

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 $y = \cosh x$ prove that $\frac{dy}{dx} = \sinh x$.(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 $x=a(\cos t + \sin t)$, $y=a(\sin t - t\cos t)$. (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 $y = x \cos y$ 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 $\sin x$ w.r.t $\cot x$. (2015)(2016) (Ex.2.5 Q 5 i)

42. If $y = \sqrt{\tan x + \sqrt{\tan x + \sqrt{\tan x + \dots \infty}}}$ 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 $\cos x$ 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 $f(x) = \cos x$ 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 $y = a \cos(\ln x) + b \sin(\ln x)$ prove that $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + y = 0$ (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 $(1-x^2)y_2 - xy_1 + m^2 y = 0$. (Ex.2.7 Q 5)
7. If $y = e^x \cdot \sin x$ then prove that $\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + 2y = 0$.(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

$$\cos(x+h) = \cos x - h \sin x - \frac{h^2}{2!} \cos x + \frac{h^3}{3!} \sin x + \dots$$
 and evaluate $\cos 61^\circ$.(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)