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100 Math Formulas

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Credits:
author = Sergiu Funieru
email = SERGIU@LUNLUN.COM
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FORMULA:

$(a+b)^2 = a^2 + 2ab + b^2$

EXAMPLE:

Calculate $(x+5)^2$

SOLUTION:

$(x+5)^2 = x^2 + 2 \cdot x \cdot 5 + 5^2 = x^2 + 10x + 25$

FORMULA:

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

EXAMPLE:

Calculate $(x+2)^3$

SOLUTION:

$$(x+2)^3 = x^3 + 3 \cdot x^2 \cdot 2 + 3 \cdot x \cdot 2^2 + 2^3 =$$
$$= x^3 + 3 \cdot 2 \cdot x^2 + 3 \cdot 4 \cdot x + 8 = x^3 + 6x^2 + 12x + 8$$

FORMULA:

$$(a-b)^2 = a^2 - 2ab + b^2$$

EXAMPLE:

Calculate $(x-5)^2$

SOLUTION:

$$(x-5)^2 = x^2 - 2 \cdot x \cdot 5 + 5^2 = x^2 - 10x + 25$$

FORMULA:

$$(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$$

EXAMPLE:

Calculate $(x-2)^3$

SOLUTION:

$$(x-2)^3 = x^3 - 3 \cdot x^2 \cdot 2 + 3 \cdot x \cdot 2^2 - 2^3 =$$

$$= x^3 - 3 \cdot 2 \cdot x^2 + 3 \cdot 4 \cdot x - 8 = x^3 - 6x^2 + 12x - 8$$

FORMULA:

$a^2 - b^2 = (a + b)(a - b)$

EXAMPLE:

Factor $x^2 - 9$

SOLUTION:

$x^2 - 9 = x^2 - 3^2 = (x + 3)(x - 3)$

FORMULA:

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

FORMULA:

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

FORMULA:

if $z = a + bi$

then $|z| = \sqrt{a^2 + b^2}$

FORMULA:

if $z_1 = a + bi$

and $z_2 = c + di$

then $z_1 + z_2 = a + c + bi + di$

FORMULA:

if $z_1 = a + bi$

and $z_2 = c + di$

then $z_1 - z_2 = a - c + bi - di$

FORMULA:

$i^2 = -1$

FORMULA:

if $z = a + bi$

then $\bar{z} = a - bi$

FORMULA:

$$\ln(a \cdot b) = \ln\ a + \ln\ b$$

FORMULA:

$$\ln \frac{a}{b} = \ln\ a - \ln\ b$$

FORMULA:

$$\ln a^b = b \ln a$$

FORMULA:

$$\log_a b = \frac{\ln b}{\ln a}$$

FORMULA:

$$a^{b+c} = a^b \cdot a^c$$

FORMULA:

$$a^{b-c} = \frac{a^b}{a^c}$$

FORMULA:

$$(a^b)^c = a^{b \cdot c}$$

FORMULA:

$$a^{-1} = \frac{1}{a}$$

FORMULA:

$$|a \cdot b| = |a| \cdot |b|$$

FORMULA:

$$\left|\frac{a}{b}\right| = \frac{|a|}{|b|}$$

FORMULA:

if $f(-x) = f(x)\ \forall x$

then f is even.

FORMULA:

if $f(-x) = -f(x)\ \forall x$

then f is odd.

FORMULA:

$$\sqrt{a} \cdot \sqrt{b} = \sqrt{ab}$$

FORMULA:

$c' = 0$

EXAMPLE:

Calculate $8'$

SOLUTION:

$8' = 0$

FORMULA:

$(x^n)' = n \cdot x^{n-1}$

EXAMPLE:

Calculate $(x^3)'$

SOLUTION:

$(x^3)' = 3 \cdot x^{3-1} = 3x^2$

FORMULA:

$$[c \cdot f(x)]' = c \cdot f'(x)$$

EXAMPLE:

Calculate $(7x^3)'$

SOLUTION:

$$(7x^3)' = 7 \cdot (x^3)' = 7 \cdot 3 \cdot x^{3-1} = 21x^2$$

FORMULA:

$$[f(x) + g(x)]' = f'(x) + g'(x)$$

EXAMPLE:

Calculate $(x^5 + x^2)'$

SOLUTION:

$$(x^5 + x^2)' = (x^5)' + (x^2)' = 5 \cdot x^{5-1} + 2 \cdot x^{2-1} =$$

$$= 5x^4 + 2x^1 = 5x^4 + 2x$$

FORMULA:

$$[f(x) - g(x)]' = f'(x) - g'(x)$$

EXAMPLE:

Calculate $(x^5 - x^2)'$

SOLUTION:

$$(x^5 - x^2)' = (x^5)' - (x^2)' = 5 \cdot x^{5-1} - 2 \cdot x^{2-1} =$$

$$= 5x^4 - 2x^1 = 5x^4 - 2x$$

FORMULA:

$$(\sin x)' = \cos x$$

FORMULA:

$$(\cos x)' = -\sin x$$

FORMULA:

$$(\tan x)' = \frac{1}{\cos^2 x}$$

FORMULA:

$$(e^x)' = e^x$$

FORMULA:

$$(c^x)' = c^x \cdot \ln c$$

FORMULA:

$$(\ln x)' = \frac{1}{x}$$

FORMULA:

$$(\arcsin x)' = \frac{1}{\sqrt{1-x^2}}$$

FORMULA:

$$(\arctan x)' = \frac{1}{x^2 + 1}$$

FORMULA:

$$\int f(x)dx = \frac{x^{n+1}}{n+1}$$

FORMULA:

$$\int c \cdot f(x)dx = c \cdot \int f(x)dx$$

FORMULA:

$$\int [f(x) + g(x)]dx = \int f(x)dx + \int g(x)dx$$

FORMULA:

$$\int [f(x) - g(x)]dx = \int f(x)dx - \int g(x)dx$$

FORMULA:

$$\int \sin x \; dx = -\cos x$$

FORMULA:

$$\int \cos x \; dx = \sin x$$

FORMULA:

$$\int \frac{1}{x^2+1}\,dx = \arctan x$$

FORMULA:

$$\int e^x \, dx = e^x$$

FORMULA:

$$\int c^x \, dx = \frac{c^x}{\ln c}$$

FORMULA:

$$\int \frac{1}{x}\, dx = \ln|x|$$

FORMULA:

$$\int \frac{1}{\sin^2 x}\, dx = -\cot x$$

FORMULA:

$$\int \frac{1}{\cos^2 x}\, dx = \tan x$$

FORMULA:

$p = 4s$

where:

p = the perimeter of the square

s = the side

EXAMPLE:

Find the perimeter of the square, knowing that the side is 3 cm.

SOLUTION:

$p = 4s = 4 \cdot 3\ cm = 12\ cm$

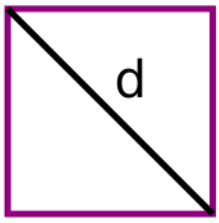
FORMULA:

$d = s \cdot \sqrt{2}$

where:

d = the diagonal of the square

s = the side



EXAMPLE:

Find the diagonal of the square, knowing that the side is 3 cm.

SOLUTION:

$d = s \cdot \sqrt{2}$

$= 3\ cm \cdot \sqrt{2}$

$= 3\sqrt{2}\ cm$

FORMULA:

$A = s^2$

where:

A = the area of the square

s = the side

EXAMPLE:

Find the area of the square,
knowing that the side is 3 cm.

SOLUTION:

$A = s^2$

$= (3\ cm)^2$

$= 3^2\ cm^2$

$= 9\ cm^2$

FORMULA:

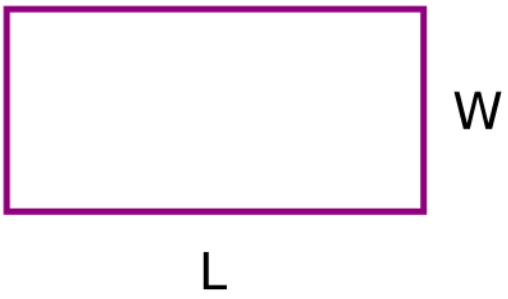
$P = 2L + 2W$

where:

P = the perimeter of the rectangle

L = the length

W = the width



EXAMPLE:

Find the perimeter of the rectangle,
knowing that the length is 7 cm
and the width is 3 cm.

SOLUTION:

$P = 2L + 2W$

$= 2 \cdot 7\ cm + 2 \cdot 3\ cm$

$= 14\ cm + 6\ cm$

$= 20\ cm$

FORMULA:

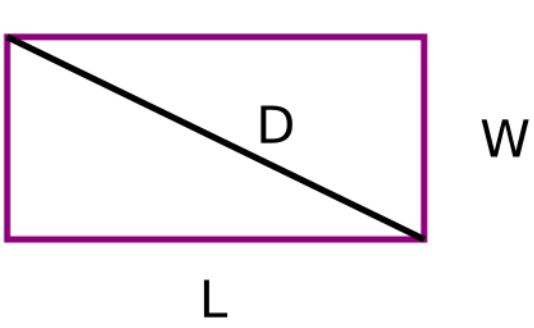
$D = \sqrt{L^2 + W^2}$

where:

D = the diagonal of the rectangle

L = the length

W = the width



EXAMPLE:

Find the diagonal of the rectangle, knowing that the length is 7 cm and the width is 3 cm.

SOLUTION:

$D = \sqrt{L^2 + W^2}$

$= \sqrt{(7\ cm)^2 + (3\ cm)^2}$

$= \sqrt{49\ cm^2 + 9\ cm^2}$

$= \sqrt{58\ cm^2}$

$= \sqrt{58}\ cm$

FORMULA:

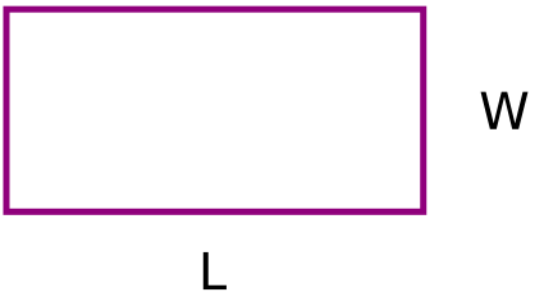
$A = L \cdot W$

where:

A = the area of the rectangle

L = the length

W = the width



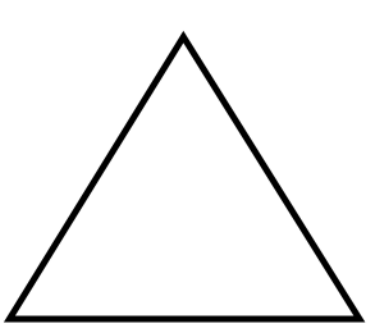
FORMULA:

$P = 3s$

where:

P = the perimeter of the equilateral triangle

s = the side



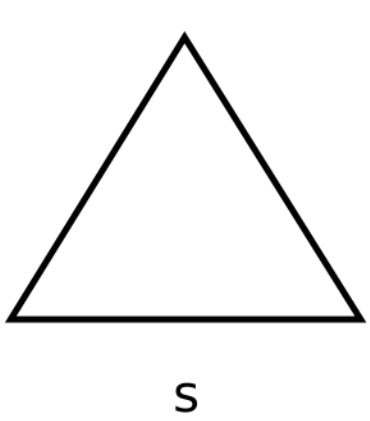
FORMULA:

$$A = \frac{s^2 \cdot \sqrt{3}}{4}$$

where:

A = the area of the equilateral triangle

s = the side



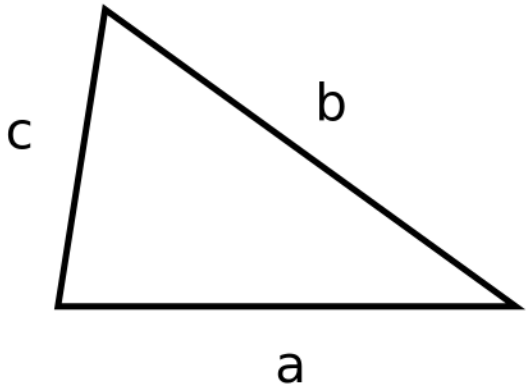
FORMULA:

$P = a + b + c$

where:

P = the perimeter of the scalene triangle

a, b and c = the sides



FORMULA:

$$A = \sqrt{p(p-a)(p-b)(p-c)}$$

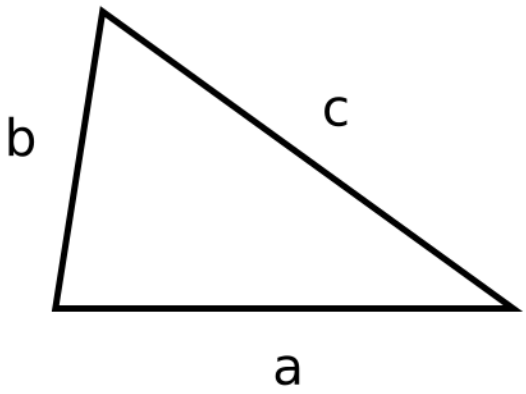
$$p = \frac{a+b+c}{2}$$

where:

A = the area of the scalene triangle

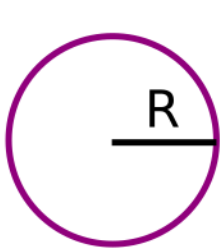
p = the semi-perimeter

a, b and c = the sides



FORMULA:

$C = 2\pi R$



where:

C = the circumference of the circle

R = the radius

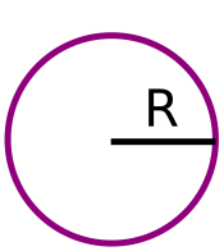
FORMULA:

$D = 2R$

where:

D = the diameter of the circle

R = the radius



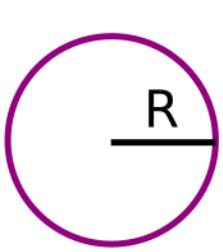
FORMULA:

$A = \pi R^2$

where:

A = the area of the circle

R = the radius



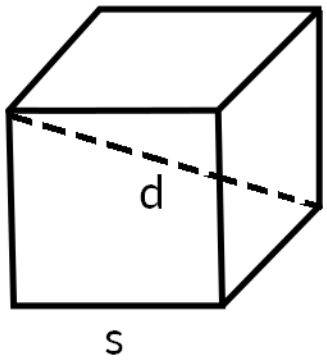
FORMULA:

$d = s\sqrt{3}$

where:

d = the diagonal of the cube

s = the side



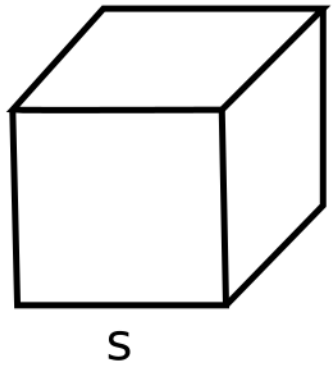
FORMULA:

$A_{lat} = 4s^2$

where:

A_{lat} = the lateral area of the cube

s = the side



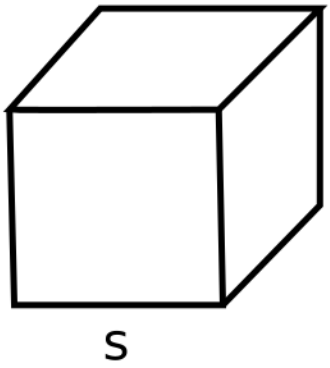
FORMULA:

$A_{tot} = 6s^2$

where:

A_{tot} = the total area of the cube

s = the side



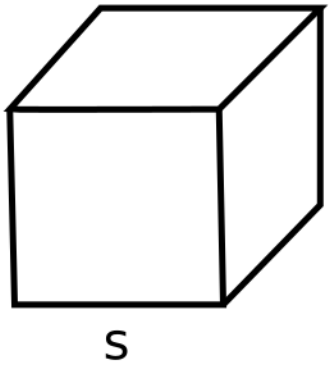
FORMULA:

$V = s^3$

where:

V = the volume of the cube

s = the side



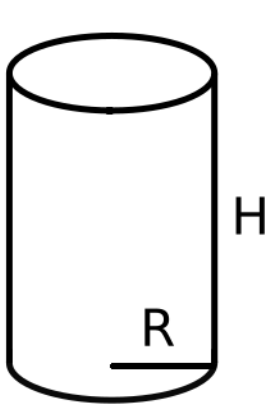
FORMULA:

$A_{lat} = 2\pi RH$

where:

