PÁGINA DE REFERÊNCIA 1

ÁLGEBRA

Operações Aritméticas

$a(b + c) = ab + ac$ $\qquad \dfrac{a}{b} + \dfrac{c}{d} = \dfrac{ad + bc}{bd}$

$\dfrac{a + c}{b} = \dfrac{a}{b} + \dfrac{c}{b}$ $\qquad \dfrac{\frac{a}{b}}{\frac{c}{d}} = \dfrac{a}{b} \times \dfrac{d}{c} = \dfrac{ad}{bc}$

Expoentes e Radicais

$x^m x^n = x^{m+n}$ $\qquad \dfrac{x^m}{x^n} = x^{m-n}$

$(x^m)^n = x^{mn}$ $\qquad x^{-n} = \dfrac{1}{x^n}$

$(xy)^n = x^n y^n$ $\qquad \left(\dfrac{x}{y}\right)^n = \dfrac{x^n}{y^n}$

$x^{1/n} = \sqrt[n]{x}$ $\qquad x^{m/n} = \sqrt[n]{x^m} = (\sqrt[n]{x})^m$

$\sqrt[n]{xy} = \sqrt[n]{x}\sqrt[n]{y}$ $\qquad \sqrt[n]{\dfrac{x}{y}} = \dfrac{\sqrt[n]{x}}{\sqrt[n]{y}}$

Fatoração de Polinômios Especiais

$x^2 - y^2 = (x + y)(x - y)$

$x^3 + y^3 = (x + y)(x^2 - xy + y^2)$

$x^3 - y^3 = (x - y)(x^2 + xy + y^2)$

Teorema Binomial

$(x + y)^2 = x^2 + 2xy + y^2$ $\qquad (x - y)^2 = x^2 - 2xy + y^2$

$(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$

$(x - y)^3 = x^3 - 3x^2y + 3xy^2 - y^3$

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

onde $\dbinom{n}{k} = \dfrac{n(n-1)\cdots(n-k+1)}{1 \cdot 2 \cdot 3 \cdot \cdots \cdot k}$

Fórmula Quadrática

Se $ax^2 + bx + c = 0$, então, $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Desigualdades e Valor Absoluto

Se $a < b$ e $b < c$, então $a < c$.

Se $a < b$, então $a + c < b + c$.

Se $a < b$ e $c > 0$, então $ca < cb$.

Se $a < b$ e $c < 0$, então $ca > cb$.

Se $a > 0$, então

$|x| = a$ significa que $x = a$ ou $x = -a$

$|x| < a$ significa que $-a < x < a$

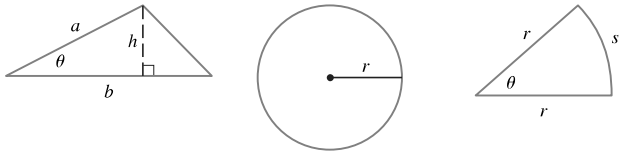
$|x| > a$ significa que $x > a$ ou $x < -a$

GEOMETRIA

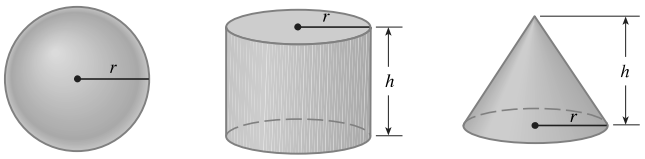
Fórmulas Geométricas

Fórmulas para área A, circunferência C e volume V:

Triângulo	Círculo	Setor do Círculo
$A = \frac{1}{2}bh$	$A = \pi r^2$	$A = \frac{1}{2}r^2\theta$
$= \frac{1}{2}ab \operatorname{sen}\theta$	$C = 2\pi r$	$s = r\theta$ (θ em radianos)



Esfera	Cilindro	Cone
$V = \frac{4}{3}\pi r^3$	$V = \pi r^2 h$	$V = \frac{1}{3}\pi r^2 h$
$A = 4\pi r^2$		$A = \pi r\sqrt{r^2 + h^2}$



