March 29, 2022

Applications of Integration Review

Diffential
general solutions + C
particular solution - solve for C

$$\int \frac{d^2y}{dx^2} = \int 12x \quad \leftarrow \text{general}$$

$$\int \frac{dy}{dx} = \int 6x^2 + C$$

$$y = 2x^3 + Cx + C_2$$

Particular
$y' = 4$ when $x = 1$
$y = -3$ when $x = 2$

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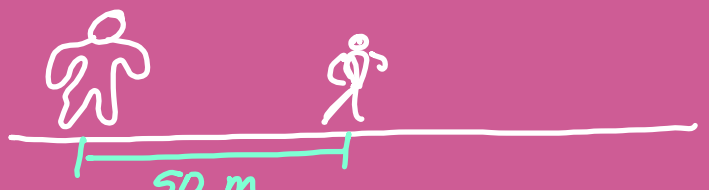


$a = 0.5 \frac{m}{sec}$ $V = 2 \frac{m}{s}$ constant

$a(t) = 0.5$

$V(t) = 0.5t + C$

$0 = 0 + C$

$V(t) = 0.5t$

$S(t) = 0.5\frac{t^2}{2} + C$

$S(t) = 0.25t^2 + C$

$0 = 0 + C$

$S(t) = 0.25t^2$

$V(t) = 2$

$S(t) = 2t + C$

$50 = 0 + C$

$S(t) = 2t + 50$

$0.25t^2 = 2t + 50$

$0.25t^2 - 2t - 50 = 0$

quadratic formula

$t = -10.69$ or $t = 18.69$

Business Appl.

$\frac{dR}{dx}$ or $\frac{dC}{dx}$

Maximize Profit. $P = R - C$

$P = -2000x^2 + 60{,}000x - 82{,}000$

$P' = -4000x + 60000 = 0$

$x = 15$

Optimize

1) Find crit pts.
$f'(x) = 0$

$[0, 20]$
$[0, \infty)$

$P(0) = -82000$
$P(15) = 368{,}000$
$P(20) = 318{,}000$

Sell 15,000 watches

$\lim_{x \to \infty} -2000x^2 = -\infty$

Hyperbolics $\sinh x = \frac{e^x - e^{-x}}{2}$ $\cosh x = \frac{e^x + e^{-x}}{2}$

$$\sinh(\ln 6) = \frac{e^{\ln 6} - e^{-\ln 6}}{2}$$

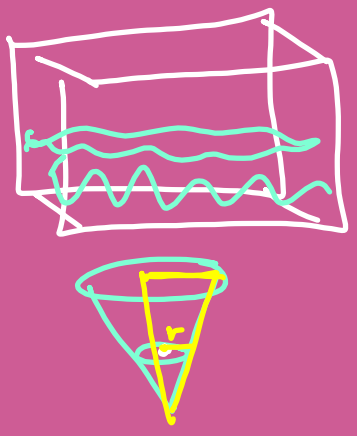
$$= \frac{6 - \frac{1}{6}}{2} \quad \frac{35}{6} \cdot \frac{1}{2} = \frac{35}{12}$$

$\frac{d}{dx} \cosh x = + \sinh x$

$\frac{d}{dx} \operatorname{sech} x = -\operatorname{sech} x \tanh x$

Formulas to Know:

6 deriv. of hyperb. func



Given:

$\sinh x = \frac{e^x - e^{-x}}{2}$

$\cosh x = \frac{e^x + e^{-x}}{2}$

Hooke's Law $F(x) = Kx$

Work (pump)

$W = \int_a^b \rho\, A(x)$ depth dx

Fluid Force: $\int_a^b \rho\, l(x)\, h(x)\, dx$