created by Syed Abdullah

MA1521: Precalculus

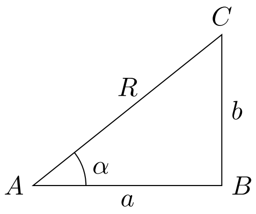
Trigonometry Identities

S	A
T	C

deg	30	45	60
sin	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$
cos	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$
tan	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$

- $\csc / \sec / \cot / \theta = \dfrac{1}{\sin / \cos / \tan \theta}$
- $\cos / \sin / \tan(\frac{\pi}{2} - \theta) = \sin / \cos / \cot \theta$
- $\sin^2(\theta) + \cos^2(\theta) = 1$ (derive others)
- $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$
- $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$
- $\tan(A \pm B) = \dfrac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$
- $\sin 2A = 2 \sin A \cos A$
- $\cos 2A = \cos^2 A - \sin^2 A = 2\cos^2 A - 1$ $= 1 - 2\sin^2 A$
- $\tan 2A = \dfrac{2 \tan A}{1 - \tan^2 A}$
- $\sin 3A = 3 \sin A - 4 \sin^3 A$
- $\cos 3A = 4 \cos^3 A - 3 \cos A$
- $\tan 3A = \dfrac{3 \tan A - \tan^3 A}{1 - 3\tan^2 A}$
- $\sin P \pm \sin Q = 2 \sin \left(\frac{P \pm Q}{2}\right) \cos \left(\frac{P \mp Q}{2}\right)$
- $\cos P \pm \cos Q = \pm 2 \frac{\cos}{\sin} \left(\frac{P+Q}{2}\right) \frac{\cos}{\sin} \left(\frac{P-Q}{2}\right)$
- $\sin A \cos B = \frac{1}{2}[\sin(A+B) + sin(A-B)]$
- $\cos A \cos B = \frac{1}{2}[\cos(A+B) + cos(A-B)]$
- $\sin A \sin B = -\frac{1}{2}[\cos(A+B) - \cos(A-B)]$

R Formula



$\tan \alpha = \frac{b}{a}$
$R = \sqrt{a^2 + b^2}$

- $a \sin \theta \pm b \cos \theta = R \sin(\theta \pm \alpha)$
- $a \cos \theta \pm b \sin \theta = R \cos(\theta \mp \alpha)$

Partial Fractions

- $\dfrac{P(x)}{(ax+b)(cx+d)} = \dfrac{A}{ax+b} + \dfrac{B}{cx+d}$
- $\dfrac{P(x)}{(ax+b)(cx+d)^2} = \dfrac{A}{ax+b} + \dfrac{B}{cx+d} + \dfrac{C}{(cx+d)^2}$
- $\dfrac{P(x)}{(ax+b)(cx^2+dx+e)} = \dfrac{A}{ax+b} + \dfrac{Bx+C}{cx^2+dx+e}$

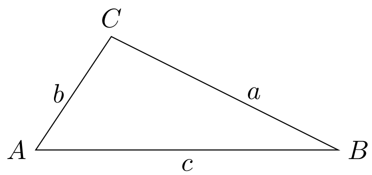
Inequalities & Absolutes

- When multiplying inequality with negative value, change the inequality sign!
- **NEVER** multiply inequality by expression which is **NOT** always +ve/-ve!
- For $\dfrac{P(x)}{Q(x)} > / < / \geq / \leq 0$ type, multiply both sides by $(Q(x))^2$ to get $(P(x))(Q(x))^2 > / < / \geq / \leq 0$ (no change of inequality sign)
- Graphical Method: $f(x) > g(x)$ means f graph above g
- $| f(x) | = \begin{cases} f(x) & x > 0 \\ -f(x) & x < 0 \end{cases}$
- Reflect about ***x*-axis** the parts of $y = f(x)$ that lies **below** x-axis

Logarithms

- $y = a^x \iff x = \log_a y$
- $\log_a x + \log_a y = \log_a xy$
- $\log_a x - \log_a y = \log_a \left(\dfrac{x}{y}\right)$
- $\log_a x^n = n \log_a x$
- $\log_x y = \dfrac{\log_a y}{\log_a x}; \log_a b = \dfrac{1}{\log_b a}$
- $\log_a a = 1; \log_a 1 = 0$

Triangle Formulae

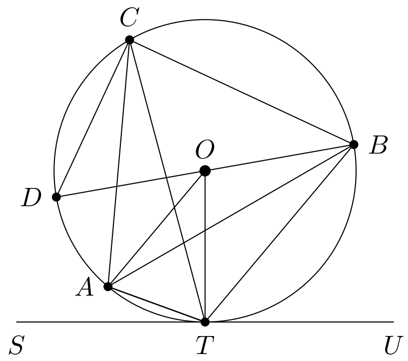


- $\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$
- $c^2 = a^2 + b^2 - 2ab \cos C$
- Area: $\dfrac{1}{2} ab \sin C$
- Area: $\sqrt{s(s-a)(s-b)(s-c)}$, where $s = \dfrac{1}{2}(a+b+c)$

Mensuration

Solid	**Volume**	**Surface Area**
Cone	$\frac{1}{3}\pi r^2 h$	Curved: $\pi r \sqrt{r^2 + h^2}$
Cylinder	$\pi r^2 h$	Curved: $2\pi r h$
Sphere	$\frac{4}{3}\pi r^3$	$4\pi r^2$

Angle Properties of Circle



- $\angle$ in the same segment are equal: $\angle ABT = \angle ACT$ or $\angle TAB = \angle TCB$
- $\angle$ at centre is twice at circumference: $\angle AOT = 2\angle ABT$, $\angle TOB = 2\angle TCB$, obtuse $\angle AOB = 2\angle ACB$ & reflex $\angle AOB = 2\angle ATB$
- $\angle$ between tangent & chord equals $\angle$ in alternate segment: $\angle BTU = \angle TCB$ & $\angle ATS = \angle ABT$
- Opposite $\angle$s of a cyclic quadrilateral are supplementary: $\angle ACB + \angle ATB = 180$ $\angle CAT + \angle CBT = 180$
- Tangent $\perp$ Radius: $\angle OTS = \angle OTU = 90$
- $\angle$ subtended by diameter: $\angle DCB = 90$