Chapter one

Short Questions:

1. Prove the identity $\cosh^2 x + \sinh^2 x = \cosh 2x$ (2016)(Example 2 p.g 9)

2. Define explicit and Implicit function. (2019)

Explicit function "If y is easily expressed in term of the independent variable x , then y is called an explicit function of x. for example: $y = x^2 + 2x - 1$, $y = \sqrt{x-1}$" Symbolically it is written as f(x)=y

Implicit function "If x and y are so mixed up and y cannot be expressed in term of independent variable x, then y is called implicit function of x.For example $x^2 + xy + y^2 = 2$ and $\frac{xy^2 - y + 9}{xy}$ are implicit function of x and y. Symbolically it is written as f(x,y)=0

3. Determine whether the function f(x) = $x\sqrt{x^2+5}$ is even or odd. (2019)(E.x#1.1 Q9 iii)

4. Express the volume V of a cube as a function of area A of its base**.** (E.x#1.1 Q3 c)

5. Express the Area A of a circle as a function of its circumference.(2017) (E.x#1.1 Q3 b)

6. Find $\frac{f(a+h) - f(a)}{h}$ and simplify where f(x)=sinx. (2015) (E.x#1.1 Q2 ii)

7. Determine the function is even or odd if f (x) = $x^{\frac{2}{3}} + 6$. (2015) (E.x#1.1 Q9 v)

8. Find the Domain and Range of the function F(x) = $\frac{x^2-16}{x-4}$ $x \neq 4$. (E.x#1.1 Q4 viii)

9. Define Continuous function.

Continuous function " A function f is said to be continuous at a number iff the following three conditions are satisfied:

i) f(c) is defined ii) $\lim_{x \to c}$ f(x) exists iii) $\lim_{x \to c}$ f(x) = f(c) "

10. Prove that sinh2x = 2 sin h x coshx. (E.x#1.1 Q8 i)

11. Find Domain and Range of the given function f(x) = $|x-3|$.(E.x#1.1 Q4 iv)

12. Define Even and odd function with example.

Even Function: "A function f is said to be even if f(-x) = f(x) for every number x in the domain of f.

For example: f(x) = x^2 here f(-x) = $(-x)^2 = x^2$ = f(x) "

Odd Function: "A function f is said to be odd if f(-x) = -f(x) for every number x in the domain of f.

For example: f(x) = x^3 here f(-x) = $(-x)^3 = -x^3$ = f(x) "

13. If f(x)= $\sqrt{x+1}$ and g(x)= $\frac{1}{x^2}$ find gof(x) . (2017)(E.x 1.2 Q1 iii)

14. If $f(x) = (-x + 9)^3$ then verify that $f^{-1}(f(x)) = x$. (2015) (2017) (E.x 1.2 Q2 iii)

15. Evaluate $\lim_{\theta \to 0} \frac{1-\cos\theta}{\theta}$ (2017)(Example 7 p.g 26)

16. Prove that $\lim_{x \to 0} \frac{\sqrt{x+a}-\sqrt{a}}{x} = \frac{1}{2\sqrt{a}}$ (2019)(pg#20 1.5.2)

17. Prove that: $\lim_{x \to 0} \frac{a^x - 1}{x} = \log_e a$. (pg#23 1.5.6)

18. Evaluate $\lim_{h \to 0} \frac{\sqrt{x+h}-\sqrt{x}}{h}$. (2012) (E.x 1.3 Q2 viii)

19. Evaluate $\lim_{\theta \to 0} \frac{\tan\theta - \sin\theta}{\sin^3\theta}$ (2012) (E.x 1.3 Q3 xii)

20. Evaluate $\lim_{x \to 0} \frac{1-\cos x}{\sin^2 x}$ (2017)(E.x 1.3 Q3 viii)

21. Express each limit in term of e, $\lim_{n \to \infty} \left(1 - \frac{1}{n}\right)^n$.(2014) (E.x 1.3 Q4 iii)

22. Express each limit in term of e, $\lim_{n \to \infty} \left(1 + \frac{4}{n}\right)^n$ (2014) (E.x 1.3 Q4 v)

23. Evaluate $\lim_{n \to \infty} \left(\frac{x}{1+x}\right)^x$ in term of e. (E.x 1.3 Q4 iv)

24. Evaluate $\lim_{x \to 0} \frac{e^{\frac{1}{x}} - 1}{e^{\frac{1}{x}} + 1}$ where x >0 . (E.x 1.3 Q4 xi)

25. Evaluate $\lim_{\theta \to 0} \frac{\sin^2\theta}{\theta}$. (E.x 1.3 Q3 ix)

26. Evaluate $\lim_{x \to 0} \frac{\sin x^\circ}{x}$. (E.x 1.3 Q3 ii)

27. Evaluate $\lim_{x \to \pi} \frac{\sin x}{\pi - x}$. (E.x 1.3 Q3 iv)

Long Question:

28. Prove that $\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$ = e .(2014,2017)(pg 23 1.5.5)

29. Let $f(x)=\frac{2x+1}{x-1}$; $x\neq 1$, *find* $f^{-1}(x)$ *and verify that* $fof^{-1}(x)=x$ (2016)(E.x #1.2 Q.2 iv)

30. Evaluate the following $\lim_{\theta\to 0}\frac{1-\cos p\theta}{1-\cos q\theta}$. (2016)(E.x 1.3 Q3 iv)

31. Evaluate $\lim_{x\to 0}\frac{\sin ax}{\sin bx}$.(2015,2017) (E.x 1.3 Q3 v)

32. Discuss the continuity of function f(x)= $\begin{cases}\frac{x^2-9}{x-3} & if \quad x\neq 3\\ 6 \quad if & x=3\end{cases}$ at x=3 (2016)(Example #4 p.g 30)

33. If F(x) = $\begin{cases}x-1 & if \quad x<3\\ 2x+1 \quad if & x\geq 3\end{cases}$ discuss continuity at x=3 (2016)(Example 5 p.g30)

34. If f(x) = $\begin{cases}3x-1 & if \quad x<1\\ 4 & if \quad x=1\\ 2x & if \quad x>1\end{cases}$ Discuss the continuity of f(x) at x = 1. (E.x 1.4 Q2 ii)

35. If F(x) = $\begin{cases}3x & if \quad x\leq -2\\ x^2-1 & if \quad -2<x<2\\ 3 & if \quad x\geq 2\end{cases}$ discuss continuity at x=2 and x=-2. (2013)(E.x 1.4 Q3)

36. If F(x) = $\begin{cases}mx & if \quad x<3\\ n & if \quad x=3\\ -2x+9 & if \quad x>2\end{cases}$ discuss continuity at x=2 (2015)(E.x 1.4 Q4)

37. If F(x) = $\begin{cases}\frac{\sqrt{2x+5}-\sqrt{x+7}}{x-2} & if \quad x\neq 2\\ k & if \quad x=2\end{cases}$

find the value of K if function is continues.(2014) (E.x 1.4 Q6)

Questions Bank
Mathematics Part II
Chapter 1

A. MCQs.

1. $2\ sinhx =$
   - a. $e^x + e^{-x}$
   - b. $e^x - e^{-x}$
   - c. $\frac{e^x + e^{-x}}{2}$
   - d. $\frac{e^x - e^{-x}}{2}$

2. $2\ coshx =$
   - a. $e^x - e^{-x}$
   - b. $e^x + e^{-x}$
   - c. $\frac{e^x - e^{-x}}{2}$
   - d. $\frac{e^x + e^{-x}}{2}$

3. $\frac{1}{2}\text{sech}\, x =$
   - a. $\frac{1}{e^x + e^{-x}}$
   - b. $\frac{1}{e^x - e^{-x}}$
   - c. $\frac{2}{e^x + e^{-x}}$
   - d. $\frac{2}{e^x - e^{-x}}$

4. If a vertical line meets the curve at more than 1 points, then the curve represents
   - a. 1 – 1 function
   - b. Not a function
   - c. Into function
   - d. Onto function

5. The volume "V" of a sphere as a function of its radius "r" is given by:
   - a. $\frac{4}{3}\pi r^2$
   - b. $\frac{4}{3}\pi r^3$
   - c. $\frac{2}{3}\pi r^2$
   - d. $\frac{2}{3}\pi r^3$

6. The domain of $y = \cot x$ is:
   - a. $\left\{x : x \in R \ and\ x \neq (2n+1)\frac{\pi}{2}, n\ an\ integer\right\}$
   - b. $\left\{x : x \in R \ and\ x \neq n\frac{\pi}{2}, n\ an\ integer\right\}$
   - c. $\{x : x \in R \ and\ x \neq n\pi, n\ an\ integer\}$
   - d. None of the above

7. The domain of $y = \tan x$ is:
   - a. $\left\{x : x \in R \ and\ x \neq (2n+1)\frac{\pi}{2}, n\ an\ integer\right\}$
   - b. $\left\{x : x \in R \ and\ x \neq n\frac{\pi}{2}, n\ an\ integer\right\}$
   - c. $\{x : x \in R \ and\ x \neq n\pi, n\ an\ integer\}$
   - d. None of the above

8. The domain of $y = \sec x$ is:
   a. $\left\{x : x \in R \ and \ x \neq (2n+1)\frac{\pi}{2}, n \ an \ integer\right\}$
   b. $\left\{x : x \in R \ and \ x \neq n\frac{\pi}{2}, n \ an \ integer\right\}$
   c. $\{x : x \in R \ and \ x \neq n\pi, n \ an \ integer\}$
   d. None of the above

9. The domain of $y = \csc x$ is:
   a. $\left\{x : x \in R \ and \ x \neq (2n+1)\frac{\pi}{2}, n \ an \ integer\right\}$
   b. $\left\{x : x \in R \ and \ x \neq n\frac{\pi}{2}, n \ an \ integer\right\}$
   c. $\{x : x \in R \ and \ x \neq n\pi, n \ an \ integer\}$
   d. None of the above

10. $\sinh^{-1} x =$
   a. $\ln(x + \sqrt{x^2 + 1})$
   b. $\ln(x + \sqrt{x^2 - 1})$
   c. $\ln(\frac{x+1}{x-1})$
   d. None of these

11. $\cosh^{-1} x =$
   a. $\ln(x + \sqrt{x^2 - 1})$
   b. $\ln(x + \sqrt{x^2 + 1})$
   c. $\frac{1}{2}\ln(\frac{x+1}{x-1})$
   d. None of these

12. $\tanh^{-1} x =$
   a. $\ln(x + \sqrt{x^2 - 1})$
   b. $\frac{1}{2}\ln(\frac{1+x}{1-x})$
   c. $\frac{1}{2}\ln(\frac{x+1}{x-1})$
   d. None of these

13. $\coth^{-1} x =$
   a. $\ln(x + \sqrt{x^2 - 1})$
   b. $\frac{1}{2}\ln(\frac{1+x}{1-x})$
   c. $\frac{1}{2}\ln(\frac{x+1}{x-1})$
   d. None of these

14. $\operatorname{sech}^{-1} x =$
   a. $\ln(x + \sqrt{x^2 - 1})$
   b. $\ln(\frac{1}{x} + \frac{\sqrt{1-x^2}}{x})$
   c. $\frac{1}{2}\ln(\frac{x+1}{x-1})$
   d. None of these

15. $\operatorname{csch}^{-1} x =$
   a. $\ln(x + \sqrt{x^2 - 1})$
   b. $\ln(\frac{1}{x} + \frac{\sqrt{x^2+1}}{|x|})$
   c. $\frac{1}{2}\ln(\frac{x+1}{x-1})$
   d. None of these

16. $\lim_{x \to 2} \frac{x^5 - 32}{x - 2}$
   a. 40
   b. 160
   c. 80
   d. 120

