6/ Radium-226 half-life 1800 yrs

100 grams

$$q = q_0 e^{kt}$$

$$\frac{50}{100} = \frac{\cancel{100} e^{k \cdot 1800}}{\cancel{100}}$$

$$\ln(0.5) = \ln\left(e^{1800k}\right)$$

$$\frac{\ln(0.5)}{1800} = \frac{\cancel{1800} k}{\cancel{1800}}$$

$$-3.85 * 10^{-4} = k$$

$$-0.000385 = k$$

4/

$$P = 50e^{-t/250}$$

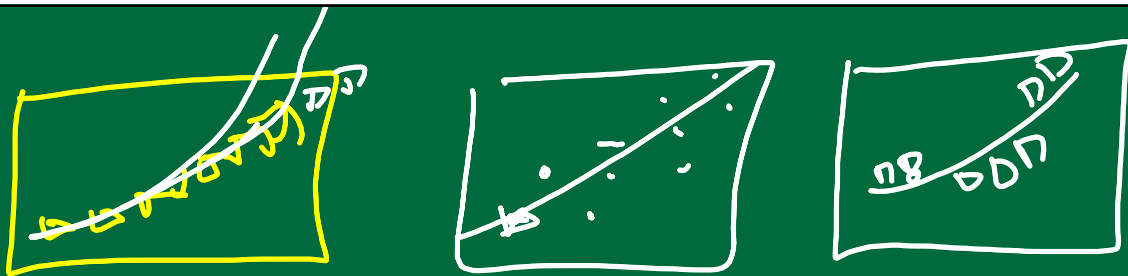
$$\frac{10}{50} = \frac{50e^{-t/250}}{50}$$

$$\ln 0.2 = \ln e^{-t/250}$$

$$-250 \cdot \ln(0.2) = \frac{-t}{250} \cdot -250$$

402 days $= t$

February 1, 2022



1) r^2

2) pts. balanced around line

3) Predict future

LOG REVIEW

No Calculator

#1-3

Use "pink" sheet

Common Bases

3/ Evaluate

$\log_8 \frac{1}{64} = \log_8 8^{-2} = -2$

$\log_4 \sqrt[7]{64} = \log_4 \sqrt[7]{4^3}$

$= \log_4 4^{3/7} = 3/7$

2/ $\left(\frac{1}{36}\right)^{x+2} = \sqrt[5]{6^x}$

Solve for x

$\left(\frac{1}{6^2}\right)^{x+2} = 6^{\frac{x}{5}}$

$\left(6^{-2}\right)^{x+2} =$

$6^{-2x-4} = 6^{x/5}$

$5\left[-2x-4 = \frac{x}{5}\right]$

$-10x-20 = x$

$\frac{-20}{11} = \frac{\cancel{11}x}{\cancel{11}}$

$$y = 3^{\overset{-(x-5)}{5-x}} - 6$$

Right 5
Down 6

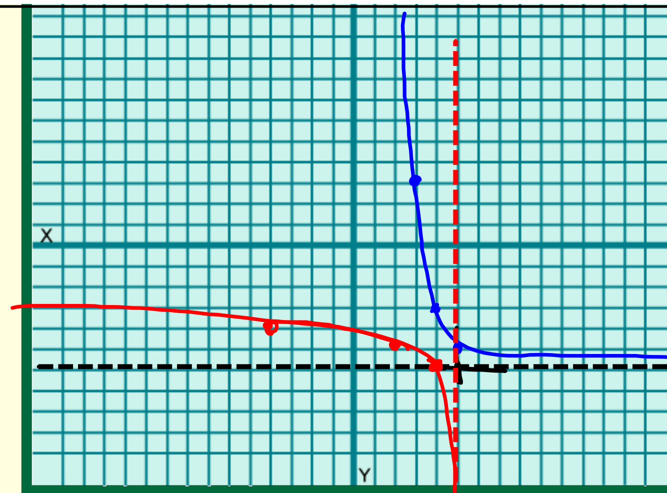
$$y = \log_3 \underset{-(x-5)}{\cancel{(5-x)}} - 6$$

