COMPUTER SCIENCE & MATHEMATICS

Integral Tak Tentu (1)

Fakultas Ilmu Komputer, Universitas Indonesia

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Odometer
(pengukur jarak yang ditempuh mobil)

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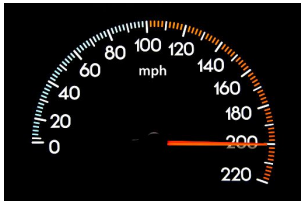
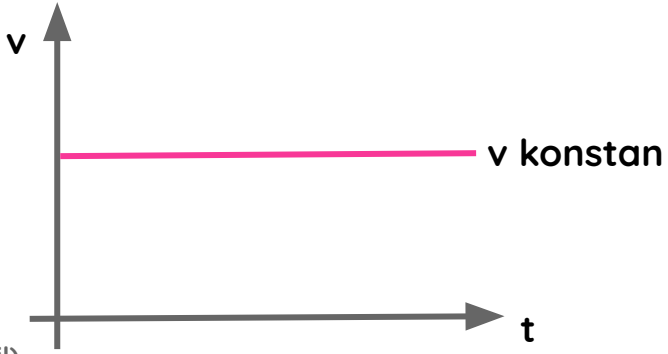


Speedometer
(pengukur kecepatan mobil)



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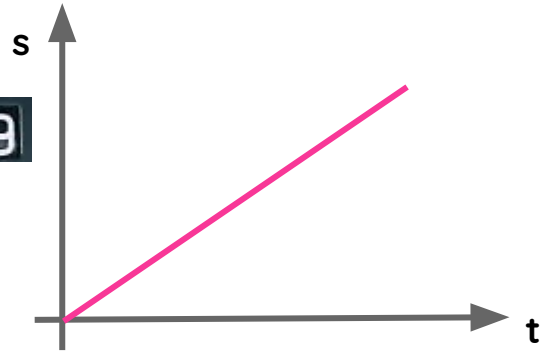

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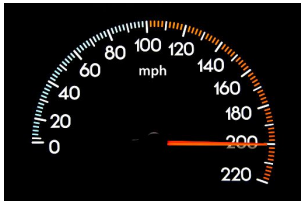

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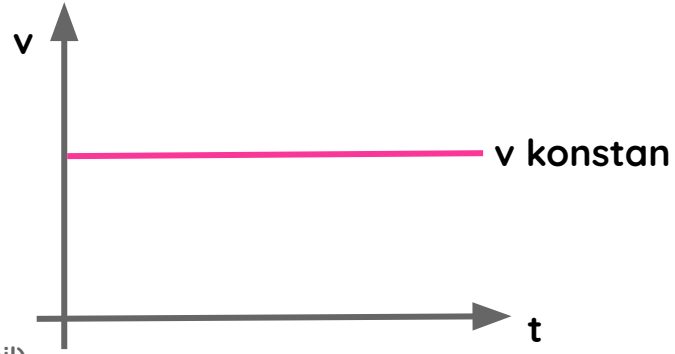

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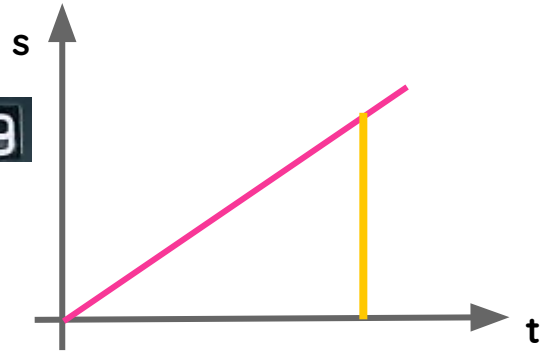

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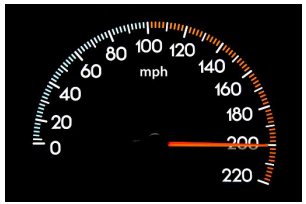

