1-5: No log diff needed.

#3 $10 \log x = 10 \log_{10} x$

common log
assume 10

$$10 \frac{1}{x \ln 10} = \frac{10}{x \ln(10)}$$

#4 $\frac{e^{2+\ln x}}{x}$ .... but also, $e^{(2+\ln x)}$

$$= e^2 e^{\ln x}$$

$$y = e^2 x$$

$$y' = e^2$$

6-10:

#9 $\frac{1}{3}\int_5^8 3e^{3x-4}\,dx$ $\quad u = 3x-4$

$du = 3\,dx$

$$\frac{1}{3}\int_{5=x}^{8=x} e^u\,du = \frac{1}{3} e^u \Big|_{5=x}^{8=x} = \frac{1}{3} e^{3x-4}\Big|_5^8$$

$$= \frac{1}{3}(e^{20} - e^{11})$$

11-15: Log-diff

#5 $y = \sqrt[x]{x} = x^{1/x}$

$$\ln y = \ln\left(x^{1/x}\right)$$

Log rule $\ln y = \frac{1}{x}\ln x$

DERIVE

$$\underbrace{\frac{1}{y}y'}_{\text{chain}} = \underbrace{\frac{1}{x}\frac{1}{x} + -\frac{1}{x^2}\ln x}_{\text{product}}$$

$$\frac{1}{y}y' = \frac{1}{x^2} - \frac{\ln x}{x^2}$$

$$y' = y\left(\frac{1-\ln x}{x^2}\right)$$

$$y' = \sqrt[x]{x}\left(\frac{1-\ln x}{x^2}\right)$$

16-20: manipulate the expression.

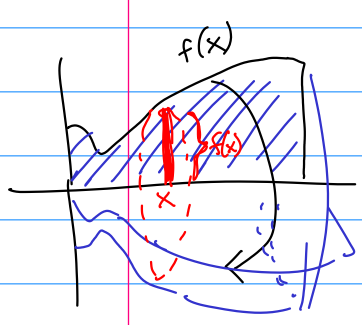
#18 $\int 2^x 3^{2x}\,dx$

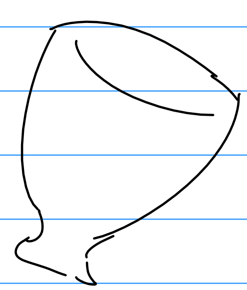
$$\int 2^x (3^2)^x\,dx$$

$$\int 2^x 9^x\,dx$$

$$\int 18^x\,dx$$

$$\frac{18^x}{\ln 18} + C$$





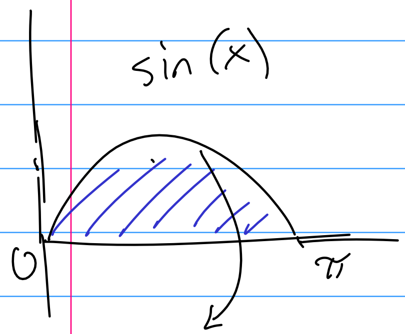
$$\underset{\text{Volume}}{V} = \int_a^b \underbrace{A(x)}_{\text{cross-section area}}\,dx$$

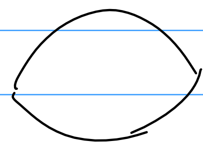
For solids of revolution,

$A(x) = \pi[f(x)]^2 \Longleftarrow$ $A(x)$ represents the area of a circle.

$$V = \int_a^b \pi [f(x)]^2 \, dx .$$

"Disk method"

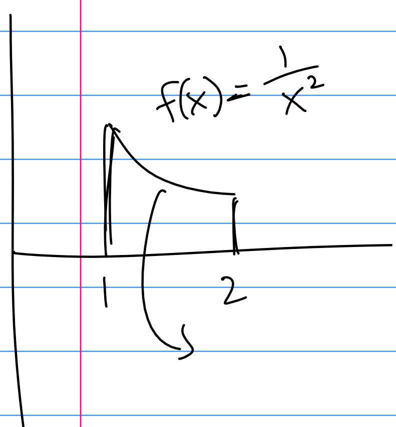


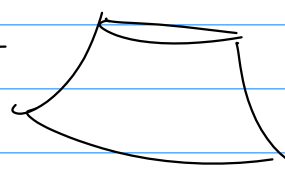


$$V = \int_0^{\pi} \pi (\sin(x))^2 \, dx$$

$$V = \pi \int_0^{\pi} \sin^2 x \, dx$$

etc.





$$V = \int_1^2 \pi \left(\frac{1}{x^2}\right)^2 dx$$

$$\pi \int_1^2 x^{-4} \, dx$$

$$\pi \left(-\frac{1}{3} x^{-3}\right)\Big|_1^2$$

$$\pi \left(-\frac{1}{3}\frac{1}{8} - -\frac{1}{3} 1\right)$$

$$\pi \left(-\frac{1}{24} + \frac{\overset{8}{\cancel{1}}}{\underset{24}{\cancel{3}}}\right)$$

$$\pi \left(\frac{7}{24}\right) = \boxed{\frac{7\pi}{24}}$$