Fórmulas de Distância e Ponto Médio

Distância entre $P_1(x_1, y_1)$ e $P_2(x_2, y_2)$:

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

Ponto Médio de $\overline{P_1P_2}$: $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$

Retas

Inclinação da reta através de $P_1(x_1, y_1)$ e $P_2(x_2, y_2)$:

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

Coeficiente angular da reta através de $P_1(x_1, y_1)$ com inclinação m:

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

Função afim da reta com inclinação m e interceptando o eixo y em b:

$$y = mx + b$$

Círculos

Equação do círculo com centro (h, k) e raio r:

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

PÁGINA DE REFERÊNCIA 2

TRIGONOMETRIA

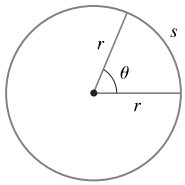
Medição do Ângulo

π radianos $= 180°$

$1° = \dfrac{\pi}{180}$ rad $\qquad 1 \text{ rad} = \dfrac{180°}{\pi}$

$s = r\theta$

(θ em radianos)

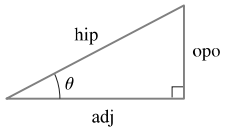


Trigonometria de Ângulo Reto

$\operatorname{sen}\theta = \dfrac{\text{opo}}{\text{hip}} \qquad \operatorname{cossec}\theta = \dfrac{\text{hip}}{\text{opo}}$

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

$\operatorname{tg}\theta = \dfrac{\text{opo}}{\text{adj}} \qquad \operatorname{cotg}\theta = \dfrac{\text{adj}}{\text{opo}}$

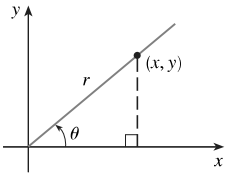


Funções Trigonométricas

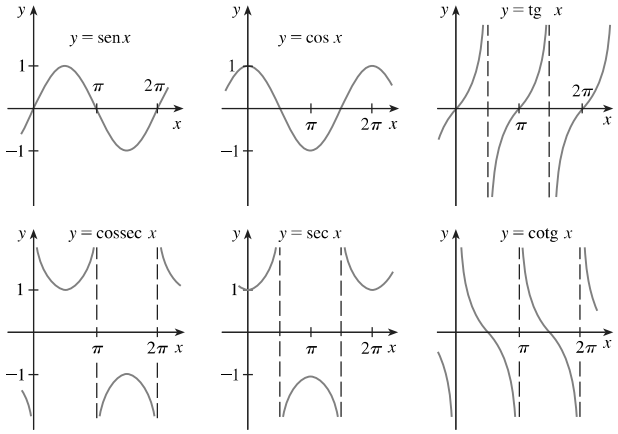
$\operatorname{sen}\theta = \dfrac{y}{r} \qquad \operatorname{cossec}\theta = \dfrac{r}{y}$

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

$\operatorname{tg}\theta = \dfrac{y}{x} \qquad \operatorname{cotg}\theta = \dfrac{x}{y}$



Gráficos de Funções Trigonométricas



Funções Trigonométricas de Ângulos Importantes

θ	radianos	sen θ	cos θ	tg θ
0°	0	0	1	0
30°	$\pi/6$	$1/2$	$\sqrt{3}/2$	$\sqrt{3}/3$
45°	$\pi/4$	$\sqrt{2}/2$	$\sqrt{2}/2$	1
60°	$\pi/3$	$\sqrt{3}/2$	$1/2$	$\sqrt{3}$
90°	$\pi/2$	1	0	—

Identidades Fundamentais

$\operatorname{cossec}\theta = \dfrac{1}{\operatorname{sen}\theta} \qquad \sec\theta = \dfrac{1}{\cos\theta}$

