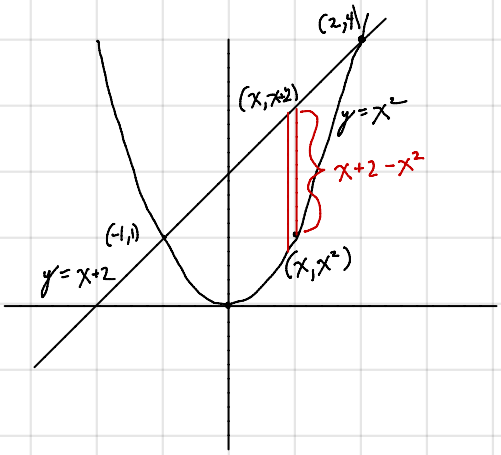
(1) Consider the region between

$$y = x^2$$

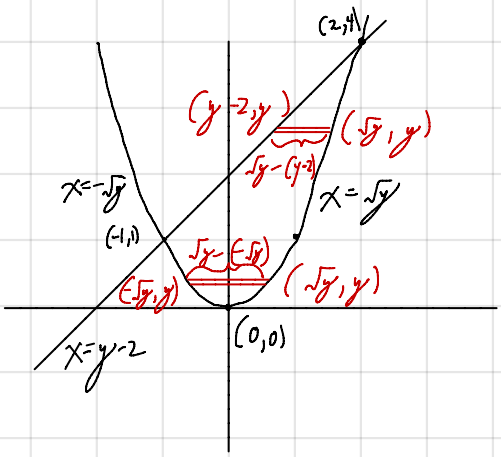
$$y = x + 2$$

(a) Write an integral or integrals with respect to x representing the above region. You do not need to evaluate the integral.



$$\int_{-1}^{2} (x+2-x^2)\,dx$$

(b) Write an integral or integrals with respect to y representing the above region. You do not need to evaluate the integral.



$$\int_0^1 2\sqrt{y}\,dy + \int_1^4 (\sqrt{y} - (y-2))\,dy$$

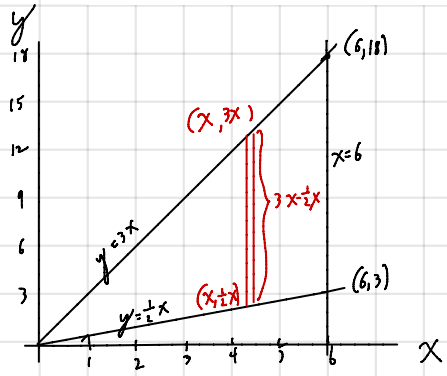
(2) Consider the region between

$$y = 3x$$

$$y = \frac{1}{2}x$$

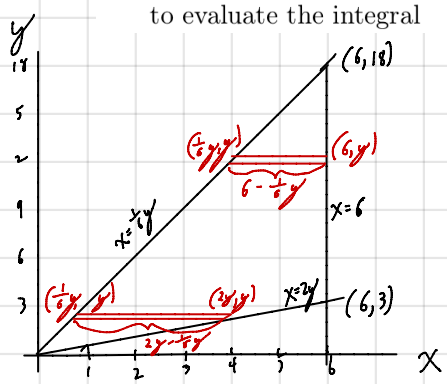
$$x = 6$$

(a) Write an integral or integrals with respect to x representing the above region. You do not need to evaluate the integral..



$$\int_0^6 \left(3x - \frac{1}{2}x\right) dx$$

(b) Write an integral or integrals with respect to y representing the above region. You do not need to evaluate the integral

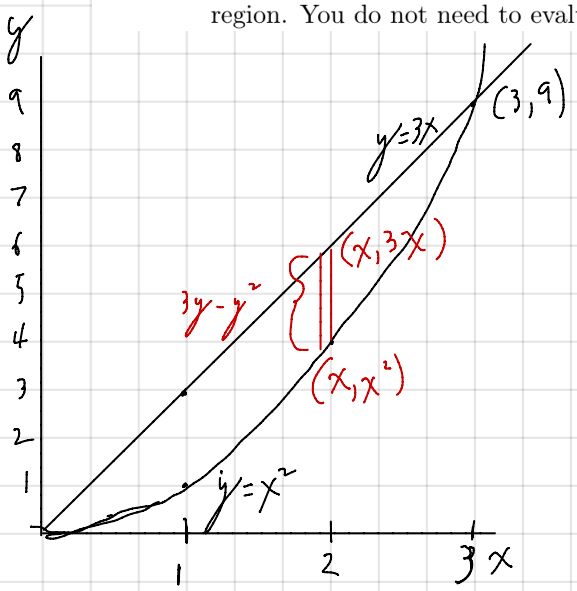


$$\int_0^3 \left(2y - \frac{1}{6}y\right) dy + \int_3^{18} \left(6 - \frac{1}{6}y\right) dy$$

(3) Consider the region given by

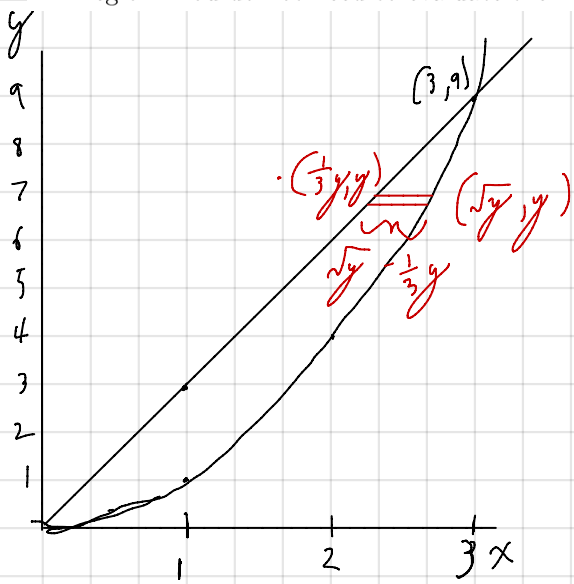
$$x^2 \leq y \leq 3x$$

(a) Write an integral (or sum of integrals) with respect to x representing the area of the above region. You do not need to evaluate the integral.



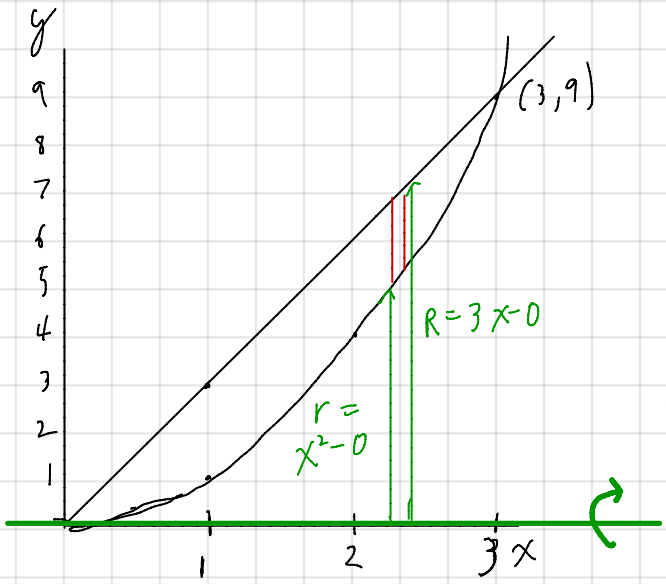
$$\int_0^3 (3x - x^2)\,dx$$

(b) Write an integral (or sum of integrals) with respect to y representing the area of the above region. You do not need to evaluate the integral.



$$\int_0^9 \left(\sqrt{y} - \frac{1}{3}y\right) dy$$

(c) Suppose the above region is rotated about the x-axis. Write an integral (or sum of integrals) with respect to x representing the volume of the resulting solid of revolution. Do not evaluate the resulting integral.

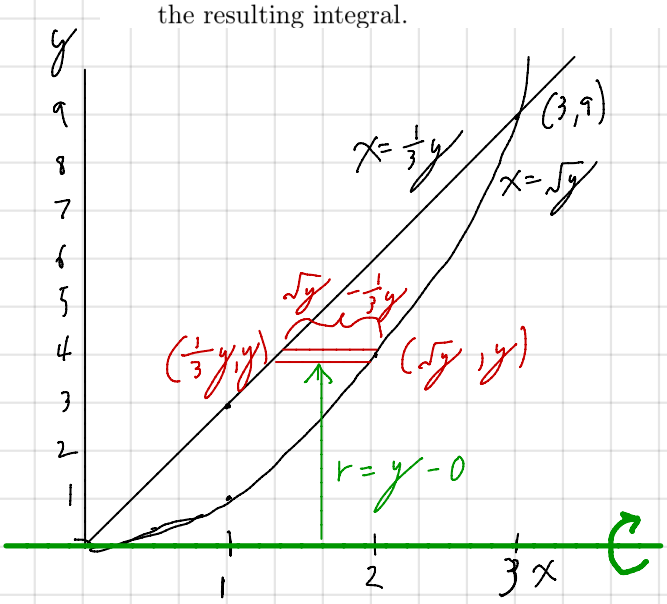


Washers

$$\pi \int_0^3 (R^2 - r^2)\,dx$$

$$\pi \int_0^3 \left((3x)^2 - (x^2)^2\right) dx$$

(d) Suppose the above region is rotated about the x-axis. Write an integral (or sum of integrals) with respect to y representing the volume of the resulting solid of revolution. Do not evaluate the resulting integral.

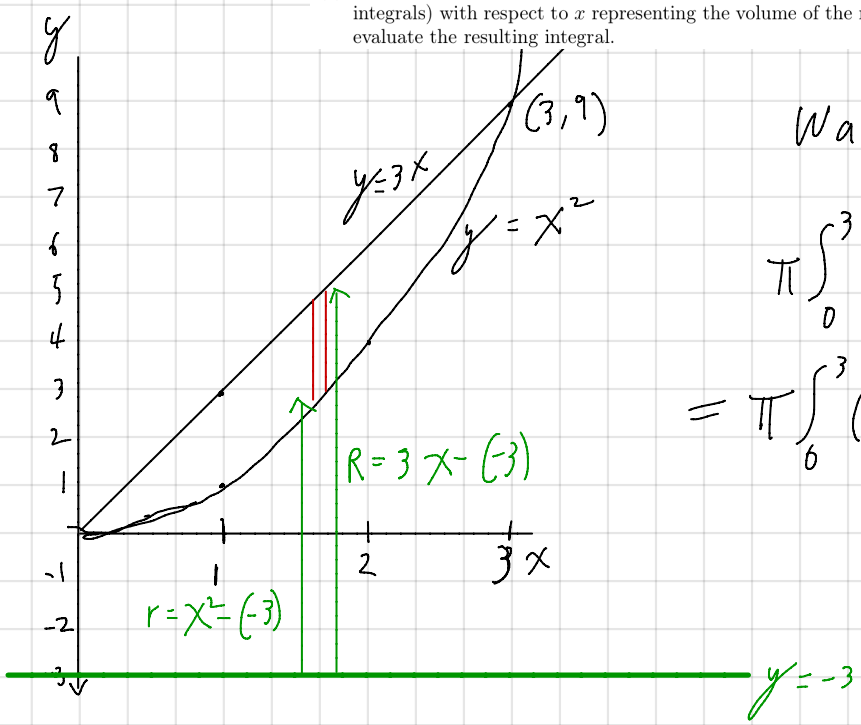


Shells

$$2\pi \int_0^9 r\,h\,dy$$

$$= 2\pi \int_0^9 y\left(\sqrt{y} - \frac{1}{3}y\right) dy$$

(e) Suppose the above region is rotated about the line $y = -3$. Write an integral (or sum of integrals) with respect to x representing the volume of the resulting solid of revolution. Do not evaluate the resulting integral.

