

BUDHA DAL PUBLIC SCHOOL PATIALA
SECOND TERM EXAMINATION (11 December 2023)
Class - XII

Paper- Applied Mathematics

Time: 3hrs.

M.M. 80

General Instructions:

1. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer type questions of 2 marks each.
4. Section C has 6 Short Answer type questions of 3 marks each.
5. Section D has 4 Long Answer type questions of 5 marks each.
6. Section E has 3 case based studies of 4 marks each.

Section - A

1. Degree of differential equation $\left(\frac{d^2y}{dx^2}\right)^2 - \left(\frac{dy}{dx}\right) = y^3$ is
a) $\frac{1}{2}$ b) 2 c) 3 d) 4
2. Value of $\int_0^1 \frac{1}{2x-3} dx$ is
a) $\frac{1}{2} \log 3$ b) $\log 3$ c) $-\frac{1}{2} \log 3$ d) $-\log 3$
3. An observed set of population that has been selected for analysis is called
a) sample b) a process c) a forecast d) a parameter
4. At what rate of interest will the present value of perpetuity of Rs. 500 payable at the end of each quarter be Rs. 40,000?
a) 1.25% b) 2.5% c) 5% d) 6%
5. An annuity in which the periodic payment begin on a fixed date and continue forever is called
a) perpetuity b) sinking fund c) loan d) EMI
6. $\int e^{3\log x} x^4 dx =$
a) $\frac{x^7}{7} + C$ b) $\frac{x^8}{8} + C$ c) $\frac{x^9}{9} + C$ d) none
7. Objective function of LPP is
a) a constraint
b) a function to be optimized
c) a relation between the variables
d) none of these

8. The assumed hypothesis which is tested for rejection considering it to be true is called
- a) null hypothesis b) alternative hypothesis c) simple hypothesis d) all of the above
9. The number of arbitrary constants in the general solution of a differential equation of order three is
- a) 1 b) 2 c) 3 d) 4
10. Rs. 100 shares of a company are selling at Rs. 80. If the company is paying a dividend of 12% then rate of return is
- a) 10% b) 12% c) 15% d) 18%
11. The solution of the differential equation $\frac{dx}{x} + \frac{dy}{y} = 0$ is
- a) $\frac{1}{x} + \frac{1}{y} = C$ b) $xy = C$ c) $\log x \log y = C$ d) $x + y = C$
12. If the calculated value of $|t| < t_v(\alpha)$, then null hypothesis is
- a) rejected b) accepted c) can't be determined d) both (a) and (b)
13. The present value of a perpetuity of Rs. R payable at the end of each payment period, when the money is worth i per period is given by
- a) Ri b) $R + \frac{R}{i}$ c) $\frac{R}{i}$ d) $R - Ri$
14. Value of $\int_{+4}^{+1} \frac{1}{x} dx$ is
- a) 0 b) $-\log 4$ c) $-\log 1$ d) none
15. If constraints in a LPP are changed
- a) The problem is to be re - evaluated
 b) Solution is not defined
 c) The objective function has to be modified
 d) The change in constraints is ignored
16. A specific characteristic of population is known as
- a) sample b) parameter c) statistic d) mean

17. A fund which is created to accumulate money over the years to discharge a future obligation is called
- a) perpetuity b) sinking fund c) loan d) EMI
18. The number of arbitrary constants in particular solution of differential equation of order 3 is
- a) 1 b) 2 c) 3 d) 0

Assertion - Reason Based Questions

The following questions consists of two statements - Assertion (A) and Reason (R). Answer the question selecting appropriate option given below:

- a) Both A and R are true and R is correct explanation for R.
 b) Both A and R are true but R is not correct explanation for R.
 c) A is true but R is false.
 d) A is false but R is true.
19. Assertion (A) : The maximum value of $Z = 11x + 7y$ subject to the constraints $2x + y \leq 6$, $x \leq 2$, $x, y \geq 0$ occurs at (0, 6)
 Reason (R) : If the feasible region of given LPP is bounded then maximum and minimum values occurs at corner points.
20. Assertion (A) : The present value of a perpetuity of Rs. 20,000 payable at the beginning of every quarter is Rs. 16,20,000 if the money is worth 5% per annum compounded quarterly.
 Reason (R) : The present value of perpetuity in $P = \frac{R}{i}$ when periodic payment is made at the beginning of each payment period.

Section - B

21. Two tailors, A and B, earn Rs. 300 and Rs. 400 per day respectively. A can stitch 6 shirts and 4 pairs of trousers while B can stitch 10 shirts and 4 pairs of trousers per day. To find how many days should each of them work and if it is desired to produce atleast 60 shirts and 32 pairs of trousers at a minimum labour cost, formulate this as an LPP.
22. A machine costing Rs. 30,000 is expected to have a useful life of 13 years and a final scrap value of Rs. 4000. Find annual depreciation charge using straight line method.
23. Find particular solution of the differential equation $\frac{dy}{dx} = 1 + x + y + xy$, given $y = 0$ when $x = 1$
24. Evaluate : $\int xe^{3x} dx$
25. A company has been producing steel tubes of mean inner diameter of 2cm. A sample of 10 tubes on inner diameter of 2.01 cm and a variance of 0.004 cm². Is difference in the values of means significant? [$t_9(0.05)=2.262$]