$\operatorname{tg}\theta = \dfrac{\operatorname{sen}\theta}{\cos\theta} \qquad \operatorname{cotg}\theta = \dfrac{\cos\theta}{\operatorname{sen}\theta}$

$\operatorname{cotg}\theta = \dfrac{1}{\operatorname{tg}\theta} \qquad \operatorname{sen}^2\theta + \cos^2\theta = 1$

$1 + \operatorname{tg}^2\theta = \sec^2\theta \qquad 1 + \operatorname{cotg}^2\theta = \operatorname{cossec}^2\theta$

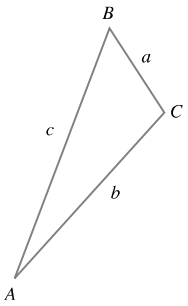
$\operatorname{sen}(-\theta) = -\operatorname{sen}\theta \qquad \cos(-\theta) = \cos\theta$

$\operatorname{tg}(-\theta) = -\operatorname{tg}\theta \qquad \operatorname{sen}\left(\dfrac{\pi}{2} - \theta\right) = \cos\theta$

$\cos\left(\dfrac{\pi}{2} - \theta\right) = \operatorname{sen}\theta \qquad \operatorname{tg}\left(\dfrac{\pi}{2} - \theta\right) = \operatorname{cotg}\theta$

Lei dos Senos

$$\frac{\operatorname{sen} A}{a} = \frac{\operatorname{sen} B}{b} = \frac{\operatorname{sen} C}{c}$$



Lei dos Cossenos

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

$b^2 = a^2 + c^2 - 2ac\cos B$

$c^2 = a^2 + b^2 - 2ab\cos C$

Fórmulas de Adição e Subtração

$\operatorname{sen}(x + y) = \operatorname{sen} x\cos y + \cos x\operatorname{sen} y$

$\operatorname{sen}(x - y) = \operatorname{sen} x\cos y - \cos x\operatorname{sen} y$

$\cos(x + y) = \cos x\cos y - \operatorname{sen} x\operatorname{sen} y$

$\cos(x - y) = \cos x\cos y + \operatorname{sen} x\operatorname{sen} y$

$$\operatorname{tg}(x + y) = \frac{\operatorname{tg} x + \operatorname{tg} y}{1 - \operatorname{tg} x\operatorname{tg} y}$$

$$\operatorname{tg}(x - y) = \frac{\operatorname{tg} x - \operatorname{tg} y}{1 + \operatorname{tg} x\operatorname{tg} y}$$

Fórmulas de Ângulo Duplo

$\operatorname{sen} 2x = 2\operatorname{sen} x\cos x$

$\cos 2x = \cos^2 x - \operatorname{sen}^2 x = 2\cos^2 x - 1 = 1 - 2\operatorname{sen}^2 x$

$$\operatorname{tg} 2x = \frac{2\operatorname{tg} x}{1 - \operatorname{tg}^2 x}$$

Fórmulas de Metade do Ângulo

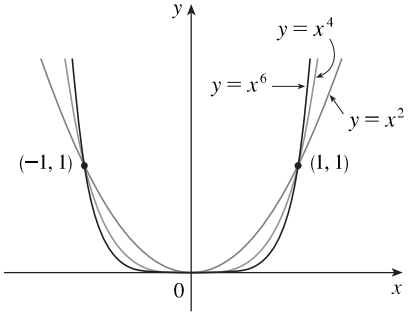
$\operatorname{sen}^2 x = \dfrac{1 - \cos 2x}{2} \qquad \cos^2 x = \dfrac{1 + \cos 2x}{2}$

