

D 130231

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Name.....

Reg. No.....

**FIFTH SEMESTER (CBCSS—U.G.) DEGREE EXAMINATION  
NOVEMBER 2025**

Mathematics/Mathematics and Physics (Double Main)

MTS 5D 01—APPLIED CALCULUS

(2020 Syllabus)

Time : Two Hours

Maximum : 60 Marks

**Part A***Answer any number of questions.**Each question carries 2 marks.**Ceiling is 20.*

1. If  $f(x) = x^2 + 4x - 8$ , find  $f(2)$  and  $f(-2)$ .
2. If  $f(x) = \frac{5}{x-2} + 4(x-2)^3$ , find functions  $g(u)$  and  $h(x)$  such that  $f(x) = g(h(x))$ .
3. Suppose the total cost in dollars of manufacturing  $q$  units of a certain commodity is given by the function  $C(q) = q^3 - 30q^2 + 500q + 200$ .
  - (a) Compute the cost of manufacturing 10 units of the commodity.
  - (b) Compute the cost of manufacturing the 10<sup>th</sup> unit of the commodity.
4. Find the slope of the line joining the points  $(-2, 5)$  and  $(3, -1)$ .
5. Define critical point of a function  $f(x)$ .
6. Find  $x$  such that  $\log_x 27 = 3$ .
7. Find  $\ln \sqrt{e}$ .
8. Find all points of intersection of the graphs of  $f(x) = 3x + 2$  and  $g(x) = x^2$ .

**Turn over**

9. Verify that  $F(x) = \frac{1}{7}x^7 + 5x + 2$  is an antiderivative of  $f(x) = x^6 + 5$ .
10. Find  $\int x^{16} dx$ .
11. Find  $\int_2^5 \alpha dx$ .
12. Find the second derivative of the function  $f(x) = 1.5x^4 + 2x^3 + 4.2x^2 + 2.1x + 10$ .

**Part B**

*Answer any numbers of questions.*

*Each question carries 5 marks.*

*Ceiling is 30.*

13. Find  $\lim_{x \rightarrow 1} \frac{x^2 - 1}{x^2 - 3x + 2}$ .
14. The gross domestic product (GDP) of a certain country was  $N(t) = t^2 + 5t + 106$  billion dollars  $t$  years after 1998.
- (a) At what rate was the GDP changing with respect to time in 2008 ?
- (b) At what percentage rate was the GDP changing with respect to time in 2008 ?
15. A manufacturer determines that  $t$  months after a new product is introduced to the market,  $x(t) = t^2 + 3t$  hundred units can be produced and then sold at a price of  $p(t) = -2t^{3/2} + 30$  dollars per unit.
- (a) Express the revenue  $R(t)$  for this product as a function of time.
- (b) At what rate is revenue changing with respect to time after 4 months ? Is revenue increasing or decreasing at this time ?
16. Find all inflection points of the function  $f(x) = 3x^5 - 5x^4 - 1$ .
17. Find  $\int x^3 e^{x^4+2} dx$ .

18. Sketch the graphs of  $y = 2^x$  and  $y = \left(\frac{1}{2}\right)^x$ .

19. Evaluate  $\int_{\frac{1}{4}}^2 \frac{\ln x}{x} dx$ .

### Part C

*Answer any **one** question.*

*The question carries 10 marks.*

20. The manager of a company determines that when  $q$  hundred units of a particular commodity are produced, the total cost of production is  $C$  thousand dollars, where  $C^2 - 3q^3 = 4275$ . When 1,500 units are being produced, the level of production is increasing at the rate of 20 units per week. What is the total cost at this time and at what rate is it changing?
21. Determine where the function  $f(x) = 3x^4 - 2x^3 - 12x^2 + 18x + 15$  is increasing and decreasing, and where its graph is concave up and concave down. Find all relative extrema and points of inflection and sketch the graph.

(1 × 10 = 10 marks)

D 110213

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Name.....

