Cumulative Function

Cumulative Function	F(x)
function	f(x) = F'(x)
rate of change of the function	f'(x) = F''(x)
rate of change of the rate of change	f''(x) = F'''(x)

Introduce & Use the Name "Cumulative Function" Early & Often

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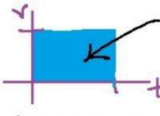
TI calculator
normal, geometric, and Poisson
cumulative & probability functions

normalcdf(geometcdf(poissoncdf(
normalpdf(geometpdf(poissonpdf(

Think back to 6th grade.
D=RT distance equals rate times time
W=RT work equals rate times time.



$d(t) = (v(t))(t)$
area is (rate)(time)
= work
= distance

D(t) is the absement - Cumulative displacement
D(t) is the absition - Cumulative position
D(t) is cumulative distance
d(t) is the distance
v(t) is the velocity
a(t) is acceleration

$\int d(t)\,dt = D(t)$
$\int v(t)\,dt = d(t)$
$\int a(t)\,dt = v(t)$

$a(x) = D_x(D_x(D_x(F(x))))$ $\quad F(x) = \int\int\int a(x)\,dx\,dx\,dx$ where all c of integration = 0

F(x) function's cumulative function $\int f(x)\,dx$ ← take the antiderivative
f(x) function f(x)
f'(x) function's rate of change function $\frac{d(f(x))}{dx}$ ← take the derivative

f(x) function f(x) ← the cumulative function for f'(x)
f'(x) function's rate of change function $\frac{d(f(x))}{dx}$ ← the rate of change function for f(x)

F(x) function's cumulative function $\int f(x)\,dx$ ← the cumulative function for f(x)
f(x) function f(x) ← the rate of change function for F(x)

absement - absence from initial placement
absition - absence from initial position

Casa Omar Connect-the-Dots

State the anti-derivative. Connect the answer dots in order.

1. $\int_0^{\pi/2}\cos(x)dx$
2. $\int_0^{\pi}\sin(x)dx$
3. $-\int_0^{2\pi}\cos(x)dx$
4. $\int_0^{4}x^2dx$
5. $\int_{-4}^{4}x^2dx$
6. $\int_{-4}^{4}35x^7dx$
7. $\int_a^b(x+4)dx$
8. $\int_a^b 4xdx$
9. $\int dx$
10. $\int_1^2 4xdx$
11. $\int_2^1 4xdx$
12. $\int_0^4 \sqrt{x}dx$
13. $\frac{5}{2}\int_1^4 x\sqrt{x}dx$
14. $\int_a^b 4x^3dx$
15. $\int_b^a 4x^3dx$
16. $\int 4x^3dx$
17. $-\int_b^0 4x^3dx$
18. $\int_a^0 4x^3dx$
19. $\int_0^1 10dx$
20. $\int_3^4 xdx$
21. $\int_0^9 2\sqrt{x}dx$
22. $\int_{-2}^{14}dx$
23. $\int_0^x ada$
24. $\int_0^a adx$
25. $\int_0^1 2\sin(3)dx$
26. $\int(4x^3-6x^2)dx$
27. $\frac{4}{5}\int_0^c(x-2)dx$
28. $\int_{-3}^{3}\cos(x)dx$
29. $\int_{-1}^{8}\frac{4\sqrt[3]{x}}{3}dx$
30. $\int_0^b(\sin(x)+\cos(x))dx$
31. $\int_0^{\pi/2}\sin(x)dx$
32. $\int\sin(a)da$
33. $-\int\cos(a)da$
34. $-\int\sin(a)da$
35. $\int\cos(a)da$
36. $\int\int\cos(a)da\,da$, where $c_1 = 0$
37. $\int\sin(m)dm$
38. $-\int\cos(m)dm$
39. $-\int\sin(m)dm$
40. $\int\cos(m)dm$
41. $\int\int\cos(m)dm\,dm$, where $c_1 = 0$

64/3 • x^4-2x^2+c • $\frac{2c^2}{5}-2c$ • $\cos^2(a)$ • b^4a^4+c • $\sin^2(m)$ • $\frac{2c^2}{5}-\frac{8c}{5}$ • 0 • 2 • $2b^2-2a^2$ • $2\sin(3)$ • a^2 • 15 • $\cos(a)+c$ • 128/3 • $\cos^2(m)$ • $-\cos(m)+c$ • $-\sin(m)+c$ • $-\sin(a)+c$ • $b-a$ • $-\cos^2(a)$ • $x+c$ • 31 • b^4-a^4 • $-a^4$ • 36 • $\sin(m)$ • 6 • b^4 • 16 • $\sin(a)+c$ • 9 • -6 • 16/3 • 10 • -8 • $\cos(m)+c$ • $-\sin^2(a)$ • $-\cos(a)+c$ • a^4-b^4 • x^4+c • 7/2 • $\sin(m)+c$ • $\sin^2(a)$ • $-\sin(m)$ • $-\cos(m)$ • 1 • $\frac{b^2-a^2}{2}+4(b-a)$ • $-\cos^2(m)$ • $\sin(b)-\cos(b)+1$ • $\cos(m)$ • $\frac{x^2}{2}$ • $-\sin^2(m)$ • $\sin(b)-\cos(b)$

