Basic Identities

$$\tan t = \frac{\sin t}{\cos t} \qquad \cot t = \frac{\cos t}{\sin t} \qquad \cot t = \frac{1}{\tan t}$$

$$\sec t = \frac{1}{\cos t} \qquad \csc t = \frac{1}{\sin t} \qquad \sin^2 t + \cos^2 t = 1$$

$$1 + \tan^2 t = \sec^2 t \qquad 1 + \cot^2 t = \csc^2 t$$

Cofunction Identities

$$\sin\left(\frac{\pi}{2} - t\right) = \cos t \qquad \cos\left(\frac{\pi}{2} - t\right) = \sin t \qquad \tan\left(\frac{\pi}{2} - t\right) = \cot t$$

Odd-even Identities

$$\sin(-t) = -\sin t \qquad \cos(-t) = \cos t \qquad \tan(-t) = -\tan t$$

Addition Formulas

$$\sin(s + t) = \sin s \cos t + \cos s \sin t \qquad \sin(s - t) = \sin s \cos t - \cos s \sin t$$

$$\cos(s + t) = \cos s \cos t - \sin s \sin t \qquad \cos(s - t) = \cos s \cos t + \sin s \sin t$$

$$\tan(s + t) = \frac{\tan s + \tan t}{1 - \tan s \tan t} \qquad \tan(s - t) = \frac{\tan s - \tan t}{1 + \tan s \tan t}$$

Double Angle Formulas

$$\sin 2t = 2 \sin t \cos t \qquad \tan 2t = \frac{2 \tan t}{1 - \tan^2 t}$$

$$\cos 2t = \cos^2 t - \sin^2 t = 1 - 2\sin^2 t = 2\cos^2 t - 1$$

Half Angle Formulas

$$\sin\frac{t}{2} = \pm\sqrt{\frac{1 - \cos t}{2}} \qquad \cos\frac{t}{2} = \pm\sqrt{\frac{1 + \cos t}{2}} \qquad \tan\frac{t}{2} = \frac{1 - \cos t}{\sin t}$$

Product Formulas

$$2\sin s \cos t = \sin(s + t) + \sin(s - t) \qquad 2\cos s \cos t = \cos(s + t) + \cos(s - t)$$

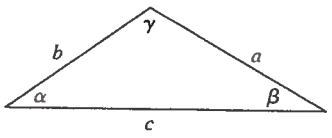
$$2\cos s \sin t = \sin(s + t) - \sin(s - t) \qquad 2\sin s \sin t = \cos(s - t) - \cos(s + t)$$

Factoring Formulas

$$\sin s + \sin t = 2\cos\frac{s - t}{2}\sin\frac{s + t}{2} \qquad \cos s + \cos t = 2\cos\frac{s + t}{2}\cos\frac{s - t}{2}$$

$$\sin s - \sin t = 2\cos\frac{s + t}{2}\sin\frac{s - t}{2} \qquad \cos s - \cos t = -2\sin\frac{s + t}{2}\sin\frac{s - t}{2}$$

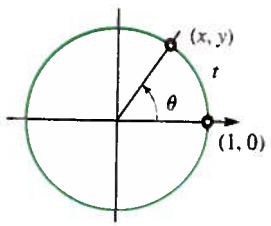
Laws of Sines and Cosines

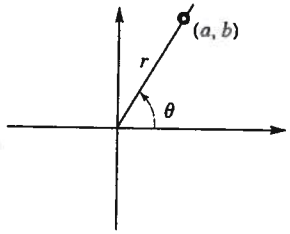


$$\frac{\sin\alpha}{a} = \frac{\sin\beta}{b} = \frac{\sin\gamma}{c}$$

$$a^2 = b^2 + c^2 - 2bc\cos\alpha$$

TRIGONOMETRY

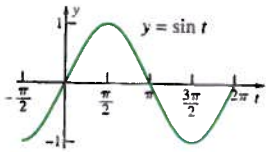


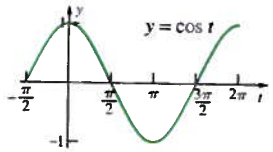


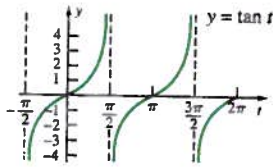
$$\sin t = \sin\theta = y = \frac{b}{r} \qquad \cos t = \cos\theta = x = \frac{a}{r}$$