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**FIFTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION  
NOVEMBER 2024**

Mathematics

MTS 5D 01—APPLIED CALCULUS

(2020 Admission onwards)

Time : Two Hours

Maximum : 60 Marks

**Section A***Answer any number of questions.**Each question carries 2 marks.**Ceiling is 20.*

1. Find the domain and range of the function  $f(x) = \frac{1}{x-3}$ .
2. Find all points of intersection of the graphs of  $f(x) = x^2$  and  $g(x) = 5x - 6$ .
3. Find the slope of the line joining the points  $(-2, 5)$  and  $(3, -1)$ .
4. Differentiate the polynomial  $y = 5x^3 - 4x^2 + 12x - 8$ .
5. Find  $\lim_{x \rightarrow 1} \frac{x^2 - 1}{x - 1}$ .
6. State Fundamental Theorem of Calculus.
7. Solve for  $x : \log_{64} 16 = x$ .
8. Expand  $\log_2 \frac{y^5}{x^2}$ .
9. Find  $\int e^{-3x} dx$ .

**Turn over**

10. Find  $\ln \sqrt{ab}$  if  $\ln a = 3$  and  $\ln b = 7$ .
11. Find the second derivative of  $y = 2x^3 - 5x^2 + 2x + 1$ .
12. Verify that  $F(x) = \frac{1}{3}x^3 + 5x + 2$  is an antiderivative of  $x^2 + 5$ .

**Section B**

*Answer any number of questions.*

*Each questions carries 5 marks.*

*Ceiling is 30.*

13. Market research indicates that consumers will buy  $x$  thousand units of a particular kind of coffee maker when the unit price is  $p(x) = -0.27x + 51$  dollars. The cost of producing the  $x$  thousand units is  $C(x) = 2.23x^2 + 3.5x + 85$  thousand dollars. Find the revenue and profit functions,  $R(x)$  and  $P(x)$ , for this production process.

14. For what value of the constant  $A$  is the following function

$$f(x) = \begin{cases} Ax + 5, & x < 1, \\ x^2 - 3x + 4, & x \geq 1, \end{cases} \text{ continuous for all real } x?$$

15. Find the fifth derivative of  $f(x) = \frac{1}{x}$ .

16. Determine intervals of concavity for the function  $f(x) = 2x^6 - 5x^4 + 7x - 3$ .

17. Find the function  $f(x)$  whose tangent has slope  $3x^2 + 1$  for each value of  $x$  and whose graph passes through the point  $(2, 6)$ .

18. Evaluate  $\int_{\frac{1}{4}}^2 \frac{\ln x}{x} dx$ .

19. Find the area of the region enclosed by the line  $y = 4x$  and the curve  $y = x^3 + 3x^2$ .

**Section C**

*Answer any **one** question.  
The questions carries 10 marks.*

20. Find :

(a)  $\lim_{x \rightarrow \infty} \frac{x^2}{2x^2 + x + 1}$ .

(b)  $\lim_{x \rightarrow 1} \frac{x^2 - 4x - 5}{x^2 + 4x + 3}$ .

21. Evaluate :

(a)  $\int e^{5x+2} dx$ .

(b)  $\int_0^1 8x(x^2 + 1)^3 dx$ .

(1 × 10 = 10 marks)

D 50670

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Name.....

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**FIFTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION  
NOVEMBER 2023**

Mathematics

MTS 5D 01—APPLIED CALCULUS

(2020 Admission onwards)

Time : Two Hours

Maximum : 60 Marks

**Section A***Answer any number of questions.**Each question carries 2 marks.**Ceiling is 20.*

1. If  $f(x) = 3x^2 + 5x - 2$ , find  $f(0)$  and  $f(-2)$ .
2. Find the distance between the points P  $(-2, 5)$  and Q  $(4, -1)$ .
3. Find  $\lim_{x \rightarrow 1} \frac{(3x^3 - 8)}{x - 2}$ .
4. If the position at time  $t$  of an object moving along a line is given by :  
 $s(t) = t^3 - 6t^2 + 9t + 5$  at a time  $t$ , find its velocity and acceleration.
5. Solve for  $x$  :  $\log_{27} x = 3$ .
6. Expand  $\log_3 (x^3 y^{-4})$ .
7. Find  $\int x^{12} dx$ .
8. Find the equation of the line that passes through the point  $(5, 1)$  with slope  $\frac{1}{2}$ .
9. Evaluate  $5^{\frac{1}{3}} \cdot 2^{\frac{1}{3}}$ .
10. Find  $\ln \sqrt{e}$ .

**Turn over**

11. Find  $x$  if  $2^x = e^3$ .
12. Find the second derivative of  $y = x^2(3x + 1)$ .

**Section B**

*Answer any number of questions.*

*Each questions carries 5 marks.*

*Ceiling is 30.*

13. Find  $f\left(-\frac{1}{2}\right)$ ,  $f(1)$  and  $f(2)$  if  $f(x) = \begin{cases} \frac{1}{x-1}, & x < 1 \\ 3x^2 + 1, & x \geq 1 \end{cases}$ .

14. Find the slope and  $y$  intercept of the line  $3y + 2x = 6$  and draw the graph.
15. Find :

(a)  $\lim_{x \rightarrow \infty} \frac{2x^2 + 3x + 1}{3x^2 - 5x + 2}$ .

(b)  $\lim_{x \rightarrow 1} \frac{\sqrt{x} - 1}{x - 1}$ .

16. Find the derivative of  $f(x) = x^3$ , and then use it to find the slope of the tangent line to the curve  $y = x^3$ , at the point where  $x = -1$ . What is the equation of the tangent line at this point ?
17. Use chain rule to find  $\frac{dy}{dx}$  where  $y = \frac{u}{u+1}$  and  $u = 3x^2 - 1$ .

18. Find the intervals of increase and decrease for the function  $f(x) = \frac{x^2}{x-2}$ .

19. Find the absolute maximum and absolute minimum of the function

$$f(x) = 2x^3 + 3x^2 - 12x - 7.$$

**Section C**

*Answer any **one** question.*

*The questions carries 10 marks.*

20. For the curve  $y = (2x + 1)(2x^2 - x - 1)$ ,

- (a) Find the derivative of  $y$ .
- (b) Find an equation for the tangent line to the curve at the point where  $x = 1$ .
- (c) Find all points on the curve where the tangent line is horizontal.

21. The highway department is planning to build a picnic park for motorists along a major highway. The park is to be rectangular with an area of 5,000 square yards and is to be fenced off on the three sides not adjacent to the highway. What is the least amount of fencing required for this job? How long and wide should the park be for the fencing to be minimized?

(1 × 10 = 10 marks)

D 30573

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Name.....

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**FIFTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION  
NOVEMBER 2022**

Mathematics

MTS 5D 01—APPLIED CALCULUS

(2020 Admission onwards)

Time : Two Hours

Maximum : 60 Marks

**Section A***Answer any number of questions.**Each question carries 2 marks. Ceiling is 20.*

1. If  $f(x) = 2x^2 - 3x + 1$ , find  $f(x - 2)$ .
2. Plot the points  $(4, 3)$ ,  $(-2, 7)$ ,  $(5, -1)$  and  $(-1, -8)$  in a rectangular co-ordinate plane.
3. Find  $\lim_{x \rightarrow -1} (3x^3 - 4x + 8)$ .
4. Differentiate the polynomial  $y = x^6 - 3x^4 + 12x^2 - 8x + 5$ .
5. Find the second derivative of  $y = 2x^3 - 3x^2 + 12x - 8$ .
6. Use logarithmic rules to expand  $\log_2 \left( \frac{y^3}{x^5} \right)$ .
7. Solve for  $x : 3 = e^{20x}$ .
8. Find  $\int (3x^2 + 2x + 1) dx$ .
9. Use the fundamental theorem of calculus to find the area of the region under the line  $y = 2x + 1$  over the interval  $1 \leq x \leq 3$ .

