

$$x+3y \leq 60,$$

$$x+y \geq 10,$$

$$x \leq y, x \geq 0, y \geq 0$$

### SECTION-C

**Note:** Long answer type questions. Attempt any one questions out of two questions. (1x10=10)

Q.19 Solve the following system of equation by matrix method.

$$x+y+z=6$$

$$x-y+z=2$$

$$2x+y-z=1$$

Q.20 Find all the points of maxima & minima and the corresponding maximum and minimum values of the function:

$$f(x) = 2x^3 + 21x^2 + 36x - 20$$

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**Level 3 / 2nd. Sem. / DVOC**  
**(Ref. & Air Cond., Auto Servicing, ITM,**  
**PT, SD, AMT, FP, EMS, GM)**  
**Subject : Mathematics**

Time : 2 Hrs.

M.M. : 50

### SECTION-A

**Note:** Very short answer type questions. All questions are compulsory (10x1=10)

Q.1 If R be the relation in the set N (set of natural numbers) given by  $R = \{(a, b) : a + b = 7\}$

Choose the correct answer

(a)  $(2, 1) \in R$  (b)  $(2, 4) \in R$

(c)  $(2, 5) \in R$  (d)  $(2, 6) \in R$

Q.2 What is the order of the differential equation

$$\left(\frac{dy}{dx}\right)^2 + \sin(x) = 0$$

(a) 1 (b) 2

(c) 5 (d) None

Q.3 If  $(a, a) \in R$  for all  $a \in X$ , then R is a \_\_\_\_ relation in X.

(a) Symmetric (b) Reflexive

(c) Transitive (d) None of these

Q.4 Fill in the blank:

The function  $f(x) = 2x + 3$  is a \_\_\_\_\_ function at every real number. (continuous/discontinuous)

Q.5 Fill in the blank :  $\frac{d}{dx} + (e^{3x}) =$  \_\_\_\_\_

Q.6 Fill in the blank :  $\int 2\sec^2 x \, dx =$  \_\_\_\_\_

Q.7 If  $\vec{A} = \hat{i} + 2\hat{j} - 2\hat{k}$  then magnitude of vector  $\vec{A}$  is

- (a) 0 (b) 1  
(c) 2 (d) 3

Q.8 The matrix  $\begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}$  is an example of

- (a) Column matrix (b) Identity matrix  
(c) Square matrix (d) Row matrix

Q.9 Points within and on the boundary of the feasible region represents feasible solutions of the constraints? (True/False)

Q.10 The value of the determinant  $\begin{bmatrix} 1 & -2 \\ 1 & 2 \end{bmatrix}$  is

- (a) 0 (b) 1  
(c) 2 (d) 4

## SECTION-B

**Note:** Short answer type questions. Attempt any six questions out of eight questions. (6x5=30)

Q.11 Define Row Matrix. Also find the values of  $x, y, z$

and  $w$  if  $\begin{bmatrix} x & 3x-y \\ 2x+z & 3y-w \end{bmatrix} = \begin{bmatrix} 3 & 2 \\ 4 & 7 \end{bmatrix}$

Q.12 Let  $f: \mathbb{N} \rightarrow \mathbb{N}$  and  $g: \mathbb{N} \rightarrow \mathbb{N}$  be given by  $f(x) = x + 1$  and  $g(x) = 2x + 3$ , show that  $g \circ f \neq f \circ g$

Q.13 Prove that  $\tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{13}\right) = \tan^{-1}\left(\frac{2}{9}\right)$

Also write the formula which are used to prove.

Q.14 Form a differential equation by eliminating arbitrary constant  $A$  and  $B$  from  $y = Ax^2 + Bx$

Q.15 Find  $|\vec{a} \times \vec{b}|$  &  $|\vec{a} \times \vec{a}|$  if  $\vec{a} = \hat{i} + \hat{j} - \hat{k}$  and  $\vec{b} = \hat{i} - \hat{j} + \hat{k}$

Q.16 Evaluate  $\int_2^4 \frac{2x^3 + 4x + 1}{x} \, dx$

Q.17 Find the angle between the two planes

$$3x - 6y + 2z = 7 \text{ and } 2x + 2y - 2z = 5$$

Q.18 Solve the following linear programming problem graphically

Minimize :  $z = 3x + 9y$

Subject to the constraints: