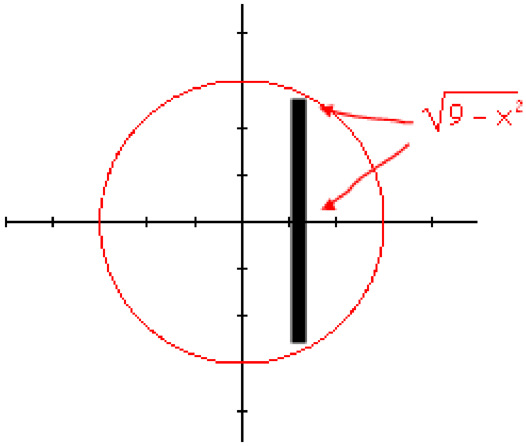
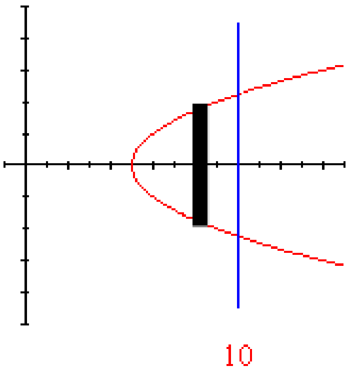
Note: On many (most) of these solutions only the setup and answer is given. You should *always show any and all mathematics* you do including showing where intersections come from, integrations, etc. You should also *always* include an appropriately labeled diagram.

1. Side of square: $2\sqrt{9-x^2}$
   Area of square cross-section: $\left(2\sqrt{9-x^2}\right)^2 = 4(9-x^2)$



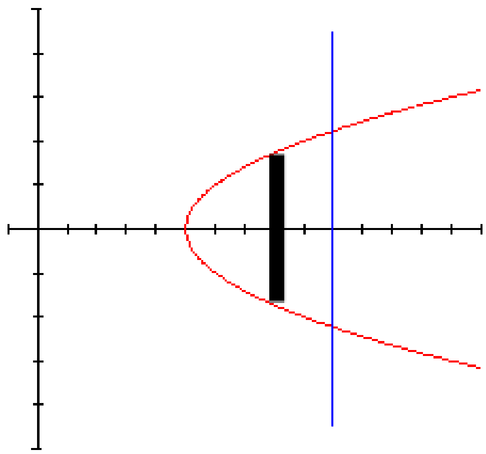
$$V = \int_{-3}^{3} 4(9-x^2)\,\mathrm{d}x = 144$$

2. Area of equilateral triangle: $\frac{\sqrt{3}}{4}(base)^2$
   Length of side of equilateral triangle: $2\sqrt{x-5}$
   Area of equilateral cross-section: $\frac{\sqrt{3}}{4}\left(2\sqrt{x-5}\right)^2 = \sqrt{3}(x-5)$
   Note: The following diagram is not completely labeled!



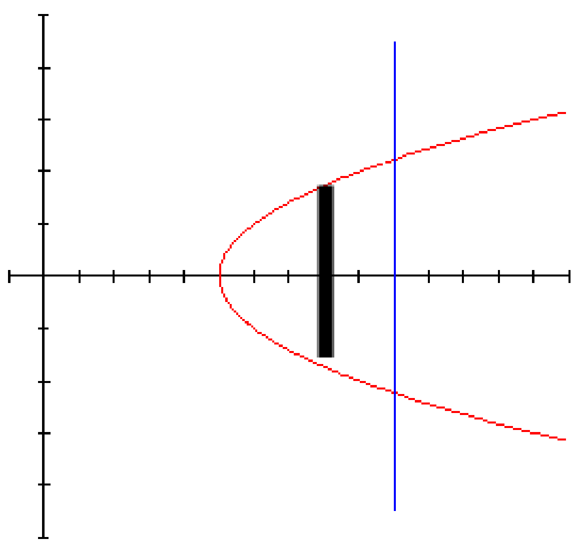
$$V = \int_{5}^{10} \sqrt{3}(x-5)\,\mathrm{d}x = \frac{25\sqrt{3}}{2}$$

3. From x-axis up to curve: $\sqrt{x-5}$
   Length of base of square: $2\sqrt{x-5}$
   Area of square cross-section: $\left(2\sqrt{x-5}\right)^2 = 4(x-5)$
   Note: The following diagram is not completely labeled!



$$V = \int_5^{10} 4(x-5)\,\mathrm{d}x = 50$$

4. Radius of semicircle: $\sqrt{x-5}$
   Area of semicircle: $\frac{1}{2}r^2$
   Area of semicircle cross-section: $\frac{1}{2}\left(\sqrt{x-5}\right)^2 = \frac{\pi}{2}(x-5)$
   Note: The following diagram is not completely labeled!



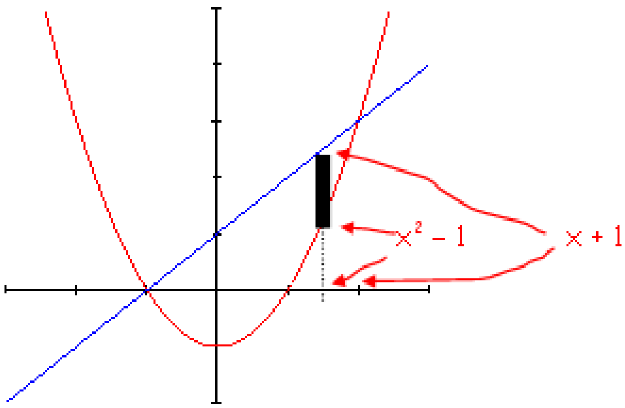
$$V = \frac{\pi}{2}\int_5^{10} (x-5)\,\mathrm{d}x = \frac{25\pi}{4}$$

5. Intersections

   $x+1=x^2-1 \longrightarrow x=-1$ or $x=2$

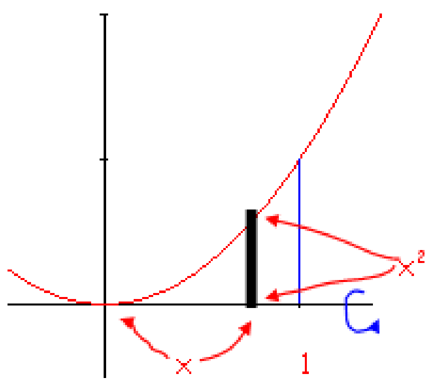
   Base of square: $(x+1)-(x^2-1)$

   Area of square cross-section: $\left[(x+1)-(x^2-1)\right]^2$



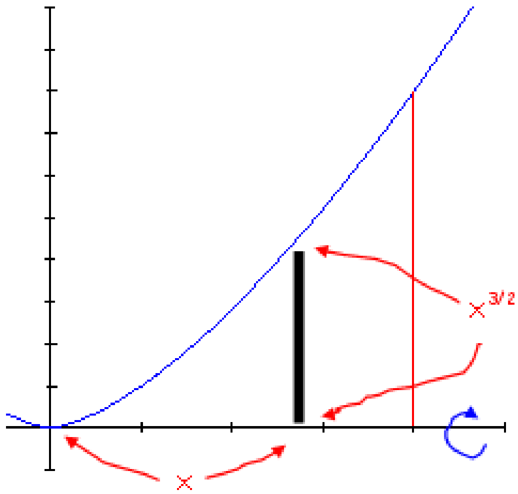
   $$V=\int_{-1}^{2}\left[(x+1)-(x^2-1)\right]^2 \mathrm{d}x=\frac{81}{10}$$

6. Radius of disk: x^2



   $$V=\pi\int_0^1 (x^2)^2\,\mathrm{d}x=\frac{\pi}{5}x^5\Big|_0^1=\frac{\pi}{5}$$

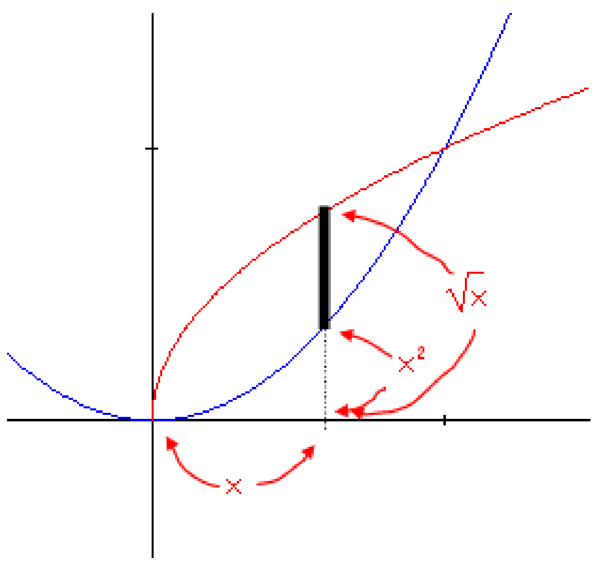
7. Radius of disk: $x^{3/2}$



$$V = \pi \int_0^4 \left(x^{3/2}\right)^2 \mathrm{d}x = \frac{\pi}{4} x^4 \Big|_0^4 = 64\pi$$

8. Intersections
$x^2 = \sqrt{x} \longrightarrow x = 0$ or $x = 1$

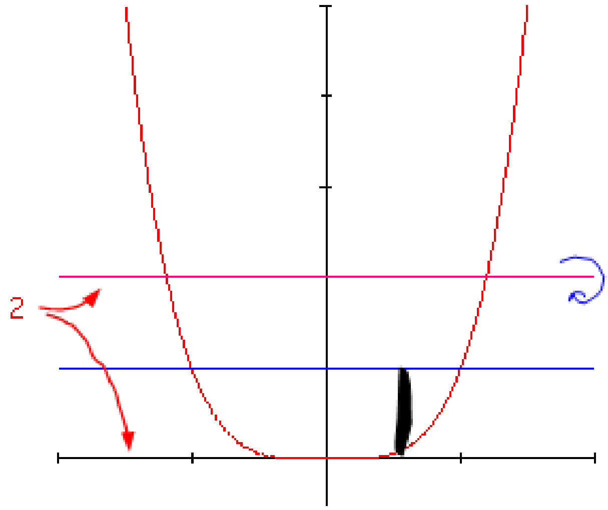
Outer radius of washer: $\sqrt{x}$
Inner radius of washer: x^2



$$V = \pi \int_0^1 \left[\left(\sqrt{x}\right)^2 - \left(x^2\right)^2\right] \mathrm{d}x = \pi \int_0^1 \left(x - x^4\right) \mathrm{d}x = \frac{3\pi}{10}$$

9. Intersections
$x^4 = 1 \longrightarrow x = -1$ or $x = 1$

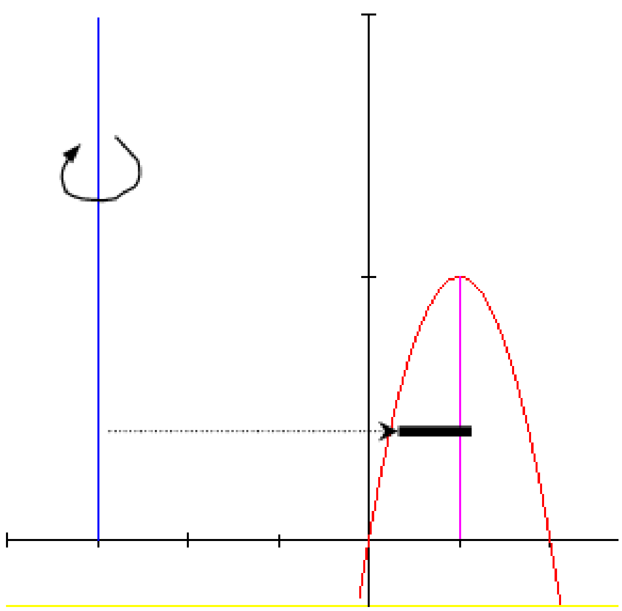
Outer radius of washer: $2 - x^4$
Inner radius of washer: 1



$$V = \pi \int_{-1}^{1} \left[\left(2 - x^4\right)^2 - 1^2 \right] \mathrm{d}x = \frac{208\pi}{45}$$

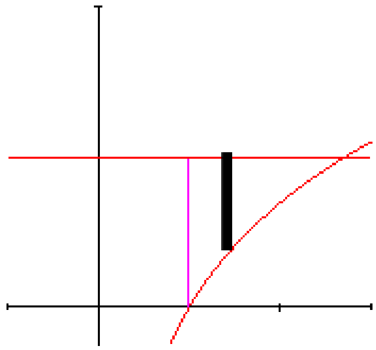
10. This problem needs to be done in term of y.

