(13) $\int_2^5 2+2t+3t^2\,dt$

— antider & eval — $(\quad) - (\quad)$

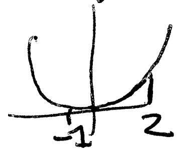
$\int 2+2t+3t^2\,dt = 2t + 2\frac{t^2}{2} + t^3 \Big| = 2t+t^2+t^3$

$\dots \Big|_{t=2}^{t=5} = 2\cdot 5+2\cdot\frac{5^2}{2}+5^3 - (2\cdot 2+2\cdot\frac{2^2}{2}+2^3)$

$= \dots \underbrace{10+25+125}_{160} - \underbrace{(4+4+8)}_{16} = 144.$

numerical $\underline{144}$ ~~to ±2~~

37 Area $y=x^4$, above $-1 \le x \le 2$



$\int_{-1}^{2} x^4\,dx = \frac{x^5}{5} + \text{eval} \Big|_{x=-1}^{2}$

$= \frac{2^5}{5} - \frac{(-1)^5}{5} = \cancel{125 + \frac{1}{5} = 125.2} = \frac{33}{5} = 6.6$

careful

45. Storage Cost

12000 lbs use "constant rate" 300 per week

cost .2¢/lb/week over 40 weeks

Amt lbs. Stored at time t (weeks)

Store $S = 12000 - 300t$ lbs

Storage cost t to $t+dt \approx [12000 - 300t]\,.2¢\,dt$

$\int_0^{40} (12000-300t)\,dt\,(.02¢)$

(N.B. at $t=40$ $S = 12000 - 300\cdot 40 = 0$

$\int = 12000t - 300\frac{t^2}{2}\Big|_{t=0}^{t=40} = (\underbrace{12000\cdot 40 - 300\frac{40^2}{2}}_{240000}) - (0)$

= \$480.00

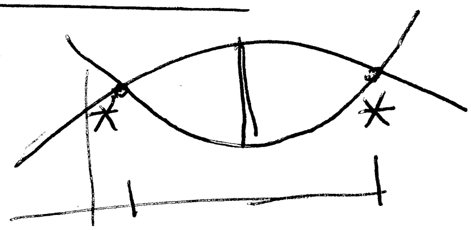
num $240000 \cdot .002$

5.3

$\boxed{48}$ $\frac{dC}{dq} = 6q+1$; cost of first 10

$$\int_0^{10} 6q+1 \, dq \quad \text{next 10;} \quad \int_{10}^{20} 6q+1 \, dq$$

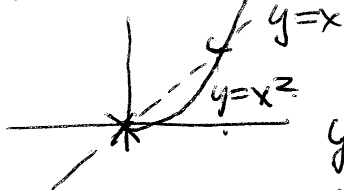
Area between curves $a \le x \le b$



* algebra

$$\text{Area} \approx \sum \text{Area} \underset{\Delta x}{[\,]} \text{top-bott.} \approx \Rightarrow \int_{x_1}^{x_2} \text{upper}(x) - \text{lower}(x) \, dx$$

Example 5.4. "Area enclosed by $y = x^2$ and $y = x$.



Intersect (get lucky on equation)

$y_1 = x \qquad y_1 = y_2$ when

$y_2 = x^2 \qquad x = x^2$ TWO: $x=0, x=1$

from graph "y_1 on top"

$$\text{Area} = \int_0^1 (x - x^2) \, dx = \underbrace{\frac{x^2}{2} - \frac{x^3}{3}}_{\int \dots} \Big|_{x=0}^{x=1} = \left(\frac{1^2}{2} - \frac{1^3}{3}\right) - \underbrace{\left(\frac{0^2}{2} - \frac{0^3}{3}\right)}_{\text{"0"}}$$

$$= \frac{1}{6}.$$

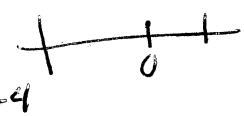
More complicated Multiple Intersection

"Enclosed by line $y = 4x$ and $y = x^3 + 3x^2$

Solve $4x = x^3 + 3x^2$ Cubic-

but $x=0$ or $4 = x^2 + 3x$; $x^2 + 3x - 4 = 0$

$(x+4)(x-1)$



Two areas $\displaystyle\int_{-4}^{0} (x^3 + 3x^2 - 4x) \, dx$ and $\displaystyle\int_0^1 4x - (x^3 + 3x^2) \, dx$

Excess Profit

Profit $P_1(t)$ certain type of prod (total accumulated up to time t

Profit $P_2(t)$ certain ti

rate of of change of profit $\frac{P_1'(t)}{P_2(t)}$ $P_1'(t) \geq P_2'(t)$ $0 \leq t \leq N$ yr

· $E(t) = P_1$

Net excess profit is

$$P_1(t) = \int_0^t P_1'(t)\, dt \quad (P_1(0) = 0!)$$

① when are rate of change the same

Ex 5.4.3 $P_1'(t) = 50 + t^2$; $P_1(0)$ Rates > 0

$P_2'(t) = 200 + 5t$ dollars/yr.

Solve $50 + t^2 = 200 + 5t$

$t^2 - 5t - 150 = 0$ lucky! $(t-15)(t+10)$

= when $t = 15$ $E(N) = P_1(t) - P_2(t)$

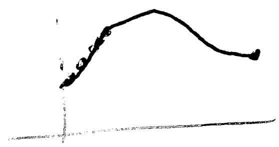
NE Net excess $= E_1(N) - E_2(N)$

Net excess profit $0 \leq t \leq N$

$$\int [P_1'(t) - P_2'(t)] = \int_{t=0}^{t=15} (200+5t) - (50+t^2)\, dt$$

Average Value of a fn. $f(x)$, $a \le x \le b$ 3004 0406 4/4

S



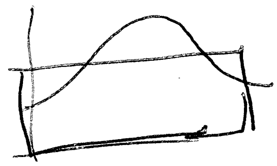
Sample at N points equally distributed..

$$\frac{f(x_1) + \dots + f(x_n)}{N}$$

Spacing $\frac{\Delta x}{b-a} = \frac{b-a}{N(b-a)} = \frac{1}{N}$ $\quad \frac{1}{b-a} \sum f(x_i)\,\Delta x \to \frac{1}{b-a} \int_a^b f(x)\,dx$

"Average height" of fn f · A

Area "under $f(x)$" $\int_a^b f(x)\,dx = A \cdot (b-a)$



~~rectang~~ rectangle of same width which has same area

~~St~~ Stalk to Soy Storage

$12000 - 300t$, $0 \le t \le 40$ | Average stored is 6000

$$\frac{1}{40} \int_0^{40} \cancel{2000}\,12000 - 300t \, dt = \dots = \frac{24000}{40} \quad \text{Average} = 6000$$

~~$600 \cdot .2 = 600$ lbs~~ Average 600 lbs

Total cost is $.2 \times \underbrace{40}_{\text{weeks}} \times 6000 = \$480$

Average value 35. Food prices

t months after beginning of year

$P_{price}(t) = 0.09t^2 - 0.2t + 1.6$

average price first 3 mon $= \frac{1}{3} \int_0^3 0.09t^2 - 0.2t + 1.6$

(numerical $- 4.71 = 1.57$