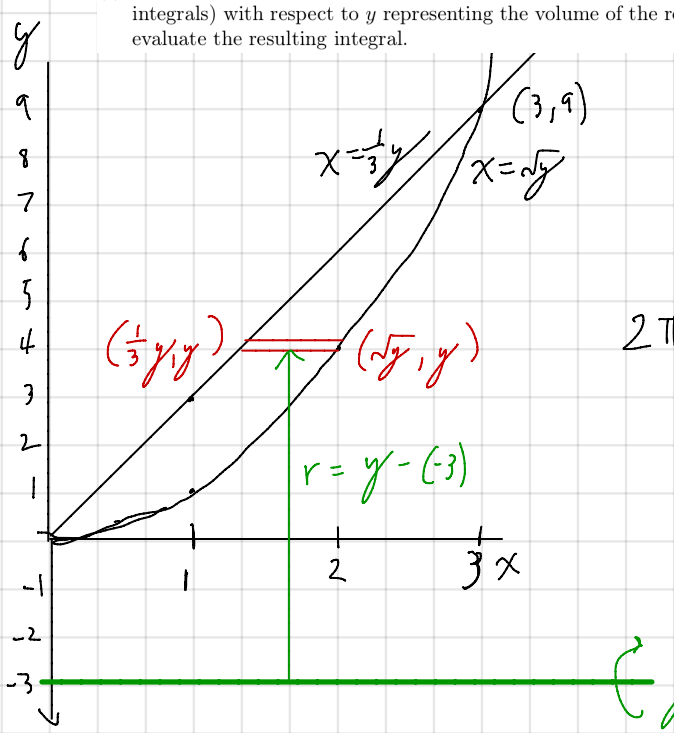


Washers

$$\pi \int_0^3 \left(R^2 - r^2\right) dx$$

$$= \pi \int_0^3 \left((3x+3)^2 - (x^2+3)^2\right) dx$$

(f) Suppose the above region is rotated about the line $y = -3$. Write an integral (or sum of integrals) with respect to y representing the volume of the resulting solid of revolution. Do not evaluate the resulting integral.

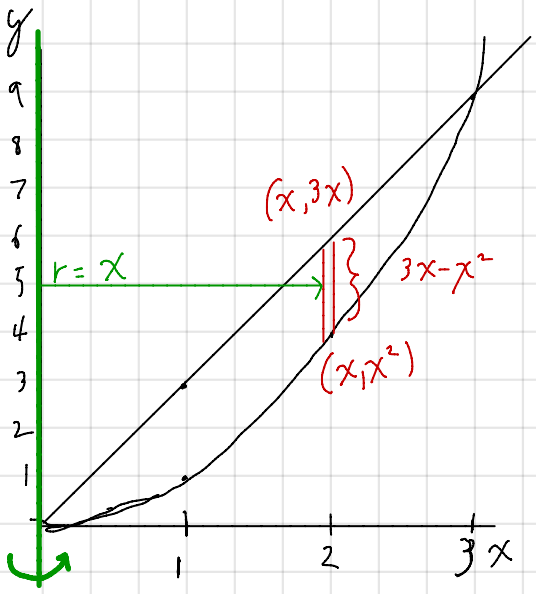


shells

$$2\pi \int_0^9 r\,h\,dy$$

$$= 2\pi \int_0^9 (y+3)\left(\sqrt{y} - \frac{1}{3}y\right) dy$$

(g) Suppose the above region is rotated about the y-axis. Write an integral (or sum of integrals) with respect to x representing the volume of the resulting solid of revolution. Do not evaluate the resulting integral.

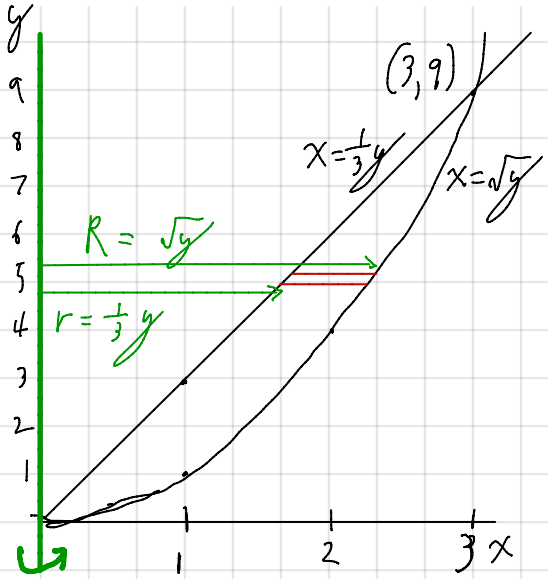


Shells

$$2\pi \int_0^3 r\,h\,dx$$

$$= 2\pi \int_0^3 x\,(3x - x^2)\,dx$$

(h) Suppose the above region is rotated about the y-axis. Write an integral (or sum of integrals) with respect to y representing the volume of the resulting solid of revolution. Do not evaluate the resulting integral.