17. $\lim_{n\to\infty}\left(1+\frac{5}{n}\right)^n$

a. $e^{\frac{1}{5}}$
b. e^5
c. e^{10}
d. $e^{\frac{1}{10}}$

18. $\lim_{x\to 2}(\sqrt{x^3+1}-\sqrt{x^2+5})$

a. 1
b. 0
c. 2
d. 3

19. $\lim_{x\to 0}\frac{\sin x^0}{x}$

a. $\frac{\pi}{2}$
b. $\frac{\pi}{180}$
c. $\frac{180}{\pi}$
d. 1

20. The domain of $f(x)=\frac{x^3-8}{x-2}$ is:

a. R
b. $R-\{2\}$
c. $[0,2]$
d. None of these

21. $\lim_{x\to a}\frac{x^n-a^n}{x-a}=$

a. na^{n-1}
b. na
c. na^{n-2}
d. 0

22. The function $f(x)$ is continuous at $x=a$ if

a. $\lim_{x\to a^-}f(x)$ exists
b. $\lim_{x\to a^+}f(x)$ exists
c. $\lim_{x\to a}f(x)=f(a)$
d. None of these

23. The parametric equations of the circle $x^2+y^2=a^2$ are:

a. $x=a\cos t, y=a\sin t$
b. $x=a\sin t, y=a\cos t$
c. $x=a\sinh t, y=a\cosh t$
d. $x=a\cosh t, y=a\sinh t$

24. $\lim_{x\to 0}\frac{\sin 7x}{x}=$

a. 1
b. 7
c. $1/7$
d. None of these

25. The function $f(x)=\cos x$ is:

a. Even
b. Odd
c. Neither even nor odd
d. None of the above

26. Which of the following is an odd function.
   a. $f(x) = x^2 + x$
   b. $f(x) = \frac{x^3 - x}{x^2 - 1}$
   c. $f(x) = x^2\sqrt{x^2 + 5}$
   d. $f(x) = x^{2/3} + 6$

27. Which of the following is an even function.
   a. $f(x) = x^3 + x$
   b. $f(x) = \frac{x^3 - x}{x^2 - 1}$
   c. $f(x) = x^{2/3} + 6$
   d. None of these

28. If $f(x) = \sqrt{x + 2}$ then range of f^{-1} is
   a. R
   b. $[-2, \infty)$
   c. $(-\infty, 2]$
   d. $R - \{0\}$

29. $\cosh^2 x - \sinh^2 x =$
   a. 1
   b. 0
   c. -1
   d. 2

30. $\lim_{h \to 0} \frac{\sqrt{x+h} - \sqrt{x}}{h} =$
   a. $\frac{1}{2\sqrt{h}}$
   b. $\frac{1}{2\sqrt{x}}$
   c. $\frac{-1}{2\sqrt{x}}$
   d. $\frac{-1}{2\sqrt{h}}$

B. Short Questions.

1. Define function with examples.
2. What is polynomial function?
3. Describe parametric function with example.
4. Define odd function?
5. What is an even function?
6. Define left hand limit.
7. Define right hand limit.
8. Define rational function with example.
9. Define explicit function.
10. Prove that $\lim_{x \to 0} \frac{\sqrt{x+a} - \sqrt{a}}{x} = \frac{1}{2\sqrt{a}}$
11. Define implicit function.
12. Evaluate $\lim_{x \to 2} \frac{\sqrt{x} - \sqrt{2}}{x - 2}$.
13. Determine whether the function $f(x) = \frac{x^3 - x}{x^2 + 1}$ is even or odd.
14. Evaluate $\lim_{x \to 0} \frac{\sec x - \cos x}{x}$.
15. Express area A of a circle as a function of its circumference.
16. Express perimeter P of a square as a function of its side x.
17. State the sandwich theorem.
18. Define continuity of a function $f(x)$ at $x = a$.

19. Find $fof^{-1}(x)$ if $f(x) = \sqrt{x+1}$.
20. Evaluate $\lim_{x\to\pi} \frac{\sin x}{\pi - x}$.
21. Evaluate $\lim_{n\to 0}(1+3x)^{2/x}$.
22. Discuss the continuity of $f(x)$ at $x = c$.

$$f(x) = \begin{cases} 3x-1, if\ x < -1 \\ 4, if\ x = 1, c = 1 \\ 2x, \quad if\ x > 1 \end{cases}$$

23. Discuss the continuity of $f(x)$ at $x = 3$, when,

$$f(x) = \begin{cases} x-1, if\ x < 3 \\ 2x+1, if\ 3 \le x \end{cases}$$

24. Evaluate $\lim_{x\to -1} \frac{x^3 - x}{x+1}$.
25. Without finding the inverse, state the domain and range of f^{-1}.
    a. $f(x) = \sqrt{x+2}$
    b. $f(x) = \frac{x-1}{x-4}$

C. Long Questions

1. If

$$f(x) = \begin{cases} \frac{\sqrt{2x+5} - \sqrt{x+7}}{x-2}, if\ x \ne 2 \\ k, \quad if\ x = 2 \end{cases}$$

   Find the value of k, so that $f(x)$is continuous at $x = 2$.

2. Find the values of m and n, so that given function is continuous at $x = 3$.

$$f(x) = \begin{cases} mx, if\ x < 3 \\ n, if\ x = 3 \\ -2x+9, if\ x > 3 \end{cases}$$

3. Evaluate

$$\lim_{\theta\to 0} \frac{1-\cos p\theta}{1-\cos q\theta}$$

4. If

$$f(x) = \begin{cases} 3x, if\ x \le -2 \\ x^2 - 1, if - 2 < x < 2 \\ 3, if\ x \ge 2 \end{cases}$$

   Discuss continuity at $x = 2$ and $x = -2$.

5. Evaluate

$$\lim_{x\to\infty} \left(\frac{x}{1+x}\right)^x$$

6. Evaluate

$$\lim_{x\to 0}\frac{e^{1/x}-1}{e^{1/x}+1}, x<0$$

7. Evaluate

$$\lim_{x\to 0}\frac{e^{1/x}-1}{e^{1/x}+1}, x>0$$

8. Evaluate

$$\lim_{\theta\to 0}\frac{\tan\theta-\sin\theta}{\sin^3\theta}$$

9. Prove that $f\left(f^{-1}(x)\right)=f^{-1}\left(f(x)\right)=x$ if

$$f(x)=(-x+9)^3$$

10. Evaluate

$$\lim_{x\to 0}\frac{1-\cos 2x}{x^2}$$

Answer Keys (MCQs):

1. b	2. b	3. a	4. b
5. b	6. c	7. a	8. a
9. c	10. a	11. a	12. b
13. c	14. b	15. b	16. c
17. b	18. b	19. b	20. b
21. a	22. c	23. a	24. b
25. a	26. b	27. c	28. b
29. a	30. b		

Chapter Two

Short Question

1. If y = c find $\frac{dy}{dx}$ by definition where c is constant.(2016,2014)(Example #1a p.g 45)
2. Find the derivation $f(x)=x^2$ by definition.(2015) (Example #1b p.g 45)
3. Find by definition, derivative w.r.t x of x^m.(2012)(Ex#2.1 Q1 xi)
4. Find from first principles, the derivative of $(3t+2)^{-2}$ w.r.t x.(2012) (Ex#2.2 Q1 iii)
5. Differentiate w.r.t x $\frac{a+x}{a-x}$.(2012)(2014)(2016) (Ex#2.3 Q3)
6. Differentiate w.r.t x (x-5)(3-x). (2015) (Ex#2.3 Q5)
7. Find the derivative of $\sqrt{\frac{a-x}{a+x}}$. (2017) (Ex#2.3 Q12)
8. If $y=x^4+2x^2+2$ prove that $\frac{dy}{dx}=4x\sqrt{y-1}$.(2014) (Ex#2.3 Q17)
9. Find $\frac{dy}{dx}$ if $xy+y^2=2$.(2016) (Ex#2.4 Q2 ii)
10. Find $\frac{dy}{d\theta}$ if $y=(\sin 2\theta - \cos 3\ )^2$. (2016)(Ex#2.5 Q2 iii)
11. Differentiate $y=a^x$ w.r.t x . (2016)(Example#2 p.g 81)
12. If y = coshx prove that $\frac{dy}{dx}$ = sinhx .(2016)(pg 85)
13. Find $\frac{dy}{dx}$ if $y= x\, e^{\sin x}$.(2013)(2016)(Ex#2.6 Q2 x)
14. Find $f'(x)$ if $f(x)=\ln(e^x+e^{-x})$.(2015)(2016)(Ex#2.5 Q1 v)
15. Differentiate $(\ln x)^x$ w.r.t x.(2014)(Example 3 p.g 84)
16. Find y_2 if $y=\ln\left(\frac{2x+3}{3x+2}\right)$.(Ex#2.7 Q2 ii)
17. Find y_2 if $x^2+y^2=a^2$.(2015)(Ex#2.7 Q3 i)
18. Find $y_4=\ln(x^2-9)$. (2014)(Ex#2.7 Q4 iii))
19. State Taylors series of a function f(x) at x=a . (2016)(pg 99)
20. If $f(x) = x^3 - 6x^2 + 9x$, determine the interval in which f(x) is decreasing. (2016)(Example 1 pg111)
21. If $y = (x^2+5)(x^3+7)$ find $\frac{dy}{dx}$. (2017)(Example 3 pg 55)
22. Differentiate $\sqrt{x+\sqrt{x}}$ w.r.t x. (2017)(Ex#2.4 Q1 ii)
23. Differentiate $\frac{x^2+1}{x^2-1}$ w.r.t $\frac{x-1}{x+1}$.(2014)(Ex#2.4 Q5 iii)

24. Find $\frac{dy}{dx}$ of x=a(cost+ sint) , y=a (sint-tcost). (2013)()2017)(Ex#2.5 Q9)

25. Differentiate $x^2+\frac{1}{x^2}$ w.r.t $x-\frac{1}{x}$. (2015)(p.g70 Example #5)

26. Differentiate $\ln(x^2+2x)$ w.r.t .x. (2017)(Example 2 pg 83)

27. If y = $\sinh^{-1}$ (ax+b) find $\frac{dy}{dx}$.(2017)(Example 1 p.g 89)

28. If y= x cosy find $\frac{dy}{dx}$. (2017)(Ex#2.5 Q3 i)

29. Prove that $\frac{d}{dx}\sin^{-1}x=\frac{1}{\sqrt{1-x^2}}$. (2017)(pg 87)

30. Define point of inflexion. (2017)

Point of inflexion: "The function f is increasing before x=0 and also it is increasing after x=0 such point is called point of inflexion.

31. Define critical point. (2017)

Critical point: "If $c\in Df$ and $f'(c)=0$ or $f'(c)$ does not exist, then the number c is called a critical value of f while the point (c,f(c)) on the graph of f is named as a critical point "

32. Define Stationary point.

Stationary point: "Any point where f is neither increasing or decreasing is called a stationary point, provided that f(x)=0 at that point"

33. If $y=\sqrt{x}-\frac{1}{\sqrt{x}}$ $find$ $\frac{dy}{dx}$. (2019)(Ex.2.3 Q 16)

34. Find $\frac{dy}{dx}$ if $x^2+y^2=4$. (2019)(Example 1 p.g 68)

35. Differentiate $\frac{ax^2+b}{ax^2+d}$.(2017)

36. Prove that $\frac{d}{dx}\tan^{-1}x=\frac{1}{1-x^2}$. (2019)(pg77 proof 3)

37. Differentiate $\sin^{-1}\sqrt{1-x^2}$ w.r.t x. (2019)(Ex.2.5 Q 10 iv)

38. Differentiate $y=a^{\sqrt{x}}$. (2019)(Example 1b pg 80)

39. Find the derivative of $\frac{1}{a}\sin^{-1}\left(\frac{a}{x}\right)$ w.r.t x .(2013)(Ex.2.5 Q 10 iii)

40. Prove that $\frac{d}{d\theta}(\cos^2\theta+\sin^2\theta)=0$.(2013)

41. Differentiate sinx w.r.t cotx.(2015)(2016) (Ex.2.5 Q 5 i)

42. If $y=\sqrt{\tan x+\sqrt{\tan x+\sqrt{\tan x+....\infty}}}$ then prove that $(2y-1)\frac{dy}{dx}=\sec^2 x$. (Ex.2.5 Q 4 ii)

43. Prove that $\frac{d}{dx}(\cosh x) = \sinh x$. (2019)(pg# 85)

44. Find $\frac{dy}{dx}$ if $y=(x+1)^x$. (2019)(E.x 2.6 Q2 xii)

45. Find $\frac{dy}{dx}$ if $y = \ln\left(\frac{2x+3}{3x+2}\right)$. (E.x 2.6 Q2 v)

46. Find $\frac{dy}{dx}$ if $y = (\ln x)^{\ln x}$.(E.x 2.6 Q2 xiii)

47. Expand cosx by Maclaurins series expansion (2016)(E.x 2.8 Q1 ii)

48. State the Maclaurins series expansion.(2013)(pg 95)

49. Define decreasing and increasing function. Give an example. (2019)

"If f be a differential function on the open interval (a,b).then

i) f is increasing function on (a,b) if $f'(x) > 0$ for each $x \in (a,b)$

ii) f is decreasing function on (a,b) if $f'(x) < 0$ for each $x \in (a,b)$."