Outer radius of washer: 4
Inner radius of washer: $\left[3 + (1 - \sqrt{1-y})\right]^2$



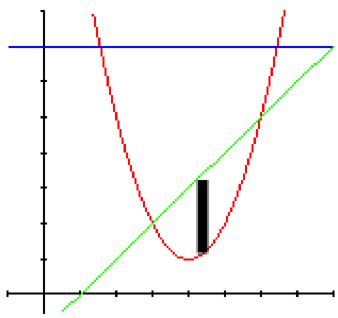
$$V = \pi \int_{0}^{1} \left[(4)^2 - \left[3 + \left(1 - \sqrt{1-y}\right)\right]^2 \right] \mathrm{d}y = \frac{29\pi}{6}$$

11. Again, the sketch below is not labeled, yours should be. You should also show how you determined any intersections.



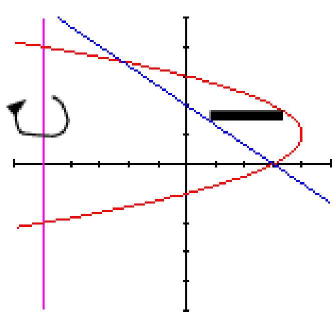
Outer radius of washer: 1
Inner radius of washer: $\ln x$
$V = \pi \int_1^e \left[(1)^2 - (\ln x)^2\right] \mathrm{d}x$

12. Again, the sketch below is not labeled, yours should be. You should also show how you determined any intersections.



Outer radius of washer: $7 - \left[(x-4)^2 + 1\right]$
Inner radius of washer: $7 - (x-1)$
$V = \pi \int_3^6 \left[\left[7 - \left[(x-4)^2 + 1\right]\right]^2 - \left[7 - (x-1)\right]^2\right] \mathrm{d}x$

13. Again, the sketch below is not labeled, yours should be. You should also show how you determined any intersections.



Outer radius of washer: $5 + (4 - (y-1)^2)$
Inner radius of washer: $5 + \frac{6-3y}{2}$
$V = \pi \int_0^{7/2} \left[\left[5 + (4 - (y-1)^2)\right]^2 - \left[5 + \frac{6-3y}{2}\right]^2\right] \mathrm{d}y$

14. Outer radius of washer: 2
Inner radius of washer: $x^{1/3}$

$$V = \pi \int_0^8 \left[(2)^2 - (x^{1/3})^2\right] \mathrm{d}x = \frac{64\pi}{5}$$

15. Radius of disk: $2 - x^{1/3}$

$$V = \pi \int_0^8 \left(2 - x^{1/3}\right)^2 \mathrm{d}x = \frac{16\pi}{5}$$

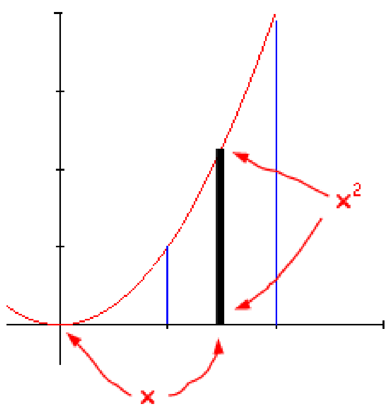
16. Outer radius of washer: $8 - y^3$
Inner radius of washer: $8 - 4y$

$$V = \pi \int_0^2 \left[\left(8 - y^3\right)^2 - (8 - 4y)^2\right] \mathrm{d}y = \frac{832\pi}{21}$$

17. Outer radius of washer: $2 - \frac{1}{4}x$
Inner radius of washer: $2 - x^{1/3}$

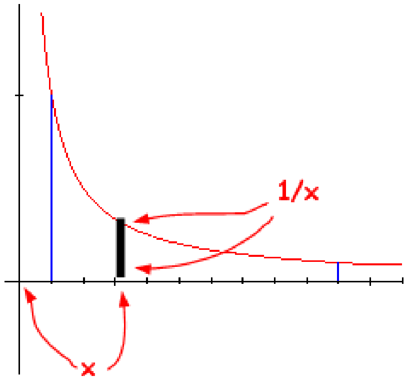
$$V = \pi \int_0^8 \left[\left(2 - \frac{1}{4}x\right)^2 - \left(2 - x^{1/3}\right)^2\right] \mathrm{d}x = \frac{112\pi}{15}$$

18. Radius of shell: x
Height of shell: x^2



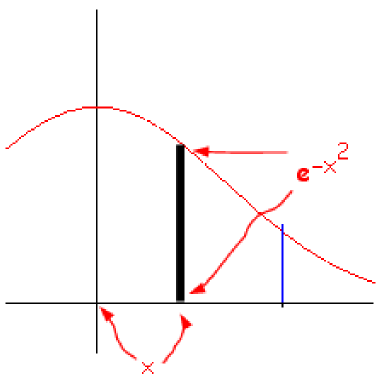
$$V = 2\pi \int_1^2 (x)(x^2)\, \mathrm{d}x = \frac{15\pi}{2}$$

