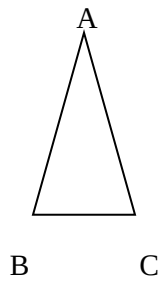
I. GENERAL RESULTS:

1. $a^0 = 1$
2. $a^m . a^n = a^{m+n}$
3. $(a+b)^2 = a^2 + 2ab + b^2$
4. $(a-b)^2 = a^2 - 2ab + b^2$
5. $(a-b)(a+b) = a^2 - b^2$
6. $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
7. $(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$
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. $\frac{a/b}{c/d} = \frac{a}{b} x \frac{d}{c}$
11. Area of Circle with radius r is πr^2
12. Perimeter (circumfrance) of circle is $2\pi r$
13. <u>Area of Triangle</u>

Area = $\Delta = \frac{1}{2}(base)(hight)$



$\Delta = \frac{1}{2} abSinC$

$\Delta = \frac{1}{2} bcSinA$

$\Delta = \frac{1}{2} caSinB$

$\Delta = \frac{abc}{4R}$, R is Circum Radius.

14. Volume of Sphere = $\frac{4}{3}\pi r^3$
44. $\int \sqrt{a^2 - x^2}\, dx = \frac{x}{2}\sqrt{a^2 - x^2} + \frac{a^2}{2} Sin^{-1}\left(\frac{x}{a}\right) + c$
45. $\int udv = uv - \int vdu$

XII. Expansion of some standard functions

(i) $e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots\ldots\ldots + \infty$

(ii) $\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots\ldots\ldots + \infty$

(iii) $\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \ldots\ldots\ldots + \infty$

(iv) $\tan x = x + \frac{x^3}{3} + \frac{2x^5}{15} + \ldots\ldots\ldots + \infty$

(v) $(1+x)^{-1} = \frac{1}{(1+x)} = 1 - x + x^2 - x^3 + x^4 - x^5 + \ldots\ldots\ldots\infty$

(vi) $(1-x)^{-1} = \frac{1}{(1-x)} = 1 + x + x^2 + x^3 + x^4 + \ldots\ldots\ldots\infty$

(vii) $\text{Log}\,(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \ldots\ldots + \infty$

30. $\int Sec^2 x dx = \tan x + c$

31. $\int \text{Secxdx} = \log(\sec \ \text{x} + \tan \ \text{x}) + \text{c}$

32. $\int Co\sec^2 x dx = -Cotx + c$

33. $\int Secx \tan x dx = Secx + c$

34. $\int Co\sec x Cotx dx = -Co\sec x + c$

35. $\int \text{Co sec xdx} = \log \tan\left(\frac{\text{x}}{2}\right) + \text{c}$

36. $\int \frac{dx}{x^2 + a^2} = \frac{1}{a}\tan(\frac{x}{a}) + c$

37. $\int \frac{dx}{x^2 - a^2} = \frac{1}{2a}\log\left|\frac{x-a}{x+a}\right| + c$

38. $\int \frac{dx}{a^2 - x^2} = \frac{1}{2a}\log\left|\frac{a+x}{a-x}\right| + c$

39. $\int \frac{dx}{\sqrt{x^2 + a^2}} = \log\left(x + \sqrt{x^2 + a^2}\right) + c$

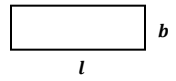
40. $\int \frac{dx}{\sqrt{x^2 - a^2}} = \log\left(x + \sqrt{x^2 - a^2}\right) + c$

41. $\int \frac{dx}{\sqrt{a^2 - x^2}} = Sin^{-1}\left(\frac{x}{a}\right) + c$

42. $\int \sqrt{x^2 + a^2}\, dx = \frac{x}{2}\sqrt{x^2 + a^2} + \frac{a^2}{2}\log(x + \sqrt{x^2 + a^2}) + c$

43. $\int \sqrt{\text{x}^2 - \text{a}^2}\,\text{dx} = \frac{\text{x}}{2}\sqrt{\text{x}^2 - \text{a}^2} - \frac{\text{a}^2}{2}\log(\text{x} + \sqrt{\text{x}^2 - \text{a}^2}) + \text{c}$

15. Surface area of Sphere = $4\pi r^2$
16. Surface area of Hemi Sphere = $2\pi r^2$
17. Total Surface area of Hemi Sphere = $3\pi r^2$
18. Volume of Cylinder = $\pi r^2 h$
19. Curved Surface Area of Cylinder = $2\pi rh$
20. Total Surface Area of Cylinder = $2\pi rh + 2\pi r^2 = 2\pi r(h + r)$
21. Volume of Cone = $\frac{1}{3}\pi r^2 h$
22. Curved Surface Area of Cone = πrl
23. Total Surface Area of Cone = $\pi rl + \pi r^2 = \pi r(l + r)$
24. Area of Square = a^2
25. Perimeter of Square = 4a
26. Area of rectangle = lb
27. Perimeter = $2(l + b)$
28. Volume of Cube = a^3
29. Surface area of Cube = $6a^2$



