Diploma Mathematics formulae(20SC01T)

Co - ordinate geometry

1. Slope of a straight line $m = tan\theta$
2. Slope of line joining two points $m = \frac{y_2 - y_1}{x_2 - x_1}$
3. General form of equation of straight line
   $ax + by + C = 0$
4. Slope of a straight line $= -\frac{a}{b}$
   $X - intercept = -\frac{b}{a}$
   $Y - intercept = -\frac{c}{a}$
5. Slope intercept form y=mx+C
6. Two point form of a straight line
   $\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$
7. Slope point form of a straight line
   $y - y_1 = m(x - x_1)$
8. Intercept form of the straight line
   $\frac{x}{a} + \frac{y}{b} = 1$
9. Equation of the straight line which is parallel to line $ax + by + c = 0$ and passing through the point (x_1 , y_1) is
   $ax_1 + by_1 + K = 0$
10. Equation of the straight line which is perpendicular to the line
   $ax + by + c = 0$ and passing through the point (x_1 , y_1) is $bx_1 - ay_1 + k = 0$
11. Midpoint of the line formed by the points (x_1 , y_1) and (x_2 , y_2) is given by

$$(x , y) = \left(\frac{x_1 + x_2}{2} , \frac{y_1 + y_2}{2}\right)$$

Trigonometric formulae

Radian to degree conversion and vice versa

$x\ radian = x\frac{180}{\pi}\ degree$		$x\ degree = \frac{\pi}{180} \times x\ radians$	
$\frac{\pi}{2}$	$\frac{\pi}{2} \times \frac{180^0}{\pi} = 90^0$	90^0	$90^0 \times \frac{\pi}{180} = \frac{\pi}{2}$
$\frac{\pi}{4}$	45^0	45^0	$\frac{\pi}{4}$
$\frac{\pi}{12}$	15^0	15^0	$\frac{\pi}{12}$
$\frac{5\pi}{12}$	75^0	75^0	$\frac{5\pi}{12}$

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T - Values of standard angles

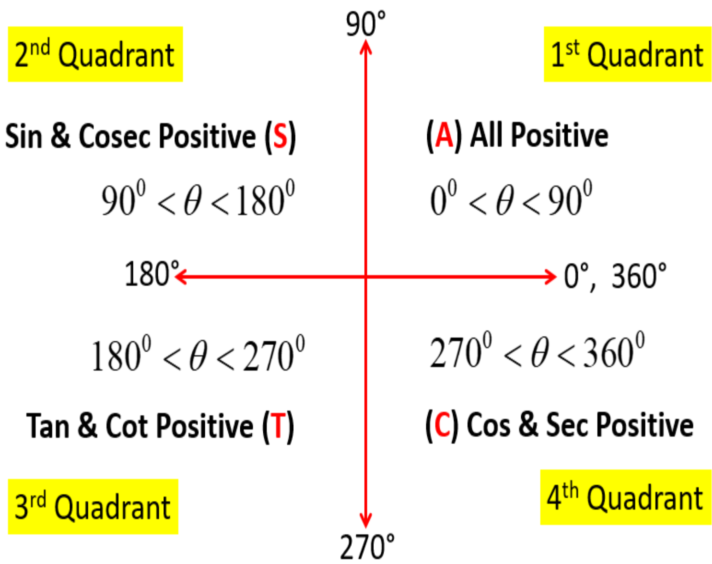
	0^0	30^0	45^0	60^0	90^0	180^0	270^0	360^0
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	0	-1	0
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	1	0	1
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞	0	$-\infty$	0
cot	∞	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0	∞	0	∞
sec	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	∞	1	∞	1
cosec	∞	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1	∞	-1	∞

Trigonometric ratios of Allied angles (without proof)

Trigonometric ratios of allied angles, when the sum or difference of two angles is either zero or a multiple of 90°. For example 30° and 60° are allied angles because their sum is 90°.

The angles $-\theta, 90° \pm \theta, 180° \pm \theta, 360° \pm \theta$ etc. are angles allied to the angle θ, if θ is measured in degrees. However, if θ is measured in radians, then the angles allied to θ are $-\theta, \frac{\pi}{2} \pm \theta, \pi \pm \theta,$ $2\pi \pm \theta$ etc.

Using trigonometric ratios of allied angles we can find trigonometric ratios of angles of any magnitude.