50. Determine f(x) = cosx is increasing or decreasing in an interval $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$. (2019)(Ex 2.9 Q1 ii)

Long Question

1. Differentiate $\cos\sqrt{x}$ by first principles.(2015)(E.x2.5 Q1 vii)

2. Compute $\frac{dy}{dx}$ when y= $\frac{ax+b}{cx+d}$ $w.r.t$ $\frac{ax^2+b}{ax^2+d}$.(2015)(E.x#2.4 Q.5 iv)

3. Prove that $y\frac{dy}{dx} + x = 0$ if $x = \frac{1-t^2}{1+t^2}$, $y = \frac{2t}{1+t^2}$.(2018)(E.x#2.4 Q.4)

4. When y= a cos (lnx) + bsin(lnx) prove that $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$ (2015) (Ex#2.7 Q9)

5. Differentiate $\sin\sqrt{\frac{1+2x}{1+x}}$ w.r.t x.(2016) (Ex.2.5 Q 4 ii)

6. If x = $\sin\theta$, y=$\sin m\theta$,show that $(1-x^2)y_2-xy_1+m^2y = 0$.(Ex.2.7 Q 5)

7. If y= e^x sinx then prove that $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0$.(2019)(Ex.2.7 Q 6)

8. If $y=\tan(p\tan^{-1} x)$ show that $(1+x^2)y_1-p(1+y^2) = 0$.(2012)(2015)(2017)(Ex.2.5 Q 12)

9. Show that $\frac{dy}{dx} = \frac{y}{x}$ if $\frac{y}{x} = \tan^{-1}\frac{x}{y}$.(2016)(Ex.2.5 Q 11)

10. Show that

$\cos(x+h) = \cos x - h\sin x - \frac{h^2}{2!}\cos x + \frac{h^3}{3!}\sin x + \ldots$ and evaluate $\cos 61°$.(Ex.2.8Q 2)(2016)

11. Show that $y = \frac{\ln x}{x}$ has maximum value at x = e. (Ex.2.9 Q 4)

12. Show that $y = x^x$ has minimum value at x= $\frac{1}{e}$ (2018)(Ex.2.9 Q 5)

Chapter Three

Multiple Choice Questions

1) $\int (n+1)\left[x^2+2x-1\right]^n (2x+2)dx =$

(a) $\left(x^2+2x-1\right)^{n+1}+c$ (b) $\frac{\left(x^2+2x-1\right)^{n+1}}{n+1}+c$ (c) $\left(x^2+2x-1\right)^{n-1}$ (d) $n\left(x^2+2x-1\right)^{n-1}$

2) $\int \frac{d}{dx}\left(x^2+3x\right)dx =$

(a) $\frac{x^3}{3}+\frac{3x^2}{2}+c$ (b) 2x + 3 (c) $x^2 + 3x + c$ (d) 2x+3+c

3) $\int e^{nx}dx =$

(a) $e^{nx+1}+c$ (b) $\ln e^{nx}+c$ (c) $\frac{e^{nx}}{n}+c$ (d) $e^{nx}+c$

4) $\int \frac{-1}{\sqrt{1-x^2}}dx =$

(a) $\tan^{-1}x+c$ (b) $\cot^{-1}x+c$ (c) $\cos^{-1}x+c$ (d) $\sin^{-1}x+c$

5) $\int\left(\sqrt{x}-\frac{1}{\sqrt{x}}\right)^2 dx =$

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

6) $\int \frac{dx}{\sqrt{a^2-x^2}} =$

(a) $\cos^{-1}\left(\frac{x}{a}\right)+c$ (b) $\sin^{-1}\left(\frac{a}{x}\right)+c$ (c) $\sin^{-1}\left(\frac{x}{a}\right)+c$ (d) $\sin^{-1}x+c$

7) $\int \sec x dx =$

(a) $\ln\left(\sec x+\tan x\right)+c$ (b) $\ln\left(\operatorname{cosec} x-\cot x\right)+c$

(c) $\ln\left(\sec x-\tan x\right)+c$ (d) $-\ln\left(\operatorname{cosec} x-\cot x\right)+c$

8) $\int e^x\left[f(x)+f'(x)\right]dx =$

(a) $e^x f^/(x)+c$ **(b)** $e^x f(x)+c$

(c) $f(x)+f^/(x)+c$ **(d)** $e^x[f(x)+f^/(x)]+c$

9) $\int_{-\pi}^{\pi} Sinx\ dx =$ _______

a) 0 b) 1 c) 2 d) None of these

10) There are _______ types of solution of differential equations

(a) 1 b) 2 c) 3 d) 4

11) The area bounded by $y = \text{Cos}x$ from $x = \frac{-\pi}{2}$ *to* $x = \frac{\pi}{2}$ is square unit

a) 0 b) 1 c) 2 d) 1/2

12) The order of differential equation $x\frac{dy}{dx}+\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^3 = 1$ is

a) 3 b) 2 c) 1 d) None of these

13) n arbitrary constants in general solution of a differential equation of order n can be evaluated by _______

a) initial value conditions b) n initial value conditions c) both a,b d) None of these

14) **If** $\frac{dy}{dx} = 2x$ **&** $y(-1) = 0$ **then**

a) $y = x^2 + c$ b) $y = x^2 - 1$ c) $y = x^2$ d) $y = x^2 + 1$

15) $\int_0^{\pi} \cos x dx =$

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

16) $\int_1^2 e^x\left[\frac{1}{x}-\frac{1}{x^2}\right]dx =$

(a) $e^2 + e$ **(b)** $\frac{e^2}{2} - e$ **(c)** $e - \frac{e^2}{2}$ **(d)** $e^4 - e$

17) **If** $\int_{-1}^{2} f(x)dx = 8$, $\int_{2}^{3} f(x)dx = ?$ **and** $\int_{-1}^{3} f(x)dx = 12$

(a) 14 (b) 4 (c) 8 (d) 20

18) $\int_0^1 \frac{dx}{1+x^2} =$

(a) $\frac{\pi}{6}$ **(b)** $\frac{\pi}{4}$ **(c)** $\frac{\pi}{3}$ **(d)** $\frac{\pi}{2}$

19) $\int_0^\infty \frac{dx}{1+x^2} =$

(a) $\frac{\pi}{6}$ **(b)** $\frac{\pi}{4}$ **(c)** $\frac{\pi}{3}$ **(d)** $\frac{\pi}{2}$

20) **If** $\frac{d}{dx}\left(x\sqrt{x+1}\right) = \frac{3x+2}{2\sqrt{x+1}}$ **then** $\int_3^8 \frac{3x+2}{2\sqrt{x+1}}dx =$

(a) 48 (b) 36 (c) 24 (d) 18

21) If $\int_1^2 (3x^2 + 2x - k)\, dx = 12$ then k =

(a) –1 (b) 0 (c) 1 (d) –2

22) If $\int \ln x \, dx$ is equals to:

(a) $\frac{1}{x} \ln x + c$ (b) $x - x \ln x + c$ (c) $x \ln x - x + c$ (d) $x \ln x + x + c$

23) $\int a^x \, dx =$

(a) $\frac{ax}{lna} + c$ (b) $\frac{lna}{ax} + c$ (c) $\frac{l}{an\, lna} + c$ (d) $ax \ln a + c$

24) $\int a^{x-1} \, dx =$

(a) $\frac{a^{x-1}}{\ln(a)} + c$ (b) $\frac{a^x}{\ln(a)} + c$ (c) $a^x \ln x + c$ (d) none of them

25) : $\int \frac{e^{\tan^{-1} x}}{1+x^2} dx$ =?

(a) $e^{\sec x} + c$ (b) $e^{\tan x} + c$ (c) $e^{\tan^{-1} x} + c$ (d) $e^{\cot^{-1} x} + c$

26) $\int x^{100} dx$ is:

a) $100x^{99} + c$ b) $100x^{101} + c$ c) $x^{100} + c$ d) $\frac{x^{101}}{101} + c$

27) $\int x\left(\frac{1}{x}+x\right)dx$ is:

a) $\frac{2}{3}x^{\frac{3}{2}}+x+c$ b) $\frac{2}{3}x^{\frac{3}{2}}+x^2+c$ (c) $x+\frac{x^3}{3}+c$ d) $\frac{2}{3}x^{\frac{3}{2}}+x^3+c$

28) Value of $\int_0^{\frac{1}{2}}\left(\frac{1}{\sqrt{1-x^2}}\right)dx$:

a) π b) $\frac{\pi}{6}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{4}$

29) $\int_1^2 6x^5\ dx$ is equal to:

a) 73 b) 83 c) 63 d) 53

30) Area of region enclosed between the curve $f(x) = x^2 + 1$ and x-axis from x = 0 to x = 2 is:

a) $\frac{14}{3}$ b) 14 c) $\frac{16}{3}$ d) 16

31) Solution of differential equation $\frac{dy}{dx}=\frac{1}{1+x^2}$ Is:

(a) $y = Sec^{-1} x + c$ (b) $y = Tan^{-1} x + c$ (c) $y = Sin^{-1} x + c$ (d) $y = Cosec^{-1} x + c$

32) If y = f(x) is a differentiable function, then differential of x is defined by the relation.

(a) $dx=\delta x$ (b) $dx=dy$ (c) $dy=\delta x$ (d) $dx=\delta x$

33) Suitable substitution for expressions involving $\sqrt{a^2-x^2}$ to be integrated as

(a) $a = a \sec\theta$ (b) $x = a \tan\theta$ (c) $x = a \cos\theta$ (d) $x = a \sin\theta$

34) $\int \sinh x\ dx =$:

(a) - coshx +c (b) coshx+c (c) ln(coshx)+c (d) cosec hx +c

35) The function $f(x) = 3x^2$ is maximum at:

(a) 0 (b) 1 (c) 2 (d) 3

Answer Keys

1	a	16	b	31	b
2	c	17	b	32	d
3	c	18	b	33	d
4	d	19	d	34	b
5	d	20	d	35	a
6	c	21	c		
7	a	22	c		
8	b	23	a		
9	A	24	a		
10	b	25	c		
11	c	26	a		
12	b	27	c		
13	c	28	a		
14	b	29	c		
15	c	30	a		