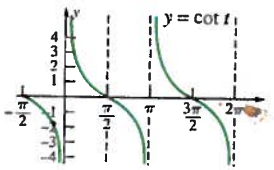
$$\tan t = \tan\theta = \frac{y}{x} = \frac{b}{a} \qquad \cot t = \cot\theta = \frac{x}{y} = \frac{a}{b}$$

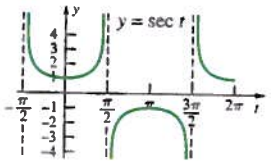
Graphs

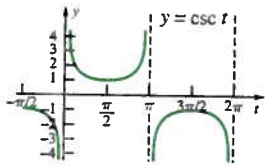












Inverse Trigonometric Functions

$$y = \sin^{-1} x \Leftrightarrow x = \sin y, -\pi/2 \le y \le \pi/2$$

$$y = \cos^{-1} x \Leftrightarrow x = \cos y, 0 \le y \le \pi$$

$$y = \tan^{-1} x \Leftrightarrow x = \tan y, -\pi/2 < y < \pi/2$$

$$y = \sec^{-1} x \Leftrightarrow x = \sec y, 0 \le y \le \pi, y \ne \pi/2$$

$$\sec^{-1} x = \cos^{-1}(1/x)$$

Hyperbolic Functions

$$\sinh x = \frac{1}{2}(e^x - e^{-x}) \qquad \cosh x = \frac{1}{2}(e^x + e^{-x})$$

$$\tanh x = \frac{\sinh x}{\cosh x} \qquad \coth x = \frac{\cosh x}{\sinh x}$$

$$\operatorname{sech} x = \frac{1}{\cosh x} \qquad \operatorname{csch} x = \frac{1}{\sinh x}$$

Series

$$\frac{1}{1 - x} = 1 + x + x^2 + x^3 + \cdots, \quad -1 < x < 1$$

$$\ln(1 + x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots, \quad -1 < x \le 1$$

$$\tan^{-1} x = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \cdots, \quad -1 \le x \le 1$$

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots$$

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \cdots$$

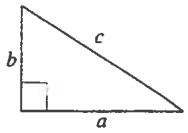
$$\sinh x = x + \frac{x^3}{3!} + \frac{x^5}{5!} + \frac{x^7}{7!} + \cdots$$

$$\cosh x = 1 + \frac{x^2}{2!} + \frac{x^4}{4!} + \frac{x^6}{6!} + \cdots$$

$$(1 + x)^p = 1 + \binom{p}{1}x + \binom{p}{2}x^2 + \binom{p}{3}x^3 + \cdots, \quad -1 < x < 1$$

$$\binom{p}{k} = \frac{p(p-1)(p-2)\cdots(p-k+1)}{k!}$$

GEOMETRY

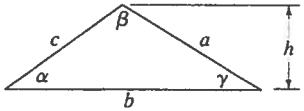


Triangles

Pythagorean Theorem

$a^2 + b^2 = c^2$

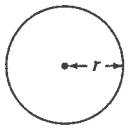
Right triangle



Angles $\alpha + \beta + \gamma = 180°$

Area $A = \frac{1}{2}bh$

Any triangle

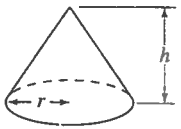


Circles

Circumference	$C = 2\pi r$
Area	$A = \pi r^2$

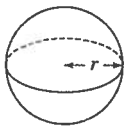
Cylinders

Surface area	$S = 2\pi r^2 + 2\pi rh$
Volume	$V = \pi r^2 h$



Cones

Surface area	$S = \pi r^2 + \pi r\sqrt{r^2 + h^2}$
Volume	$V = \frac{1}{3}\pi r^2 h$