Section - C

26. The marginal revenue function of a commodity is given by $MR = 11 - 3x + 4x^2$, find revenue function. Also, find the demand function.
27. Suppose a person invested Rs. 15000 in a mutual fund and the value of investment at the time of redemption was Rs. 25000. If CAGR for this investment is 8.88%, calculate number of years for which he has invested the amount. [$\log 1.667 = 0.2219$, $\log 1.089 = 0.0370$]
28. A dietician wishes to mix two kinds of food X and Y in such a way that the mixture contains atleast 10 units of vitamin A, 12 units of vitamin B and 8 units of Vitamin C. The vitamin contains of one kg food is given below :

Food	Vitamin A	Vitamin B	Vitamin C
X	1 unit	2 units	3 units
Y	2 units	2 units	1 unit

One kg of food X costs Rs. 24 and one kg of food Y costs Rs. 36. Using linear programming, find the least cost of the total mixture which will contain the required vitamins.

29. Solve : $x \frac{dx}{dy} + y = 3x^2 - 2$

30. The mean weekly sales of a four-wheeler were 50 units per agency in 20 agencies. After an advertising campaign, the mean weekly sales increased to 55 units per agency with standard deviation of 10 units. Test whether the advertising campaign was successful.
(Use $t_{0.05, 19} = 1.729$ for 19 d.f.)

31. Utkarsh purchased a laptop worth Rs. 80,000. He paid Rs. 20,000 as cash down and balance in EMI in 2 years. If bank charges 9% p.a. compounded monthly. Calculate EMI.

$[(1.0075)^{24} = 1.964]$

Section - D

32. A company has two factories located at P and Q and has three depots situated at A, B and C. The weekly requirement of the depots at A, B and C is respectively 5, 5 and 4 units, while the production capacity of the factories at P and Q are respectively 8 and 6 units. The cost (in ₹) of transportation per unit is given below.

		Cost (in ₹)		
		A	B	C
From	To			
P		160	100	150
Q		100	120	100

How many units should be transported from each factory to each depot in order that the transportation cost is minimum?

33. In a bank, principal increases continuously at the rate of 5% per year. In how many years Rs. 1000 double itself?
34. Solve : $\int \frac{2x+3}{(2-x)(x^2+3)} dx$
35. The decay rate of radium at any time t is proportional to its mass at that time. Find the time when the mass will be halved of its initial mass.

Section - E (Case Studies)

36. In year 2000, Mr. Talwar took a home loan of ₹3000000 from State Bank of India at 7.5% p.a. compounded monthly for 20 years.

Based on the above information, answer the following questions:

- (a) Find the equated monthly installment paid by Mr. Talwar.
 (b) Find the interest paid by Mr. Talwar in 150th payment.

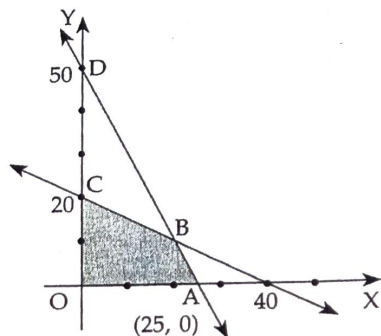
OR

Find the principal paid by Mr. Talwar in 150th payment.

- (c) Find the total interest paid by Mr. Talwar.

[Use $(1.00625)^{240} = 4.4608$, $(1.00625)^{91} = 1.7629$, $(1.00625)^{48} = 1.1187$]

37. The feasible region for an L.P.P is shown in the figure given below:



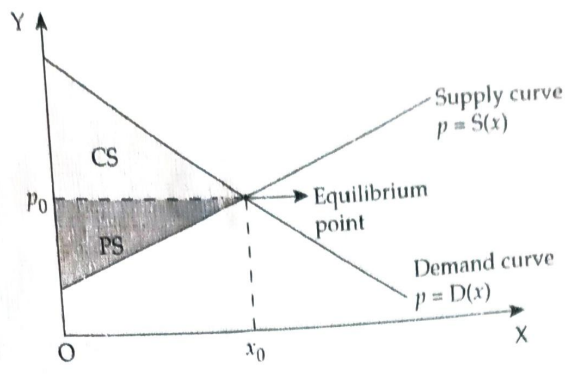
Based on the given information, answer the following questions:

- (a) Find the equation of the line AD.
 (b) Find the equation of the line BC.
 (c) Find the constraints for the L.P.P.

OR

Find the maximum value of the objective function $Z = 3x + 4y$.

38. Consumer surplus and producer surplus



The graph given above showing the demand and supply curves of a mobile phone company are linear. When the price of a mobile phone was Rs. 16000 per unit, Singh mobiles sold 20 units every month and when price dropped to Rs. 10000 per unit, Singh mobiles sold 80 units every month. When the price was Rs. 16,000 per unit, 155 mobiles were available per month for sale and when the price was only Rs. 10000 per unit, 35 mobiles remained

Based on the above information, answer the following questions:

- a) Find the demand function
- b) Find the supply function
- c) Find the consumer surplus at (65, 11500)

OR

Find the producer surplus at (65, 11500)