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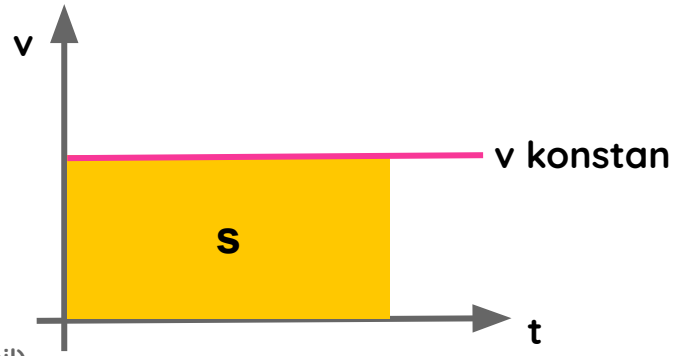

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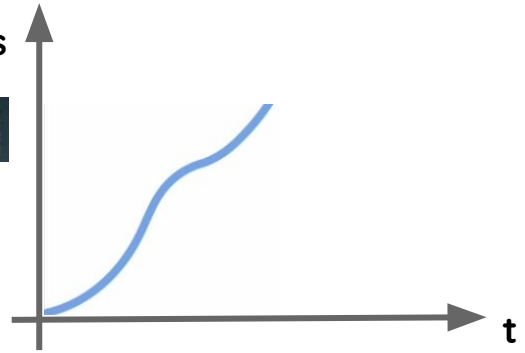
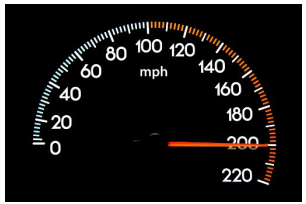


$s = v.t$

Mobil Kalkulus



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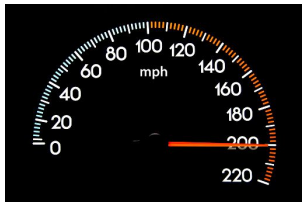

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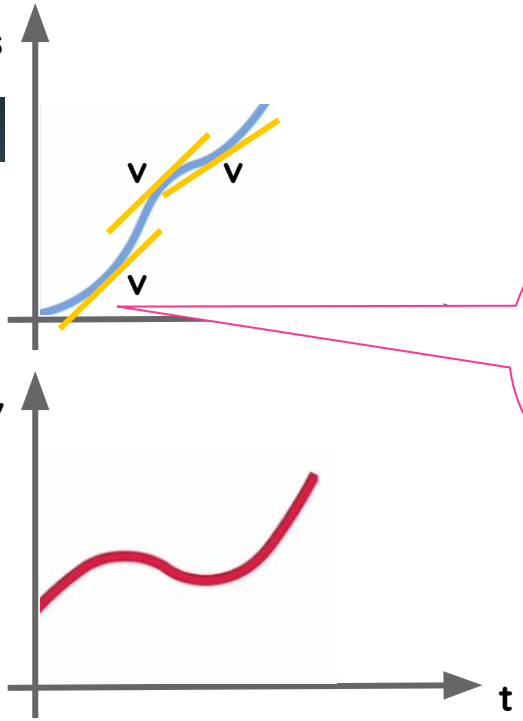

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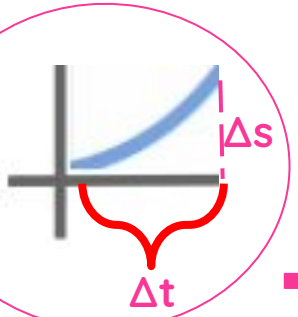

$v = s/t$

Mobil Kalkulus

Sebelumnya ...

Derivative (Turunan)

Kita bisa mendapatkan derivative atau turunan dari semua jenis fungsi seperti di tabel berikut:

f(x)	c	x^n	sin x	cos x	ln x	e^x
f(x) dx	0	nx^{n-1}	cos x	-sin x	1/x	e^x

Dan kita juga bisa punya beberapa aturan (*rule*) yang *applicable* untuk derivative:

- Aturan rantai
- Aturan tambah/kurang ⇒ $d[f(x) \pm g(x)] = d\,f(x) \pm d\,g(x)$, jika $(f \pm g)'(x) = f'(x) \pm g'(x)$
- Aturan kali ⇒ $d[f(x) \cdot g(x)] = f(x)\,dg(x) + g(x)\,d\,f(x)$, jika $(fg)'(x) = f(x)g'(x) + g(x)f'(x)$
- Aturan bagi ⇒ $d[f(x) / g(x)] = \frac{g(x)\,df(x) - f(x)\,dg(x)}{g^2(x)}$, jika $(f/g)'(x) = \frac{g(x)f'(x) - f(x)g'(x)}{g^2(x)}$

