

CÁLCULO DIFERENCIAL E INTEGRAL

Respostas dos exercícios

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1 Integral indefinida: parte I

1.

$$\begin{array}{lll}
 1) \ 4x + \frac{3x^2}{2} + \frac{2x^3}{3} + \frac{1}{4}x^4 + c & 2) \ \frac{3x^{4/3}}{4} + \frac{2x^{3/2}}{3} + c & 3) \ \sqrt{2}x - ex + \pi x + c \\
 4) \ e^x + \frac{1}{2}(-4 + x)x + c & 5) \ x[-2 + \log(x^2)] + c & 6) \ -\operatorname{sen} x + c \\
 7) \ -\ln[\cos(x)] + c & 8) \ \frac{1}{4}\left(4x + x^2 + \frac{x^3}{3}\right) + c & 9) \ \frac{4 + 12x^2 + 3x^7 + 2x^9}{12x^3} + c \\
 10) \ -\cos(x) + c & 11) \ \frac{1}{3}\log(1 - 3x^2 + x^3) + c & 12) \ \log(2 + x) + c \\
 13) \ dx + \frac{cx^2}{2} + \frac{bx^3}{3} + \frac{ax^4}{4} + C & 14) \ \frac{2}{25}\sqrt{x}(25 + x^2) & 15) \ \frac{2w^{3/2}}{3} + \frac{w^4}{4} \\
 16) \ -8\log(1 - x) + 8\log(1 + x) & 17) \ \frac{25\left[2 + x\log\left(\frac{1-x}{1+x}\right)\right]}{2x} & 18) \ e^{-x} + e^x
 \end{array}$$

$$\begin{array}{l}
 2. \ f(x) = -\frac{1}{x} + 15x - \frac{239}{4} \\
 3. \ f(x) = e^x + \log(x) + 3 - e \\
 4. \ a) \ f(x) = 2(1 + x)b) \ f(x) = \frac{1}{x} + 2xc) \ f(x) = e^x - 2x - \operatorname{sen}(x) \\
 5. \ F(x) = cx + \frac{ax^3}{3} + \frac{\log(x)}{b}. \\
 6. \ (a) \ \frac{x^4}{4a} + \frac{x^{1+c}}{1+c} + \frac{2}{3}x\sqrt{bx}, \text{ tal que } \{x \in \mathbb{R} | a \neq 0, b > 0, c \in \mathbb{N}\} \\
 (b) \ \frac{x^4}{4a} + \frac{x^{1+c}}{1+c} + \frac{2}{3}x\sqrt{bx}, \text{ tal que } \{x \in \mathbb{R} | a \neq 0, b > 0, c \in \mathbb{Z}_-\} \\
 (c) \ \frac{x^4}{4a} + \frac{x^{1+c}}{1+c} + \frac{2}{3}x\sqrt{bx}, \text{ tal que } \{x \in \mathbb{R} | a \neq 0, b < 0, c \in \mathbb{N}\}
 \end{array}$$

7.

$$1) x^2 + \frac{1}{6}(5+x)^6 + c \quad 2) \frac{8}{27}(-4+x^3)^{9/8} + c \quad 3) -\frac{5}{9}(6-3t^2)^{3/2} + c$$

$$4) \frac{(1+3x^2)\sqrt{x^2+3x^4}}{9x} + c \quad 5) -\frac{4+x e^{1/x}}{x} + c \quad 6) \frac{\text{sen}^6(x)}{6} + c$$

$$7) 2\sqrt{x(x+2)} - 2\ln\left|\sqrt{x(x+2)} + x + 1\right| + c$$

$$8) \frac{1}{4}\arctg\frac{x}{4} + c \quad 9) \frac{|1+x|^3}{3} + c$$

$$10) \frac{ae^{x^2}}{2} + bx + c \quad 11) \frac{1}{4}(-\log(\cos(2e^x)) + \log(\text{sen}(2e^x)))$$

$$12) \frac{x^4}{4}$$

8.

