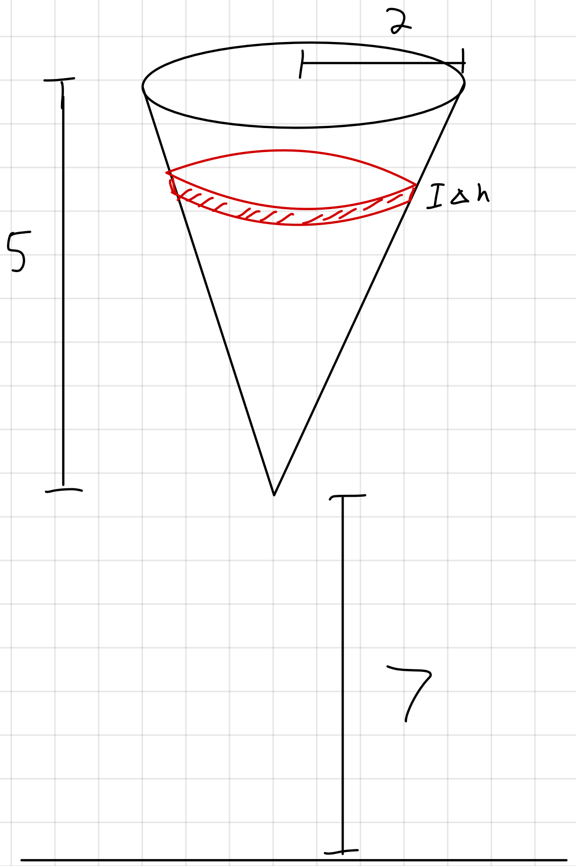
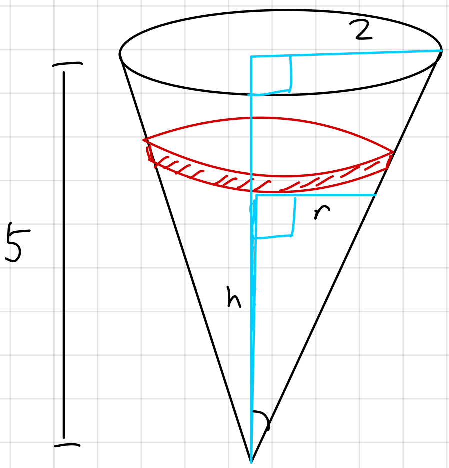
Question 36:



Find radius in terms of height:



By similar right triangles

$$\frac{2}{5} = \frac{r}{h} \Rightarrow r = \frac{2}{5}h$$

work from 1 slice of water (depicted in red):

$$W_{slice} = \rho \, V \, g \, d$$

$$W_{slice} = \rho \, (\pi r^2 \Delta h) \, g \, (h+7)$$

$$W_{slice} = \rho \, (\pi r^2 \Delta h) \, g \, (h+7)$$

plug in r in terms of h

$$W_{slice} = \rho \left(\pi \left(\tfrac{2}{5}h\right)^2 \Delta h\right) g \, (h+7)$$

$$W_{slice} = \rho \, \pi \left(\tfrac{2}{5}h\right)^2 g \, (h+7) \, \Delta h$$

$$\Rightarrow W_{cone\ top} = \int_2^5 \rho \, \pi \left(\tfrac{2}{5}h\right)^2 g \, (h+7) \, dh$$

Question 37:

$$\int \frac{4x-2}{x^2-2x+1} \, dx = \int \frac{4x-2}{(x-1)^2} \, dx$$

$$\Rightarrow \int \frac{4x-2}{x^2-2x+1} \, dx = \int \frac{A}{x-1} \, dx + \int \frac{B}{(x-1)^2} \, dx$$

$$\int \frac{4x-2}{x^2-2x+1} = \int \frac{A(x-1) + B}{(x-2)^2}$$

Equating the numerators together

$$\Rightarrow 4x-2 = A(x-1) + B$$

$$\Rightarrow 4x-2 = (Ax) + (B-A)$$

$$\Rightarrow \quad \begin{matrix} A = 4 \\ B - A = -2 \end{matrix} \quad \Rightarrow \quad \begin{matrix} A = 4 \\ B = 2 \end{matrix}$$