Note:

Easy steps to find the allied angle

Step 1(Negativiting)

If it's a t ratio of negative angle change it to positive by using the following table

$\sin(-\theta) = -sin\theta$	$cosec(-\theta) = -cosec\theta$
$\cos(-\theta) = +cos\theta$	$sec(-\theta) = sec\theta$
$\tan(-\theta) = -tan\theta$	$cot(-\theta) = -cot\theta$

Step 2(Splitting)

Express the given angle as $90 \pm \theta, 180 \pm \theta, 270 \pm \theta$ *and* $360 \pm \theta$,Check which group does it belongs to (we have divided into two groups 1. Odd group($90 \pm \theta$ *and* $270 \pm \theta$) and 2. Even group ($180 \pm \theta, 360 \pm \theta$)

Step 3(Grouping)

If it belongs to even group T function doesn't changes

If it belongs to odd group T ratio changes ($sin\theta \leftrightarrow cos\theta, cosec\theta \leftrightarrow sec\theta, tan\theta \leftrightarrow cot\theta$

Step 4(Quadranting)

To assign the sign for the obtained value ,follow the ASTC rule

Compound Angles Formulae:

Addition Formulae:

1. $\sin(A + B) = \sin A \cos B + \cos A \sin B$
2. $\cos(A + B) = \cos A \cos B - \sin A \sin B$
3. $\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$

Subtraction Formulae:

1. $\sin(A - B) = \sin A \cos B - \cos A \sin B$
2. $\cos(A - B) = \cos A \cos B + \sin A \sin B$
3. $\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$

Multiple Angles

1. sin2A=2sinAcosA
2. $sin\, 2A = \frac{2\, tan\, A}{1 + tan^2 A}$.
3. $cos\, 2A = cos^2 A - sin^2 A$.
4. $cos\, 2A = 2\, cos^2 A - 1$.
5. $cos\, 2A = \frac{1 - tan^2 A}{1 + tan^2 A}$.
6. $tan\, 2A = \frac{2\, tan\, A}{1 - tan^2 A}$

Angle/ Function	$-\theta$	$90° - \theta$ or $\frac{\pi}{2} - \theta$	$90° + \theta$ or $\frac{\pi}{2} + \theta$	$180° - \theta$ or $\pi - \theta$	$180° + \theta$ or $\pi + \theta$	$270° - \theta$ or $\frac{3\pi}{2} - \theta$	$270° + \theta$ or $\frac{3\pi}{2} + \theta$	$360° - \theta$ or $2\pi - \theta$	$360° + \theta$ or $2\pi + \theta$
Sine	$-\sin\theta$	$\cos\theta$	$\cos\theta$	$\sin\theta$	$-\sin\theta$	$-\cos\theta$	$-\cos\theta$	$-\sin\theta$	$\sin\theta$
Cosine	$\cos\theta$	$\sin\theta$	$-\sin\theta$	$-\cos\theta$	$-\cos\theta$	$-\sin\theta$	$\sin\theta$	$\cos\theta$	$\cos\theta$
tangent	$-\tan\theta$	$\cot\theta$	$-\cot\theta$	$-\tan\theta$	$\tan\theta$	$\cot\theta$	$-\cot\theta$	$-\tan\theta$	$\tan\theta$
cotangent	$-\cot\theta$	$\tan\theta$	$-\tan\theta$	$-\cot\theta$	$\cot\theta$	$\tan\theta$	$-\tan\theta$	$-\cot\theta$	$\cot\theta$
secant	$\sec\theta$	$\mathrm{cosec}\,\theta$	$-\mathrm{cosec}\,\theta$	$-\sec\theta$	$-\sec\theta$	$-\mathrm{cosec}\,\theta$	$\mathrm{cosec}\,\theta$	$\sec\theta$	$\sec\theta$
cosecant	$-\mathrm{cosec}\,\theta$	$\sec\theta$	$\sec\theta$	$\mathrm{cosec}\,\theta$	$-\mathrm{cosec}\,\theta$	$-\sec\theta$	$-\sec\theta$	$-\mathrm{cosec}\,\theta$	$\mathrm{cosec}\,\theta$

Table : 4.1

7. $sin\, 3A = 3\, sin\, A - 4\, sin^3 A$
8. $cos\, 3 = 4\, cos^3 A - 3\, cos\, A$.
9. $tan3 = \frac{3tanA - \tan^3 A}{1 - 3\tan^2 A}$