1. Anti-derivative

Pengenalan

Notasi:

$$\int f(x)dx = F(x) + C \quad \text{dengan kata lain} \quad \int dF(x) = F(x) + C$$

dengan f(x) = integran

2. Properti Dasar Integral Tak Tentu

Anti-derivative (Integral Tak Tentu)

anti-derivative

Kumpulan derivative:

f(x)	c	x^n	sin x	cos x	ln x	e^x
f(x) dx	0	nx^{n-1}	cos x	-sin x	1/x	e^x

Aturan yang dapat diaplikasikan pada anti-derivative:

1. $\int kf(x)dx = k\int f(x)dx$
2. $\int (f(x) \pm g(x))\,dx = \int f(x)dx \pm \int g(x)dx$

2. Properti Dasar Integral Tak Tentu

Anti-derivative (Integral Tak Tentu)

Kumpulan fungsi, derivative, dan anti-derivative:

f(x)	c	x^n	sin x	cos x	ln x	e^x
f(x) dx	0	nx^{n-1}	cos x	-sin x	1/x	e^x
$\int$ f(x) dx	C	x^n	sin x	cos x	ln x	e^x

**Contoh teorema anti-derivative lainnya:*

1. $\int a^x dx = \frac{a^x}{\ln a} + C$
2. $\int \frac{du}{\sqrt{a^2 - u^2}} = \sin^{-1}\left(\frac{u}{a}\right) + C$
3. $\int \frac{du}{a^2 + u^2} = \frac{1}{a}\tan^{-1}\left(\frac{u}{a}\right) + C$
4. $\int x^r dx = \frac{x^{r+1}}{r+1} + C$ *Power Rule*
5. $\int [g(x)]^r g'(x) dx = \frac{[g(x)]^{r+1}}{r+1} + C$ *Generalized Power Rule*

2. Properti Dasar Integral Tak Tentu

Anti-derivative (Integral Tak Tentu)

Kumpulan anti-derivative:

f(x) dx	0	nx^{n-1}	cos x	-sin x	1/x	e^x
$\int$ f(x) dx	C	x^n	sin x	cos x	ln x	e^x

Contoh:

1. $f(x) = x^n \rightarrow f'(x) = nx^{n-1}\,dx \Rightarrow \int nx^{n-1}\,dx = ?$

2. $f(x) = 2x+1 \rightarrow f'(x) = 2\,dx + 0 \Rightarrow$ Tentukan: $\int 2\,dx$ pada interval $(-\infty, \infty)$?

2. Properti Dasar Integral Tak Tentu

Anti-derivative (Integral Tak Tentu)

Kumpulan anti-derivative:

f(x) dx	0	nx^{n-1}	cos x	-sin x	1/x	e^x
$\int$ f(x) dx	C	x^n	sin x	cos x	ln x	e^x

Contoh:

1. f(x) = x^n → f'(x) = nx^{n-1} dx ⇒ $\int nx^{n-1}\,dx$ = ?

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C$$

2. f(x) = 2x+1 → f'(x) = 2 dx + 0 ⇒ Tentukan: $\int$ 2 dx pada interval (-∞, ∞) ?

⇒ $2\int dx = 2\int x^0 dx = 2\frac{x^{0+1}}{0+1} + C = 2x + C$ *berapa C nya?*

Latihan Soal

Anti-derivative (Integral Tak Tentu)

Tentukan integral tak tentu dari:

1. $\int e^x \sec^2 x + e^x \tan x dx =$
2. $\int -\csc x \cot x + x^4 - x^2 \, dx =$
3. $\int \frac{2}{x} - \csc x \left(\csc x + \cot x\right) + x^3 - x^2 \, dx =$

Latihan Soal

Anti-derivative (Integral Tak Tentu)

Tentukan integral tak tentu dari:

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Jika dilakukan derivative, maka sebenarnya F(x) = e^x . tan(x)
Tapi apakah hasil derivative nya (dF(x)) dapat kita integralkan?
Perlu teknik integral tertentu

End