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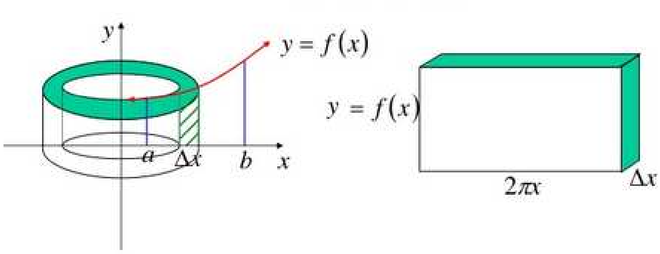
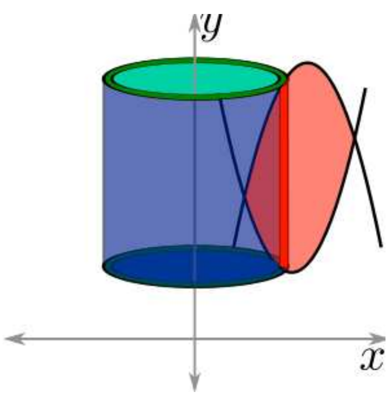
Section 6.3: Volume by Cyndrical Shells

The Method of Cylindrical Shells: Within the bounded region, we rotate a rectangle around the axis of rotation. This results in what is called a **cylindrical shell**:

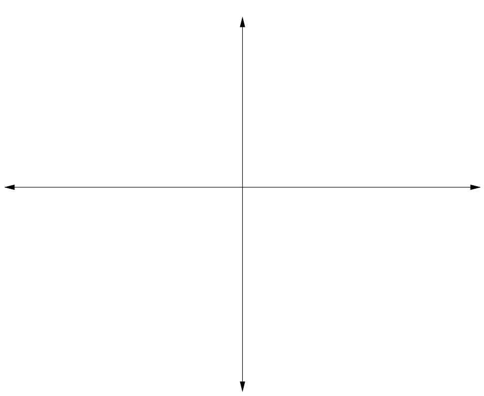


- **Revolution about the y axis:** $V = \int_a^b 2\pi x(f(x) - g(x))\,dx$,

where $f(x) \geq g(x)$ for $a \leq x \leq b$.



1. Find the volume of the solid obtained by rotating the region bounded by $y = x - x^2$, $y = 0$, about the y axis.



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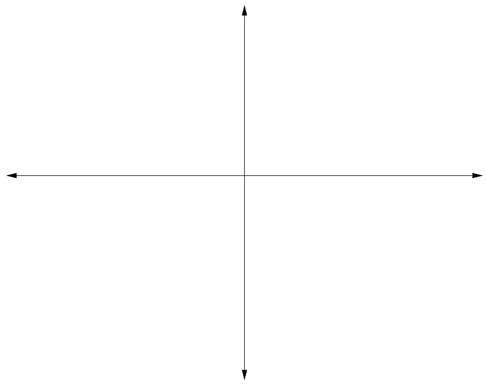
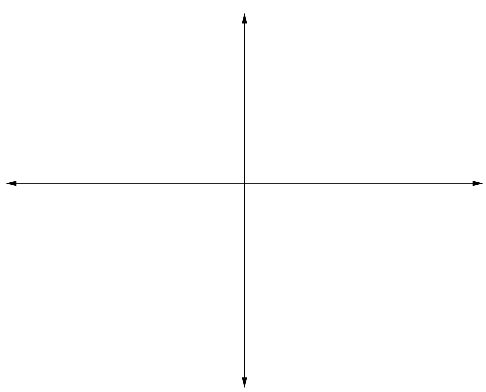
2. Find the volume of the solid obtained by rotating the region bounded by $y = \dfrac{1}{x}$, $y = -2$, $x = 1$, $x = 4$ about the y axis.



3. Set up but do not evaluate an integral that gives the volume of the solid obtained by rotating the region bounded by $y = x^2$, $y = x$ about the line $x = 3$ using two different methods.