Spheres

Surface area	$S = 4\pi r^2$
Volume	$V = \frac{4}{3}\pi r^3$

CONVERSIONS

1 inch = 2.54 centimeters	1 kilometer ≈ 0.62 miles
1 liter = 1000 cubic centimeters	1 liter ≈ 1.057 quarts
1 kilogram ≈ 2.20 pounds	1 pound ≈ 453.6 grams
π radians = 180 degrees	1 cubic foot ≈ 7.48 gallons

Fold here

INTEGRALS

1. $\int u\,dv = uv - \int v\,du$
2. $\int u^n\,du = \frac{1}{n+1}u^{n+1} + C, n \neq -1$
3. $\int \frac{1}{u}\,du = \ln|u| + C$
4. $\int e^u\,du = e^u + C$
5. $\int a^u\,du = \frac{a^u}{\ln a} + C$
6. $\int \sin u\,du = -\cos u + C$
7. $\int \cos u\,du = \sin u + C$
8. $\int \sec^2 u\,du = \tan u + C$
9. $\int \csc^2 u\,du = -\cot u + C$
10. $\int \sec u \tan u\,du = \sec u + C$
11. $\int \csc u \cot u\,du = -\csc u + C$
12. $\int \tan u\,du = -\ln|\cos u| + C$
13. $\int \cot u\,du = \ln|\sin u| + C$
14. $\int \sec u\,du = \ln|\sec u + \tan u| + C$
15. $\int \csc u\,du = \ln|\csc u - \cot u| + C$
16. $\int \frac{1}{\sqrt{a^2 - u^2}}\,du = \sin^{-1}\frac{u}{a} + C$
17. $\int \frac{1}{a^2 + u^2}\,du = \frac{1}{a}\tan^{-1}\frac{u}{a} + C$
18. $\int \frac{1}{a^2 - u^2}\,du = \frac{1}{2a}\ln\left|\frac{u+a}{u-a}\right| + C$
19. $\int \frac{1}{u\sqrt{u^2 - a^2}}\,du = \frac{1}{a}\sec^{-1}\left|\frac{u}{a}\right| + C$

Fold here

Formula Card
to accompany
CALCULUS, 9/E
Varberg, Purcell, and Rigdon

DERIVATIVES

$D_x x^r = rx^{r-1}$	$D_x\lvert x\rvert = \frac{\lvert x\rvert}{x}$
$D_x \sin x = \cos x$	$D_x \cos x = -\sin x$
$D_x \tan x = \sec^2 x$	$D_x \cot x = -\csc^2 x$
$D_x \sec x = \sec x \tan x$	$D_x \csc x = -\csc x \cot x$
$D_x \sinh x = \cosh x$	$D_x \coth x = -\operatorname{csch}^2 x$
$D_x \cosh x = \sinh x$	$D_x \operatorname{sech} x = -\operatorname{sech} x \tanh x$
$D_x \tanh x = \operatorname{sech}^2 x$	$D_x \operatorname{csch} x = -\operatorname{csch} x \coth x$
$D_x \ln x = \frac{1}{x}$	$D_x \log_a x = \frac{1}{x \ln a}$
$D_x e^x = e^x$	$D_x a^x = a^x \ln a$
$D_x \sin^{-1} x = \frac{1}{\sqrt{1 - x^2}}$	$D_x \cos^{-1} x = \frac{-1}{\sqrt{1 - x^2}}$
$D_x \tan^{-1} x = \frac{1}{1 + x^2}$	$D_x \sec^{-1} x = \frac{1}{\lvert x\rvert\sqrt{x^2 - 1}}$