Short Questions

1. Find dy in y = x^2+2x when x changes from 2 to 1.8 . (2017)(E.x# 3.1 Q1 ii)
2. If x y + x = 4 ,find $\frac{dx}{dy}$ by using differentials.(2016)(2021)(E.x# 3.1 Q2 i)
3. Using differentials find $\frac{dx}{dy}$ xy - lnx = c .(2015) (E.x# 3.1 Q2 iv)
4. Use differential to approximate the value of $\cos 29°$.(2015) (E.x# 3.1 Q3 iii)
5. Evaluate $\int \tan^2 x dx$. (2017)(E.x# 3.2 Q#2 xiv)
6. Find $\int a^{x^2} x dx$. (2017)(Examle #9 pg #134)
7. Evaluate $\int \cos 3x \ \sin 2x\, dx$.(2015)
8. Evaluate $\int \frac{2x}{1-\cos x} dx$.(2015)
9. Evaluate $\int \frac{3-x}{1-x+6x^2} dx$.(2015)
10. Evaluate $\int_{-1}^{3} (x^3+3x^2)dx$.(2015)
11. Evaluate $\int_{0}^{\frac{\pi}{6}} x \cos x \ dx$.(2015)
12. Find the Area bounded by the curve y = x^3+1 the x-axis and the line x = 2.(2015)
13. Solve the differential equations $\frac{dy}{dx} = \frac{y^2+1}{e^{-x}}$. (2015)
14. Evaluate $\int \frac{1}{x \ln x} dx$. (2017)(E.x#3.3 Q #4)
15. Evaluate $\int \frac{e^x(1+x)}{(2+x)^2} dx$. (2017)(Example #5 pg #147)
16. Evaluate $\int x \ln x dx$. (2017,2015)(2021)((E.x#3.4 Q#1iii)
17. Write two properties of definite integral. (2017)(pg #156 c,d)
18. Find the area between the x-axis and curve y = $4x-x^2$. (2017)((E.x#3.7 Q#5)
19. Solve the differential equation $\frac{x^2+1}{y+1} = \frac{x}{y}\frac{dy}{dx}$. (2017) (E.x#3.8 Q#8)

20. Evaluate $\int \frac{1}{\sqrt{x+1}-\sqrt{x}}\,dx$.(2016)(2021)(Example# 12 v pg 128)

21. Evaluate $\int \frac{ax+b}{ax^2+2bx+c}\,dx$.(2016)(E.x#3.2 Q2 xi)

22. Evaluate $\int \frac{\sec^2 x}{\sqrt{\tan x}}\,dx$.(2016) (2021)(E.x#3.2 Q7)

23. Evaluate $\int \tan^{-1} x\,dx$.(2016)

24. Evaluate $\int_{2}^{\sqrt{5}} x\sqrt{x^2-1}\,dx$.(2016) (E.x#3.6 Q#6)

25. Evaluate $\int \frac{e^{\tan^{-1} x}}{1+x^2}\,dx$.(2016)

26. Evaluate $\int x^2 \ln x\,dx$.(2016)

27. Solve $x^2(2y+1)\frac{dy}{dx}-1=0$.(2016)((E.x#3.8 Q#1 ii)

28. Show that $y=\tan(e^x+c)$ *is solution of* $\frac{dy}{dx}=\frac{y^2+1}{e^{-x}}$.(2016) (E.x#3.8 Q#1 v)

29. Evaluate $\int_{\pi/6}^{\pi/3} \cos t\,dt$.(E.x#3.6 Q#11)

30. What is differential coefficient? (2019)

31. Define Definite integral.(p.g #156)

32. State Fundamental theorem of calculus .(p.g 156)

33. Evaluate $\int \frac{e^{2x}+e^x}{e^x}\,dx$. (2019)

34. Integrate by substitution $\int \frac{-2x}{\sqrt{4-x^2}}\,dx$. (2019)

35. Find the integral $\int \frac{\cos x}{\sin x \ln(\sin x)}\,dx$. (2019)

$\int x \sin^{-1} x\,dx$

36. Evaluate integral $\sqrt[4]{17}$. (2019)

$\frac{1}{x}\frac{dy}{dx}=\frac{1}{2}(1+y^2)$

37. Find indefinite integral $\int a^{ax}\left[a\sec^{-1} x+\frac{1}{x\sqrt{x^2-1}}\right]dx$. (2019)

38. Evaluate $\int \frac{5x+8}{(x+3)(2x-1)}dx$ by using partial fraction. (2019)

39. Define integral. (2019)

40. Calculate the integral $\int_0^{\frac{\pi}{4}} \sec x(\sec x+\tan x)dx$. (2019)(2021)

41. If $\int_{-2}^{1} f(x)dx=5$, $\int_{-2}^{1} g(x)dx=4$ then Evaluate $\int_{-2}^{1}[3f(x)-2g(x)]dx$ (2019) (Example#9 pg162)

42. Evaluate $\int \frac{x+b}{(x^2+2bx+c)^{\frac{1}{2}}}dx$. (2021)

43. Evaluate $\int \frac{3x+2}{\sqrt{x}}dx$.(2021)

44. Evaluate $\int e^x(\cos x+\sin x)\,dx$.(2021)

45. Evaluate $\int \frac{(a-b)x}{(x-a)(x-b)}dx$. (2021)

46. Evaluate $\int_{-1}^{1}(x^{\frac{1}{3}}+1)\,dx$. (2021)

47. Find the area above the x-axis and under the curve y = 5- x^2 from x= -1 to x =1 .(2021)

48. Solve the differential Equation y dx+ x dy =0.(2021)

49. Use differential to approximate the value of $\sqrt[4]{17}$.(2021) (E.x# 3.1 Q3)(2021)

50. Solve the differential equation $\frac{1}{x}\frac{dy}{dx}=\frac{1}{2}(1+y^2)$.(2021)

Long Question

1. Evaluate $\int \frac{\sqrt{2}}{\sin x+\cos x}dx$.(2019) (2021)(E.x#3.3 Q#21)

2. Show that $\int \frac{dx}{\sqrt{x^2-a^2}}=\ln\left(x+\sqrt{x^2-a^2}\right)+c$.(2017,2015)(E.x#3.3 Q#8a)

3. Show that $\int e^{ax}\sin bx\,dx=\frac{1}{\sqrt{a^2+b^2}}e^{ax}\sin\left(bx-\tan^{-1}\frac{b}{a}\right)+c$. (E.x#3.4 Q#3)

4. Evaluate $\int (\frac{1-\sin x}{1-\cos x})\,e^x\,dx$.(2016)(E.x#3.4 Q#5 xi)

5. Evaluate $\int \frac{4+7x}{(1+x)^2(2+3x)}\,dx$.(E.x#3.5 Q#12)

6. Evaluate $\int_0^{\frac{\pi}{4}} \frac{\sec\theta}{\sin\theta+\cos\theta}\,d\theta$.(2016)(E.x#3.6 Q#21)

7. Evaluate $\int_0^{\frac{\pi}{4}} \frac{\sin x-1}{\cos^2 x}\,dx$.(2015)

8. Evaluate $\int_1^3 \frac{x^2-2}{x+1}\,dx$.(2017) (E.x#3.6 Q#24)

9. Solve the differential equation $(x^2-yx^2)\frac{dy}{dx}+y^2+xy^2=0$.(2019) (E.x#3.8 Q#12)

10. Find the area between the x-axis and the cure $y=\sqrt{2ax-x^2}$ when a>0. (E.x#3.7 Q#13)(2015)

11. Evaluate $\int \frac{1}{x(x^3-1)}\,dx$.(2015)

12. Find the area bounded by the cure $y=x^3-4x$ and the x-axis. (E.x#3.7)(2021)

13. Evaluate $\int_0^{\frac{\pi}{4}} \frac{1}{1+\sin x}\,dx$. (2021)

14. Evaluate $\int x\sin^{-1}x\,dx$. (2021)

15. Evaluate $\int x^2 \ln x\,dx$.

Chapter Three

Short Questions

1. Find dy in $y=x^2+2x$ when x changes from 2 to 1.8 . (2017)(E.x# 3.1 Q1 ii)
2. If x y+x = 4 ,find $\frac{dx}{dy}$ by using differentials.(2016)(E.x# 3.1 Q2 i)
3. Using differentials find $\frac{dx}{dy}$ xy - lnx = c .(2015) (E.x# 3.1 Q2 iv)
4. Use differential to approximate the value of $\cos 29°$.(2015) (E.x# 3.1 Q3 iii)
5. Evaluate $\int \tan^2 x dx$. (2017)(E.x# 3.2 Q#2 xiv)
6. Find $\int a^{x^2} x dx$. (2017)(Examle #9 pg #134)
7. Evaluate $\int \cos 3x \sin 2x\, dx$.(2015)(E.x# 3.2 Q#2 xii)
8. Evaluate $\int \frac{ax+b}{ax^2+2bx+c} dx$.(2016)(E.x#3.2 Q2 xi)
9. *Evaluate* $\int \sqrt{1-\cos 2x}\, dx \quad ,(1-\cos 2x) > 0$.(2015)(E.x#3.2 Q2 vi)
10. Evaluate $\int \frac{\sec^2 x}{\sqrt{\tan x}} dx$.(2016)(E.x#3.2 Q7)
11. Evaluate $\int \frac{e^{2x}+e^x}{e^x} dx$. (2019)(E.x# 3.2 Q#1 xi)
12. Integrate by substitution $\int \frac{-2x}{\sqrt{4-x^2}} dx$. (2019)(Ex# 3.3 Q 1)
13. Find the integral $\int \frac{\cos x}{\sin x \ln(\sin x)} dx$. (2019) (E.x# 3.3 Q#15)
14. Evaluate $\int \frac{1}{x \ln x} dx$. (2017)(E.x#3.3 Q #4)
15. Evaluate $\int \frac{2x}{1-\sin x} dx$.(2015)(E.x# 3.4 Q# ix)
16. Evaluate $\int \frac{e^x(1+x)}{(2+x)^2} dx$. (2017)(Example #5 pg #147)
17. Evaluate $\int x \ln x dx$. (2017,2015)((E.x#3.4 Q#1iii)
18. Evaluate $\int \frac{3-x}{1-x+6x^2} dx$.(2015) (E.x# 3.5 Q#5)
19. Evaluate $\int_{-1}^{3} (x^3+3x^2) dx$.(2015)(Example #1 pg #157)

20. Evaluate $\int_0^{\frac{\pi}{6}} x\cos x\,dx$.(2015)(Example #7 pg #161)

21. Find the Area bounded by the curve y = x^3+1 the x-axis and the line x = 2.(2015) (E.x# 3.7 Q#7)

22. Solve the differential equations $\frac{dy}{dx}=\frac{y^2+1}{e^{-x}}$. (2015)(E.x# 3.8 Q#1 v)

23. Write two properties of definite integral. (2017)(pg #156 c,d)

24. Find the area between the x-axis and curve y = 4x-x^2 . (2017)((E.x#3.7 Q#5)

25. Solve the differential equation $\frac{x^2+1}{y+1}=\frac{x}{y}\frac{dy}{dx}$. (2017) (E.x#3.8 Q#8)

26. Evaluate $\int \frac{1}{\sqrt{x+1}-\sqrt{x}}dx$.(2016,2015)(Example# 12 v pg 128)

27. Evaluate $\int \frac{dx}{x(\ln 2x)^3}$ $x>0$.(2015)(Example#8 pg 134)

28. Evaluate $\int x^5 \ln x\, dx$.(2015)(Example#4 pg 139)

29. Evaluate $\int \frac{2a}{a^2-x^2}dx$, $x<a$.(2015)(Example#3 pg 146)

30. Evaluate $\int_{-1}^{2}[x+|x|]dx$.(2015)(Example#4 pg 159)

31. Evaluate $\int_0^3 \frac{dx}{x^2+9}$.(2015)(E.x#3.6 Q10)

32. Evaluate $\int \tan^{-1}x\,dx$.(2016)(E.x#3.4 Q1 vii)

33. Evaluate $\int_2^{\sqrt{5}} x\sqrt{x^2-1}\,dx$.(2016) (E.x#3.6 Q#6)

34. Evaluate $\int \frac{e^{\tan^{-1}x}}{1+x^2}dx$.(2016) (E.x#3.4 Q5 viii)

35. Evaluate $\int x^2 \ln x\,dx$.(2016)(E.x#3.4 Q1 iv)

36. Evaluate integral $\int x.\sin x dx$. (2019)(E.x# 3.4 Q#1 i)

37. Find indefinite integral $\int e^{ax}\left[a\sec^{-1}x+\frac{1}{x\sqrt{x^2-1}}\right]dx$. (2019)(E.x# 3.4 Q#5 iii)

38. Evaluate $\int \frac{5x+8}{(x+3)(2x-1)}dx$ by using partial fraction. (2019)(E.x# 3.5 Q#2 iii)

39.