PÁGINA DE REFERÊNCIA 3

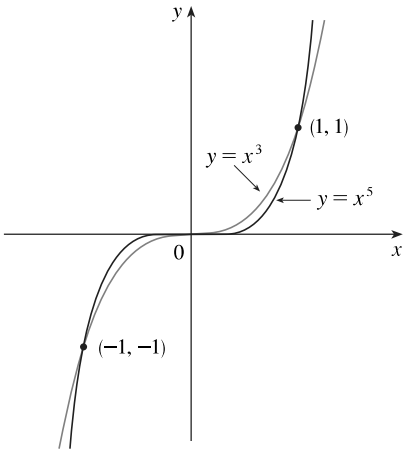
FUNÇÕES ESPECIAIS

Funções Potências $f(x) = x^a$

(i) $f(x) = x^n$, n um inteiro positivo

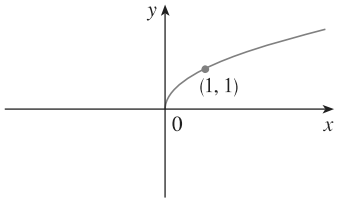


n par

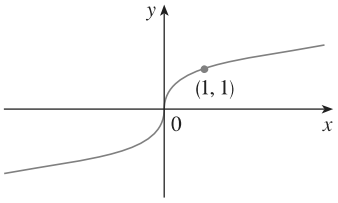


n ímpar

(ii) $f(x) = x^{1/n} = \sqrt[n]{x}$, n um inteiro positivo

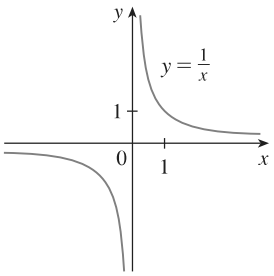


$f(x) = \sqrt{x}$



$f(x) = \sqrt[3]{x}$

(iii) $f(x) = x^{-1} = \dfrac{1}{x}$

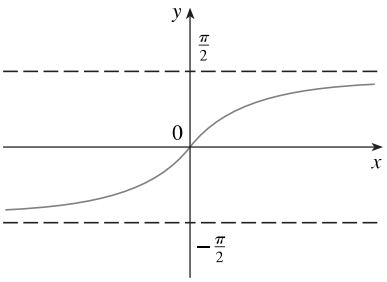


Funções Trigonométricas Inversas

$\arcsen\, x = \operatorname{sen}^{-1} x = y \iff \operatorname{sen} y = x \quad \text{e} \quad -\dfrac{\pi}{2} \leqslant y \leqslant \dfrac{\pi}{2}$

$\arccos x = \cos^{-1} x = y \iff \cos y = x \quad \text{e} \quad 0 \leqslant y \leqslant \pi$

$\operatorname{arctg}\, x = \operatorname{tg}^{-1} x = y \iff \operatorname{tg} y = x \quad \text{e} \quad -\dfrac{\pi}{2} < y < \dfrac{\pi}{2}$



