

MAHATMA GANDHI UNIVERSITY, KOTTAYAM
MGU-UGP (HONOURS)
FIRST SEMESTER EXAMINATION
(2024 ADMISION ONWARDS)
MG1DSCMAT100-GROUND ROOTS OF MATHEMATICS

Duration: 2 hrs

Maximum Marks: 70

Students should attempt atleast one question from each course outcome to enhance their overall outcome attainability.

Part A

Answer any five questions. Each question carries 2 marks

1. Define conditional statement $p \rightarrow q$ of two propositions p and q . [K][1]
2. Give an example of a propositional function having two variables. [U][1]
3. Given $f(x) = \sqrt{x}$ and $g(x) = \sqrt{1-x}$, find $\frac{f}{g}$ and write the domain. [U][2]
4. Define odd functions. Give an example. [A][2]
5. Find $\frac{dy}{dx}$, if $y = 5x^2 + 4x + 5$. [A][4]
6. Differentiate $f(x) = x - \frac{1}{x}$. [E][4]
7. Check whether the following limits are of indeterminate form or not.
 - (a) $\lim_{x \rightarrow 0^+} x \ln x$. [An][6]
 - (b) $\lim_{x \rightarrow +\infty} \sqrt{x}(1-x^2)$. [An][6]
8. Find $\lim_{x \rightarrow +\infty} \frac{x}{e^x}$. [A][6]

Part B

Answer any five questions. Each question carries 6 marks

9. Explain universal quantifier, existential quantifier and the uniqueness quantifier with examples. [K][1]
10. Show that $\neg p \rightarrow (q \rightarrow r)$ and $q \rightarrow (p \vee r)$ are logically equivalent. [An][1]
11. Find the domain and graph the function $f(x) = 5 - 2x$. [U][2]

12. Verify if $f(x) = x^3 + 1$ and $g(x) = \sqrt[3]{x-1}$ are inverses of each other. [An][3]
13. Find d^2y/dx^2 for $y = \sin x \cos x$. [A][4]
14. Find the derivative of $\cos\left(\frac{x}{x+1}\right)$. [A][4]
15. Find the intervals in which $f(x) = x^2 - 3x + 8$ is increasing and decreasing? [A][5]
16. Find the limit $\lim_{x \rightarrow 1} \frac{x^3 - x^2 + x - 1}{x^3 - x^2}$ using L'Hôpital's rule and check the result by factoring. [A][6]

Part C

Answer any three questions. Each question carries 10 marks

17. (a) Show that $\forall x(P(x) \wedge Q(x))$ and $\forall xP(x) \wedge \forall xQ(x)$ are logically equivalent. [A][1]
- (b) Show that $\forall xP(x) \vee \forall xQ(x)$ and $\forall x(P(x) \vee Q(x))$ are not logically equivalent. [A][1]
18. (a) Define a one-to-one function and state the horizontal line test for one-to-one functions. [An][3]
- (b) Sketch the following functions and determine whether the following functions are one-to-one or not:
 (i) $y = \sqrt{x}$ (ii) $y = x^2$ [An][3]
19. (a) Find the composites $f \circ g$, $g \circ f$, $f \circ f$, and $g \circ g$ and the domain of each of the functions if $f(x) = \sqrt{x}$ and $g(x) = x + 1$. [S][2]
- (b) Given the function $y = x^2$. Write the formula when the graph of the function is shifted up 1 unit and sketch it. [S][2]
20. Use implicit differentiation to find $\frac{dy}{dx}$ if $2(x^2 + y^2)^2 = 25(x^2 - y^2)$ at $(3, 1)$. [A][4]
21. Determine the intervals where the following functions are increasing and decreasing.
- (a) $f(x) = 2x^3 - 24x + 7$. [A][5]
- (b) $f(x) = x^4 - 4x$. [A][5]
22. Identify the type of indeterminate form and evaluate the following limits.
- (a) $\lim_{x \rightarrow +\infty} x \sin \frac{\pi}{x}$ [A][6]
- (b) $\lim_{x \rightarrow \frac{\pi}{2}^-} \sec 3x \cos 5x$. [A][6]

**MAHATMA GANDHI UNIVERSITY,
KOTTAYAM**
MGU-UGP (HONOURS) FIRST SEMESTER EXAMINATION
(2024 ADMISION ONWARDS)
MG1MDCMAT100-MATHEMATICS FOR COMPETITIVE
EXAMINATIONS

Duration: 1 hrs

Maximum Marks: 50

Students should attempt atleast one question from each course outcome to enhance their overall outcome attainability.

