $\frac{x}{x-3} + 1 + \frac{x-3}{x} + ...$ The range of values of x for the series is convergent is:

$A: x > 3$ $B: x < \frac{3}{2}$ $C: x > \frac{3}{2}$ $D: x < 3$

23. If $\cos t = -\frac{1}{2}$, then the general solution is:

$A: 2n\pi \pm \frac{2\pi}{3}$ $B: 2n\pi + \frac{2\pi}{3}$ $C: 2n\pi - \frac{2\pi}{3}$ $D: 2n\pi \pm \frac{\pi}{3}$

24. The direction of the vector $a = \vec{i} + 5\vec{j}$ is:

$A: 59°$ $B: -59°$ $C: 120°$ $D: 31°$

25. If $x^3 + y^3 = 10$ then $\frac{dy}{dx}$ at the point $(1,1)$ is:

$A: 1$ $B: -1$ $C: \frac{1}{2}$ $D: 2$

26. A committee of 4 boys and 5 girls is to be selected from a group of 8 boys and 9 girls. In how many ways can this committee be formed?

A: 8 820 ways B: 196 ways C: 24 310 ways D: 2 ways

27. An even function is symmetrical about:

A: the line $y = x$ B: the origin C: the $y-$axis D: the $x-$axis

28. If $f(x) = 0$ has a solution at $x = T$ then

$A: f(T) > 0$ $B: f(T) < 0$ $C: f(T) = 0$ $D: f(T) \neq 0$

29. The length of the vector $2\vec{i} - 4\vec{j} - 4\vec{k}$ is

$A: 36$ $B: \pm 36$ $C: \pm 6$ $D: 6$

30. The arg of z if $z = -\sqrt{3} - i$ is:

$A: \frac{\pi}{6}$ $B: \frac{7\pi}{6}$ $C: -\frac{5\pi}{6}$ $D: \frac{5\pi}{6}$

31. Given that $P(A) = \frac{1}{4}$ and $P(A \cup B) = \frac{1}{3}$, if the events A and B are independent, then $P(B)$ is:

$A: \frac{1}{12}$ $B: \frac{1}{9}$ $C: \frac{3}{4}$ $D: \frac{2}{3}$

32. The upper quartile of distribution is:

A: The value below which 25% of the distribution lies

B: The value above which 25% of the distribution lies

C: The value below which 50% of the distribution lies

D: The value above which 50% of the distribution lies

33. The discrete random variable X has a probability mass function defined by $P(X = x) = c(3 - x)$; $x = 0, 1, 2, 3$. The value f the constant c is

$A : \frac{5}{6}$ $B : \frac{1}{2}$ $C : \frac{2}{3}$ $D : \frac{1}{6}$

34. 12 numbers are such that the sum is 72. Another set of 8 numbers is such that their sum is 80. The mean of the combined set of 20 numbers is:

$A : 75$ $B : 7$ $C : \frac{38}{5}$ $D : 8$

35. A bag contains 4 red balls and 5 yellow balls. Two balls are randomly draw from the bag without replacement, one after the other. What is the probability that both ball are of the same color?

$A : \frac{5}{9}$ $B : \frac{5}{18}$ $C : \frac{1}{20}$ $D : \frac{4}{9}$

36. Two random variables X and Y are such that $\overline{X} \sim N(30, 3)$ and $\overline{Y} \sim N(40, 5)$. The distribution of $4\overline{X} - 2\overline{Y}$ is:

$A : N(40, 28)$ $B : N(40, 68)$ $C : N(200, 4)$ $D : N(40, 22)$

37. A random of two variable has probability density function $f(x) = 3x^k$ if $0 \leq x \leq 1$ and $f(x) = 0$ otherwise. The value of the constant k is:

$A : \frac{1}{2}$ $B : 4$ $C : 2$ $D : \frac{1}{3}$

38. A panel of two judges conducted an interview for 7 children and their respective ranking orders revealed that $\sum d^2 = 48$. Spearman's coefficient of rang correlation is:

$A : \frac{6}{7}$ $B : \frac{42}{7}$ $C : \frac{1}{7}$ $D : \frac{3}{7}$

39. Linear regression is defined as:

A- Straight line regression

B- The measure of the degree of relationship between two variables

C- The process of estimating one variable corresponding to a given value of another variable.

D- A function that relate two variables

40. The power of a statistical test is:

A- The probability of rejecting a false hypothesis

B- The probability of not rejecting a false hypothesis

C- The probability of committing a type 1 error

D- The probability of committing a type 2 error