LIST OF FORMULAE

1. $(a+b)^2 = a^2 + 2ab + b^2$
2. $(a-b)^2 = a^2 - 2ab + b^2$
3. $(x+a)(x+b) = x^2 + x(a+b) + ab$
4. $(x+a)(x+b)(x+c) = x^3 + x^2(a+b+c) + x(ab+bc+ca) + abc$
5. $(a+b+c)^2 = a^2 + b^2 + c^2 + 2(ab+bc+ca)$
6. $(a+b)^3 = a^3 + 3ab(a+b) + b^3$
7. $(a-b)^3 = a^3 - 3ab(a-b) - b^3$
8. $(a^3 - b^3) = (a-b)(a^2 + ab + b^2)$
9. $(a^3 + b^3) = (a+b)(a^2 - ab + b^2)$
10. $(a^2 - b^2) = (a+b)(a-b)$
11. $(a^2 + b^2) = (a+ib)(a-ib)$
12. $(a^4 + a^2b^2 + b^4) = (a^2 - ab + b^2)(a^2 + ab + b^2)$
13. $a^3 + b^3 + c^3 - 3abc = (a+b+c)(a^2 + b^2 + c^2 - 2ab - 2bc - 2ca)$
14. $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$
15. $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$
16. $\tan(A \pm B) = \dfrac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$
17. $\sin 2A = 2 \sin A \cos A = \dfrac{2 \tan A}{1 + \tan^2 A}$
18. $\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1 = 1 - 2\sin^2 A = \dfrac{1 - \tan^2 A}{1 + \tan^2 A}$
19. $\tan 2A = \dfrac{2 \tan A}{1 - \tan^2 A}$
20. $\sin 3A = 3 \sin A - 4 \sin^3 A$
21. $\cos 3A = 4 \cos^3 A - 3 \cos A$
22. $\tan 3A = \dfrac{3 \tan A - \tan^3 A}{1 - 3 \tan^2 A}$
23. $\sin C + \sin D = 2 \sin\left(\dfrac{C+D}{2}\right) \cos\left(\dfrac{C-D}{2}\right)$
24. $\sin C - \sin D = 2 \cos\left(\dfrac{C+D}{2}\right) \sin\left(\dfrac{C-D}{2}\right)$
25. $\cos C + \cos D = 2 \cos\left(\dfrac{C+D}{2}\right) \cos\left(\dfrac{C-D}{2}\right)$
26. $\cos C - \cos D = -2 \sin\left(\dfrac{C+D}{2}\right) \sin\left(\dfrac{C-D}{2}\right)$
27. $\sin(A+B) + \sin(A-B) = 2 \sin A \cos B$
28. $\sin(A+B) - \sin(A-B) = 2 \cos A \sin B$
29. $\cos(A+B) + \cos(A-B) = 2 \cos A \cos B$

30. $\cos(A - B) - \cos(A + B) = 2 \sin A \sin B$

31. $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$, R : rad. of circum circle.

32. $a^2 = b^2 + c^2 - 2bc \cos A$ or $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ similarly other 2 results.

33. Area of triangle ABC, $\Delta = \frac{1}{2} bc \sin A$ similarly 2 results or $\Delta = \frac{abc}{4R}$

or $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$.

34. $\sum n = 1 + 2 + 3 + \ldots\ldots + n = \frac{n(n+1)}{2}$

35. $\sum n^2 = 1^2 + 2^2 + 3^2 + \ldots\ldots n^2 = \frac{n(n+1)(2n+1)}{6}$

36. $\sum n^3 = 1^3 + 2^3 + 3^3 + \ldots\ldots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$.

37. $\sinh ax = \frac{e^{ax} - e^{-ax}}{2}$.

38. $\cosh ax = \frac{e^{ax} + e^{-ax}}{2}$.

39. $\sin ax = \frac{e^{iax} - e^{-iax}}{2i}$.

40. $\cos ax = \frac{e^{iax} + e^{-iax}}{2i}$.

