Journal Title: Calculus of a single variable /

ISSN:

Volume:
Issue:
Month/Year:
Pages: A77 to back cover

Article Author:

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INDEX

ALGEBRA

EXPONENTS AND RADICALS

$a^m a^n = a^{m+n}$ $\qquad$ $a^{m/n} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$

$(a^m)^n = a^{mn}$ $\qquad$ $\sqrt[n]{ab} = \sqrt[n]{a}\sqrt[n]{b}$

$(ab)^n = a^n b^n$ $\qquad$ $\sqrt[n]{\dfrac{a}{b}} = \dfrac{\sqrt[n]{a}}{\sqrt[n]{b}}$

$\left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n}$ $\qquad$ $\sqrt[m]{\sqrt[n]{a}} = \sqrt[mn]{a}$

$\dfrac{a^m}{a^n} = a^{m-n}$ $\qquad$ $a^{-n} = \dfrac{1}{a^n}$

ABSOLUTE VALUE ($d > 0$)

$|x| < d$ if and only if $-d < x < d$

$|x| > d$ if and only if either $x > d$ or $x < -d$

$|a + b| \leq |a| + |b|$ (Triangle inequality)

$-|a| \leq a \leq |a|$

INEQUALITIES

If $a > b$ and $b > c$, then $a > c$

If $a > b$, then $a + c > b + c$

If $a > b$ and $c > 0$, then $ac > bc$

If $a > b$ and $c < 0$, then $ac < bc$

QUADRATIC FORMULA

If $a \neq 0$, the roots of $ax^2 + bx + c = 0$ are

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

LOGARITHMS

$y = \log_a x$ means $a^y = x$ $\qquad$ $\log_a 1 = 0$

$\log_a xy = \log_a x + \log_a y$ $\qquad$ $\log_a a = 1$

$\log_a \dfrac{x}{y} = \log_a x - \log_a y$ $\qquad$ $\log x = \log_{10} x$

$\log_a x^r = r \log_a x$ $\qquad$ $\ln x = \log_e x$

BINOMIAL THEOREM

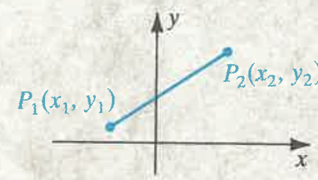
$$(x + y)^n = x^n + \binom{n}{1}x^{n-1}y + \binom{n}{2}x^{n-2}y^2 + \cdots + \binom{n}{k}x^{n-k}y^k + \cdots + y^n,$$

where $\dbinom{n}{k} = \dfrac{n!}{k!(n-k)!}$

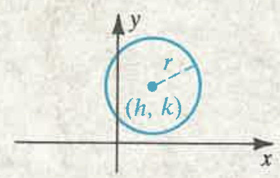
ANALYTIC GEOMETRY

DISTANCE FORMULA

$$d(P_1, P_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

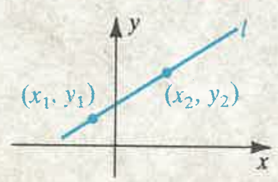


EQUATION OF A CIRCLE



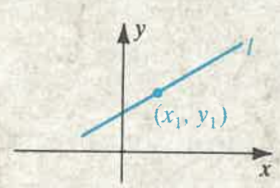
$$(x - h)^2 + (y - k)^2 = r^2$$

SLOPE m OF A LINE



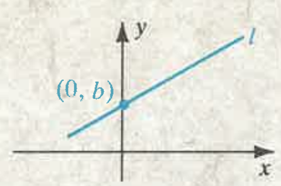
$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

POINT–SLOPE FORM



$$y - y_1 = m(x - x_1)$$

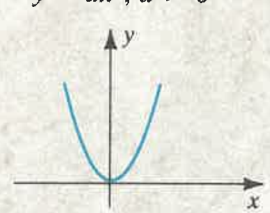
SLOPE–INTERCEPT FORM



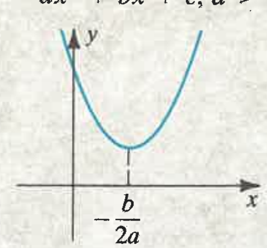
$$y = mx + b$$

GRAPH OF A QUADRATIC FUNCTION

$y = ax^2, a > 0$



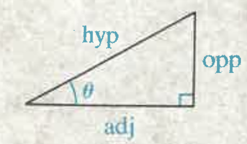
$y = ax^2 + bx + c, a > 0$



TRIGONOMETRY

TRIGONOMETRIC FUNCTIONS

OF ACUTE ANGLES

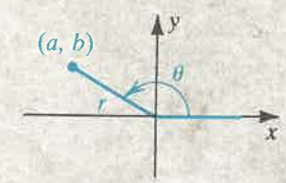


$\sin\theta = \dfrac{\text{opp}}{\text{hyp}}$ $\qquad$ $\csc\theta = \dfrac{\text{hyp}}{\text{opp}}$

$\cos\theta = \dfrac{\text{adj}}{\text{hyp}}$ $\qquad$ $\sec\theta = \dfrac{\text{hyp}}{\text{adj}}$

$\tan\theta = \dfrac{\text{opp}}{\text{adj}}$ $\qquad$ $\cot\theta = \dfrac{\text{adj}}{\text{opp}}$