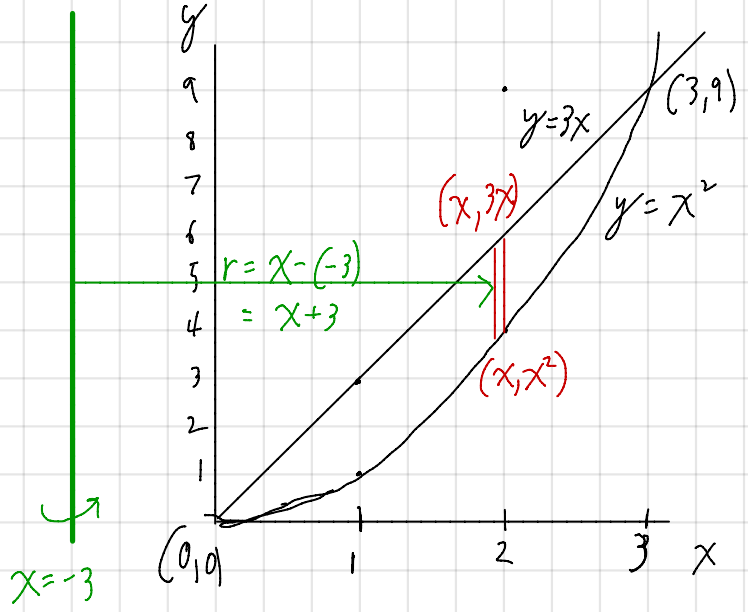


Washers

$$\pi \int_0^9 (R^2 - r^2)\,dy$$

$$= \pi \int_0^9 \left((\sqrt{y})^2 - (\tfrac{1}{3}y)^2\right) dy$$

(i) Suppose the above region is rotated about the line $x = -3$. Write an integral (or sum of integrals) with respect to x representing the volume of the resulting solid of revolution. Do not evaluate the resulting integral.

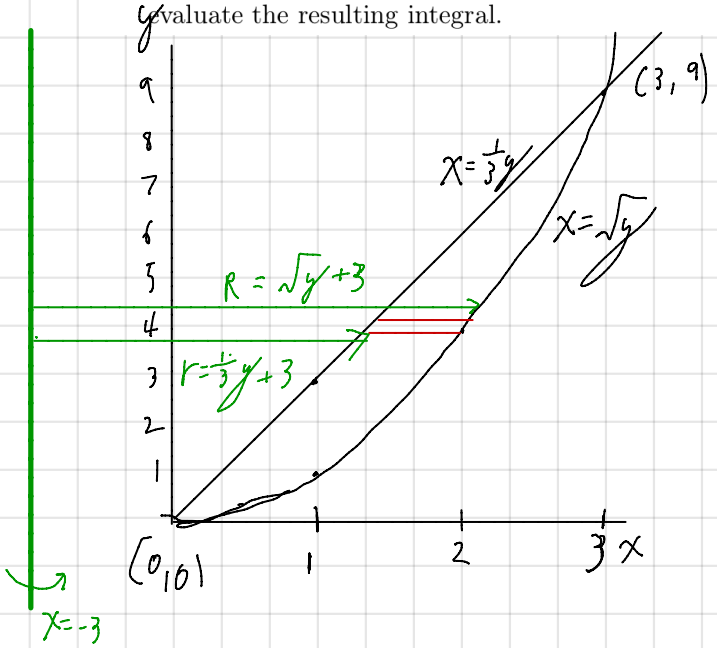


shells

$$2\pi \int_0^3 r\,h\,dx$$

$$= 2\pi \int_0^3 (x+3)\,(3x - x^2)\,dx$$

(j) Suppose the above region is rotated about the line $x = -3$. Write an integral (or sum of integrals) with respect to y representing the volume of the resulting solid of revolution. Do not evaluate the resulting integral.