$y = 3^x$

0	1
-1	3
-2	9

$y = \log_3 x$

-1	0
-3	1
-9	2



Solving log equations

4. $\log_{\sqrt{2}} 32 = x$

$$\cancel{\sqrt{2}}^{\cancel{\log_{\sqrt{2}}} 32} = \sqrt{2}^{x}$$

Common base

$$32 = \sqrt[2]{2^x}$$

$$2^5 = 2^{x/2}$$

$$2 \cdot 5 = \frac{x}{\cancel{2}} \cdot \cancel{2}$$

$$10 = x$$

5(e)

$$\frac{1}{2}\left(\cancel{2}\log 4^{2} - \cancel{3}\log 2^{3}\right) = \log x$$

$$\frac{1}{2}\left(\log 16 - \log 8\right) = \log x$$

$$\frac{1}{2}\log\left(\frac{16}{8}\right) = \log x$$

$$\cancel{\frac{1}{2}}\log 2^{1/2} = \log x$$

$$10^{\log_{10} 2^{1/2}} = 10^{\log x}$$

$$\sqrt[2]{2} = 2^{1/2} = x$$

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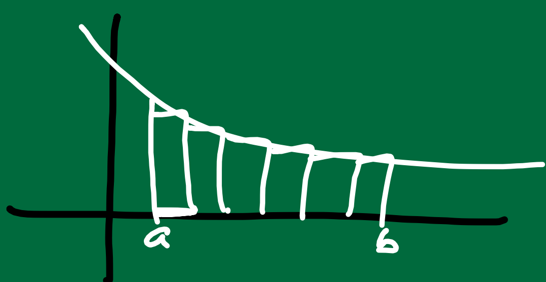


$$\lim_{\Delta x \to 0} \sum_{x=a}^{b} \underbrace{f(x)}_{l} \cdot \underbrace{\Delta x}_{w} = \int_a^b f(x)\,dx$$

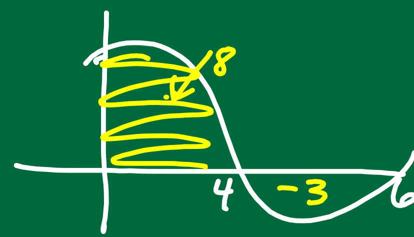
Let rect. width go to 0

sum of rectangles

p. 359 # 42

$\int_1^4 f(x)\,dx = 8$

$\int_1^6 f(x)\,dx = 5$



$-3\int_1^4 \cancel{-3}\cdot f(x)\,dx = -3\cdot 8 = -24$

c) $\int_6^4 12 f(x)\,dx = -12\int_4^6 f(x)\,dx = -12\cdot -3 = 36$

63/ $\frac{d}{dx}\int_2^{x^3} \frac{1}{p^2}\,dp = \frac{1}{(x^3)^2}\cdot 3x^2 = \frac{1}{x^{\cancel{6}4}}\cdot 3\cancel{x^2}$