40. Solve $x^2(2y+1)\frac{dy}{dx}-1=0$.(2016)((E.x#3.8 Q#1 ii)

41. Show that $y = \tan(e^x + c)$ *is solution of* $\frac{dy}{dx} = \frac{y^2+1}{e^{-x}}$.(2016) (E.x#3.8 Q#1 v)

42. Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \cos t dt$.(E.x#3.6 Q#11)

43. What is differential coefficient? (2019)(pg#124)

44. Define Definite integral.(p.g #156)(pg #156)

45. State Fundamental theorem of calculus .(p.g 156)(pg #156)

46. Define integral. (2019)(pg #124)

47. Calculate the integral $\int_0^{\frac{\pi}{4}} \sec x(\sec x + \tan x)dx$. (2019)(Example# 2 pg 158)

48. If $\int_{-2}^{1} f(x)dx = 5$, $\int_{-2}^{1} g(x)dx = 4$ then Evaluate $\int_{-2}^{1}\left[3f(x) - 2g(x)\right]dx$ (2019) (Example#9 pg162)

Long Question

1. Evaluate $\int \frac{\sqrt{2}}{\sin x+\cos x}\, dx$.(2019) (E.x#3.3 Q#21)
2. Show that $\int \frac{dx}{\sqrt{x^2-a^2}} = \ln\left(x+\sqrt{x^2-a^2}\right)+c$.(2017,2015)(E.x#3.3 Q#8a)
3. Show that $\int e^{ax}\sin bx\, dx = \frac{1}{\sqrt{a^2+b^2}} e^{ax} \sin\left(bx-\tan^{-1}\frac{b}{a}\right)+c$. (E.x#3.4 Q#3)(2016)
4. Evaluate $\int (\frac{1-\sin x}{1-\cos x})\, e^x\, dx$.(2016)(E.x#3.4 Q#5 xi)
5. Evaluate $\int \frac{4+7x}{(1+x)^2(2+3x)}\, dx$.(E.x#3.5 Q#12)
6. Evaluate $\int_0^{\frac{\pi}{4}} \frac{\sec\theta}{\sin\theta+\cos\theta}\, d\theta$.(2016)(E.x#3.6 Q#21)
7. Evaluate $\int_0^{\frac{\pi}{4}} \frac{\sin x-1}{\cos^2 x} dx$.(2015)(E.x 3.6 Q 26)
8. Evaluate $\int_1^3 \frac{x^2-2}{x+1}\, dx$.(2017) (E.x#3.6 Q#24)
9. Solve the differential equation $(x^2-yx^2)\frac{dy}{dx}+y^2+xy^2=0$.(2019) (E.x#3.8 Q#12)
10. Find the area between the x-axis and the cure $y=\sqrt{2ax-x^2}$ when a>0. (E.x#3.8 Q#13)(2015)
11. Evaluate $\int \frac{3}{x(x^3-1)}\, dx$.(2015)(example #8 pg 149)

Questions Bank
Mathematics Part II
Chapter 5

A. MCQs.

1. A vertical line divides the plane into
   a. Left half plane
   b. Right half plane
   c. Both (a) and (b)
   d. None of these

2. A non-vertical line divides the plane into
   a. Upper half plane
   b. Lower half plane
   c. Both (a) and (b)
   d. None of these

3. The linear equation formed out of the linear inequality is called
   a. Linear equation
   b. Associated equation
   c. Both a and b
   d. None of these

4. A point of a solution region where two of its boundary lines intersects, is called
   a. Corner point
   b. Vertex
   c. Both (a) and (b)
   d. None of these

5. The system of linear inequalities involved in the problem concerned are called
   a. Simultaneous inequalities
   b. Feasible inequalities
   c. Problem constraints
   d. None of these

6. The solution region restricted to the first quadrant is called
   a. Feasible region
   b. Objective region
   c. Solution region
   d. None of these

7. Each point of the feasible region is called
   a. Feasible solution
   b. Objective solution
   c. Optimal solution
   d. None of these

8. A function that is to be maximized or minimized is called
   a. Feasible function
   b. Objective function
   c. Solution function
   d. None of these

9. The feasible solution that maximizes or minimizes the objective function is called
   a. Optimal solution
   b. Solution
   c. Both (a) and (b)
   d. None of these

10. $(0,1)$ is solution of inequality:
   a. $9x + 2y > 8$
   b. $-x + 3y < 0$
   c. $3x + 5y > 6$
   d. $3x + 4y > 4$

B. Short Questions.

1. Graph the inequality
$$x + 3y > 6$$
2. Graph the inequality
$$2x + 4y \leq 8$$
3. State the theorem of Linear Programming.
4. Define feasible region.
5. Describe feasible solution set.
6. What is an optimal solution?
7. Define corner points.
8. Graph the following inequalities and indicate their solution set by shading
$$4x - 3y \leq 12$$
$$x \geq -\frac{3}{2}$$
9. Define non-negative constraints. What role they play in real life?
10. Define convex region.

C. Long Questions

1. Graph the feasible solution region of the following system of linear inequalities and find the corner points
$$x + y \leq 5$$
$$2x + y \leq 2$$
$$y \geq 0$$
2. Graph the feasible solution region of the following system of linear inequalities and find the corner points
$$2x + 3y \leq 18$$
$$x + 4y \leq 12$$
$$3x + y \leq 12$$
$$x \geq 0$$
$$y \geq 0$$
3. Maximize $z = 2x + y$ subject to the constraints.
$$x + y \geq 3$$
$$7x + 5y \leq 35$$
$$x \geq 0, y \geq 0$$

4. Graph the feasible solution region of the following system of linear inequalities and find the corner points

$$2x - 3y \leq 6$$
$$2x + 3y \leq 12$$
$$x \geq 0$$
$$y \geq 0$$

5. Maximize $f(x, y) = 2x + 5y$
subject to the constraints

$$2y - x \leq 8$$
$$x - y \leq 4$$
$$x \geq 0$$
$$y \geq 0$$

6. Maximize $f(x, y) = 2x + 3y$
subject to the constraints

$$3x + 4y \leq 12$$
$$2x + y \leq 4$$
$$2x - y \leq 4$$
$$x \geq 0$$
$$y \geq 0$$

Answer Keys (MCQs):

1. a	2. c	3. b
4. c	5. c	6. a
7. a	8. b	9. a
10. a		

Chapter Five

1. Define Optimal solution.(2014,2017,2018)
"The feasible solution which maximizes or minimizes the objective function is called optimal solution"
2. Define Decision variable.(2017)

"The variables used in the system of linear inequalities relating to the problem of everyday life are non-negative are called decision variable".
3. If a non-vertical line divides a plane into two, then write the name those two planes?(2019)

"Upper half plane and lower half plane"
4. Graph the inequality x+3y > 6. (2019)
5. Graph $x+y\le 5$, $-2x+y\le 2$, $y\ge 0$.(2016) (E.x#5.2 Q1 ii)
6. Find the corner points $5x+7y\le 35$, $x-2y\le 4$, $y\ge 0$, $x\ge 0$.(2016) (E.x#5.2 Q1 vi)
7. Indicate the solution set of the system of linear inequality
$x+y\ge 5$, $-y+x\le 1$ (2017) (E.x#5.1 Q2 ii)
8. Graph the region indicated $4x-3y\le 12$, $x\ge -\frac{3}{2}$ (2018) (E.x#5.1 Q2 iv)
9. Define problem constraints(2015)
"The systems of linear inequalities involved in the problem concerned are called problem constrains".
10. Define corner points.(2014)
"Those point of solution region of inequalities where they intersect each other are called corner point"
11. Define Feasible region.(2014,2018)
"The region restricted to 1^{st} Quadrant is called feasible region"
12. Define Feasible solution set.(2010,2013)
"The region restricted to 1^{st} Quadrant is called feasible region and solution is called feasible solution"
13. Define convex region.(2012)
"If the line segment obtained by joining any two point of a region lies entirely within the region is called a convex region"

Long Question

1. Graph the feasible region subject to the following constraints.
   $2x+3y\le 6\ \ ,2x+y\le 2\ ,\ y\ge 0\ \ ,x\ge 0$ (2013,2014,2017) (Example 3 pg 241)
2. Graph the feasible region and find the corner points of linear inequality.
   $2x-3y\le 6\ \ ,2x+3y\le 12\ ,\ y\ge 0\ \ ,x\ge 0$ (2015 G-I) (E.x#5.2 Q1 i)

3. Graph the feasible region and find the corner points of linear inequality.
   $x+y\le 5\ \ ,-2x+y\ge 2\ \ ,x\ge 0$ (2015 G-II,2019) (E.x#5.2 Q1 iii)
4. Maximize f (x,y) = x+3y subject to the constrains.
   $2x+5y\le 30\ \ ,5x+4y\le 20\ \ ,x\ge 0\ ,\ y\ge 0$, (2016,2017) (E.x#5.3 Q2)
5. Maximize f (x,y) = 2x+y subject to the constrains.
   $x+y\ge 3\ \ ,5y+7x\le 35\ \ x\ge 0\ ,\ y\ge 0$, (2014,2018)(E.x#5.3 Q4)
6. Maximize f (x,y) = 2x+3y subject to the constrains.
   $2x+y\le 8\ \ ,x+2y\le 14\ \ ,x\ge 0\ ,\ y\ge 0$, (2016)(E.x#5.3 Q5)
7. Graph the feasible region and find the corner points of linear inequality.
   $2x+3y\le 18\ \ ,x+4y\le 12\ \ 3x+y\le 12, x\ge 0\ ,\ y\ge 0$, (2018) (E.x#5.2 Q2 iii)

Mathematics Question Bank (Inter Part – II)
Short Questions

Section I (Question No. 4)

1. $\underline{a} = 3\underline{i} - 2\underline{j} + \underline{k}$, $\underline{b} = \underline{i} + \underline{j}$, find $b \times a$. 17 Grp II,
2. A force $\underline{F} = 7\underline{i} + 4\underline{j} - 3\underline{k}$ is applied at P $(1, -2, 3)$. Find its moment about the point Q $(2, 1, 1)$. 19 Grp I,
3. By means of slope, show the points lie on the same line A $(-1, -3)$, B $(1, 5)$, C $(2, 9)$. 17 Grp II,
4. Calculate the projection of $\underline{a}$ along $\underline{b}$ when $\underline{a} = \underline{i} + \underline{k}, \underline{b} = \underline{j} + \underline{k}$. 15 Grp I,
5. Check the position of the point $(5, 6)$ with respect to the circle $2x^2 + 2y^2 + 12x - 8y + 1 = 0$. 19 Grp I,
6. Check whether $(-2, 4)$ lies above or below $4x + 5y - 3 = 0$. 15 Grp II,
7. Check whether the point $(-2, 4)$ lies above or below the line $4x + 5y - 3 = 0$. 16 Grp II,
8. Check whether the point $(-4, 7)$ is above or below of the line $6x - 7y + 70 = 0$. 17 Grp II,
9. Convert $2x - 4y + 11 = 0$ into slope intercept form. 18 Grp I, 18 Grp II,
10. Convert the equation $4x + 7y - 2 = 0$ into two intercept form. 17 Grp II,
11. Convert the equation into two intercept form $4x + 7y - 2 = 0$. 17 Grp II, 16 Grp II,
12. Define direction angles and direction cosines of a vector. 18 Grp II,
13. Define focal chord of parabola. 17 Grp II,
14. Define parabola. 19 Grp I,
15. Define trapezium. 19 Grp I,
16. Define unit vector. 18 Grp I,
17. Find a scalar "α" so that the vectors $2\underline{i} + \alpha\underline{j} + 5\underline{k}$ and $3\underline{i} + \underline{j} + \alpha\underline{k}$ are perpendicular. 18 Grp I,

18. Find a vector of length 5, in the direction of opposite that of $\underline{v} = \underline{i} - 2\underline{j} + 3\underline{k}$. 17 Grp II,

