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NCERT Class 11 Mathematics Solutions: Chapter 13 – Limits and Derivatives Miscellaneous Exercise Part 8

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Basic Differentiation Rules for Elementary Functions

$$1. \frac{d}{dx}[cu] = cu'$$

$$2. \frac{d}{dx}[u \pm v] = u' \pm v'$$

$$3. \frac{d}{dx}[uv] =$$

$$4. \frac{d}{dx}\left[\frac{u}{v}\right] = \frac{vu' - uv'}{v^2}$$

$$5. \frac{d}{dx}[c] = 0$$

$$6. \frac{d}{dx}[u^n] =$$

$$7. \frac{d}{dx}[x] = 1$$

$$8. \frac{d}{dx}[|u|] = \frac{u}{|u|}(u'), \quad u \neq 0$$

$$9. \frac{d}{dx}[\ln u]$$

$$10. \frac{d}{dx}[e^u] = e^u u'$$

$$11. \frac{d}{dx}[\log_a u] = \frac{u'}{(\ln a)u}$$

$$12. \frac{d}{dx}[a^u] =$$

$$13. \frac{d}{dx}[\sin u] = (\cos u)u'$$

$$14. \frac{d}{dx}[\cos u] = -(\sin u)u'$$

$$15. \frac{d}{dx}[\tan u]$$

$$16. \frac{d}{dx}[\cot u] = -(\csc^2 u)u'$$

$$17. \frac{d}{dx}[\sec u] = (\sec u \tan u)u'$$

$$18. \frac{d}{dx}[\csc u]$$

$$19. \frac{d}{dx}[\arcsin u] = \frac{u'}{\sqrt{1-u^2}}$$

$$20. \frac{d}{dx}[\arccos u] = \frac{-u'}{\sqrt{1-u^2}}$$

$$21. \frac{d}{dx}[\arctan u]$$

$$22. \frac{d}{dx}[\operatorname{arccot} u] = \frac{-u'}{1+u^2}$$

$$23. \frac{d}{dx}[\operatorname{arcsec} u] = \frac{u'}{|u|\sqrt{u^2-1}}$$

$$24. \frac{d}{dx}[\operatorname{arccsc} u]$$

1. Find the derivative of the following functions (it is to be understood that a, b, c, d, p, q, r and s are fixed non-zero constants and m and n are integers): $\frac{\cos x}{1 + \sin x}$

Answer:

$$f(x) = \frac{\cos x}{1 + \sin x}$$

By quotient rule,

$$\begin{aligned} f_1'(x) &= \frac{(1 + \sin x) \frac{d}{dx}(\cos x) - (\cos x) \frac{d}{dx}(1 + \sin x)}{(1 + \sin x)^2} \\ &= \frac{(1 + \sin x)(-\sin x) - (\cos x)(\cos x)}{(1 + \sin x)^2} \\ &= \frac{-\sin x - \sin^2 x - \cos^2 x}{(1 + \sin x)^2} \\ &= \frac{-\sin x - (\sin^2 x + \cos^2 x)}{(1 + \sin x)^2} \\ &= \frac{-\sin x - 1}{(1 + \sin x)^2} \\ &= \frac{-(1 + \sin x)}{(1 + \sin x)^2} \\ &= \frac{-1}{(1 + \sin x)} \end{aligned}$$

2. Find the derivative of the following functions (it is to be understood that a, b, c, d, p, q, r are fixed non-zero constants and m, n are integers): $\frac{\sin x + \cos x}{\sin x - \cos x}$

Answer:

$$f(x) = \frac{\sin x + \cos x}{\sin x - \cos x}$$

By quotient rule,

$$\begin{aligned} f'(x) &= \frac{(\sin x - \cos x) \frac{d}{dx}(\sin x + \cos x) - (\sin x + \cos x) \frac{d}{dx}(\sin x - \cos x)}{(\sin x - \cos x)^2} \\ &= \frac{(\sin x - \cos x)(\cos x - \sin x) - (\sin x + \cos x)(\cos x + \sin x)}{(\sin x - \cos x)^2} \\ &= \frac{-(\sin x - \cos x)^2 - (\sin x + \cos x)^2}{(\sin x - \cos x)^2} \\ &= -\frac{[\sin^2 x + \cos^2 x - 2 \sin x \cos x + \sin^2 x + \cos^2 x + 2 \sin x \cos x]}{(\sin x - \cos x)^2} \\ &= \frac{-[1 + 1]}{(\sin x - \cos x)^2} \\ &= \frac{-2}{(\sin x - \cos x)^2} \end{aligned}$$