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Name..................................

Reg. No..............................

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2010

(CCSS)

MM 1C 01—MATHEMATICS

Time : Three Hours

Maximum Weightage : 30

Part A (Objective Type Questions)

Answer all **twelve** *questions.*
Each bunch of four questions carries Weight.

1. Evaluate $\lim_{x \to -5} \frac{y^2}{5-y}$.

2. Find $\lim_{x \to 1} \frac{1-\sqrt{x}}{1-x}$.

3. Determine $\lim_{x \to 1^+} \sqrt{\frac{x-1}{x+2}}$.

4. Find the point of discontinuity of the function $y = \frac{x+2}{\cos x}$.

(4 × ¼ = 1 weight)

5. Find the slope of the curve $f(x) = \frac{x}{x-2}$ at $(3, 3)$.

6. Determine the point(s) at which the curve $y = x^3 + \frac{4}{3}x^2 - 5x + 1$ has horizontal tangents.

7. Find the derivative of $y = \left(x^2+1\right)\left(x^3+2\right)$.

8. State the quotient rule of differentiation.

(4 × ¼ = 1 weight)

9. Find the absolute maximum of $y = x^2$ in [0, 2].

10. Where does the function $y = \sec x$ have vertical asymptotes ?

11. Evaluate $\Sigma_{k=1}^{1} \frac{k-1}{k}$.

12. Find the average value of $f(x) = 4 - x^2$ on [0, 3].

(4 × ¼ = 1 weight)

Turn over

Short Answer Type Questions

Answer all **nine** *questions.*
Each question carries 1 weight.

13. Find the average rate of change of the function $f(x) = x^3 + 1$ in the interval [2, 3].

14. If $1 - \frac{x^2}{4} \le u(x) \le 1 + \frac{x^2}{2}$ for all $x \ne 0$, find $\lim_{x \to 0} u(x)$.

15. Show that $\lim_{x \to a} k = k$.

16. Check the continuity of the function $f(x) = |x|$ in R.

17. Find the second order derivative of $y = \frac{(x-1)(x^2 - 2x)}{x^4}$.

18. Check whether the function $f(x) = \sqrt{x(x-1)}$ satisfy the hypotheses of Mean Value Theo… in [0, 1].

19. Find the critical points of $f(x) = x^{1/3}(x-4)$.

20. Determine the interval on which the function $f(x) - x^3 + 12x + 5, x \varepsilon [-3, 3]$ is increasing.

21. Find the area of the region between the curve $y = 3x^2$ and the x-axis on the interval $[0, b]$.

(9 × 1 = 9 weig…

Short Essay Questions

Answer any **five** *questions.*
Each question carries 2 *weights.*

22. At seconds after lift-off, the height of a rocket is $3t^2$ ft. How fast is the rocket climbing a… 10 sec. ?

23. Can $\lim_{x \to c} f(x)/g(x)$ exist even if $\lim_{x \to c} f(x) = 0$ and $\lim_{x \to c} g(x) = 0$? Give reasons for your ans…

24. Explain why the function $f(x) = \sin\left(\frac{1}{x}\right)$ has no continuous extension to $x = 0$.

25. Find $\frac{dy}{dx}$, if $y = 2x^3$ using the definition of derivatives.

26. The curves $y = x^2 + ax + b$ and $y = cx - x^2$ have a common tangent line the point (1, 0). Find … and c.

27. Suppose the derivative of the function $y = f(x)$ is $y' = (x-1)^2 (x-2)(x-4)$. What points, if … does the graph of f have a local minimum, local maximum, or point of inflection ?

28. Find the volume of the solid generated by revolving the region bounded by $y = \sqrt{x}$ and the lines $y = 1$, $x = 4$ about the line $y = 1$.

(5 × 2 = 10 weights)

Essay Questions

Answer any **two** *questions.*
Each question carries 4 weights.

29. Graph the function

$$f(x) = \begin{cases} \sqrt{1-x^2} & \text{if } 0 \le x \le 1 \\ 1 & \text{if } 1 \le x \le 2. \\ 2 & \text{if } \quad x = 2 \end{cases}$$

(a) What are the domain and range of f ?

(b) At what points c, if any, does $\lim\limits_{x \to c} f(c)$ exist ?

(c) At what points does only the left-hand limit exist ?

(d) At what points does only the right-hand limit exist ?

(e) At what points does the function is continuous ?

30. The first derivative of a continuous function $y = f(x)$ is $y' = \left(x^2 - 2x\right)(x-5)^2$. Find y″ and sketch the general shape of the graph of f.

(a) What are the critical points of f ?

(b) On what intervals is f increasing or decreasing ?

(c) At what points, if any, does f assume local maximum and minimum values ?

(d) What are the points of inflexion of f ?

31. Find :

(a) The length of the curve $y = \left(x/2\right)^{2/3}$ from $x = 0$ to $x = 2$.

(b) The area of the surface generated by revolving the curve $y = x^3, 0 \le x \le 1/2$, about the x-axis.

(c) The volume of the solid generated by revolving the region bounded by the curves $x = \sqrt{y}, x = -y, y = 2$.

(2 × 4 = 8 weights)