19. Find a vector perpendicular to each of the vector $\underline{a} = 2\underline{i} - \underline{j} - \underline{k}$ and $\underline{b} = 4\underline{i} + 2\underline{j} - \underline{k}$. 16 Grp I,

20. Find a vector perpendicular to each of the vectors $= 2\hat{\imath} + \hat{\jmath} + \hat{k}$ and $= 4\hat{\imath} + 2\hat{\jmath} - \hat{k}$. 18 Grp II,

21. Find a vector whose magnitude is '4' and is parallel to $2\underline{i} - 3\underline{j} + 6\underline{k}$. 18 Grp I, 16 Grp I,

22. Find an equation of a line bisecting 2nd and 4th quadrants. 18 Grp II,

23. Find an equation of a line through the points (−2 , 1) and (6 , −4). 18 Grp I,

24. Find an equation of a line with x-intercept: −9 and slope: −4. 18 Grp II,

25. Find an equation of hyperbola if its foci $(0, \pm 9)$ and directrices $y = \pm 4$. 19 Grp I,

26. Find an equation of the circle with ends of diameter at $(-3, 2)$ and $(5, -6)$. 16 Grp II,

27. Find an equation of the ellipse with centre (0 , 0), focus (0 , −3), vertex (0 , 4). 18 Grp I,

28. Find an equation of the line bisecting the first and third quadrants. 18 Grp I,

29. Find an equation of the line through $(-4, -6)$ and perpendicular to the line having slope $\frac{-3}{2}$. 19 Grp I, 15 Grp II,

30. Find the angle from the line with slope $\frac{-7}{3}$ to the line with slope $\frac{5}{2}$. 14 Grp II,

31. Find an equation of the line through $(5, -8)$ and perpendicular to the join of A $(-15, -8)$, B $(10, -7)$. 15 Grp I,

32. Find an equation of the line with x-intercept: −3 and y-intercept: 4. 18 Grp I,

33. Find an equation of the perpendicular bisector of the segment joining the points A $(3, 5)$ and B $(9, 8)$. 17 Grp II,

34. Find an equation of the vertical line through $(-5, 3)$. 17 Grp II, 16 Grp I, 16 Grp II,

35. Find an unit vector in the direction of the vector $v = \frac{1}{2}\underline{i} + \frac{\sqrt{3}}{2}\underline{j}$. 18 Grp I,

36. Find and equation of a circle of radius "a" and lying in the second quadrant such that it is tangent to both the axes. 15 Grp I,

37. Find and equation of an ellipse with foci $(\pm 3, 0)$ and minor axis of length 10. 18 Grp II,

38. Find centre and radius of circle $5x^2 + 5y^2 + 14x + 12y - 10 = 0$. 15 Grp II,

39. Find centre and vertices of ellipse $\frac{(x-1)^2}{4} + \frac{(y-1)^2}{9} = 1$. 17 Grp II,

40. Find condition that the lines $y = m_1x + c_1, y = m_2x + c_2,\ y = m_3x + c_3$ are concurrent. 15 Grp II,

41. Find coordinates of the point that divide the join of A $(-6, 3)$ and B $(5, -2)$ in the ratio of $2 : 3$ internally. 19 Grp I,

42. Find direction cosine of $\underline{v} = 3\underline{i} - \underline{j} + 2\underline{k}$. 15 Grp II,

43. Find eccentricity of the ellipse $x^2 + 4y^2 = 16$. 19 I,

44. Find equation of hyperbola with foci $(\pm 5, 0)$ and vertex of $(3, 0)$. 15 Grp I,

45. Find equation of latux rectum of parabola $y^2 = -8(x - 3)$. 18 Grp II,

46. Find the focus and vertex of parabola $y^2 = -8(x - 3)$. 15 Grp I,

47. Find the focus and vertex of the parabola $y^2 = 8x$. 16 Grp I,

48. Find equation of parabola with focus $(1, 2)$, vertex $(3, 2)$. 15 Grp II,

49. Find foci, eccentricity of hyperbola $\frac{y^2}{4} - x^2 = 1$. 15 Grp II,

50. Find focus and vertex of the parabola $y = 6x^2 - 1$. 18 Grp II,

51. Find h such that A $(-1, h)$, B $(3, 2)$ and C $(7, 3)$ are collinear. 17 Grp II, 16 Grp I,

52. Find length of tangent segment from $(-5, 4)$ to $5x^2 + 5y^2 - 10x + 15y - 131 = 0$. 15 Grp II,

53. Find measure of the angle between the lines represented by $x^2 - xy - 6y^2 = 0$. 16 Grp I,

54. Find point which divide A $(-6\,,3)$ ad B $((5\,,-2)$ internally in 2 : 3. 15 Grp II,

55. Find position vector of a point which divide the join of E with position vector $5i$ and F with position vector $4\underline{i} + \underline{j}$ in ratio 2 : 5. 15 Grp II,

56. Find slope and inclination of the line joining points $(4\,,6), (4\,,8)$. 16 Grp I,

57. Find the angle between the vectors $\underline{u} = 2\underline{i} - \underline{j} + \underline{k}$ and $\underline{v} = -\underline{i} + \underline{j}$. 15 Grp I,

58. Find the area of the triangle with vertices A $(1\,,-1\,,1)$, B $(2, 1\,,-1)$ and C $(-1\,,1\,,2)$. 15 Grp I,

59. Find the centre and radius of the circle $x^2 + y^2 + 12x - 10y = 0$. 16 Grp I, 16 Grp II,

60. Find the coordinate of the points of the points of intersection of the line $x + 2y = 6$ with the circle $x^2 + y^2 - 2x - 2y - 39 = 0$. 16 Grp I,

61. Find the coordinates of the points of intersection of the line $2x + y = 5$ and $x^2 + y^2 + 2x - 9 = 0$. 15 Grp I,

62. Find the direction cosines for $\overrightarrow{PQ}$, where P $(2, 1\,,5)$, Q $(1, 3\,,1)$. 15 Grp I,

63. Find the direction cosines of the vector $6\underline{i} - 2\underline{j} + \underline{k}$. 16 Grp II,

64. Find the distance from the point P $(6\,,-1)$ tto the line $6x - 4y + 9 = 0$. 16 Grp I,

65. Find the eccentricity and directrices of the ellipse whose equation is $26x^2 + 9y^2 - 225$. 18 Grp I,

66. Find the equation of ellipse when foci $(\pm 3\,,0)$ and minor axis of length 10. 17 Grp II,

67. Find the equation of the line through A $(-6\,,5)$ having slope 7. 16 Grp II,

68. Find the foci and length of the latux rectum of the ellipse $9x^2 + y^2 = 18$. 18 Grp II,

69. Find the focus and directrix of the parabola $y^2 = -12x$. 17 Grp II,

70. Find the focus and directrix of the parabola $y = 6x^2 - 1$. 18 Grp I,

71. Find the focus and vertex of parabola $(x-1)^2 = 8(y+2)$. 16 Grp II,

72. Find the lines represented by $20x^2 + 17xy - 24y^2 = 0$. 16 Grp II,

73. Find the lines represented by $x^2 - xy - 6y^2 = 0$, also find the angle between them. 15 Grp I,

74. Find the measure of angle between the lines represented by $x^2 - xy - 6y^2 = 0$. 18 Grp II,

75. Find the mid-point of the line joining the two points A $(-8, 3)$, B $(2, 1)$. 17 Grp II,

76. Find the point P on the join of A $(1, 4)$ and B $(5, 6)$ that is twice as far from A as B is from A and lies on the same side of A as B does. 15 Grp I,

77. Find the point three-fifth of the way along line segment from A $(-5, 8)$ to B $(5, 3)$. 16 Grp I,

78. Find the projection of vector $\underline{a}$ along vector $\underline{b}$ and projection of vector $\underline{b}$ along when $\underline{a} = \hat{\imath} - \hat{k}$, $\underline{b} = \hat{\jmath} + \hat{k}$. 18 Grp II,

79. Find the value of $3\underline{j}.\underline{k} \times \underline{a}$. 17 Grp II,

80. Find the value of $2\underline{i} \times 2\underline{j} \,.\, \underline{k}$. 16 Grp II,

81. Find the vector form the point A to the origin where $AB = 4i - 2j$ and B is the point $(-2, 5)$. 17 Grp II,

82. Find the vertices and directrices of the ellipse $25x^2 + y^2 = 225$. 16 Grp II,

83. Find unit vector perpendicular to the plane of $\underline{a}$ and $\underline{b}$ if $\underline{a} = \underline{-i} - \underline{j} - \underline{k}$, $\underline{b} = 2\underline{i} - 3\underline{j} + 4\underline{k}$. 19 Grp I,

84. Find vertices and equation of directrices of hyperbola $x^2 - y^2 = 9$. 17 Grp II,

85. Find α so that $\underline{u} = \alpha\underline{i} + 2\alpha\underline{j} - \underline{k}$ and $\underline{v} = \underline{i} + \alpha\underline{j} + 3\underline{k}$ are perpendicular. 15 Grp II,

86. Find α, so that $\left|a\underline{i} + (a+1)\underline{j} + 2\underline{k}\right| = 3$. 17 Grp II,

87. Fine the value $3\underline{j} \cdot \underline{k} \times \underline{i}$. 16 Grp I,

88. If $\overrightarrow{AB} = \overrightarrow{CD}$, find coordinates of points A. If B, C, D are $(1, 2)$, $(-2, 5)$, $(4, 11)$. 19 Grp I,

89. If $\underline{a} = 2\underline{i} + \underline{j} - \underline{k}$ and $\underline{b} = \underline{i} - \underline{j} + \underline{k}$ find the cross product $\underline{a} \times \underline{b}$. 16 Grp II,

90. If $\underline{u} = 3\underline{i} + \underline{j} - \underline{k}$ and $\underline{v} = 2\underline{i} - \underline{j} + \underline{k}$, find the cosines of the angle θ between $\underline{u}$ and $\underline{v}$. 16 Grp II,

91. If length of perpendicular from origin to a line is 5 units and its inclination is 120°, find the slope of y-intercept of the line? 15 Grp I,

92. If O is the origin and $\overrightarrow{OP} = \overrightarrow{AB}$, find the point P when A and B are $(-3, 7)$ and $(1, 0)$ respectively. 16 Grp I,

93. Prove that if $\underline{a} + \underline{b} + \underline{c} = 0$ then $\underline{a} \times \underline{b} = \underline{b} \times \underline{c} = \underline{c} \times \underline{a}$. 15 Grp II,

94. Prove that $\underline{a} \times (\underline{b} + \underline{c}) + \underline{b} \times (\underline{c} + \underline{a}) + \underline{c} \times (\underline{a} + \underline{b}) = 0$. 14 Grp II,

95. Prove that if the lines are perpendicular, then product of their slopes $= -1$. 18 Grp II,

96. Show that the points A (3 , 1), B (−2 ,−3) and C (2 , 2) are vertices of an isosceles triangle. 18 Grp I,

97. Show that the points A $(-1, 2)$, B $(7, 5)$ and C $(2, -6)$ are vertices of a right triangle. 17 Grp II,

98. Show that the triangle with vertices A $(1, 1)$, B $(4, 5)$ and C $(12, -5)$ is right triangle. 19 Grp I,

99. Show that vectors $3\underline{i} - 2\underline{j} + \underline{k}$, $\underline{i} - 3\underline{j} + 5\underline{k}$ and $2\underline{i} + \underline{j} - 4\underline{k}$ from a right triangle. 19 Grp I,

100. The points A (−5 , −2) and B (5 , −4) are ends of a diameter of a circle, find the centre and radius of the circle. 17 Grp II,