R = the radius

H = the height



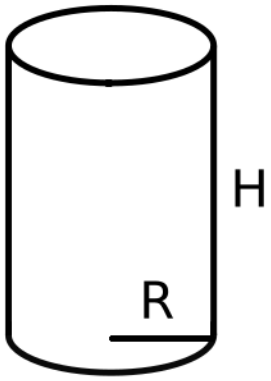
FORMULA:

$A_{tot} = 2\pi RH + 2\pi R^2$

where:

R = the radius

H = the height



FORMULA:

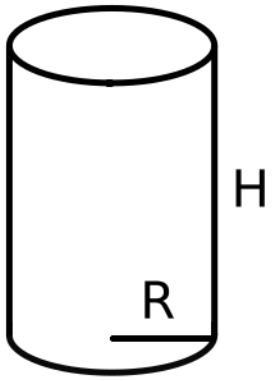
$V = \pi R^2 H$

where:

V = the volume of the right circular cylinder

R = the radius

H = the height



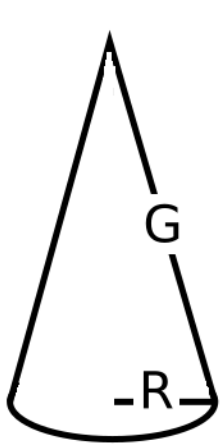
FORMULA:

$A_{lat} = \pi RG$

where:

R = the radius

G = the slant height



FORMULA:

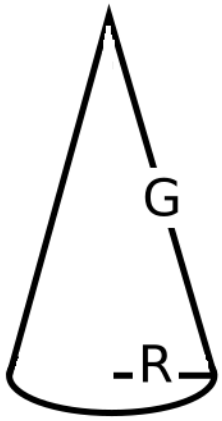
$A_{tot} = \pi RG + \pi R^2$

where:

A_{tot} = the total area of the right circular cone

R = the radius

G = the slant height



FORMULA:

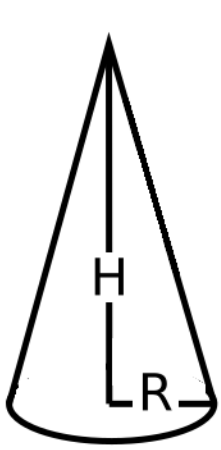
$$V = \frac{\pi R^2 H}{3}$$

where:

V = the volume of the right circular cone

R = the radius

H = the height



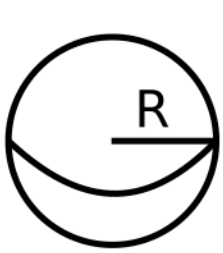
FORMULA:

$A = 4\pi R^2$

where:

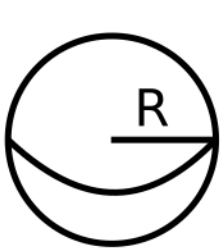
A = the area of the sphere

R = the radius



FORMULA:

$$V = \frac{4\pi R^3}{3}$$



where:

V = the volume of the sphere

R = the radius

FORMULA:

$\sin^2 \ a + \cos^2 \ a = 1$

EXAMPLE:

Calculate

$(\sin \ 79°)^2 + (\cos \ 79°)^2$

SOLUTION:

$(\sin \ 79°)^2 + (\cos \ 79°)^2$

$= \sin^2 \ 79° + \cos^2 \ 79°$

$= 1$

FORMULA:

$$\sin\ (a+b) = \sin\ a \cdot \cos\ b + \cos\ a \cdot \sin\ b$$

EXAMPLE:

Calculate $\sin\ 75°$

SOLUTION:

$$\begin{aligned}
&\sin\ 75° \\
&= \sin\ (45° + 30°) \\
&= \sin\ 45° \cdot \cos\ 30° + \cos\ 45° \cdot \sin\ 30° \\
&= \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{3}}{2} + \frac{\sqrt{2}}{2} \cdot \frac{1}{2} \\
&= \frac{\sqrt{6}}{4} + \frac{\sqrt{2}}{4} \\
&= \frac{\sqrt{6} + \sqrt{2}}{4}
\end{aligned}$$

FORMULA:

$$\cos\ (a+b) = \cos\ a \cdot \cos\ b - \sin\ a \cdot \sin\ b$$

EXAMPLE:

Calculate $\cos\ 75°$

SOLUTION:

$$\begin{aligned}
&\cos\ 75° \\
&= \cos\ (45° + 30°) \\
&= \cos\ 45° \cdot \cos\ 30° - \sin\ 45° \cdot \sin\ 30° \\
&= \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{3}}{2} - \frac{\sqrt{2}}{2} \cdot \frac{1}{2} \\
&= \frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{4} \\
&= \frac{\sqrt{6} - \sqrt{2}}{4}
\end{aligned}$$

FORMULA:

$$\sin\ (a-b) = \sin\ a \cdot \cos\ b - \cos\ a \cdot \sin\ b$$

EXAMPLE:

Calculate $\sin\ 15^\circ$

SOLUTION:

$$\begin{aligned}
&\sin\ 15^\circ \\
&= \sin\ (45^\circ - 30^\circ) \\
&= \sin\ 45^\circ \cdot \cos\ 30^\circ - \cos\ 45^\circ \cdot \sin\ 30^\circ \\
&= \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{3}}{2} - \frac{\sqrt{2}}{2} \cdot \frac{1}{2} \\
&= \frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{4} \\
&= \frac{\sqrt{6} - \sqrt{2}}{4}
\end{aligned}$$

FORMULA:

$$\cos\ (a-b) = \cos\ a \cdot \cos\ b + \sin\ a \cdot \sin\ b$$

EXAMPLE:

Calculate $\cos\ 15°$

SOLUTION:

$$\cos\ 15°$$
$$= \cos\ (45° - 30°)$$
$$= \cos\ 45° \cdot \cos\ 30° + \sin\ 45° \cdot \sin\ 30°$$
$$= \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{3}}{2} + \frac{\sqrt{2}}{2} \cdot \frac{1}{2}$$
$$= \frac{\sqrt{6}}{4} + \frac{\sqrt{2}}{4}$$
$$= \frac{\sqrt{6} + \sqrt{2}}{4}$$

FORMULA:

$$\tan\ (a+b) = \frac{\tan a + \tan b}{1 - \tan a \cdot \tan b}$$

FORMULA:

$$\tan\ (a-b) = \frac{\tan a - \tan b}{1 + \tan a \cdot \tan b}$$

FORMULA:

$$\sin\ 2a = 2 \cdot \sin\ a \cdot \cos\ a$$

FORMULA:

$$\cos\ 2a = 2 \cdot \cos^2\ a - 1$$

FORMULA:

$$\tan\ 2a = \frac{2 \cdot \tan\ a}{1 - \tan^2\ a}$$

FORMULA:

$$\sin\ (-a) = -\sin\ a$$

FORMULA:

$$\cos\ (-a) = \cos\ a$$

FORMULA:

$$\tan\ (-a) = -\tan\ a$$

FORMULA:

$$\sin\ 3a = 3 \cdot \sin\ a - 4 \cdot \sin^3\ a$$

FORMULA:

$$\cos\ 3a = 4 \cdot \cos^3\ a - 3 \cdot \cos\ a$$

FORMULA:

$$\sin\ a + \sin\ b = 2 \cdot \sin \frac{a+b}{2} \cdot \cos \frac{a-b}{2}$$

FORMULA:

$$\cos\ a + \cos\ b = 2 \cdot \cos \frac{a+b}{2} \cdot \cos \frac{a-b}{2}$$

FORMULA:

$$\tan\ a + \tan\ b = \frac{\sin\ (a+b)}{\cos\ a \cdot \cos\ b}$$

FORMULA:

$$\sin\ a - \sin\ b = 2 \cdot \sin \frac{a-b}{2} \cdot \cos \frac{a+b}{2}$$

FORMULA:

$$\cos\ a - \cos\ b = -2 \cdot \sin \frac{a+b}{2} \cdot \sin \frac{a-b}{2}$$

FORMULA:

$$\sin^2 \frac{a}{2} = \frac{1 - \cos\ a}{2}$$

FORMULA:

$$\cos^2 \frac{a}{2} = \frac{1 + \cos\ a}{2}$$

FORMULA:

$$\tan^2 \frac{a}{2} = \frac{1 - \cos\ a}{1 + \cos\ a}$$

FORMULA:

$$\sin\ (90^\circ - a) = \cos\ a$$

FORMULA:

$$\cos\ (90^\circ - a) = \sin\ a$$

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