41. $(\cos\theta + i \sin\theta)^n = (\text{cis}\ \theta)^n = \text{cis}\ n\theta = \cos n\theta + i \sin n\theta$

42. Area of the circle $= \pi r^2$

43. Area of the ellipse $= \pi ab$

44. Surface area of the sphere $= 4\pi r^2$

45. Volume of the sphere $= 4/3\ \pi r^3$

46. Volume of the cone $= 1/3\ (\pi r^2 h)$

47. Volume of the right circular cylinder $= \pi r^2 h$

48. Total surface area of the cylinder $= \pi r (r + l)$. (l = slant height)

Differentiation

1. $\frac{d}{dx}(x^n) = n \cdot x^{n-1}$

2. $\frac{d}{dx}(ax + b)^n = n(ax + b)^{n-1} a$

3. $\frac{d}{dx}(a^{mx}) = a^{mx} \log a$

$= m a^{mx} \log a$

Integration

1. $\int x^n dx = \frac{x^{n+1}}{n+1} + c$ add c to all

2. $\int (ax + b)^n dx = \frac{(ax + b)^{n+1}}{a(n+1)} + c$

3. $\int a^{mx} dx = \frac{a^{mx}}{m \log a}$

4. $\frac{d}{dx}(e^{mx}) = me^{mx}$

4. $\int e^{mx}\,dx = \frac{e^{mx}}{m}$

5. (i) $\frac{d}{dx}(\log x) = \frac{1}{x}$

5. $\int \frac{dx}{x} = \log x = \log_e x$

(ii) $\frac{d}{dx}(\log_a x) = \frac{1}{x \cdot \log a}$

6. $\frac{d}{dx}[\log f(x)] = \frac{f'(x)}{f(x)}$

6. $\int \frac{f'(x)}{f(x)}\,dx = \log f(x)$

7. $\frac{d}{dx}(\sin mx) = m \cos mx$

7. $\int \cos mx\,dx = \frac{\sin mx}{m}$

8. (i) $\frac{d}{dx}(\cos mx) = -m \cdot \sin mx$

8. (i) $\int \sin mx\,dx = -\frac{\cos mx}{m}$

(ii) $\frac{d}{dx}(\log \sec x) = \tan x$

(ii) $\int \tan x\,dx = -\log \cos x = \log \sec x$

9. $\frac{d}{dx}(\tan mx) = m \cdot \sec^2 mx$

9. $\int \sec^2 mx\,dx = \frac{\tan mx}{m}$

10. (i) $\frac{d}{dx}(\cot mx) = -m \cdot \operatorname{cosec}^2 mx$

10. (i) $\int \operatorname{cosec}^2 mx\,dx = -\frac{\cot mx}{m}$

(ii) $\frac{d}{dx}(\log \sin x) = \cot x$

(ii) $\int \cot x\,dx = \log \sin x$

11. $\frac{d}{dx}(\sec mx) = m \cdot \sec mx \cdot \tan mx$

11. $\int \sec mx \tan mx\,dx = \frac{\sec mx}{m}$

12. $\frac{d}{dx}(\operatorname{cosec} mx) = -\operatorname{cosec} mx \cot mx$

12. $\int \operatorname{cosec} mx \cot mx\,dx = -\frac{\operatorname{cosec} mx}{m}$

13. $\frac{d}{dx}(\log(\sec x + \tan x)) = \sec x$

13. $\int \sec x\,dx = \log(\sec x + \tan x)$

14. $\frac{d}{dx}(\log(\operatorname{cosec} x + \cot x)) = -\operatorname{cosec} x$

