Mathematical Formulae

Nakul Singh

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1 Trigonometry

1.1 Addition/Difference Formulae:

$sin(A+B) = sinA\,cosB + cosA\,sinB$
$sin(A-B) = sinA\,cosB - cosA\,sinB$
$cos(A+B) = cosA\,cosB - sinA\,sinB$
$cos(A-B) = cosA\,cosB + sinA\,sinB$

$$tan(A+B) = \frac{tanA + tanB}{1 - tanA\,tanB}$$
$$tan(A-B) = \frac{tanA - tanB}{1 + tanA\,tanB}$$
$$cot(A+B) = \frac{cotA\,cotB - 1}{cotB + cotA}$$
$$cot(A-B) = \frac{cotA\,cotB + 1}{cotB - cotA}$$
$$sinC + sinD = 2\,sin\left(\frac{C+D}{2}\right)cos\left(\frac{C-D}{2}\right)$$
$$sinC - sinD = 2\,cos\left(\frac{C+D}{2}\right)sin\left(\frac{C-D}{2}\right)$$
$$cosC + cosD = 2\,cos\left(\frac{C+D}{2}\right)cos\left(\frac{C-D}{2}\right)$$
$$cosC - cosD = 2\,sin\left(\frac{C+D}{2}\right)cos\left(\frac{D-C}{2}\right)$$

1.1.1 Special Cases:

$$tan\left(\frac{\pi}{4} + \theta\right) = \frac{1 + tan\theta}{1 - tan\theta}$$
$$tan\left(\frac{\pi}{4} - \theta\right) = \frac{1 - tan\theta}{1 + tan\theta}$$

1.2 Product Formulae:

$2\,sinA\,cosB = sin(A+B) + sin(A-B)$
$2\,cosA\,sinB = sin(A+B) - sin(A-B)$
$2\,cosA\,cosB = cos(A+B) + cos(A-B)$
$2\,sinA\,sinB = cos(A-B) - cos(A+B)$
$sin^2A - sin^2B = sin(A+B)\,sin(A-B)$
$cos^2A - sin^2B = cos(A+B)\,cos(A-B)$

1.3 Double Angle Formulae:

$sin\,2\theta = 2\,sin\theta\,cos\theta$
$$sin\,2\theta = \frac{2\,tan\theta}{1 + tan^2\theta}$$
$cos\,2\theta = cos^2\theta - sin^2\theta$