**Turn over**

10. Find  $\int_0^1 (4x^3 + 4) dx$ .
11. Show that  $\ln \frac{1}{x} = -\ln x$ .
12. If  $f(x) = 5^{x^2 + 2x}$ , find all values of  $x$  such that  $f(x) = 125$ .

**Section B**

*Answer any number of questions.  
Each question carries 5 marks. Ceiling is 30.*

13. If  $f(x) = x^2 + 3x + 1$  and  $g(x) = x + 1$ , find  $f(g(x))$  and  $g(f(x))$ .
14. Graph the function  $f(x) = x^2$ .
15. Find :
- (i)  $\lim_{x \rightarrow +\infty} \frac{(-x^3 + 2x + 1)}{x - 3}$  ; and
- (ii)  $\lim_{x \rightarrow -2} \frac{(x^2 - x - 6)}{x^2 + 3x + 2}$ .
16. Verify the power rule for the function  $F(x) = \frac{1}{x^2} = x^{-2}$  by showing that its derivative is
- $$F'(x) = -2x^{-3}.$$
17. Find  $\frac{dy}{dx}$  if  $x^2y + y^2 = x^3$ .
18. Find all inflection points of  $f(x) = 3x^5 - 5x^4 - 1$ .
19. Evaluate  $\int_0^1 8x(x^2 + 1)^3 dx$ .

**Section C**

*Answer any **one** question.  
The question carries 10 marks.*

20. Sketch the graph of the function  $f(x) = \frac{x}{(x+1)^2}$ .

21. Suppose \$1,000 is invested at an annual interest rate of 6%. Compute the balance after 10 years if the interest is compounded :

- a) Quarterly ;
- b) Monthly ;
- c) Daily ; and
- d) Continuously.

(1 × 10 = 10 marks)

D 30564

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Name.....

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**FIFTH SEMESTER (CBCSS-UG) DEGREE EXAMINATION  
NOVEMBER 2022**

Mathematics

MTS 5D 01—APPLIED CALCULUS

(2019 Admission only)

Time : Two Hours

Maximum : 60 Marks

**Section A**

*All questions can be answered.*

*Each question carries 2 marks.*

*Ceiling is 20.*

1. Find  $f\left(\frac{-1}{2}\right)$  and  $f(2) = \frac{1}{x-1}, x < 1$   
 $= 3x^2 + 1, x \geq 1.$
2. Find the domain and range of  $g(t) = \sqrt{t-2}.$
3. Find all points of intersection of the graphs of  $f(x) = 3x + 2$  and  $g(x) = x^2.$
4. Find the equation of the line that passes through the point (5,1) with slope  $\frac{1}{2}.$
5. Show that the polynomial  $p(x) = 3x^3 - x + 5$  is continuous at  $x = 1.$
6. If  $s(t) = t^2 - 2t + 6$  for  $0 \leq t \leq 2$  is the position of a particle moving along a straight line at time  $t,$  find velocity.
7. Solve for  $x$  if  $\log_4 x = \frac{1}{2}.$
8. Differentiate  $\frac{1}{\sqrt{5-3x}}.$

**Turn over**

9. Find the intervals of increase of the function  $f(x) = x^2 - 2x + 3$ .
10. Evaluate  $5^{\frac{1}{3}} 2^{\frac{1}{3}}$ .
11. Differentiate  $f(x) = 5^{2x-3}$ .
12. Find  $f(x-1)$ , if  $f(x) = 3x^2 + \frac{1}{x} + 5$ .

**Section B**

*All questions can be answered.*

*Each question carries 5 marks.*

*Ceiling is 30.*

13. Find  $\lim_{x \rightarrow 1} \frac{-x^3 + 2x + 1}{x - 3}$ .
14. Differentiate the quotient  $\frac{x^2 - 5x + 7}{2x}$ .
15. Find the fifth derivative of  $f(x) = 4x^3 + 5x^2 + 6x - 1$ .
16. Find  $\int 8x(4x^2 - 3)^5 dx$ .
17. Find all real numbers  $x$  that satisfy the equation  $2^{3-x} = 4^x$ .
18. Find all points on the graph of the function  $f(x) = (x+1)(x^2 - x - 2)$  where the tangent line is horizontal.
19. Find the slope and y-intercept of the line  $3y + 2x = 6$  and draw the graph.