101. Transform $5x - 12y + 39 = 0$ into two intercept form. 15 Grp II,

102. Two lines l_1 and l_2 with respective slopes m_1 and m_2 are parallel if $m_1 = m_2$. 15 Grp I,

103. Write and equation of parabola with focus (−1 , 0), vertex (−1 , 2). 18 Grp I,

104. Write direction cosine of $\overrightarrow{PQ}$, if P $(2\,,1\,,5)$, Q $(1\,,3\,,1)$. 19 Grp I,

105. Write down the equation of straight line with x-intercept (2 , 0) and y-intercept (0,−4). 18 II,

106. Write the standard equation of hyperbola. 17 Grp II,

107. Find the mid-point of line segment joining the points A $\left(-\sqrt{5}\,,-\frac{1}{3}\right)$ and $(-3\sqrt{5}\,,5)$. 14 Grp II,

108. Find the slope and inclination of the line joining the points $(-2\,,4)$ and $(5\,,11)$. 14 Grp II,

109. Find and equation of horizontal line through $(7\,,-9)$. 14 Grp II,

110. Find an equation of each of the lines represented by $10x^2 - 23xy - 5y^2 = 0$. 14 Grp II,

111. The points A $(-5\,,-2)$ and B $(5\,,-4)$ are ends of diameter of a circle. Find the centre and radius. 14 Grp II,

112. Find equation of tangent to the circle $x^2 + y^2 = 25$ at $(4\,,3)$.

113. Find the vertex and directrix of parabola $x^2 = 4(y-1)$. 14 Grp II,

114. Find the centre and vertices of the ellipse $9x^2 + y^3 = 18$. 14 Grp II,

115. Find the sum of vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$, given the four points A $(1\,,-1)$, B $(2\,,0)$, C $(-1\,,3)$ and D $(-2\,,2)$. 14 Grp II,

116. Find a vector perpendicular to each of the vectors $\underline{a} = 2\underline{i} + \underline{j} + \underline{k}$ and $\underline{b} = 4\underline{i} + 2\underline{j} - \underline{k}$. 14 Grp II,

117. Prove that the vectors $\underline{i} - 2\underline{j} + 3\underline{k}$, $-2\underline{i} + 3\underline{j} - 4\underline{k}$ and $\underline{i} - 3\underline{j} + 5\underline{k}$ are co-planar. 14 Grp II,

118. Find equation of a line through $(-4\ ,7)$ and parallel to the line $2x-7y+4=0$. 14 Grp I,

119. Find equation of a line through $(-6\ ,5)$ having slope $=7$. 14 Grp I,

120. Find distance from the point P $(6\ ,-1)$ to the line $6x-14y+9=0$. 14 Grp I,

121. Find area of triangular region whose vertices are A $(5\ ,3)$, B $(-2\ ,2)$, C $(4\ ,2)$. 14 Grp I,

122. Find the equation of tangent to the circle $x^2+y^3=25$ at $(4\ ,3)$. 14 Grp I,

123. Find the equation of parabola whose focus is $(2\ ,5)$ and directrix is $y=1$. 14 Grp I,

124. Find foci and eccentricity of ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$. 14 Grp I,

125. Find eccentricity and foci of the asymptotes of hyperbola $\frac{y^2}{16}-\frac{x^2}{49}=1$. 14 Grp I,

126. Find vector from A to origin hwose $\overline{AB}=4\underline{i}-2\underline{j}$ and B $(-2\ ,5)$. 14 Grp I,

127. Find a vector whose magnitude is 2 and is parallel to $\underline{i}+\underline{j}+\underline{k}$. . 14 Grp I,

128. Find α so that the vectors $2\underline{i}+\alpha\underline{j}+5\underline{k}$ and $3\underline{i}+\underline{j}+\alpha\underline{k}$ are perpendicular. 14 Grp I,

129. Find α so that $\alpha\underline{i}+\underline{j}$, $\underline{i}+\underline{j}+3\underline{k}$, $2\underline{i}+\underline{j}-2\underline{k}$ are co-planar. 14 Grp I,

Mathematics Question Bank (Inter Part – II)

Chapter Wise Long Questions

Chapter No. 1 (Functions and Limits)

1. Evaluate $\lim_{x\to 0}\frac{1-cosx}{sin^2x}$ 17 Grp I,

   (Pg#27)

2. Evaluate $\lim_{x\to 0}\frac{sinx}{x}=1$

3. Evaluate $\lim_{\theta\to 0}(\frac{1-cosp\theta}{1-cosq\theta})$ 16 Grp I, 12 Grp I,

   (Pg#27)

4. Evaluate $\lim_{\theta\to 0}\frac{tan\theta-sin\theta}{sin^3\theta}$ 13 Grp II,

   (Pg#27)

5. Find the values of m and n, so that given function f is continuous at $x=3$.19 Grp I, 15 Grp I,

   If $f(x)=\begin{cases} mx & if\ x<3 \\ n & if\ x=3 \\ -2x+9 & if\ x>3 \end{cases}$ (Pg#32)

6. Discuss the continuity of $f(x)$ at $x=2$ and $x=-2$. 13 Grp I,

   If $f(x)=\begin{cases} 3x & if\ x\le -2 \\ x^2 & if\ -2<x<2 \\ 3 & if\ x\ge 2 \end{cases}$ (Pg#31)

7. If $f(x)=\begin{cases} \frac{\sqrt{2x+5}-\sqrt{x+7}}{x-2}, & x\neq 2 \\ k & x=2 \end{cases}$ (Pg#32)

   Find the value of k so that f is continuous at $x=2$. 18 Grp I, 15 Grp II, 14 Grp I,

8. Let $f(x)=\frac{2x+1}{x-1}$; $x\neq 1$, find $f^{-1}(x)$ and verify $fof^{-1}(x)=x$ 16 Grp II,

9. Prove $\lim_{x\to\infty}\left(1+\frac{1}{n}\right)^n=e$ 14 Grp II, (Pg#22)

10. Prove that $\lim_{x \to 0}\left(\frac{a^x - 1}{x}\right) = \log_e a$ 18 II, (Pg#23)

11. Prove that $\lim_{x \to 0}\frac{sinx}{x} = 1$ 12 II,

Chapter No. 2 (Differentiation)

1. Differentiate $\frac{x^2+1}{x^2-1}$ w.r.t. $\frac{x-1}{x+1}$ 14 Grp I,
2. Differentiate $x^2+\frac{1}{x^2}$ w.r.t. $x-\frac{1}{x}$ 15 Grp II,
3. Differentiate $cos\sqrt{x}$ from the first principle. 15 Grp I,
4. Differentiate $sin\sqrt{\frac{1+2x}{1+x}}$ w.r.t x 16 Grp I,
5. Find $\frac{dy}{dx}$ if $x=a(cost+sint), y=a(sint-tcost)$ 17 Grp I,
6. Find two positive integers whose sum is 9 and the product of one with the square of the other will be maximum. 11 Grp I, 10 Grp II,

   (Pg#114)
7. If $x=sin\theta, y=sinm\theta$, Show that $(1-x^2)y_2-xy_1+m^2y=0$ 13 Grp II,
8. If $y=(cos^{-1}x)^2$, prove that $(1-x^2)y_2-xy_1-2=0$ 12 Grp II,
9. If $y=e^x.sinx$, then prove that $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y=0$ 19 Grp I,

   (Pg#95)
10. Prove that $y\frac{dy}{dx}+x=0$ if $x=\frac{1-t^2}{1+t^2}, y=\frac{2t}{1+t^2}$. 18 Grp II, 12 Grp I, (Pg#71)
11. Show that $\cos(x+h)=cosx-h\sin x-\frac{h^2}{\underline{|2}}cosx+\frac{h^3}{\underline{|3}}sinx+\ldots$. And evaluate $cos61^o$ 10 Grp I,
12. Show that $\frac{dy}{dx}=\frac{y}{x}$ if $\frac{y}{x}=Tan^{-1}\frac{y}{x}$ 16 Grp II,
13. Show that $y=\frac{lnx}{x}$ has maximum value at $x=e$. 14 Grp II, 11 Grp II, (Pg#113)
14. Show that $y=x^x$ has a maximum value at $=\frac{1}{e}$ 18 Grp I, (Pg#113)

Chapter No. 3 (Integration)

1. Evaluate $\int \left(\frac{1-sinx}{1-cosx}\right) e^x\, dx$ 16 Grp II, 11 Grp II, (Pg#145)
2. Evaluate $\int \left(\frac{1-sinx}{1-cosx}\right) e^x dx$ 16 Grp II, 11 Grp II, (Pg#145)
3. Evaluate $\int \frac{\sqrt{2}}{sinx+cosx}\, dx$ 19 Grp I, (Pg#137)
4. Evaluate $\int \frac{e^x(1+sinx)}{(1+cosx)}\, dx$ 12 Grp II, 11 Grp I,

   (Pg#143)
5. Evaluate $\int \frac{1}{x(x^3-1)}\, dx$ 15 Grp II.
6. Evaluate $\int cos^3 x\sqrt{sinx}\, dx$, $(sinx > 0)$ 10 Grp I, (Pg#133)
7. Evaluate $\int cosec^3 x\, dx$ 13 Grp II, (Pg#144)
8. Evaluate $\int \frac{cosx}{sinx \ln sinx}\, dx$ 16 Grp I, (Pg#163)
9. Evaluate $\int \frac{dx}{\frac{1}{2}sinx+\frac{\sqrt{3}}{2}cosx}$ 12 Grp I,
10. Evaluate $\int e^{2x} cos3x\, dx$ 18 Grp I, (Pg#144)
11. Evaluate $\int tan^3 x \sec x\, dx$ 17 Grp I, (Pg#144)
12. Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} \frac{cosx}{sinx(2+sinx)} dx$ 10 Grp I,
13. Evaluate $\int_0^{\frac{\pi}{4}} cos^4 t\, dt$ 18 Grp II, 12 Grp I, (Pg#163)
14. Evaluate $\int_0^{\frac{\pi}{6}} cos^3\theta d\theta$ 10 Grp II, (Pg#163)
15. Evaluate $\int_0^{\pi/4} \frac{sinx-1}{cos^2 x} dx$ 15 Grp I,
16. Evaluate $\int_0^{\pi/4} \frac{sec\theta}{sec\theta+cos\theta} d\theta$ 16 Grp II,

   (Pg#163)
17. Evaluate $\int_{-1}^{2} (x+|x|)\, dx$ 14 Grp II,
18. Evaluate $\int_2^3 \frac{3x^2-2x+1}{(x-1)(x^2+1)} dx$ 16 Grp I,

19. Evaluate $\int_2^3 \left(x-\frac{1}{x}\right)^2 dx$ 13 Grp II, (Pg#163)

20. Evaluate the indefinite integral $\int \sqrt{a^2-x^2}\ \ dx$ 14 Grp I, (Pg#144)

21. Find the area between the x-axis and the curve $y=\sqrt{2ax-x^2}; a>0.$ 17 Grp I, 15 Grp II,

22. Find the area bounded by the curve $y = x^3 - 4x$ and x-axis. 18 Grp I, 12 Grp II,

23. Show that $\int \frac{dx}{\sqrt{x^2-a^2}} = \ln\left(x+\sqrt{x^2-a^2}\right)+c$ 18 Grp II, 15 Grp I, 10 Grp I,

24. Solve the differential equation $(x^2-yx^2)\frac{dy}{dx}+y^2+xy^2=0$ 19 Grp I, 11 Grp I,

25. Solve the following differential equation $(x^2-yx^2)\frac{dy}{dx}+y^2+xy^2=0$ 11 Grp I, (Pg#177)

26. Solve the following differential equation $1+cos\ x\ tan\ y\ \frac{dy}{dx}=0$ 14 Grp I, (Pg#178)

27. Solve the following differential equation $x\ dy+y(x-1)dx=0$ 11 Grp II,

28. Use differentials to approximate the values of $(31)^{1/5}$ 14 Grp II, (Pg#123)

$y=\sqrt{2ax-x^2}$ when $a>0$.

