

END TERM EXAMINATION

FIRST SEMESTER [BBA] NOVEMBER-DECEMBER 2018

Paper Code: BBA-103 Subject: Business Mathematics

Time: 3 Hours Maximum Marks: 75

Note: Attempt any six questions.

- Q1 (a) Use mathematical induction to prove that

$$1^3 + 2^3 + 3^3 + \dots + n^3 = \frac{n^2(n+1)^2}{4}$$
 (6)
- (b) Prove that for any positive integer number n , $n^3 + 2n$ is divisible by 3. (6.5)
- Q2 (a) Let a, b, c be positive integers such that $\frac{b}{a}$ is an integer. If a, b, c are in geometric progression and the arithmetic mean of a, b, c is $b+2$, find the value of $\frac{a^2 + a - 14}{a+1}$. (6)
- (b) Real numbers a_1, a_2, \dots, a_{99} form an arithmetic progression. Suppose that $a_2 + a_3 + a_8 + \dots + a_{98} = 205$. Find the value of $\sum_{k=1}^{99} a_k$. (6.5)
- Q3 (a) If $a + b + c = 0$ and $\begin{vmatrix} a-x & c & b \\ c & b-x & a \\ b & a & c-x \end{vmatrix} = 0$, then show that $x = 0$ or $x = \sqrt{\frac{3}{2}(a^2 + b^2 + c^2)}$. (6)
- (b) Using Cramer's rule solve the following:-
 $2x + y - 2z = 4, \quad x - 2y + z = -2, \quad 5x - 5y + z = -2$. (6.5)
- Q4 (a) Show that the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ satisfies the equation $A^2 - 4A - 5I = 0$ and hence find A^{-1} . (6)
- (b) Solve the following system of linear equations by matrix method (6.5)
 $y + 2z = 4, \quad 2x + x = 5, \quad x + 2y = 7$.
- Q5 (a) If $y = (\sin^{-1} x)^2$, prove that $(1-x^2)y_2 - xy_1 - 2 = 0$. (6)
- (b) If $y = \log(x^e + \operatorname{cosec}^2 x)$ find $\frac{dy}{dx}$. (6.5)
- Q6 (a) An apartment complex has 250 apartments to rent. If they rent x -apartments then their monthly profit, in dollars, is given by $P(x) = -8x^2 + 3200x - 80,000$. How many apartments should they rent in order to maximize their profit. (6)
- (b) Suppose you are running a factory, producing some sort of widget that requires steel as a raw material. Your costs are predominantly

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human labour, which is \$20 per hour for your workers and the steel itself, which runs for \$170 per ton. Suppose your revenue R is loosely modelled by the following equation $R(h, s) = 200h^{2/3}s^{1/3}$, where h represents hours of labour and s represents tons of steel. If your budget is \$20000, what is maximum possible revenue? (6.5)

- Q7 (a) Evaluate $\int_0^{\pi/4} \log(1 + \tan \theta) d\theta$. (6)
- (b) Evaluate $\int x\sqrt{x+x^2} dx$. (6.5)

- Q8 (a) For a certain item the demand curve is $p = D(q) = \frac{20}{q+1}$ and the supply curve is Evaluate $p = S(q) = q+2$. Find the consumer and producer surplus. (7)
- (b) Compute the consumer's surplus for the milk demand function Evaluate $D(q) = -0.05Q + 7.75$ dollars per gallon, where Q is the quantity of milk in thousands of gallons. Assume an equilibrium quantity of 95 thousand and an equilibrium price of \$3 per gallon. (5.5)

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