14. $\int \operatorname{cosec} x\,dx = -\log(\operatorname{cosec} x + \cot x)$

or $= \log\left(\tan \frac{x}{2}\right)$

15. $\frac{d}{dx}\left(\sin^{-1} x\right) = \frac{1}{\sqrt{1-x^2}}$

15. $\int \frac{dx}{\sqrt{1-x^2}} = \sin^{-1} x$ or $-\cos^{-1} x$

16. (i) $\frac{d}{dx}\left(\tan^{-1} x\right) = \frac{1}{1+x^2}$

(ii) $\frac{d}{dx}\left(\sec^{-1} x\right) = \frac{1}{x\sqrt{x^2-1}}$

16. (i) $\int \frac{dx}{1+x^2} = \tan^{-1}(x)$ or $-\cot^{-1}(x)$

(ii) $\int \frac{1}{x\sqrt{x^2-1}}\,dx = \sec^{-1} x$ or $-\text{cosec}^{-1} x$

17. $\frac{d}{dx}(\sinh x) = \cosh x$

17. $\int \cosh x\,dx = \sinh x$

18. $\frac{d}{dx}(\cosh x) = \sinh x$

18. $\int \sinh x\,dx = \cosh x$

19. $\frac{d}{dx}(\tanh x) = \text{sech}^2 x$

19. $\int \text{sech}^2 x\,dx = \tanh x$

20. $\frac{d}{dx}(\text{cosech } x) = -\text{cosech } x \cdot \coth x$

20. $\int \text{cosech } x \coth x\,dx = -\text{cosech } x$

21. $\frac{d}{dx}(\text{sech } x) = -\text{sech } x \cdot \tanh x$

21. $\int \text{sech } x \cdot \tanh x\,dx = \text{sech } x$

22. $\frac{d}{dx}(\coth x) = -\text{cosech}^2 x$

22. $\int \text{cosech}^2 x\,dx = -\coth x$

23. $\frac{d}{dx}(\sinh^{-1} x) = \frac{1}{\sqrt{1+x^2}}$

23. $\int \frac{1}{\sqrt{1+x^2}}\,dx = \sinh^{-1} x$

24. $\frac{d}{dx}(\cosh^{-1} x) = \frac{1}{\sqrt{x^2-1}}$

24. $\int \frac{dx}{\sqrt{x^2-1}} = \cosh^{-1} x$

25. $\frac{d}{dx}(\tanh^{-1} x) = \frac{1}{1-x^2}$

25. $\int \frac{dx}{1-x^2} = \tanh^{-1} x = \frac{1}{2}\log\left(\frac{1+x}{1-x}\right)$

26. $\frac{d}{dx}(\text{cosech}^{-1} x) = -\frac{1}{x\sqrt{1+x^2}}$

26. $\int \frac{dx}{x\sqrt{1+x^2}} = -\text{cosech}^{-1} x$

27. $\frac{d}{dx}(\text{sech}^{-1} x) = -\frac{1}{x\sqrt{1-x^2}}$

27. $\int \frac{dx}{x\sqrt{1-x^2}} = -\text{sech}^{-1} x$

Bernoulli's rule

28. $(uv)' = u'v + uv'$

28. $\int uv^{\bullet} = uv - \iint v u' + \iiint v u'' + \cdots$

29. $(u/v)' = \frac{u'v - uv'}{v^2}$

29. $\int \frac{dx}{a^2-x^2} = \frac{1}{2a}\log\left(\frac{a+x}{a-x}\right)$

30. $\int \frac{dx}{x^2 - a^2} = \frac{1}{2a} \log\left(\frac{x-a}{x+a}\right)$

31. $\int \frac{dx}{a^2 + x^2} = \frac{1}{a} \tan^{-1}\left(\frac{x}{a}\right)$

32. $\int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1}\frac{x}{a}$

33. $\int \frac{dx}{\sqrt{x^2 - a^2}} = \cosh^{-1} x$

34. $\int \sqrt{(a^2 - x^2)}\, dx = \frac{x}{2}\sqrt{a^2 - x^2} + \frac{a^2}{2}\sin^{-1}\frac{x}{a}$

35. $\int \sqrt{(a^2 + x^2)}\, dx = \frac{x}{2}\sqrt{a^2 + x^2} + \frac{a^2}{2}\sinh^{-1}\frac{x}{a}$

36. $\int \sqrt{(a^2 - x^2)}\, dx = \frac{x}{2}\sqrt{x^2 - a^2} - \frac{a^2}{2}\cosh^{-1}\frac{x}{a}$

37. $\int e^{ax} \sin(bx + c)\, dx = \frac{e^{ax}}{(a^2 + b^2)}\left[a \sin(bx + c) - b \cos(bx + c)\right]$

or $= \frac{e^{ax}}{(a^2 + b^2)^{1/2}}\left[\left(\sin(bx + c - \theta)\right)\right]$ where $\theta = \tan^{-1}(b/a)$

38. $\int e^{ax} \cos(bx + c)\, dx = \frac{e^{ax}}{(a^2 + b^2)}\left[a \cos(bx + c) + b \sin(bx + c)\right]$

or $= \frac{e^{ax}}{(a^2 + b^2)^{1/2}} \cos(bx + c - \theta)$ where $\theta = \tan^{-1}(b/a)$

39. $\int_0^a f(x)\, dx = \int_0^a f(a - x)\, dx$

40. $\int_0^{2a} f(x)\, dx = 2\int_0^a f(x)\, dx$ if $f(2a - x) = f(x)$

$= 0$ if $f(2a - x) = -f(x)$

41. $\int_{-a}^{a} f(x)\, dx = 2\int_0^a f(x)\, dx$, if $f(x)$ is even function, i.e., $f(-x) = f(x)$

$= 0$ if $f(x)$ is odd function, i.e., $f(-x) = -f(x)$