$y = \operatorname{tg}^{-1} x = \operatorname{arctg}\, x$

$\lim_{x \to -\infty} \operatorname{tg}^{-1} x = -\dfrac{\pi}{2}$

$\lim_{x \to \infty} \operatorname{tg}^{-1} x = \dfrac{\pi}{2}$

PÁGINA DE REFERÊNCIA 4

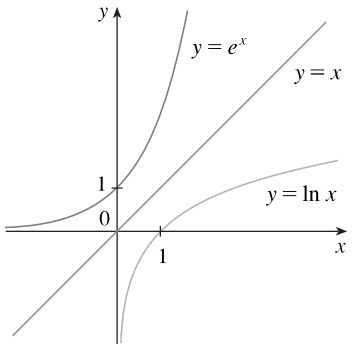
FUNÇÕES ESPECIAIS

Funções Exponenciais e Logarítmicas

$\log_a x = y \iff a^y = x$

$\ln x = \log_e x, \quad \text{onde} \quad \ln e = 1$

$\ln x = y \iff e^y = x$



$\lim_{x \to -\infty} e^x = 0$ $\quad$ $\lim_{x \to \infty} e^x = \infty$

$\lim_{x \to 0^+} \ln x = -\infty$ $\quad$ $\lim_{x \to \infty} \ln x = \infty$

Equações de Cancelamento

$\log_a(a^x) = x \qquad a^{\log_a x} = x$

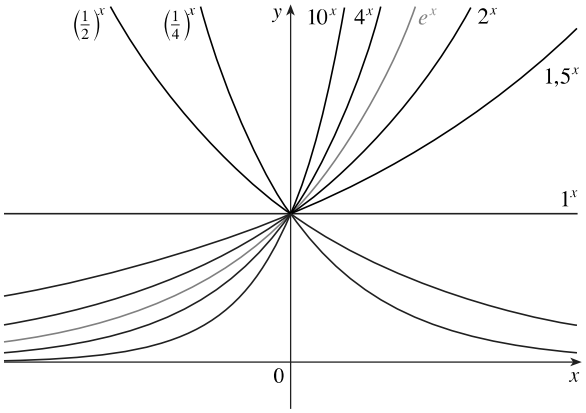
$\ln(e^x) = x \qquad e^{\ln x} = x$

Leis de Logaritmos

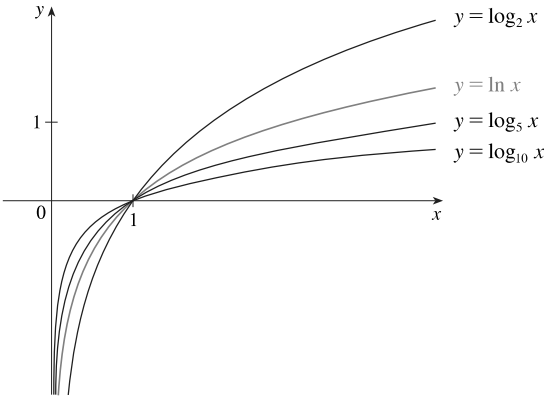
1. $\log_a(xy) = \log_a x + \log_a y$

2. $\log_a\left(\dfrac{x}{y}\right) = \log_a x - \log_a y$

3. $\log_a(x^r) = r \log_a x$



Funções Exponenciais



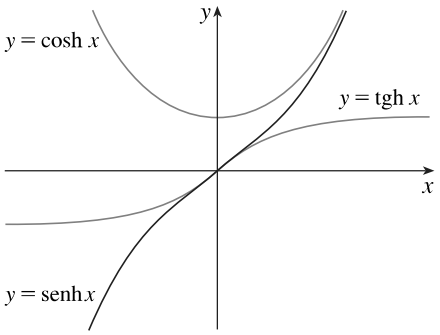
Funções Logarítmicas

Funções Hiperbólicas

$\operatorname{senh} x = \dfrac{e^x - e^{-x}}{2}$ $\qquad$ $\operatorname{cossech} x = \dfrac{1}{\operatorname{senh} x}$

$\cosh x = \dfrac{e^x + e^{-x}}{2}$ $\qquad$ $\operatorname{sech} x = \dfrac{1}{\cosh x}$

$\operatorname{tgh} x = \dfrac{\operatorname{senh} x}{\cosh x}$ $\qquad$ $\operatorname{cotgh} x = \dfrac{\cosh x}{\operatorname{senh} x}$



Funções Hiperbólicas Inversas

$y = \operatorname{senh}^{-1} x \iff \operatorname{senh} y = x$ $\qquad$ $\operatorname{senh}^{-1} x = \ln\left(x + \sqrt{x^2 + 1}\right)$

$y = \cosh^{-1} x \iff \cosh y = x \quad \text{e} \quad y \geqslant 0$ $\qquad$ $\cosh^{-1} x = \ln\left(x + \sqrt{x^2 - 1}\right)$

$y = \operatorname{tgh}^{-1} x \iff \operatorname{tgh} y = x$ $\qquad$ $\operatorname{tgh}^{-1} x = \frac{1}{2} \ln\left(\dfrac{1 + x}{1 - x}\right)$