plugging this back into the original equation

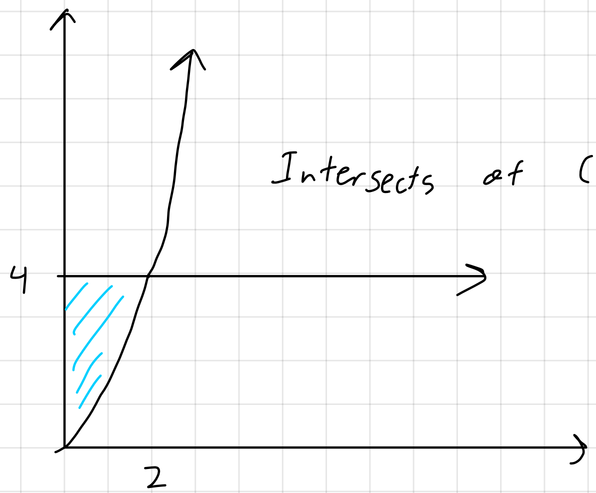
$$\int \frac{4x-2}{x^2-2x+1}\,dx = \int \frac{A}{x-1}\,dx + \int \frac{B}{(x-1)^2}\,dx$$

$$= \int \frac{4}{x-1}\,dx + \int \frac{2}{(x-1)^2}\,dx$$

$$= 4\ln|x-1| - 2(x-1)^{-1} + C$$

Question 38:

A.



B.

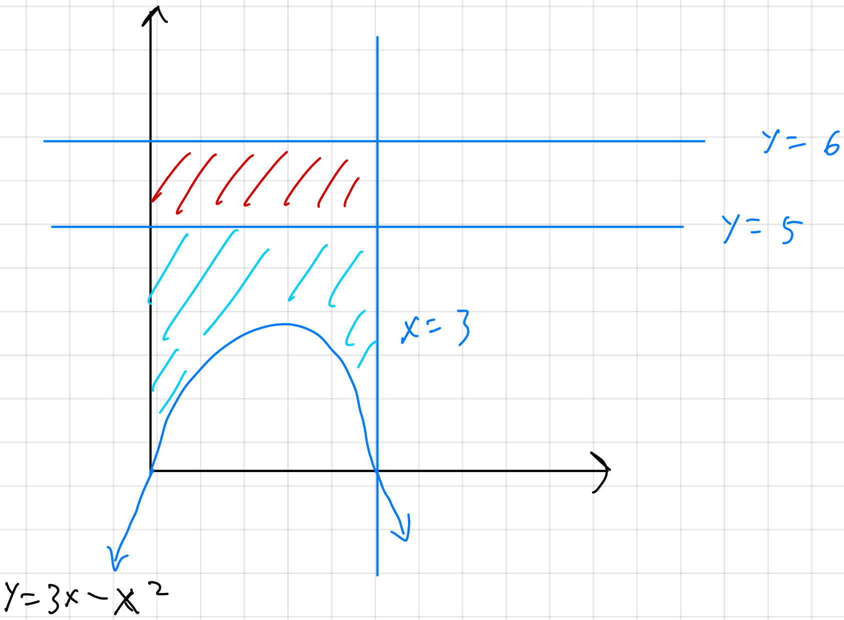
$$\text{Volume} = \int_0^2 \pi (4)^2\,dx - \int_0^2 \pi (x^2)^2\,dx$$

$$= \pi(16)(2) - \frac{1}{5}2^5(\pi)$$

$$= \pi\, 25.6$$

Question 39:

A. B,



C.

$$\text{volume} = \underbrace{\int_0^3 \pi (6-3x+x^2)^2 \, dx}_{\text{volume of blue region}} - \underbrace{\int_0^3 \pi (6-5)^2 \, dx}_{\text{volume of hole}}$$