OF ARBITRARY ANGLES

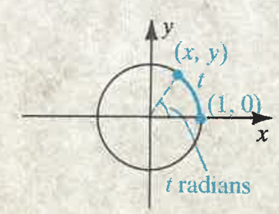


$\sin\theta = \dfrac{b}{r}$ $\qquad$ $\csc\theta = \dfrac{r}{b}$

$\cos\theta = \dfrac{a}{r}$ $\qquad$ $\sec\theta = \dfrac{r}{a}$

$\tan\theta = \dfrac{b}{a}$ $\qquad$ $\cot\theta = \dfrac{a}{b}$

OF REAL NUMBERS

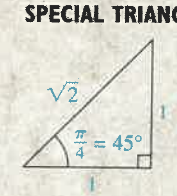


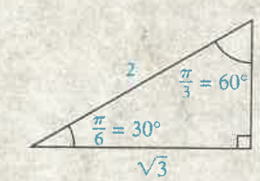
$\sin t = y$ $\qquad$ $\csc t = \dfrac{1}{y}$

$\cos t = x$ $\qquad$ $\sec t = \dfrac{1}{x}$

$\tan t = \dfrac{y}{x}$ $\qquad$ $\cot t = \dfrac{x}{y}$

SPECIAL TRIANGLES





TRIGONOMETRIC IDENTITIES

$\csc t = 1/\sin t$ $\qquad$ $\tan t = \sin t/\cos t$

$\sec t = 1/\cos t$ $\qquad$ $\cot t = \cos t/\sin t$

$\cot t = 1/\tan t$

$\sin^2 t + \cos^2 t = 1$ $\qquad$ $\sin(-t) = -\sin t$

$1 + \tan^2 t = \sec^2 t$ $\qquad$ $\cos(-t) = \cos t$

$1 + \cot^2 t = \csc^2 t$ $\qquad$ $\tan(-t) = -\tan t$

$\sin(u + v) = \sin u \cos v + \cos u \sin v$

$\cos(u + v) = \cos u \cos v - \sin u \sin v$

$\tan(u + v) = \dfrac{\tan u + \tan v}{1 - \tan u \tan v}$

$\sin(u - v) = \sin u \cos v - \cos u \sin v$

$\cos(u - v) = \cos u \cos v + \sin u \sin v$

$\tan(u - v) = \dfrac{\tan u - \tan v}{1 + \tan u \tan v}$

$\sin 2u = 2 \sin u \cos u$

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

$\tan 2u = \dfrac{2\tan u}{1 - \tan^2 u}$

$\left|\sin\dfrac{u}{2}\right| = \sqrt{\dfrac{1 - \cos u}{2}}$ $\qquad$ $\left|\cos\dfrac{u}{2}\right| = \sqrt{\dfrac{1 + \cos u}{2}}$

$\tan\dfrac{u}{2} = \dfrac{1 - \cos u}{\sin u} = \dfrac{\sin u}{1 + \cos u}$

$\sin^2 u = \dfrac{1 - \cos 2u}{2}$ $\qquad$ $\cos^2 u = \dfrac{1 + \cos 2u}{2}$

$\sin u \cos v = \frac{1}{2}[\sin(u + v) + \sin(u - v)]$

$\cos u \sin v = \frac{1}{2}[\sin(u + v) - \sin(u - v)]$

$\cos u \cos v = \frac{1}{2}[\cos(u + v) + \cos(u - v)]$

$\sin u \sin v = \frac{1}{2}[\cos(u - v) - \cos(u + v)]$

SPECIAL VALUES OF TRIGONOMETRIC FUNCTIONS

θ (degrees)	θ (radians)	$\sin\theta$	$\cos\theta$	$\tan\theta$	$\cot\theta$	$\sec\theta$	$\csc\theta$
0°	0	0	1	0	—	1	—
30°	$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$	$\sqrt{3}$	$\frac{2\sqrt{3}}{3}$	2
45°	$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1	1	$\sqrt{2}$	$\sqrt{2}$
60°	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$	$\frac{\sqrt{3}}{3}$	2	$\frac{2\sqrt{3}}{3}$
90°	$\frac{\pi}{2}$	1	0	—	0	—	1

INVERSE TRIGONOMETRIC FUNCTIONS

Function	Domain	Range
$y = \sin^{-1} x$	$-1 \leq x \leq 1$	$-\frac{\pi}{2} \leq y \leq \frac{\pi}{2}$
$y = \cos^{-1} x$	$-1 \leq x \leq 1$	$0 \leq y \leq \pi$
$y = \tan^{-1} x$	$\mathbb{R}$	$-\frac{\pi}{2} < y < \frac{\pi}{2}$
$y = \cot^{-1} x$	$\mathbb{R}$	$0 < y < \pi$
$y = \sec^{-1} x$	$\lvert x \rvert \geq 1$	$\left[0, \frac{\pi}{2}\right) \cup \left[\pi, \frac{3\pi}{2}\right)$
$y = \csc^{-1} x$	$\lvert x \rvert \geq 1$	$\left[-\frac{\pi}{2}, 0\right) \cup \left(0, \frac{\pi}{2}\right]$

Nature's power and the elegance of its creations are visible in the drifting sand dunes of the Sahara Desert. The wind causes these mountains of sand to change their shape and to shift their positions, forming smooth curves of varying complexity along their ridges.

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ISBN 0-534-93924-4
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