Part A

Answer any 10 questions. Each question carries 2 marks

1. Which of the following is a prime number? [E][1]
a)29 b)55 c) 24 d)12

2. The H.C.F. of 513, 1134 and 1215 is [U][1]
a) 81 b) 27 c) 3 d)9

3. Simplify $1200 + 568 \div 8 - 35 = ?$ [U][1]
a)1458 b) 1294 c) 1236 d)1352

4. What is the square root of 0.16? [A][1]
a) 0.04 b)0.0004 c) 0.4 d)0.004

5. Which of the following represents $ab = 36?$. [U][2]
a) $9 : a = 4 : b$ b) $a : 9 = b : 4$ c) $a : 9 = b : 4$ d) $9 : a = b : 4$

6. The third proportional to 4 and 6 is [U][2]
a) 7 b)8 c) 9 d)10

7. 0.2 % can be expressed as the decimal [U][2]
a) 2.0 b) 0.2 c) 0.02 d) 0.002

8. Rakesh purchased a mobile phone for ₹ 5400 and a refrigerator for ₹ 9600. He sold the mobile phone at half of its cost price and the refrigerator at ₹ 7200. What was the total profit/loss? [U][2]
 a) ₹ 5100 b) ₹ 5010 c) ₹ 5210 d) ₹ 5120
9. The ages of two persons differ by 16 years. If 6 years ago, the elder one be three times as old as the younger one, find their present ages of younger one. [E][2]
 a) 18 years b) 16 years c) 14 years d) 12 years
10. At what rate of simple interest, a certain sum will be doubled in 15 years? [A][3]
 a) $7\frac{1}{3}\%$ b) $6\frac{2}{3}\%$ c) $6\frac{1}{3}\%$ d) $7\frac{2}{3}\%$
11. Today is Wednesday. After 89 days, it will be ? [A][3]
 a) Thursday b) Friday c) Monday d) Tuesday
12. Peter and Paul together can complete a piece of work in 10 days and Paul alone in 20 days. In how many days can Peter alone complete the work? [U][4]
 a) 15 b) 10 c) 20 d) 40
13. If A spends 5 hours per day for a work he can complete it in 8 days and if B working the same hours every day can complete in 6 days, how long will they take to do it working together $5\frac{5}{7}$ hours a day? [K][4]
 a) 3 b) 4 c) 7 d) 5
14. A cyclist covers a distance of 750 m in 2 min 30 sec. What is the speed in km / hr of the cyclist? [A][4]
 a) 12 km/hr b) 14 km/hr c) 16 km/hr d) 18 km/hr
15. Find the cost of ₹ 4500, 8.5% stock at 4 premium. [A][4]
 a) ₹ 4680 b) ₹ 4689 c) ₹ 4650 d) ₹ 4646

Part B

Answer any 10 questions. Each question carries 3 marks

16. The L.C.M. of $\frac{3}{4}, \frac{6}{7}, \frac{9}{8}$ is [U][1]
a)3 b) 6 c) 9 d)18
17. If $a = 7, b = 5$, then the value of $a^3 - b^3 + 3a^2b$ is [U][1]
a)218 b) 307 c) 735 d)953
18. Which of the following is equal to 3.14×10^6 [K][1]
a)314 b)3140 c)3140000 d) none of these
19. Which of the following fractions is the smallest? [E][1]
a) $\frac{13}{16}$ b) $\frac{15}{19}$ c) $\frac{17}{21}$ d) $\frac{7}{8}$
20. If m is proportional to n and $m = 5$ when $n = 4$, then what is the value of m if $n = 8$? [E][2]
a) 10 b)12 c) 20 d)25
21. The salary of a person was reduced by 10%. By what percent should his reduced salary be raised so as to bring it at par with his original salary? [U][2]
a) $\frac{1}{9}$ b) $\frac{100}{9}$ c) $\frac{9}{100}$ d) $\frac{10}{9}$
22. 5 out of 2250 parts of earth is sulphur. What is the percentage of sulphur in earth? [A][2]
a) $\frac{11}{50}$ b) $\frac{2}{9}$ c) $\frac{1}{45}$ d) $\frac{2}{45}$
23. The owner of a cellphone charges his customer 23% more than the cost price. If a customer paid ₹ 7011 for a cellphone, then what was the cost price of the cellphone? [U][2]
a) ₹ 5000 b) ₹ 4750 c) ₹ 5700 d) ₹ 4700

24. A man sold two chairs at ₹ 1200 each. On one he gained 20% and on the other he loss 20%. What is his loss or gain in the whole transaction? [U][2]
a) 1% loss b)2% loss c) 4% loss d)2% gain
25. The difference between the ages of two men is 10 years. 15 years ago, the elder one was twice as old as the younger one. The present age of elder man is [A][2]
a) 25 years b) 30 years c) 35 years d) 40 years
26. The compound interest on ₹ 2800 for 18 months at 10% p.a. is [A][3]
a) ₹ 420 b) ₹ 434 c) ₹ 436.75 d) ₹ 441.35
27. A can complete a work in 10 days, B in 12 days and C in 15 days. All of them began working together, but A has to leave the work after 2 days of the start and B, 3 days before completion of work. How many days will the total work last? [U][4]
a)6 b)7 c)5 d) 8
28. A man travelled from the village to the post-office at the rate of 25 kmph and walked back at the rate of 4 kmph. If the whole journey took 5 hours 48 minutes, find the distance of the post-office from the village. [A][4]
a) 20 km b) 25 km c) 30 km d) 35 km
29. A car is driven at the speed of 100 km/hr and stops for 10 minutes at the end of every 150 km. To cover a distance of 1000 km, it will take how many hrs [A][4]
a)9 hours b)10 hours c)11 hours d)12 hours
30. Which is better investment?
7.5% stock at 105 or 6.5% stock at 94. [A][4]
a) 7.5% stock at 105. b) 6.5% stock at 94. c) Both are equally good.
d) Cannot be compared.