Washers

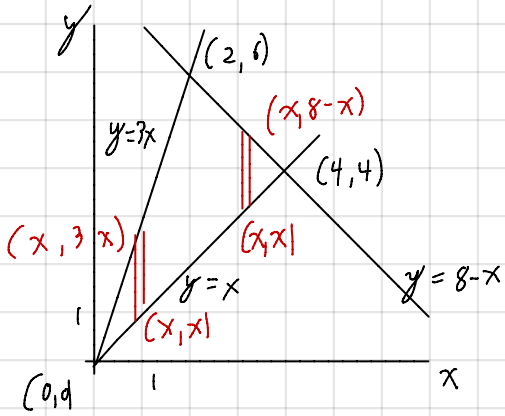
$$\pi \int_0^3 (R^2 - r^2)\, dy$$

$$= \pi \int_0^3 \left((\sqrt{y} + 3)^2 - \left(\frac{1}{3}y + 3\right)^2 \right) dy$$

(4) Consider the triangular region given by

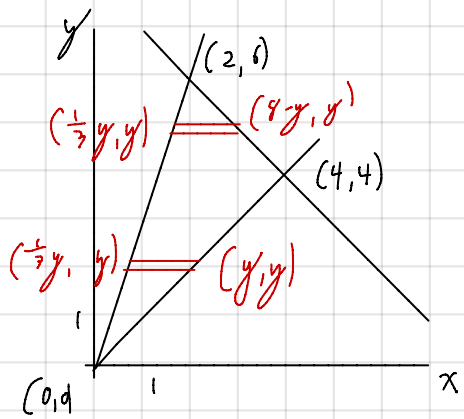
$$y \leq 3x$$
$$x \leq y$$
$$x + y \leq 8$$

(a) Write an integral (or sum of integrals) with respect to x representing the area of the above region. You do not need to evaluate the integral.



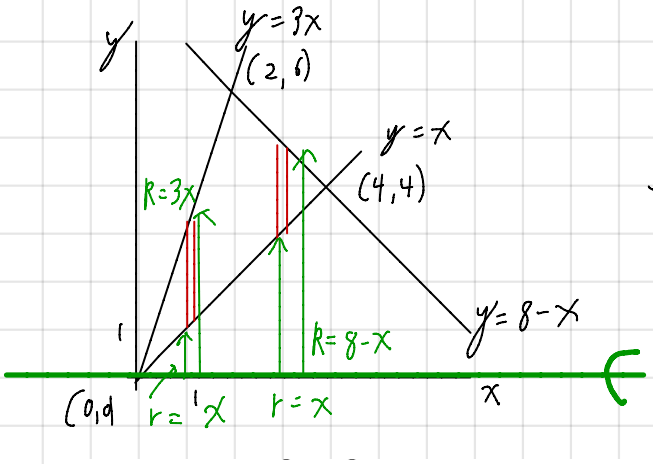
$$\int_0^2 (3x - x)\, dx + \int_2^4 (8 - x - x)\, dx$$

(b) Write an integral (or sum of integrals) with respect to y representing the area of the above region. You do not need to evaluate the integral.



$$\int_0^4 \left(y - \frac{1}{3}y\right) dy + \int_4^6 \left(8 - y - \frac{1}{3}y\right) dy$$

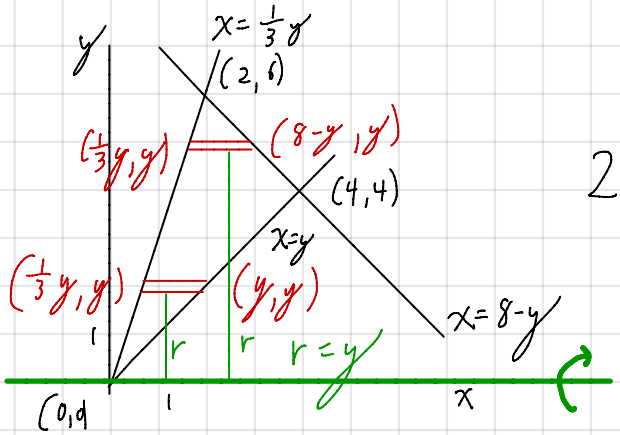
(c) Suppose the above region is rotated about the x-axis. Write an integral (or sum of integrals) with respect to x representing the volume of the resulting solid of revolution. Do not evaluate the resulting integral.