**Section C**

*Answer any **one** question.  
Each question carries 10 marks.*

20. Graph the function  $f(x) = 2x$ , if  $0 \leq x < 1$   
 $= \frac{2}{x}$ , if  $1 \leq x < 4$   
 $= 3$ , if  $x \geq 4$ .

21. Find all critical numbers of the function  $f(x) = 2x^4 - 4x^2 + 3$  and classify each critical point as a relative maximum, a relative minimum or neither.

(1 × 10 = 10 marks)

D 10671

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Name.....

Reg. No.....

## FIFTH SEMESTER U.G. DEGREE EXAMINATION, NOVEMBER 2021

(CBCSS—UG)

Mathematics

MTS 5D 01—APPLIED CALCULUS

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

## Section A

*Answer at least **eight** questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. If  $g(t) = (t-2)^{\frac{1}{2}}$ , find  $g(27)$  and  $g(5)$ ?
2. Find the domain and range of  $f(x) = \frac{1}{x-3}$ .
3. Find  $f(g(x))$  where  $f(u) = u^2 + 3u + 1$  and  $g(x) = x + 1$ .
4. Find the distance between the points P(-2, 5) and Q(4, -1).
5. State vertical line test.
6. What is slope of (a) X-axis ; and (b) Y- axis.
7. Find the equation of the line that passes through the points (3, -2) and (1, 6).
8. Find  $\lim_{x \rightarrow 1} \frac{x^3 - 8}{x - 2}$ .
9. Differentiate the polynomial  $y = 5x^3 - 4x^2 + 12x - 8$ .

Turn over

10. Find all critical numbers of the function  $f(x) = 2x^4 - 4x^2 + 3$ .
11. Find all real numbers  $x$  that satisfy the given equation  $4^{2x-1} = 16$ .
12. Evaluate  $\log_2 32$ .

(8 × 3 = 24 marks)

### Section B

Answer at least **five** questions.

Each question carries 5 marks.

All questions can be attended.

Overall Ceiling 25.

13. Find :

(a)  $\lim_{x \rightarrow \infty} \frac{2x^2 + 3x + 1}{3x^2 - 5x + 2}$ .

(b)  $\lim_{x \rightarrow 1} \frac{x^2 - 1}{x^2 - 3x + 2}$ .

14. For the function  $f(x) = 1 - x^2, 0 \leq x < 2$   
 $= 2x + 1, x \geq 2$ .

evaluate the one sided limits  $\lim_{x \rightarrow 2^-} f(x)$  and  $\lim_{x \rightarrow 2^+} f(x)$ .

15. Find the equation of the tangent line to the curve  $y = \sqrt{x}$  at the point where  $x = 4$ .
16. Find the intervals of increase and decrease for the function  $x^2 - 4x + 5$ .
17. If  $f(x) = 5^{x^2 + 2x}$  find all values of  $x$  such that  $f(x) = 125$ .

18. Discuss the continuity of the function  $f(x) = \frac{x+2}{x-3}$  on  $-2 < x < 3$  and on the closed interval  $-2 \leq x \leq 3$ .
19. The Gross Domestic Product (GDP) of a certain country was  $N(t) = t^2 + 5t + 106$  billion dollars  $t$  years after 1998 :
- At what rate was the GDP changing with respect to time in 2008.
  - At what percentage rate was the GDP changing with respect to time in 2008.

(5 × 5 = 25 marks)

### Section C

*Answer any **one** question.*

*The question carries 11 marks.*

20. Graph the function  $f(x) = -x^2 + x + 2$ . Include all  $x$  and  $y$  intercepts.
21. A manufacturer's total cost consists of a fixed overhead of \$200 plus production cost of \$50 per unit. Explore the total cost as a function of the number of units produced and draw graph.

(1 × 11 = 11 marks)