Transformation of sum or difference into product

1. $sin\, C + sin\, D = 2\, sin\left(\frac{C+D}{2}\right) cos\left(\frac{C-D}{2}\right)$
2. $sin\, C - sin\, D = 2\, cos\left(\frac{C+D}{2}\right) sin\left(\frac{C-D}{2}\right)$
3. $cos\, C + cos\, D = 2\, cos\left(\frac{C+D}{2}\right) cos\left(\frac{C-D}{2}\right)$
4. $cos\, C - cos\, D = -2\, sin\left(\frac{C+D}{2}\right) sin\left(\frac{C-D}{2}\right)$

Transformation of product into sum or difference

1. $\sin A \cos B = \frac{1}{2}[\sin(A+B) + \sin(A-B)]$
2. $\cos A \sin B = \frac{1}{2}[\sin(A+B) - \sin(A-B)]$
3. $\cos A \cos B = \frac{1}{2}[\cos(A+B) + \cos(A-B)]$
4. $\sin A \sin B = \frac{1}{2}[\cos(A-B) - \cos(A+B)]$

DIFFERENTIAL CALUCLUS

Derivatives of algebraic functions

1. $\frac{d}{dx}(x) = 1$
2. $\frac{d}{dx}(x^2) = 2x$
3. $\frac{d}{dx}(x^3) = 3x^2$
4. $\frac{d}{dx}(x^n) = nx^{n-1}$ where n€R
5. $\frac{d}{dx}\left(\frac{1}{x^n}\right) = -\frac{n}{x^{n+1}}$ where n€R
6. $\frac{d}{dx}\left(\frac{1}{x}\right) = -\frac{1}{x^2}$
7. $\frac{d}{dx}\left(\frac{1}{x^2}\right) = -\frac{1}{x^3}$
8. $\frac{d}{dx}(k) = 0$ where k is constant
9. $\frac{d}{dx}(1) = 0$
10. $\frac{d}{dx}(\sqrt{x}) = \frac{1}{2\sqrt{x}}$
11. $\frac{d}{dx}\left(\frac{1}{\sqrt{x}}\right) = -\frac{1}{2x\sqrt{x}}$
12. $\frac{d}{dx}(ku) = k\left(\frac{d}{dx}\right)$

Derivatives of trigonometric functions

13. $\frac{d}{dx}(sinx) = cosx$
14. $\frac{d}{dx}(cosx) = -sinx$
15. $\frac{d}{dx}(tanx) = \sec^2 x$
16. $\frac{d}{dx}(cotx) = -cosec^2x$
17. $\frac{d}{dx}(secx) = secx\ tanx$
18. $\frac{d}{dx}(cosecx) = -cosecx\ cotx$

Derivatives of Inverse trigonometric functions

19. $\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}$
20. $\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}}$
21. $\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$
22. $\frac{d}{dx}(\cot^{-1} x) = -\frac{1}{1+x^2}$
23. $\frac{d}{dx}(\sec^{-1} x) = \frac{1}{x\sqrt{x^2-1}}$
24. $\frac{d}{dx}(cosec^{-1}x) = -\frac{1}{x\sqrt{x^2-1}}$

Derivatives of exponential functions

25. $\frac{d}{dx}(a^x) = a^x\ loga$
26. $\frac{d}{dx}(e^x) = e^x$

Derivatives of logarithmic functions

27. $\frac{d}{dx}(logx) = \frac{1}{x}$

Sum rule

Note: u, v, w are the functions of ‘x’

28. $\frac{d}{dx}(u+v) = \frac{du}{dx} + \frac{dv}{dx}$
29. $\frac{d}{dx}(u+v+w) = \frac{du}{dx} + \frac{dv}{dx} + \frac{dw}{dx}$

Product rule

30. $\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$
31. $\frac{d}{dx}(uvw) = uv\frac{dw}{dx} + vw\frac{du}{dx} + wu\frac{dv}{dx}$

