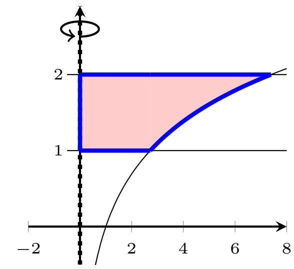
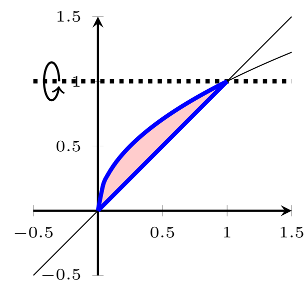
1. We use the disk method, and so integrate with respect to y. At each fixed y, our disk has radius $R = e^y$, and so the volume of this solid is given by

$$\begin{aligned} V &= \int_1^2 \pi R^2\, dy \\ &= \pi \int_1^2 e^{2y}\, dy \\ &= \pi \left[\frac{1}{2} e^{2y}\right]_1^2 \\ &= \boxed{\frac{\pi}{2}\left(e^4 - e^2\right) \approx 74.15587} \end{aligned}$$



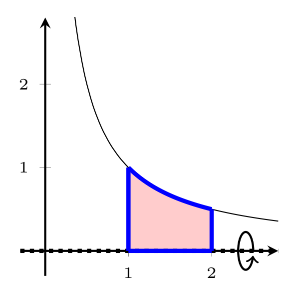
2. We use the washer method, and so integrate with respect to x. The bounding curves intersect when $x = 0$ and $x = 1$. At each fixed x, our washer has inner radius $r = 1 - \sqrt{x}$ and outer radius $R = 1 - x$, and so the volume of this solid is given by

$$\begin{aligned} V &= \int_0^1 \pi(R^2 - r^2)\, dx \\ &= \pi \int_0^1 (1-x)^2 - (1-\sqrt{x})^2\, dx \\ &= \pi \int_0^1 \left(x^2 - 3x + 2\sqrt{x}\right)\, dx \\ &= \pi \left[\frac{1}{3}x^3 - \frac{3}{2}x^2 + \frac{4}{3}x^{3/2}\right]_0^1 \\ &= \boxed{\frac{\pi}{6} \approx 0.52360} \end{aligned}$$



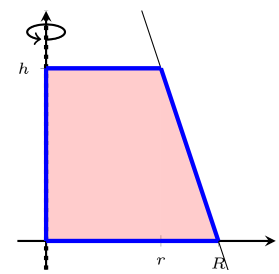
3. We use the disk method, and so integrate with respect to x. At each fixed x, the washer has radius $R = \frac{1}{x}$, and so the volume of this solid is

$$\begin{aligned} V &= \int_1^2 \pi R^2\, dx \\ &= \pi \int_1^2 \frac{1}{x^2}\, dx \\ &= \pi \left[-\frac{1}{x}\right]_1^2 \\ &= \boxed{\frac{\pi}{2} \approx 1.57080} \end{aligned}$$



4. We can view this as a solid of revolution in the following way: Place the center of the base circle at the origin. The slanted edge of the frustum passes through the points $(R, 0)$ and (r, h), and so the line representing this edge is precisely $y = \left(\frac{h}{r-R}\right)(x - R)$. Since we'll be using the disk method, we integrate with respect to y. At each fixed y, the radius of this disk is $x = \left(\frac{r-R}{h}\right) y + R$, and so the volume of the solid is

$$\begin{aligned} V &= \int_0^h \pi x^2 \, dy \\ &= \pi \int_0^h \left(\frac{r-R}{h} y + R\right)^2 dy \\ &= \pi \int_0^h \left(\frac{r-R}{h}\right)^2 y^2 + 2\pi \frac{R(r-R)}{h} y + \pi R^2 \, dy \\ &= \pi \left[\frac{1}{3}\left(\frac{r-R}{h}\right)^2 y^3 + \frac{R(r-R)}{h} y^2 + R^2 y\right]_0^h \\ &= \boxed{\frac{1}{3}\pi h \left(r^2 + rR + R^2\right)} \end{aligned}$$



5. We use the shell method, and so integrate with respect to x. At each fixed x, the cylindrical shell has radius $r = x$ and height $h = x^3$, and so the volume of the solid is

$$\begin{aligned} V &= \int_1^2 2\pi r h \, dx \\ &= 2\pi \int_1^2 x \cdot x^3 \, dx \\ &= 2\pi \int_1^2 x^4 \, dx \\ &= \pi \left[\frac{2}{5} x^5\right]_1^2 \\ &= \boxed{\frac{62}{5}\pi \approx 38.95575} \end{aligned}$$

image here

6. We use the shell method, and so integrate with respect to y. The curve $y = x^3$ can be rewritten as the curve $x = y^{1/3}$. At each y, the cylindrical shell has radius $r = y$ and height $h = y^{1/3}$, and so the volume of the solid is

$$\begin{aligned} V &= \int_0^8 2\pi r h \, dy \\ &= 2\pi \int_0^8 y \cdot y^{1/3} \, dy \\ &= 2\pi \int_0^8 y^{4/3} \, dy \\ &= \left[\frac{6\pi}{7} y^{7/3} \right]_0^8 \\ &= \boxed{\frac{768\pi}{7} \approx 344.67759} \end{aligned}$$

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7. We use the shell method, and so integrate with respect to x. At each x, the cylindrical shell has radius $r = (2 - x)$ and height $h = x^4$, and so the volume of the solid is

$$\begin{aligned} V &= \int_0^1 2\pi r h \, dx \\ &= 2\pi \int_0^1 (2 - x) x^4 \, dx \\ &= 2\pi \int_0^1 2x^4 - x^5 \, dx \\ &= 2\pi \left[\frac{2}{5} x^5 - \frac{1}{6} x^6 \right]_0^1 \\ &= \boxed{\frac{7}{15}\pi \approx 1.46608} \end{aligned}$$

image here

8. We use the shell method, and so integrate with respect to x. At each x, the cylindrical shell has radius $r = (x - 1)$ and height $h = (4x - x^2) - 3$, and so the volume of the solid is

$$\begin{aligned} V &= \int_1^3 2\pi r h \, dx \\ &= 2\pi \int_1^3 (x - 1)(4x - x^2 - 3) \, dx \\ &= 2\pi \int_1^3 -x^3 + 5x^2 - 7x + 3 \, dx \\ &= 2\pi \left[-\frac{1}{2} x^3 + \frac{5}{3} x^3 - \frac{7}{2} x + 3x \right]_1^3 \\ &= \boxed{\frac{8}{3}\pi \approx 8.37758} \end{aligned}$$

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