$= \frac{3}{x^4}$

65/ $\frac{d}{dx}\int_{e^x}^{e^{2x}} \ln t^2\,dt$

$= \ln(e^{2x})^2 \cdot e^{2x}\cdot 2 - \ln(e^x)^2\cdot e^x$

$\ln e^{4x} \qquad - \ln(e^{2x})\cdot e^x$

$= 4x\cdot e^{2x}\cdot 2 \qquad - 2xe^x$

$= 8xe^{2x}$

$= 2xe^x\left[4e^x - 1\right]$

$\frac{d}{dx}\int_a^{g(x)} f(t)\,dt = f(g(x))\cdot g'(x)$

$\frac{d}{dx}\int$

$(7x^2+5)^9$

$\int x\sin(4x^2)\cdot$

$\int \sin^5(4x^2)$

40) $\int_0^2 \frac{2x}{(x^2+1)^2}\,dx$

$u = x^2+1$
$du = 2x \cdot dx$
$\frac{du}{2x} = dx$

$\int_1^5 \frac{\cancel{2x}}{u^2}\cdot\frac{du}{\cancel{2x}}$

$\int_1^5 u^{-2}\,du$

$= \frac{u^{-1}}{-1}\Big|_1^5$

$= \frac{-1}{u}\Big|_1^5 = -\frac{1}{5} + +1 = \frac{4}{5}$

$\int_{1/3}^{1/\sqrt{3}} \frac{4}{9x^2+1}\,dx$ $\quad (3x)^2$

$u = 3x$
$du = 3\,dx$
$\frac{du}{3} = dx$

$u = 3\cdot\frac{1}{\sqrt{3}} = \frac{3}{\sqrt{3}}$ $\quad \frac{3\sqrt{3}}{3}$

$u = \cancel{3}\cdot\frac{1}{\cancel{3}}$

$4\int_1^{\sqrt{3}} \frac{1}{u^2+1}\,\frac{du}{3}$

$\frac{4}{3}\tan^{-1}u\Big|_1^{\sqrt{3}}$

$\frac{4}{3}\left[\tan^{-1}\sqrt{3} - \tan^{-1}(1)\right]$

$\frac{4}{3}\left[\frac{\pi}{3} - \frac{\pi}{4}\right]$

$\frac{4}{3}\left[\frac{4\pi}{12} - \frac{3\pi}{12}\right]$

$\frac{\cancel{4}}{3}\cdot\frac{\pi}{\cancel{12}\,3} = \boxed{\frac{\pi}{9}}$

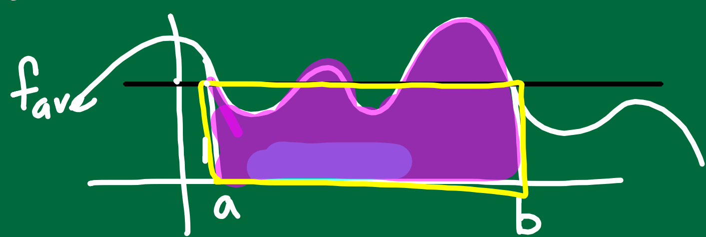
$A = \ell w$

$2w + \ell = \frac{12}{2w}$

$\ell = \frac{6}{w}$

$A = 2w + \frac{6}{w}$

Mean Value Thm for Integrals

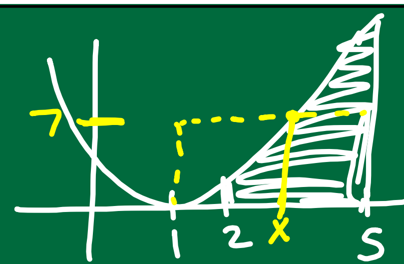


Area of $\square$ = Area under curve

$$(b-a)\cdot f_{ave} = \int_a^b f(x)\,dx$$

$$\boxed{f_{ave} = \frac{1}{b-a}\int_a^b f(x)\,dx}$$

$f(x) = x^2 - 2x + 1 \quad a=2 \quad b=5$



Find f_{ave}.

$$f_{ave} = \frac{1}{5-2}\int_2^5 (x^2 - 2x + 1)\,dx$$

$$= \frac{1}{3}\left[\frac{x^3}{3} - \frac{\cancel{2}x^2}{\cancel{2}} + x\right|_2^5$$

$$= \frac{1}{3}\left[\frac{125}{3} - 25 + 5 + \left(-\frac{8}{3} + 4 - 2\right)\right]$$

$$= \frac{1}{3}\left[\frac{117}{3} - 18\right.$$

$$= \frac{1}{3}\left[39 - 18\right]$$

$$= \frac{1}{3}\left[21\right] = 7 \qquad y = 7$$

Find x-coord where f_{ave} occurs

$$x^2 - 2x + 1 = 7$$
$$\quad\;\; -7$$

$$x^2 - 2x - 6 = 0$$

$x =$ Quadr. formula

$x = \sim \quad x = ——$

answers must be between 2 & 5.

$$\int \frac{1}{x}\,dx = \ln|x| + C$$

$$\int \frac{1}{\sqrt{1-x^2}}\,dx = \sin^{-1}x + C$$

$$\int e^x\,dx = e^x + C$$

$$\int \sec x \tan x\,dx = \sec x + C$$

$$\int \frac{(\ln x + 7)}{x}\,dx \qquad u = \ln x + 7$$

$$du = \frac{1}{x}\,dx$$

$$\int \frac{u}{\cancel{x}} \cdot \cancel{x}\,du \qquad x\,dx = dx$$

$$\cancel{\int \int x^2 \cdot u^3\,dx = \frac{x^3}{3}\cdot\frac{u^4}{4}}$$

$u =$

$$\int (x-2)\,u^3\,du$$

$u = 2x-3$

$\frac{u+3}{2} = x$

$$\int \frac{3x}{x^2+4}\,dx$$

$u = x^2+4$

$= 2x$

$$\int \frac{3}{x^2+4}\,dx$$

$$\frac{3}{4}\int \frac{1}{\frac{x^2}{4}+1}\,dx$$

$u = \frac{x}{2}$

1) Make the "1"
2) Figure out what $(u)^2$ is $u =$
3) Integrate with inverse trig function