II. TRIGONOMENTRY:

1. $\sin^2\theta + \cos^2\theta = 1$
2. $1 + \tan^2\theta = \sec^2\theta$
3. $1 + \cot^2\theta = \text{cosec}^2\theta$
4. $\sin(A + B) = \sin A\cos B + \cos A\sin B$
5. $\sin(A - B) = \sin A\cos B - \cos A\sin B$
6. $\cos(A + B) = \cos A\cos B - \sin A\sin B$
7. $\cos(A - B) = \cos A\cos B + \sin A\sin B$

8. $\sin(A+B)\sin(A-B) = \sin^2 A - \sin^2 B$
9. $\cos(A+B)\sin(A-B) = \cos^2 A - \sin^2 B$
10. $2\sin A\cos B = \sin(A+B) + \sin(A-B)$
11. $2\cos A\sin B = \sin(A+B) - \sin(A-B)$
12. $2\cos A\cos B = \cos(A+B) + \cos(A-B)$
13. $2\sin A\sin B = \cos(A-B) - \cos(A+B)$
14. $\sin C + \sin D = 2\sin\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$
15. $\sin C - \cos D = 2\cos\left(\frac{C+D}{2}\right)\sin\left(\frac{C-D}{2}\right)$
16. $\cos C + \cos D = 2\cos\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$
17. $\cos C - \cos D = -2\sin\left(\frac{C+D}{2}\right)\sin\left(\frac{C-D}{2}\right)$
18. $\tan(A+B) = \frac{\tan A+\tan B}{1-\tan A\tan B}$
19. $\tan(A-B) = \frac{\tan A-\tan B}{1+\tan A\tan B}$
20. $\sin 2A = 2sinA\cos A$
21. $\cos 2A = \cos^2 A - \sin^2 A = 1 - 2\sin^2 A = 2\cos^2 A - 1$
22. $\sin 2A = \frac{2\tan A}{1+\tan^2 A}$
23. $\cos 2A = \frac{1-\tan^2 A}{1+\tan^2 A}$
24. $\tan 2A = \frac{2\tan A}{1-\tan^2 A}$
25. $\cos^2 A = \frac{1+\cos 2A}{2}$

17. $\frac{d}{dx}\left[Cot^{-1}x\right] = -\frac{1}{1+x^2}$
18. $\frac{d}{dx}\left[Sec^{-1}x\right] = \frac{1}{x\sqrt{x^2-1}}$
19. $\frac{\mathrm{d}}{\mathrm{dx}}\left[\mathrm{Co\,sec}^{-1}\,\mathrm{x}\right] = -\frac{1}{\mathrm{x}\sqrt{\mathrm{x}^2-1}}$
20. $\mathrm{y} = \mathrm{uv}$, then $\frac{\mathrm{dy}}{\mathrm{dx}} = \mathrm{u}\frac{\mathrm{dv}}{\mathrm{dx}} + \mathrm{v}\frac{\mathrm{du}}{\mathrm{dx}}$; $\mathrm{y} = \frac{\mathrm{u}}{\mathrm{v}}$, then $\frac{\mathrm{dy}}{\mathrm{dx}} = \frac{\mathrm{v}\frac{\mathrm{du}}{\mathrm{dx}} - \mathrm{u}\frac{\mathrm{dv}}{\mathrm{dx}}}{\mathrm{v}^2}$, u, v are functions of x.
21. $\int Kdx = Kx + c$, c is constant of integration.
22. $\int x^n dx = \frac{x^{n+1}}{n+1} + c$, $\mathrm{n} \neq -1$
23. $\int \frac{1}{\mathrm{x}}\mathrm{dx} = \log_{\mathrm{e}}\mathrm{x} + \mathrm{c}$
24. $\int e^x dx = e^x + c$
25. $\int a^x dx = \frac{a^x}{\log a} + c$
26. $\int Sinxdx = -Cosx + c$
27. $\int Cosxdx = Sinx + c$
28. $\int \tan xdx = \log(\sec x) + c$
29. $\int \mathrm{Cotxdx} = \log(\sin\mathrm{x}) + \mathrm{c}$

2. $\frac{d}{dx}\left[e^x\right] = e^x$
3. $\frac{d}{dx}\left[x^n\right] = nx^{n-1}$
4. $\frac{d}{dx}\left[\frac{1}{x}\right] = \frac{-1}{x^2}$
5. $\frac{d}{dx}\left[\log x\right] = \frac{1}{x}$
6. $\frac{d}{dx}\left[\sqrt{x}\right] = \frac{1}{2\sqrt{x}}$
7. $\frac{d}{dx}\left[a^x\right] = a^x \log a$
8. $\frac{d}{dx}\left[Sinx\right] = Cosx$
9. $\frac{d}{dx}\left[Cosx\right] = -Sinx$
10. $\frac{d}{dx}\left[\tan x\right] = Sec^2 x$
11. $\frac{d}{dx}\left[Cotx\right] = -Co\sec^2 x$
12. $\frac{d}{dx}\left[Secx\right] = Secx \tan x$
13. $\frac{d}{dx}\left[Co\sec x\right] = -Co\sec xCotx$
14. $\frac{d}{dx}\left[Sin^{-1}x\right] = \frac{1}{\sqrt{1-x^2}}$
15. $\frac{d}{dx}\left[Cos^{-1}x\right] = -\frac{1}{\sqrt{1-x^2}}$
16. $\frac{d}{dx}\left[\tan^{-1} x\right] = \frac{1}{1+x^2}$