Common Differentiation Rules

1. $\frac{d}{dx}\left(cf(x)\right) =$
2. $\frac{d}{dx}\left(f(x) \pm g(x)\right) =$
3. $\frac{d}{dx}\left(C\right) =$
4. $\frac{d}{dx}\left(x\right) =$
5. $\frac{d}{dx}\left(x^n\right) =$
6. $\frac{d}{dx}\left(\sin x\right) =$
7. $\frac{d}{dx}\left(\cos x\right) =$
8. $\frac{d}{dx}\left(\tan x\right) =$
9. $\frac{d}{dx}\left(\csc x\right) =$
10. $\frac{d}{dx}\left(\sec x\right) =$
11. $\frac{d}{dx}\left(\cot x\right) =$
12. $\frac{d}{dx}\left(e^x\right) =$
13. $\frac{d}{dx}\left(a^x\right) =$
14. $\frac{d}{dx}\left(\ln x\right) =$

Common Indefinite Integral Rules

1. $\int c \cdot f(x)\, dx =$
2. $\int \left(f(x) \pm g(x)\right) dx =$
3. $\int 0\, dx =$
4. $\int 1\, dx = \int dx =$
5. $\int x^n\, dx =$
6. $\int \cos x\, dx =$
7. $\int \sin x\, dx =$
8. $\int \sec^2 x\, dx =$
9. $\int \csc x \cot x\, dx =$
10. $\int \sec x \tan x\, dx =$
11. $\int \csc^2 x\, dx =$
12. $\int e^x\, dx =$
13. $\int a^x\, dx =$
14. $\int \frac{1}{x}\, dx =$

Theorem 5.1.2 Derivatives and Antiderivatives

Common Differentiation Rules	Common Indefinite Integral Rules
1. $\frac{d}{dx}\big(cf(x)\big) = c \cdot f'(x)$	1. $\int c \cdot f(x)\,dx = c \cdot \int f(x)\,dx$
2. $\frac{d}{dx}\big(f(x) \pm g(x)\big) = f'(x) \pm g'(x)$	2. $\int \big(f(x) \pm g(x)\big)\,dx = \int f(x)\,dx \pm \int g(x)\,dx$
3. $\frac{d}{dx}\big(C\big) = 0$	3. $\int 0\,dx = C$
4. $\frac{d}{dx}\big(x\big) = 1$	4. $\int 1\,dx = \int dx = x + C$
5. $\frac{d}{dx}\big(x^n\big) = n \cdot x^{n-1}$	5. $\int x^n\,dx = \frac{1}{n+1}x^{n+1} + C \quad (n \neq -1)$
6. $\frac{d}{dx}\big(\sin x\big) = \cos x$	6. $\int \cos x\,dx = \sin x + C$
7. $\frac{d}{dx}\big(\cos x\big) = -\sin x$	7. $\int \sin x\,dx = -\cos x + C$
8. $\frac{d}{dx}\big(\tan x\big) = \sec^2 x$	8. $\int \sec^2 x\,dx = \tan x + C$
9. $\frac{d}{dx}\big(\csc x\big) = -\csc x \cot x$	9. $\int \csc x \cot x\,dx = -\csc x + C$
10. $\frac{d}{dx}\big(\sec x\big) = \sec x \tan x$	10. $\int \sec x \tan x\,dx = \sec x + C$
11. $\frac{d}{dx}\big(\cot x\big) = -\csc^2 x$	11. $\int \csc^2 x\,dx = -\cot x + C$
12. $\frac{d}{dx}\big(e^x\big) = e^x$	12. $\int e^x\,dx = e^x + C$
13. $\frac{d}{dx}\big(a^x\big) = \ln a \cdot a^x$	13. $\int a^x\,dx = \frac{1}{\ln a} \cdot a^x + C$
14. $\frac{d}{dx}\big(\ln x\big) = \frac{1}{x}$	14. $\int \frac{1}{x}\,dx = \ln\lvert x\rvert + C$