PÁGINA DE REFERÊNCIA 5

REGRAS DE DIFERENCIAÇÃO

Fórmulas Gerais

1. $\frac{d}{dx}(c) = 0$

2. $\frac{d}{dx}[cf(x)] = cf'(x)$

3. $\frac{d}{dx}[f(x) + g(x)] = f'(x) + g'(x)$

4. $\frac{d}{dx}[f(x) - g(x)] = f'(x) - g'(x)$

5. $\frac{d}{dx}[f(x)g(x)] = f(x)g'(x) + g(x)f'(x)$ (Regra de Produto)

6. $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$ (Regra do Quociente)

7. $\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$ (Regra da Cadeia)

8. $\frac{d}{dx}(x^n) = nx^{n-1}$ (Regra da Potência)

Funções Exponenciais e Logarítmicas

9. $\frac{d}{dx}(e^x) = e^x$

10. $\frac{d}{dx}(a^x) = a^x \ln a$

11. $\frac{d}{dx}\ln|x| = \frac{1}{x}$

12. $\frac{d}{dx}(\log_a x) = \frac{1}{x \ln a}$

Funções Trigonométricas

13. $\frac{d}{dx}(\operatorname{sen} x) = \cos x$

14. $\frac{d}{dx}(\cos x) = -\operatorname{sen} x$

15. $\frac{d}{dx}(\operatorname{tg} x) = \sec^2 x$

16. $\frac{d}{dx}(\operatorname{cossec} x) = -\operatorname{cossec} x \operatorname{cotg} x$

17. $\frac{d}{dx}(\sec x) = \sec x \operatorname{tg} x$

18. $\frac{d}{dx}(\operatorname{cotg} x) = -\operatorname{cossec}^2 x$

Funções Trigonométricas Inversas

19. $\frac{d}{dx}(\operatorname{sen}^{-1} x) = \frac{1}{\sqrt{1 - x^2}}$

20. $\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1 - x^2}}$

21. $\frac{d}{dx}(\operatorname{tg}^{-1} x) = \frac{1}{1 + x^2}$

22. $\frac{d}{dx}(\operatorname{cossec}^{-1} x) = -\frac{1}{x\sqrt{x^2 - 1}}$

23. $\frac{d}{dx}(\sec^{-1} x) = \frac{1}{x\sqrt{x^2 - 1}}$

24. $\frac{d}{dx}(\operatorname{cotg}^{-1} x) = -\frac{1}{1 + x^2}$

Funções Hiperbólicas

25. $\frac{d}{dx}(\operatorname{senh} x) = \cosh x$

26. $\frac{d}{dx}(\cosh x) = \operatorname{senh} x$

27. $\frac{d}{dx}(\operatorname{tgh} x) = \operatorname{sech}^2 x$

28. $\frac{d}{dx}(\operatorname{cossech} x) = -\operatorname{cossech} x \operatorname{cotgh} x$

29. $\frac{d}{dx}(\operatorname{sech} x) = -\operatorname{sech} x \operatorname{tgh} x$

30. $\frac{d}{dx}(\operatorname{cotgh} x) = -\operatorname{cossech}^2 x$

Funções Hiperbólicas Inversas

31. $\frac{d}{dx}(\operatorname{senh}^{-1} x) = \frac{1}{\sqrt{1 + x^2}}$

32. $\frac{d}{dx}(\cosh^{-1} x) = \frac{1}{\sqrt{x^2 - 1}}$

33. $\frac{d}{dx}(\operatorname{tgh}^{-1} x) = \frac{1}{1 - x^2}$

34. $\frac{d}{dx}(\operatorname{cossech}^{-1} x) = -\frac{1}{|x|\sqrt{x^2 + 1}}$

35. $\frac{d}{dx}(\operatorname{sech}^{-1} x) = -\frac{1}{x\sqrt{1 - x^2}}$

36. $\frac{d}{dx}(\operatorname{cotgh}^{-1} x) = \frac{1}{1 - x^2}$