37 $\int_0^1 \cosh^3(3x)\ \sinh(3x)\,dx$

$u = \cosh(3x)$

$du = \sinh(3x)\cdot 3\,dx$

$\dfrac{du}{3\sinh(3x)} = dx$

$\int_1^{\frac{e^2+1}{2e}} u^3 \cdot \cancel{\sinh(3x)} \cdot \dfrac{du}{3\cancel{\sinh(3x)}}$

$\dfrac{1}{3}\cdot\dfrac{u^4}{4}\Big|_1^{\frac{e^2+1}{2e}}$

$\dfrac{1}{12}\left(\left(\dfrac{e^2+1}{2e}\right)^4 - 1\right)$

$= 856.034$

$u = \cosh(0)$

$\dfrac{e^0 + e^{-0}}{2} = \dfrac{2}{2} = 1$

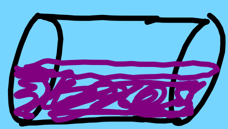
$u = \cosh(1)$

$= \dfrac{e^1 + e^{-1}}{2}$

$= \dfrac{\frac{e}{e}e + \frac{1}{e}}{2} = \dfrac{\frac{e^2+1}{e}}{2}$

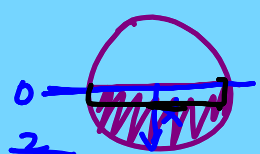
$= \dfrac{e^2+1}{2e}$

March 28, 2024



Diameter = 4'

$$\rho = 50 \frac{lb}{ft^3}$$



depth

$$\int_0^2 \rho \cdot l(x) \cdot h(x)\, dx$$

$$x^2 + y^2 = 4$$

$$\sqrt{y^2} = \pm\sqrt{4-x^2}$$

$$\int_0^2 50 \cdot 2\sqrt{4-x^2} \cdot x\, dx$$

$$u = 4 - x^2$$

APPLICATIONS OF INTEGRATION REVIEW

Differential Eq

particular solution
Solve for C.

general solution
leave C

$$\int \frac{d^2y}{dx^2} = \int (12x + 2)\,dx$$

$y' = 10$ when $x = 2$
$y = 3$ when $x = 1$

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

$$10 = 24 + 4 + C$$

$$-18 = C$$

$$\int \frac{dy}{dx} = \int 6x^2 + 2x - 18$$

$$y = 2x^3 + x^2 - 18x + C$$

$$3 = 2 + 1 - 18 + C$$

$+15$

$$18 = C$$

$$\boxed{y = 2x^3 + x^2 - 18x + 18}$$

Super car

stationary at start line:

$a = 8\ \frac{m}{s^2}$

$a(t) = 8$

$v(t) = 8t + C$

$0 = 0 + C$

$\boxed{v(t) = 8t}$

$s(t) = 4t^2 + C$

$0 = 0 + C$

$s(t) = 4t^2$

Slug bug

$v = 30\ \frac{m}{s}$

2000 m ahead

$s = 0$
$a = 8$
$v = 0$
$t = 0$

$a = 0$
$v = 30$
$s = 2000$
$t = 0$

$v(t) = 30$

$s(t) = 30t + C$

$2000 = 0 + C$

$s(t) = 30t + 2000$

$4t^2 = 30t + 2000$

$4t^2 - 30t - 2000 = 0$

$2(2t^2 - 15t - 1000) = 0$

$\int \frac{dR}{dx}$

$R =$ solve for C.

$C =$ given

Maximize Profit

$P = R - C$

1) Find critical pts.

2) Set up interval $[0, \infty)$

$\lim_{x \to \infty} P =$ ____

$$\begin{array}{c|c} 0 & \\ \text{crit pts} & \end{array}$$

Work — $F(x) = Kx$

spring constant

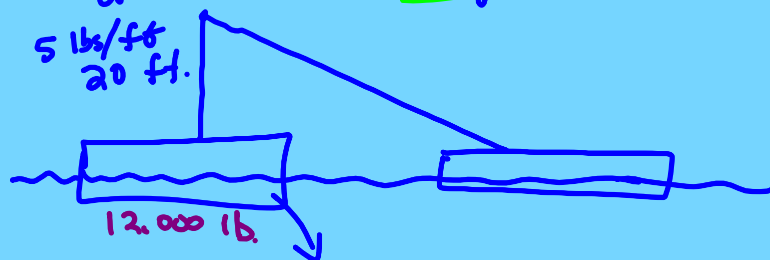
distance from natural length

Springs

5 lbs/ft

20 ft.

Lifting



$15 \frac{lb}{sec}$

10 ft in 30 sec.

$$\int_0^{10} (12000 - 45x) + (100 - 5x)\,dx$$

container cable

$$15\ \frac{lb}{\cancel{sec}} \cdot \frac{30\,\cancel{sec}}{10\,ft} = \frac{450}{10} = 45\ \frac{lb}{ft}$$