26. $\sin^2 A = \frac{1-\cos 2A}{2}$
27. $\sin A = 2\sin\left(\frac{A}{2}\right)\cos\left(\frac{A}{2}\right)$
28. $\cos A = \cos^2\left(\frac{A}{2}\right) - \sin^2\left(\frac{A}{2}\right) = 1 - 2\sin^2\left(\frac{A}{2}\right)$

$$= 2\cos^2\left(\frac{A}{2}\right) - 1$$

29. $1 + \cos A = 2\cos^2\left(\frac{A}{2}\right)$
30. $1 - \cos A = 2\sin^2\left(\frac{A}{2}\right)$
31. $\tan A = \frac{2\tan\left(\frac{A}{2}\right)}{1-\tan^2\left(\frac{A}{2}\right)}$
32. $\sin A = \frac{2\tan\left(\frac{A}{2}\right)}{1+\tan^2\left(\frac{A}{2}\right)}$
33. $\cos A = \frac{1-\tan^2\left(\frac{A}{2}\right)}{1+\tan^2\left(\frac{A}{2}\right)}$
34. $\sin 3A = 3\sin A - 4\sin^3 A$
35. $\cos 3A = 4\cos^3 A - 3\cos A$
36. $\tan 3A = \frac{3\tan A - \tan^3 A}{1-3\tan^2 A}$
37. Values of Trigonometrically ratios for known angles

θ	0^0	30^0	45^0	60^0	90^0
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞
$cosec$	∞	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
sec	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	∞
cot	∞	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

38. $\tan^{-1} x - \tan^{-1} y = \tan^{-1} \frac{x-y}{1+xy}$
39. $\tan^{-1} x + \tan^{-1} y = \tan^{-1} \frac{x+y}{1-xy}$

XIII. LOGARITHMS

1. $y = e^x \Leftrightarrow x = \log y$
2. $\log 0$ = Undefined
3. $\log 1 = 0$
4. $\log e = 1$
5. $\log \infty = \infty$
6. $\log uv = \log u + \log v$
7. $\log \left(\frac{u}{v}\right) = \log u - \log v$
8. $\log u^n = n \log u$
9. $\log_b a = \frac{\log a}{\log b}$
10. $\log_{10} x = \log_e x \times \log_{10} e$

XIV. PERMUTATIONS AND COMBINATIONS:

1. $0! = 1$
2. $n! = 1.2.3\ldots\ldots\ldots n$
3. $n! = n\,(n-1)!$
4. $nP_r = \frac{n!}{(n-r)!}$
5. $nC_r = \frac{n!}{(n-r)!\ r!}$
6. $nC_0 = nC_n = 1$
7. $nC_1 = n$
8. $nC_r = nC_{n-r}$

XV. BINOMIAL THEOREM:

1. If n is a natural number then
   $(x+a)^n = x^n + nC_1x^{n-1}a + nC_2x^{n-2}a^2 + \ldots\ldots + nC_rx^{n-r}\,a^{-r} + \ldots\ldots\ldots + a^n$
2. $(x-a)^n = x^n - nC_1x^{n-1}a + nC_2x^{n-2}a^2 + \ldots\ldots\ldots + (-1)^r\, nC_rx^{n-r}a^r + \ldots\ldots\ldots + (-1)^n\, a^n$
3. The sum of the binomial coefficients $= 2^n$
4. Sum of the coefficients of even terms = sum of the coefficients of odd terms.
   i. If n is rational number and $-1 < x < 1$ then
   $(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \frac{n(n-1)(n-2)}{2!}x^3 + \ldots\ldots\ldots$
   ii. $(1+x)^{-1} = \frac{1}{(1+x)} = 1 - x + x^2 - x^3 + x^4 - \ldots\ldots\ldots$
   iii. $(1-x)^{-1} = \frac{1}{(1-x)} = 1 + x + x^2 + x^3 + x^4 + \ldots\ldots\ldots$

XVI. *Differention* & *integration* results

1. $\frac{d}{dx}[\text{Constant}] = 0$

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Basic Formulae

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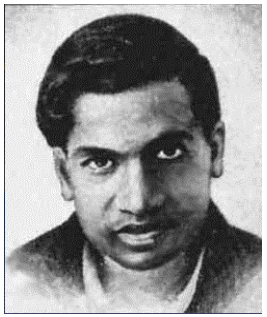

Srinivasa Ramanujam

1887-1920