Quotient rule

32. $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{vu^1 - uv^1}{v^2}$ **or**

$$\frac{d}{dx}\left(\frac{Nr}{Dr}\right) = \frac{\left(Dr\frac{d(Nr)}{dx} - Nr\frac{d(Dr)}{dx}\right)}{Dr^2}$$

where Nr→ *numerator*, *Dr* → *denominator*

33. Slope of a tangent to the curve $y = f(x)$ at the point $p(x_1, y_1)$ is $m = \left(\frac{dy}{dx}\right)$
34. Equation of tangent to the curve $y = f(x)$ at the point p(x1,y1) is $y - y_1 = m(x - x_1)$ where m is slope of a tangent
35. Slope of a normal to the curve $y = f(x)$ at the point $p(x_1, y_1)$ is $= -\frac{1}{m} = -\frac{1}{\left(\frac{dy}{dx}\right)}$
36. Equation of normal to the curve $y = f(x)$ at the point $p(x_1, y_1)$

$$y - y_1 = -\frac{1}{m}(x - x_1)$$

INTEGRAL CALUCLUS

1. $\int 0dx = C$
2. $\int 1\,dx = x + C$
3. $\int k\,dx = kx + C$

4. $\int x^n\ dx = \frac{x^{n+1}}{n+1} + C\ ;\ n \neq 1$

5. $\int \frac{1}{x^n} dx = -\frac{1}{(n-1)x^{n-1}} + c\ \ ;\ n \neq 1$

6. $\int \frac{1}{x}\ dx = ln\,|x| + C$

7. $\int \frac{1}{x^2}\ dx = -\frac{1}{x} + C$

8. $\int \frac{1}{\sqrt{x}} dx = 2\sqrt{x} + C$

9. $\int \sqrt{x}\, dx = \frac{2}{3} x^{\frac{3}{2}} + C$

10. $\int a^x\ dx = \frac{a^x}{loga} + C\ ;\ a > 0,\ \ a \neq 1$

11. $\int e^x\ dx = e^x + C$

12. $\int \sin x\, dx = -\cos x + C$

13. $\int \cos x\, dx = \sin x + C$

14. $\int tanx\ dx = logsecx + c$

15. $\int cotx\ dx = logcosx + c$

16. $\int secx\ dx = \log(secx + tanx) + c$

17. $\int cosecx\ dx = \log(cosecx - cotx) + c$

18. $\int\ sec^2 x\ dx = \tan x + C$

19. $\int cosec^2 x\ dx = -\cot x + C$

20. $\int\ \sec x\,(\tan x)\, dx = \sec x + C$

21. $\int\ cosec\,x\,(\cot x)\, dx = -\,cosec\,x + C$

22. $\int \frac{1}{\sqrt{1-x^2}} dx = \sin^{-1} x + C$

23. $\int \frac{1}{1+x^2} dx = \tan^{-1} x + C$

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

25. $\int -\frac{1}{\sqrt{1-x^2}} dx = \cos^{-1} x + C$

26. $\int -\frac{1}{1+x^2} dx = \cot^{-1} x + C$

27. $\int -\frac{1}{x\sqrt{x^2-1}} dx = \mathrm{cosec}^{-1} x + C$

28. $\int \sin\,(ax + b)\ dx = -\frac{\cos(a\,x+b)}{a} + C$

29. $\int \cos\,(ax + b)\ dx = \frac{\sin(a\,x+b)}{a} + C$

30. $\int e^{ax+b}\ dx = \frac{e^{ax+b}}{a} + C$

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

32. $\int \frac{1}{ax+b} dx = \frac{\log(ax+b)}{a} + C$

Sum rule

33. $\int (f(x) + g(x))\, dx = \int f(x)dx + \int g(x)dx$

Difference rule

34. $\int (f(x) - g(x))dx = \int f(x)dx - \int g(x)dx$

Product rule

35. $\int uv\ dx = u \int vdx - \int (\int vdx) \frac{du}{dx}\ dx$

where 'u' and 'v' are the functions of x

Definite integral

36. If $\int$ f(x)dx = $\emptyset$(x) then

$$\int_a^b \mathbf{f(x)dx} = [\emptyset(\mathbf{x})](\mathbf{b} - \mathbf{a}) = \emptyset(\mathbf{b}) - \emptyset(\mathbf{a})$$

37. The area bounded by the curve y = f(x) ,x-axis between the co-ordinates x = a and x = b is

$$\mathbf{Area} = \int_a^b \mathbf{ydx} = \int_a^b \mathbf{f(x)dx}$$

38. The area bounded by the curve y = f(x) ,y-axis between the co-ordinates y = a and y = b is

$$\mathbf{Area} = \int_a^b \mathbf{xdy} = \int_a^b \mathbf{g(y)dy}$$

39. Volume of solid generated about x-axis is:

$$\mathbf{Volume} = \pi \int_a^b \mathbf{y^2dx}$$

40. Volume of solid generated about y-axis is:

$$\mathbf{Volume} = \pi \int_a^b \mathbf{x^2dy}$$