Washers

$$\pi\int_0^2\left((3x)^2-(x)^2\right)dx+\pi\int_2^4\left((8-x)^2-(x)^2\right)dx$$

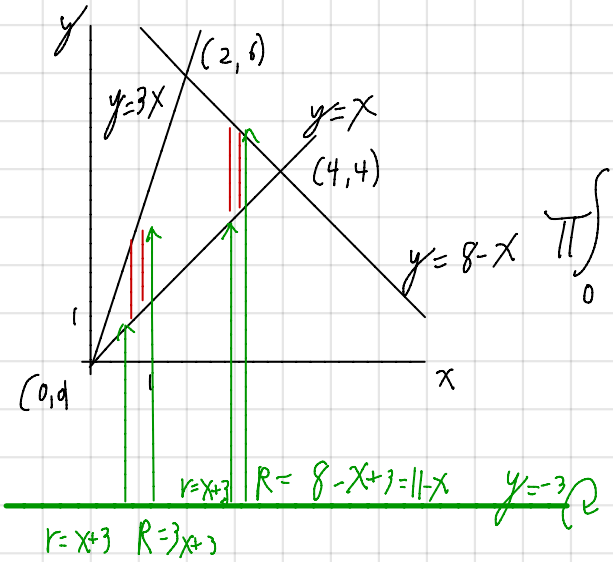
(d) Suppose the above region is rotated about the x-axis. Write an integral (or sum of integrals) with respect to y representing the volume of the resulting solid of revolution. Do not evaluate the resulting integral.



Shells

$$2\pi\int_0^4 y\left(y-\tfrac{1}{3}y\right)dy+2\pi\int_4^6 y\left(8-y-\tfrac{1}{3}y\right)dy$$

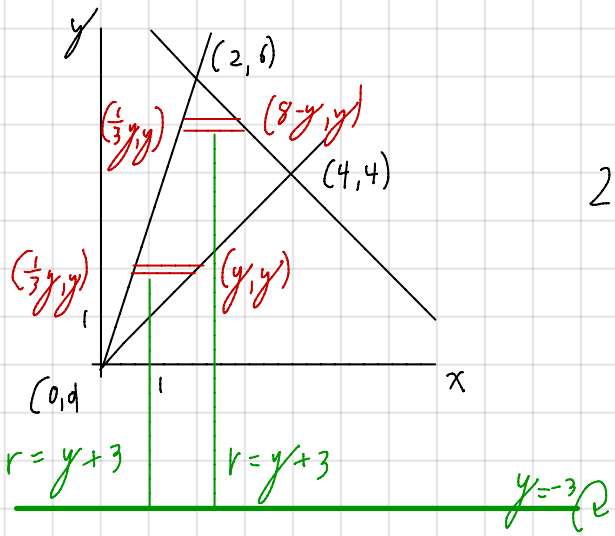
(e) Suppose the above region is rotated about the line $y=-3$. Write an integral (or sum of integrals) with respect to x representing the volume of the resulting solid of revolution. Do not evaluate the resulting integral.



Washers

$$\pi\int_0^2\left((3x+3)^2-(x+3)^2\right)dx+\pi\int_2^4\left((11-x)^2-(x+3)^2\right)dx$$

(f) Suppose the above region is rotated about the line $y = -3$. Write an integral (or sum of integrals) with respect to y representing the volume of the resulting solid of revolution. Do not evaluate the resulting integral.



Shells

$$2\pi \int_0^4 (y+3)\left(y-\tfrac{1}{3}y\right)dy + 2\pi \int_4^6 (y+3)\left(8-y-\tfrac{1}{3}y\right)dy$$