

Q1. $\lim_{x \rightarrow 2^+} \frac{x-2}{|x-2|} =$

- (a) $+\infty$
- (b) -1
- (c) 1
- (d) -10
- (e) $-\infty$

Q2. Find the value of k for which $f(x) = \begin{cases} x^2 - 1, & \text{if } x \leq 1; \\ x^3 - k, & \text{if } x > 1; \end{cases}$ is continuous

- (a) -3
- (b) -10
- (c) 1
- (d) -1
- (e) 3

Q3. Find all points on the curve $y = \frac{1}{3}x^3 - 3x + 14$ where the slope is 1.

- (a) $x = 3$
- (b) $x = 2$
- (c) $x = -2$
- (d) $x = \pm 1$
- (e) $x = \pm 2$

Q4. Sociologists studied the relation between income and number of years of education for members of a particular urban group. They found that a person with x years of education before seeking regular employment can expect to receive an average yearly income of y Saudi riyals per year, where $y = 5x^{5/2} + 5900$, for $4 \leq x \leq 16$. Find the rate of change of income with respect to number of years of education and evaluate it when $x = 9$.

- (a) $16/25$
- (b) $25/16$
- (c) $\frac{(25)(27)}{2}$
- (d) 135
- (e) 65.5

Q5. If $y = 2^x x^3$ then y' is

- (a) $2^x x^3 (x \ln 2 + 3)$
- (b) $2^x x^2 (x \ln 2^x + 3)$
- (c) $2^x x^2 (\ln 2^x + 3)$
- (d) $2^x x^3 (x \ln 2 - 3)$
- (e) $2^x x^2 (x \ln 2 - 3)$

Q6. If the total cost function for a manufacturer is given by

$$c = 5000 + \frac{5q^2}{q+3}$$

then the marginal cost function is

- (a) $\frac{5(1+6q^2)}{(q+3)^2}$
- (b) $\frac{5q(1+6q^2)}{(q+3)}$
- (c) $\frac{5(1+6q^2)}{(q+3)}$
- (d) $\frac{5q(1+6q)}{(q+3)^2}$
- (e) $10q$

Q7. If $y = \log_3(6x - 11)$, find $y'(1)$.

- (a) $6/\log 3$
- (b) $6/\ln 3$
- (c) $\ln 3^6$
- (d) $\log 3^6$
- (e) $\ln(1/3^6)$

Q8. Suppose a country's savings, S (in billions of dollars) is related to its national income I (in billions of dollars) by the equation $S = \ln \frac{3}{2 + e^{-I}}$ then its marginal propensity to consume as a function of income is

- (a) $\frac{1}{2 + e^{-I}}$
- (b) $\frac{e^I}{2 + e^{-I}}$
- (c) $\frac{e}{2 + e^I}$
- (d) $\frac{e^I}{2 + e^I}$
- (e) $\frac{2}{2 + e^{-I}}$

Q9. Find the slope of the curve $(x^2 + y^2)^3 = 16y^2$ at the point $(0, 2)$.

- (a) 0
- (b) -1
- (c) 2
- (d) -2
- (e) 1

Q10. Find the Horizontal Asymptotes of $f(x) = \frac{x^3}{x^2 - 9}$

- (a) $x = 3, x = -3$
- (b) *No Horizontal Asymptote*
- (c) $x = -1/2$
- (d) $y = 1$
- (e) $y = 1, x = 0$

Q11. If $p = 1000 - 45q - q^2$ is the demand equation, how fast is marginal revenue changing when $q = 10$?

- (a) 120
- (b) -807
- (c) 807
- (d) -150
- (e) 200

Q12. If $e^y = y^2 e^x$ then (in terms of y only) y' is
[Hint: substitute e^y for $y^2 e^x$; and e^y/y for ye^x whenever possible.]

- (a) $\frac{2y}{y-2}$
- (b) $\frac{y}{2y-2}$
- (c) $\frac{y}{y-2}$
- (d) $\frac{y}{y-1}$
- (e) $\frac{2y}{y-1}$

Q13. Find the absolute maximum of $f(x) = \frac{-x}{x^2+1}$ on $[0, 2]$

- (a) 0
- (b) $-2/5$
- (c) $2/5$
- (d) $-1/2$
- (e) 1

Q14. If $y = \frac{x^5}{100} - \frac{x^4}{20}$ then y' is increasing on

- (a) $(-\infty, 3)$
- (b) $(-\infty, 0)$
- (c) $(4, +\infty)$
- (d) $(3, +\infty)$
- (e) *None of the above*

Q15. The area bounded by the curves given in the figure is

- (a) $17/6$
- (b) $-5/6$
- (c) 2
- (d) -2
- (e) $13/6$

Q16. A manufacturer finds that the total cost c of producing a product is given by the cost function $c = 0.05q^2 + 5q + 500$. At what level of output will average cost per unit be a minimum?

- (a) 250
- (b) -150
- (c) 200
- (d) -250
- (e) 100

17. $\int 12x\sqrt{1-3x^2} dx =$

- (a) $\frac{2}{3}(\sqrt{1-3x^2})^3 + C$
- (b) $\frac{4}{3}(\sqrt{1-3x^2})^3 + C$
- (c) $\frac{-4}{6}(\sqrt{1-3x^2})^3 + C$
- (d) $\frac{-2}{3}(\sqrt{1-3x^2})^3 + C$
- (e) $\frac{-4}{3}(\sqrt{1-3x^2})^3 + C$

Q18. $\int \frac{3^x}{\ln x} dx =$

- (a) $3^{\ln x} \ln 3 + C$
- (b) $\frac{3^{\ln x}}{3} + C$
- (c) $\frac{3^{\ln x}}{3 \ln x} + C$
- (d) $\frac{3^{\ln x}}{\ln 3} + C$
- (e) None of the above

Section B. Show all steps of your solution.

Q19. Find the definite integral of $x^2 \sec^2(x^3 - 1)$ from $x = \sqrt[3]{\frac{p}{4}} - 1$ to $x = 1$. [13 pts]

Q20. If $z = \cos^2(x^2 + y^2)$ show that $y \frac{\partial z}{\partial x} - x \frac{\partial z}{\partial y} = 0$. [13 pts]

Q21. If $z = \frac{x^2 + y^2}{\ln x}$, find $\frac{\partial z}{\partial x}$ when $(x, y) = (e, 0)$.

[14 pts]

Q22. Find $\int 2x \cos(2x - 3) dx$.

[14 pts]

Scratch Paper. PLEASE DO NOT REMOVE.