1) $2 \operatorname{sen}(\sqrt{x}) + c$

2) $\ln(\sec(x+3) + \operatorname{tg}(x+3)) + c$

3) $-\frac{1}{2} \cos(x^2 + 2x) + c$

4) $\frac{1}{12} [\cos(9-3x) - 9 \cos(3-x)] + c$

5) $\frac{1}{2} \left[\ln \left(\operatorname{sen} \left(\frac{x^2}{2} \right) \right) - \ln \left(\cos \left(\frac{x^2}{2} \right) \right) \right] + c$

6) $\frac{e^{x^3}}{3} + c$

7) $-\frac{\ln(x^2) + 2}{x \ln 10} + c$

8) $-\ln \left[\operatorname{sen} \left(\frac{1}{x} \right) \right] + c$

9) $\frac{1}{2} \sec^2(\ln(x)) + \ln(\cos(\ln(x))) + c$

10) $\frac{\operatorname{sen}^3 x}{3} + c$

11) $\frac{e^{x^2}}{2} + c$

12) $\frac{\operatorname{tg}^3 x}{3} + c$

13) $-\operatorname{sen} \left(\frac{1}{x} \right) + c$

14) $-e^{\frac{1}{x}} + c$

15) $\frac{2}{3} [\ln(x) + 1]^{\frac{3}{2}} + c$

16) $-\frac{1}{2} e^{6-2x^5} + c$

17) $-\frac{1}{8} \cos(8x) + c$

18) $-2 \ln [\cos(\sqrt{x})] + c$

19) $-\frac{5}{4} \cos \left(\frac{4x-8}{5} \right) + c$

20) $-\frac{8}{3} \sqrt{4-3x} + c$

21) $\frac{5}{32(5-4x^2)^4} + c$

22) $\frac{1}{2} \cos \left(\frac{1}{x^2} \right) + c$

23) $\operatorname{arctg} \left(\frac{x}{3} \right) + c$

24) $\frac{2}{9} (x(x^2+3))^{\frac{3}{2}} + c$

9. $\frac{(ax+b)^{c+1}}{ac+a} + C$

10. $\left(\frac{b}{a} + x \right) \ln(ax+b) + \frac{e^{cx}}{c} - x + C$

11. $\ln(1+4x+x^2) - \ln(6)$

12. $-\frac{x^2}{2} + \frac{1}{2} e^{x^2-2x+4} + x + \frac{1}{2} (35 - e^{19})$

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13.

- 1) $\frac{1}{2} \operatorname{arctg} \left(\frac{x-2}{2} \right) + c$
- 2) $\frac{1}{4} \ln ((1-x) - \ln x) + c$
- 3) $\ln (x^2 - 2x + 2) - 4 \arctan (1-x) + c$
- 4) $\sqrt{x^2 - 4x + 2} + 4 \ln \left(-\sqrt{x^2 - 4x + 2} - x + 2 \right) + c$
- 5) $5\sqrt{x^2 - 2x + 2} + c$
- 6) $5 \frac{\ln (-\sqrt{x^2 - 4x + 1} - x + 2)}{\sqrt{2}} + c$
- 7) $-\operatorname{arctg} (3-x) + c$
- 8) $\frac{(x-1)[x+2\ln(x-1)-1]}{\sqrt{(x-1)^2}} + c$
- 9) $\frac{1}{2} \ln (x^2 + 12x - 10) + c$

14.

- 1) $e^x (x-1) + c$
- 2) $\sqrt{1-x^2} + x \operatorname{arcsen} (x) + c$
- 3) $\frac{1}{2} [x + \operatorname{sen} (x) \cos (x)] + c$
- 4) $x \operatorname{sen} (x) + \cos (x) + c$
- 5) $x \operatorname{arccos} (x) - \sqrt{1-x^2} + c$
- 6) $-\frac{1}{27} e^{-3x} (9x^2 + 6x + 2) + c$
- 7) $2\sqrt{x} (\ln x - 2) + c$
- 8) $\frac{5 \ln x + 1}{25x^5} + c$
- 9) $\frac{2^x (x \ln 2 - 1)}{\ln^2 2} + c$
- 10) $\frac{1}{x^2 + 2} + \frac{1}{2} \ln (x^2 + 2) + c$
- 11) $\frac{1}{27} x^3 (9 \ln^2 (x) - 6 \ln (x) + 2) + c$
- 12) $-\frac{1}{15} (2-x^2)^{\frac{3}{2}} (3x^2 + 4) + c$
- 13) $\frac{1}{4} [\cos (1-4x) - 4x \operatorname{sen} (1-4x)] + c$
- 14) $10e^{\frac{x}{5}} (3x - 14) + c$
- 15) $(w+2) \operatorname{sen}(w) \cos(w) - \frac{1}{4} (2w^2 + 8w - 1) \cos (2w) + c$
- 16) $\frac{1}{81} (6x^3 \operatorname{sen} (3x^3) + (2-9x^6) \cos (3x^3)) + c$
- 17) $-e^{-x} (x^4 - 4x^3 + 4x^2 + 8x + 8) + c$
- 18) $\frac{1}{6} \ln^2 (x^3)$

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15.