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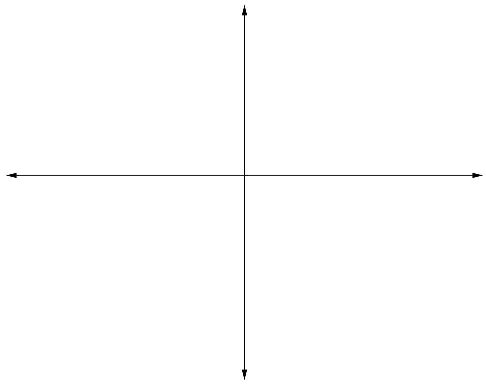
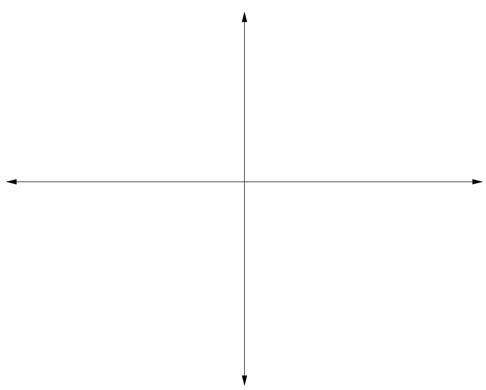
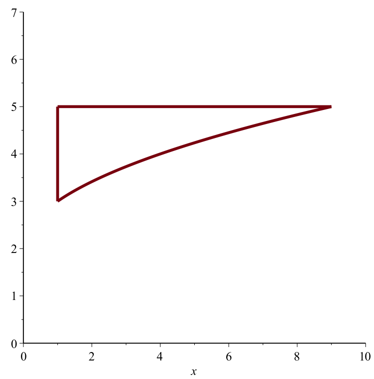
4. Set up but do not evaluate an integral that gives the volume of the solid obtained by rotating the region $y = 4x - x^2$, $y = 3$, about the line $x = 1$.



5. Set up but do not evaluate an integral that gives volume of the solid obtained by rotating the region bounded by $y = 3x^2$, $y = 0$, $x = 0$, $x = 2$ about the line $x = -1$.

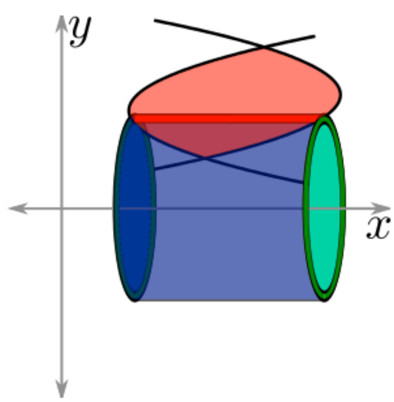


6. Set up but do not evaluate an integral that gives the volume of the solid obtained by rotating the region $y = \sqrt{x} + 2$, $x = 1$, $y = 5$, about the line $x = -1$ using two different methods.



• **Revolution about the x axis:** $V = \displaystyle\int_c^d 2\pi y(f(y) - g(y))\, dy$,

where $f(y) \geq g(y)$ for $c \leq y \leq d$.



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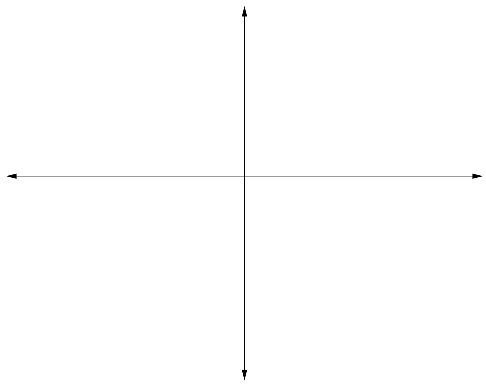
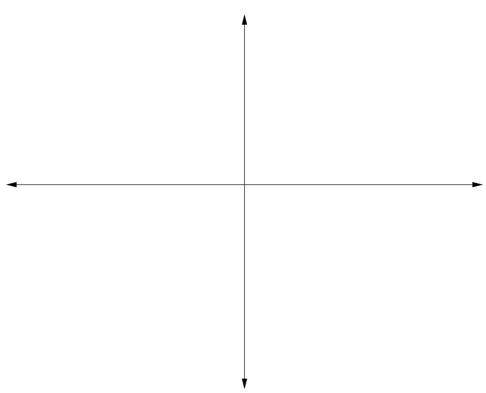
7. Find the volume of the solid obtained by rotating the region bounded by $y^2 = x$, $x = 0$, $y = 2$, $y = 5$ about the x axis.



8. Set up but do not evaluate an integral that gives the volume of the solid obtained by rotating the region bounded by $y = x^2$, $x = 0$ and $y = 2$ about the line $y = 3$ using two different methods.



9. Using two different methods, find an integral that gives the volume of the solid obtained by rotating region bounded by $y = \sqrt{x}$, $y = 0$, $x + y = 2$ about the x-axis. Do not evaluate either integral.