NEB-GRADE XII

2079 (2022)

Mathematics

Grade Increment (Supplementary) Examination

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Time: 3 hrs. **Full Marks: 75**

Attempt **all** the questions.

Group 'A' 11×1=11

Rewrite the correct options of each questions in your answer sheet.

1. A combination containing *'k'* objects chosen from a set of *'n'* objects is denoted by *C (n, k). C (n, k)* exists for all.
   A) $k > n$ *B) $n < k$* *C) $k \leq n$* *D) $n \leq k$*
2. Let '*' be the binary operation defined on set of natural nunbers (N) by the rule a*b = 3a +4b -2. 6*2 is equal to
   A) 8 B) 18 C) 24 D) 28
3. If $\sin^{-1}\left(\frac{4}{5}\right) = \theta$ then the value of $\cos\theta$ is.
   A) $\frac{2}{5}$ B) $\frac{3}{5}$ C) $\frac{4}{5}$ D) $\frac{3}{4}$
4. If $\cos\left(x + \frac{\pi}{3}\right) = \frac{\sqrt{3}}{2}$ then the value of x is ...
   A) $2n\pi + \frac{\pi}{6};\ n \in Z$ B) $2n\pi - \frac{\pi}{6};\ n \in Z$
   C) $2n\pi + \frac{\pi}{2};\ n \in Z$ D) $2n\pi - \frac{\pi}{3};\ n \in Z$
5. $y^2 = 16 - 4x^2$ is a conic section. The eccentricity of the conic section (e) is..
   A) 0 B) 1 C) less than 1 D) greater than 1

Contd...

6. If θ is the angle between any two vectors $\vec{a}$ and $\vec{b}$ such that $|\vec{a}|\,|\vec{b}| = |\vec{a} \times \vec{b}|$ then θ is equal to
   A) 0 B) $\frac{\pi}{4}$ C) $\frac{\pi}{2}$ D) π
7. The variance of the binomial distribution of getting 7 head and 5 tails in 12 tosses of an unbiased coin is...
   A) 1.732 B) 3 C) 6 D) 12
8. $\int \frac{1}{a^2 - x^2}\,dx$ is equal to ...
   A) $\ell n\left|\frac{a + x}{a - x}\right| + c$ B) $\ell n\left|\frac{x - a}{x + a}\right| + c$
   C) $\frac{1}{2a}\ell n\left|\frac{a+x}{a-x}\right| + c$ D) $\frac{1}{2a}\ell n\left|\frac{x-a}{x+a}\right| + c$
9. $\lim_{x \to \infty} \frac{\ell n\, x}{x}$ in equal to ...
   A) -1 B) 0 C) 1 D) ∞
10. The system of linear equations x-y =5 and 4x-4y = 20 has...
    A) No solution B) Infinitely many solutions
    C) One solution D) More than one solutions but finite
11. If the line of action of two forces never meet, then they are called.
    A) like forces B) parallel forces
    C) perpendicular forces D) collinear forces

    Or

    The formula for calculating consumer surplus is..
    A) $\int_0^Q$ (demand function) dQ + P_0Q_0 B) $\int_0^Q$ (demand function) dQ - P_0Q_0
    C) $\int_0^Q$ (supply function) dQ - P_0Q_0 D) $\int_0^Q$ (demand function) dQ

Group 'B' 8×5=40

12. In a binomial expansion $\left(x + \frac{1}{x}\right)^{12}$
    a) Find the 7th term (2)

Contd...

b) Find the term independent from x.. 2

c) How many terms are there in the expansion ? 1

13. Use mathematical induction and prove that 5

$$1^2 + 2^2 + 3^2 + ... + n^2 = \frac{n(n+1)\ (2n+1)}{6}$$

14. a) Write the relation between $\sin^{-1}x$ and $\cos^{-1}x$. Write the domain of $\tan^{-1}x$ and range of $\sin^{-1}x$. 3

b) Define $\vec{a} \times \vec{b}$ and give its geometric interpretation. 2

15. Raw materials used in production of a synthetic fiver is stored in a place that has no humidity control measurement of the humidity (relative) and the moisture content of samples of the raw materials (both in percentages) of 7 days yielded the following results.

Humidity (x)	46	53	37	42	34	29	60
Moisture content (y)	12	14	11	13	10	8	17

i) Find the regression equation y on x 4

ii) Predict the moisture content when the relative humidity is 50 percent. 1

16 a) State Rolle's theorem and give it's geometrical interpretation. 2

b) Give an example of linear differential equation, homogenous differential equation and standard integral each. 3

17. a) Evaluate: $\int \frac{1}{x^4 + x^2 + 1}\, dx$ 3

b) Find the equation of tangent to $y = x^2-4x+1$ at $(2, -3)$. 2

18. Solve the following LP problem using simplex method. Maximize: $P(x, y) = 4x+5y$ subject to $3x + 2y \leq 24;\ 3x + 3y \leq 21,\ x \geq 0,\ y \geq 0$

19. A particle is thrown with an initial velocity of $120ms^{-1}$ at an angle of 30^o above the horizontal. Find. 3

a) the time to attain the highest point. 1

b) the time of flight. 1

c) the horizontal range. 1

d) the greatest height reached ($g = 10ms^{-2}$) 1

Contd...

e) how much the maximum height differ by horizontal range ? 1

Or

Find the general as well as the particular solution of the differential equation $y_t = -\frac{2}{3} y_{t-1};\ \ y_0 = 75$

Group 'C' 3×8=24

20. a) Find the number of permutations and combinations of four letters taken from the world 'EXAMINATION'. 6

b) Apply De-Moivre's theorem to compute $(1+i)^{24}$ 2

21. a) Discuss the different forms of equation of plane obtained from the given condition below.

The plane passing through the points whose co-ordinates are (-1, 1, 1) and (1, -1, 1) and perpendicular to the plane $x+2y+2z-5=0$ 7

b) Justify with example $\vec{a} \times \vec{b}$ and $\vec{a} \cdot \vec{b}$ are different. 1

22. a) Let $f(x) = |x-1|$, show that there is no value of c satisfying the condition $f(3) - f(0) = f'(c)(3-0)$ 2

b) Find the derivative of $\sin(\log x)$ with respect to x by the first principle. 6

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