Chapter No. 4 (Intro. to Analytic Geometry)

1. Find a joint equation of the straight lines through the origin perpendicular to the lines represented by $x^2 + xy - 6y^2 = 0$. 15 Grp II,
2. Find an equation of the perpendicular bisector joining the points A $(3, 5)$ and B $(9, 8)$ 12 Grp I,
3. Find an equation of the perpendicular bisector of the segment joining the points A $(3, 5)$ and B $(9, 8)$. 19 Grp I, 14 Grp I, 12 Grp I,
4. Find equations of the sides, altitudes and medians of the triangle whose vertices are A $(-3, 2)$, B $(5, 4)$ and C $(3, -8)$. 11 Grp I, (Pg#216)
5. Find equations of two parallel lines perpendicular to $2x - y + 3 = 0$ such that the product of the x-intercept and y-intercept of each is 3. 15 Grp I, 12 Grp II, (Pg#218)
6. Find h such that the points A $(\sqrt{3}, -1)$, B $(0, 2)$, C $(h, -2)$ are the vertices of a right triangle with right angle at the vertex A. 14 Grp II,
7. Find interior angles of a triangle whose vertices are A $(6, 1)$, B $(2, 7)$ and C $(-6, 7)$. 16 Grp II,
8. Find the condition that the line $y = mx + c$ touches the circle $x^2 + y^2 = a^2$ at a single point. 18 Grp I,
9. Find the condition that the lines $y = m_1x + c_1$; $m_2x + c_2$; $y = m_3x + c_3$ are concurrent. 13 Grp II, (Pg#223)
10. Find the distance between the given parallel lines. Also find equation of parallel lying midway between them. $3x - 4y + 3 = 0$ and $3x - 4y + 7 = 0$ 16 Grp I, (Pg#217)
11. Find the equations of altitudes of ΔABC whose vertices are A $(-3, 2)$, B $(5, 4)$ and C $(3, -8)$ 11 Grp I,
12. Find the interior angles of a triangle whose vertices are A $(6, 1)$, B $(2, 7)$, C $(-6, -7)$. 16 Grp II,
13. Find the length of the chord cut off from the line $2x + 3y = 13$ by the circle $x^2 + y^2 = 26$. 16 Grp I,

14. Find the lines represented by each of the following and also find measure of the angle between them $x^2 + 2xy\ sec\alpha + y^2 = 0$ 19 Grp I, (Pg#228)

15. Prove that the line segment joining the midpoints of two sides of a triangle is parallel to the third side and half as long. 18 Grp II, 13 Grp II, 12 Grp II, 11 Grp I,

16. Prove that the line segments joining the mid-points of sides of quadrilateral taken in order form a parallelogram. 15 Grp II,

17. Prove that the midpoint of the hypotenuse of a right triangle is the circumcenter of the triangle. 11 Grp II,

18. The points A $(-1, 2)$, B $(6, 3)$ and C $(2, -4)$ are vertices of a triangle. Show the line joining the midpoint D of AB and the midpoing E of AC is parallel to BC and $DE = \frac{1}{2}$. 18 Grp II,

19. The three points A $(7, -1)$, B $(-2, 2)$ and C $(1, 4)$ are consecutive vertices of a parallelogram, find the fourth vertex. 18 Grp I,

20. The vertices of a triangle are A $(-2, 3)$, B $(-4, 1)$ and C $(3, 5)$. Find the circumcircle of the triangle. 17 Grp I,

Chapter No. 5 (Linear Inequalities and Linear Programming)

1. Graph the feasible region of system of linear inequalities and find the corner points. 18 Grp II,

(Pg#243)

$2x + 3y \leq 18$, $x + 4y \leq 12$, $3x + y \leq 12$ $x \geq 0, y \geq 0$

2. Graph the feasible region of system of linear inequalities and find the corner points. 12 Grp I,

$3x + 7y \leq 21$, $2x - y \leq -3$, $y \geq 0$

3. Shade the feasible region and also find the corner points of: 15 Grp II,

$2x - 3y \leq 6$, $2x + 3y \leq 12$, $x \geq 0 , y \geq 0$

4. Minimize $z = 2x + y$ subject to the constraints. 18 I, 14 Grp I,

(Pg#248)

$x + y \geq 3$; $7x + 5y \leq 35$; $x \geq 0$; $y \geq 0$

5. Graph the feasible region of system of linear inequalities and find the corner points.

19 Grp I, (Pg#243)

$x + y \leq 5$; $-2x + y \leq 2$; $y \geq 0$

6. Graph the feasible region of system of linear inequalities and find the corner points.

14 Grp II, 13 Grp II,

$2x - 3y \leq 6$; $2x + y \geq 2$; $y \geq 0 , y \geq 0$

7. Minimize f $(x , y) = x + 3y$ subject to constraint. 17 Grp I, 16 Grp I,

$2x + 5y \leq 30$; $5x + 4y \leq 20$; $x \geq 0, y \geq 0$

8. Minimize f $(x , y) = 2x + 3y$ subject to constraint. 16 Grp II, 11 Grp II,

$2x + y \leq 8$; $x + 2y \leq 14$; $x \geq 0, y \geq 0$

9. Find the minimum value of $\phi\,(x\,,y) = 4x + 6y$ under the constrains: 12 Grp II,

$2x - 3y \leq 6$, $2x + y \geq 2$, $2x + 3y \leq 12$ $x \geq 0, y \geq 0$

10. Minimize the function $z = 3x + y$ subject to the constrains: 11 Grp I,

$3x + 5y \geq 6$, $x + 6y \geq 9$, $x \geq 0, y \geq 0$

Chapter No. 6 (Conic Sections)

1. Find an equation of parabola having its focus at the origin and directrix parallel to y-axis. 18 Grp II, (Pg#274)
2. Find the centre, foci, eccentricity, vertices and equation of directices of $\frac{y^2}{4} - x^2 = 1.$
   18 Grp II, (Pg#298)
3. Find x so that points A $(1, -1, 0)$. B $(-2, 2, 1)$ and C $(0, 2, x)$ from triangle with right angle at C. 18 Grp I,
4. Find the coordinates of the points of intersection of the line $2x + y + 5 = 0$ and the circle $x^2 + y^2 + 2x - 9 = 0$. Also find the length of intercepted chord. 19 Grp I,
5. Find equation of parabola with elements directrix : $x = -2$, focus $(2, 2)$. 19 Grp I,
6. Find an equation of parabola whose focus is F $(-3, 4)$, directrix line is $3x - 44y + 5 = 0$. 15 Grp I,
7. Find the focus, vertex and the directrix of the parabola $x^2 - 4x - 8y + 4 = 0$. 15 Grp II,
8. Write an equation of the parabola with axis $y = 0$ and passing through $(2, 1)$ and $(11, -2)$. 16 Grp II,
9. Show that the line $3x - 2y = 0$ and $2x + 3y - 13 = 0$ are tangents to the circle $x^2 + y^2 + 6x - 4y = 0$. 17 Grp I, 16 Grp II,
10. Show that the equation $9x^2 - 18x + 4y^2 + 8y - 23 = 0$ represent an ellipse. Find its elements (foci, vertices and directrices) 16 Grp I,
11. Show that the equation $x^2 + 16x + 4y^2 - 16y + 76 = 0$ represent an ellipse. Find its foci eccentricity, vertices and directrices. 14 Grp I,
12. Write equations of tangent lines to the circle $x^2 + y^2 + 4x + 2y = 0$ down from the point P $(-1, 2)$. Also find the tangential distance. 14 Grp I,
13. Prove that in any triangle ABC by vector method $a^2 = b^2 + c^2 - 2bc \cos A$. 16 Grp I,

14. Find equation of ellipse having vertices $(0\,,\pm 5)$ and eccentricity $\frac{3}{5}$. 14 Grp II,

15. Find an equation of the circle passing through the point $(-2\,,-5)$ and touching the line $3x+4y-24=0$ at the point $(4\,,3)$. 14 Grp II,

16. Find the foci, vertex and directrix of the parabola $y=6x^2-1$. 13 Grp II,

17. Find equations of the tangents to the circle $x^2+y^2=2$ 13 Grp II,

18. Find an equation of an ellipse with Foci $(-3\sqrt{3}\,,0)$ and vertices $(\pm 6\,,0)$ 12 Grp II,

19. Find equation of the circle passing through A $(a\,,0)$, B $(0\,,b)$ and C $(0\,,0)$ 12 Grp II,

20. Find an equation of the parabola with focus $(1\,,2)$ and vertex $(3\,,2)$. 12 Grp I,

21. Write an equation of the circle that passes through the point A $(a\,,0)$, B $(0\,,b)$, C $(0\,,0)$.12 Grp I,

22. Write an equation of the circle that passes through the points A $(4\,,5)$, B $(-4\,,-3)$, and C $(8\,,-3)$. 11 Grp I,

23. Find the equation of parabola with focus at point $(a\cos\alpha\,,a\sin\alpha)$ and directrix as $x\ cos\alpha + y\ sin\alpha + a = 0$. 11 Grp II,

24. Find equation of the circle of radius 2 and tangent to the line $x-y-4=0$ at A $(1\,,-3)$ 15 Grp II,

Chapter No. 7 (Vectors)

1. Find the value of α, in the coplanar vectors $\alpha\underline{i}+\underline{j}, \underline{i}+\underline{j}+3\underline{k},$ and $2\underline{i}+\underline{j}-2\underline{k}$. 18 II, (Pg#362)

2. If $\underline{a}=3\underline{i}-\underline{j}-4\underline{k}$; $\underline{b}=-2\underline{i}-4\underline{j}-3\underline{k}$ and $\underline{c}=\underline{i}+2\underline{j}-\underline{k}$, then find a unit vector parallel to $-3\underline{a}-2\underline{b}+4\underline{c}$. 16 Grp II, 12 Grp I,

3. (Example) Find the volume of the tetrahedron whose vertices are A $(2,1,8)$, B $(3,2,9)$, C $(2,1,4)$ and D $(3,3,10)$. 18 Grp I, 16 Grp I, Grp II, (Pg#362)

4. Prove that $\sin(\alpha-\beta)=sina.cos\beta-cos\alpha sin\beta$ by method of vectors. 19 Grp I,

5. Find the volume of the tetrahedron with the vertices of A $(0,1,2)$, B $(3,2,1)$, C $(1,2,1)$ and D $(5,5,6)$. 15 Grp I, 14 Grp II, 13 Grp II,

6. Find the constant a such that the vectors are coplanar $\underline{i}-\underline{j}+\underline{k}, \underline{i}-2\underline{j}-3\underline{k},$ and $3\underline{i}-a\underline{j}+5\underline{k}$. 15 Grp II,

7. The position vectors of the points A, B, C and D are $2\underline{i}-\underline{j}+\underline{k},\ 3\underline{i}+\underline{j},\ 2\underline{i}+4\underline{j}-2\underline{k}$ and $-\underline{i}+2\underline{j}+\underline{k}$ respecetively. Show that AB is parallel to CD. 14 Grp II,

8. A force of magnitude 6 units acting parallel to $2\underline{i}-2\underline{j}+\underline{k}$ displaces the point of application from $(1,2,3)$ to $(5,3,7)$. Find the work done. 14 Grp I,

9. Prove by using vectors that the line segment joining the mid-points of two sides of a triangle is parallel to the third side and half as long. 14 Grp I,

10. If $\underline{a}+\underline{b}+\underline{c}=0$ then prove that $\underline{a}\times\underline{b}=\underline{b}\times\underline{c}=\underline{c}\times\underline{a}$ 12 Grp II,

11. A force $\underline{F}=4\underline{i}-3\underline{k}$ passes through the point A $(2,-2\ ,\ 5)$. Find the moment of the force about the point B $(1,-3\ ,\ 1)$. 12 Grp I,

12. Find a unit vector perpendicular to both vectors $\underline{a}$ and $\underline{b}$ where $\underline{a}=-\underline{i}-j-k$ and $\underline{b}=2\underline{i}-3\underline{j}+4\underline{k}$. 11 Grp II,

13. If $\underline{a}=3\underline{i}-j-4\underline{k}, \underline{b}=-2\underline{i}-4\underline{j}-3\underline{k}$ and $\underline{c}=\underline{i}+2\underline{j}-\underline{k}$ find a unit vector parallel to $3\underline{a}-2\underline{b}+4\underline{c}$. 11 Grp II,