- | | |
|---|--|
| 1) $\sin(x) - x \cos(x) + c$ | 2) $-\frac{\ln x + 1}{x} + c$ |
| 3) $\frac{5}{4} [3(x^4 - 1) \operatorname{arctg}(x) - x(x^2 - 3)] + c$ | 4) $\frac{1}{9} x^3 (3 \ln x - 1) + c$ |
| 5) $\frac{5}{4} e^{2x} (2x - 1) + c$ | 6) $2x (\ln^2 x - 2 \ln x + 2) + c$ |
| 7) $e^x (x^2 - 2x + 2) + c$ | 8) $-\frac{3^x [x \ln 3 (x \ln 9 - 4 - 3 \ln 3 + 4 + \ln 27)]}{\ln^3 3} + c$ |
| 9) $e^x (5x - 2) + c$ | 10) $\frac{1}{16} x^4 (4 \ln x - 1) + c$ |
| 11) $(x^2 - 2) \sin x + 2x \cos x + c$ | 12) $\frac{1}{2} e^x (\sin x - \cos x) + c$ |
| 13) $x^2 \left(\frac{1}{2} \ln(x - 4) - \frac{1}{4} \right) - 2x - 8 \ln(4 - x) + c$ | |
| 14) $\frac{x^6}{6} + c$ | 15) $\frac{5}{16} \sin(4x) + \cos\left(1 - \frac{5x}{4}\right) + c$ |
| 16) $\frac{1}{16} x^2 [-x^2 + 4(x^2 + 4) \ln x - 8] + c$ | 17) $4(3t + 5) \sin\left(\frac{t}{4}\right) + 48 \cos\left(\frac{t}{4}\right) + c$ |
| 18) $\frac{2}{15} (x + 1)^{\frac{3}{2}} (3x - 2) + c$ | 19) $\frac{2}{45} (x^3 + 1)^{\frac{3}{2}} (x^3 - 2) + c$ |
| 20) $2e^{\frac{x}{2}} (x^4 - 8x^3 + 48x^2 - 192x + 384) + c$ | 21) $-\frac{2x^2 + 1}{4(x^2 + 1)^2} + c$ |
| 22) $x + \ln(1 - x) - \ln(x + 1) + c$ | 23) $\frac{\ln x}{2} - \frac{1}{4} [\ln(x^2) - 2 \ln x] \ln(\ln(x^2)) + c$ |
| 24) $\frac{x^4}{4} + \frac{x^3}{3} - \frac{x^2}{2} - x + c$ | 25) $\sqrt{16 - x^2} + x \arcsin\left(\frac{x}{4}\right) + c$ |
| 26) $\frac{x^{a+1} [(a+1) \ln x - 1]}{(a+1)^2} + c$ | 27) $(x - 2) \operatorname{tg} x + \ln(\cos x) + c$ |
| 28) $\frac{1}{2} x [\sin(\ln x) + \cos(\ln x)] + c$ | 29) $\frac{2e^{1/x} (x - 1)}{x} + c$ |
| 30) $\frac{1}{2} \left[-\ln\left(\cos \frac{x}{2} - \sin \frac{x}{2}\right) + \ln\left(\cos \frac{x}{2} + \sin \frac{x}{2}\right) + \frac{\sin x}{\cos^2 x} \right] + c$ | |

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$$31) x (\ln (x^2 + 1) - 2) + 2 \operatorname{arctg} x + c \quad 32) \frac{1}{8} (2x (x + \operatorname{sen} (2x)) + \cos (2x)) + c$$

$$33) x (\ln (4x) (\ln (4x) (\ln (4x) - 3) + 6) - 6) + c$$