19. Radius of shell: x
Height of shell: $\frac{1}{x}$



$$V = 2\pi \int_1^{10} (x)\left(\frac{1}{x}\right) \mathrm{d}x = 18\pi$$

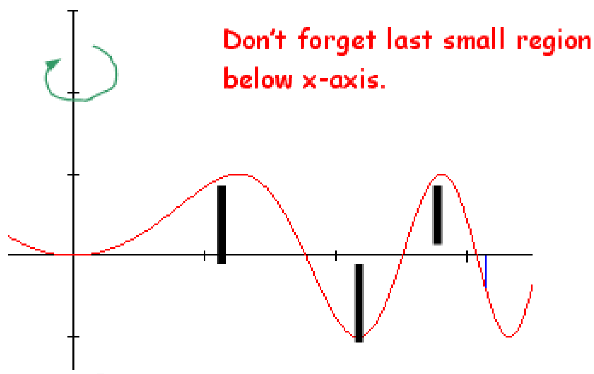
20. Radius of shell: x
Height of shell: e^{-x^2}



$$V = 2\pi \int_0^{1} (x)\left(e^{-x^2}\right) \mathrm{d}x = \frac{(e-1)\pi}{e} \approx 1.986$$

21. You actually have four regions. The radius of each region is x and the height of each shell is either $x \sin x^2$ or $-x \sin x^2$.

Roots
$\sin x^2 = 0 \longrightarrow x = 1.772$ or $x = 3.070$ or $x = 2.507$

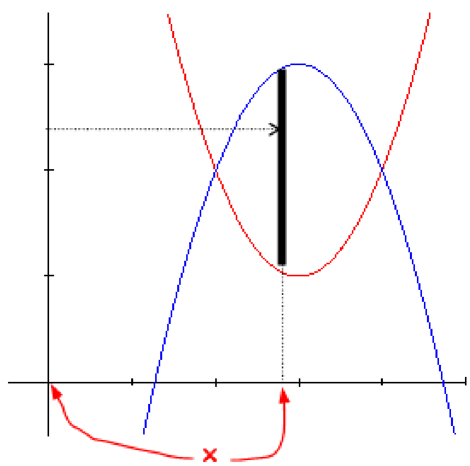


$$V = 2\pi \int_0^{\pi} |x \sin x^2| \, dx$$

$$V = 2\pi \int_0^{1.772} x \sin x^2 \, dx - 2\pi \int_{1.772}^{2.507} x \sin x^2 \, dx + 2\pi \int_{2.507}^{3.070} x \sin x^2 \, dx - 2\pi \int_{3.070}^{\pi} x \sin x^2 \, dx \approx 19.155$$

22. Intersections
$x^2 - 6x + 10 = -x^2 + 6x - 6 \longrightarrow x = 2$ or $x = 4$

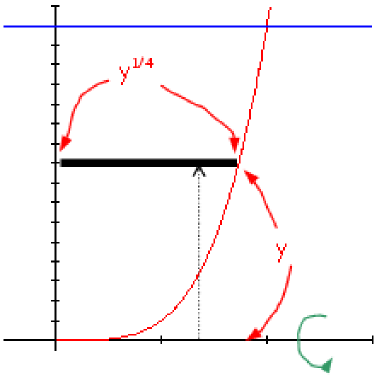
Radius of shell: x
Height of shell: $(-x^2 + 6x - 6) - (x^2 - 6x + 10)$



$$V = 2\pi \int_2^4 x \left[(-x^2 + 6x - 6) - (x^2 - 6x + 10)\right] dx = 16\pi$$

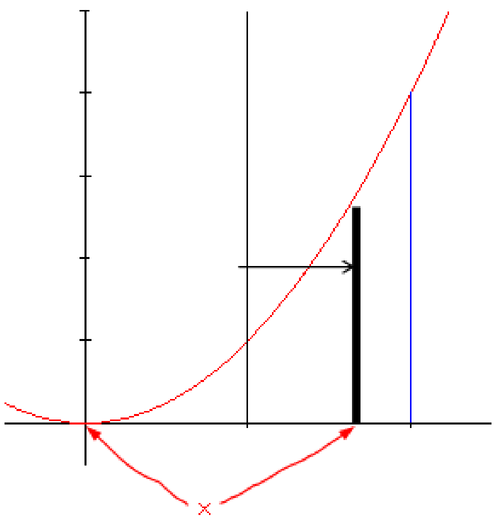
23. This problem must be done in terms of y.

Radius of shell: y
Height of shell: $y^{1/4}$



$$V = 2\pi \int_0^{16} y\left(y^{1/4}\right)\,\mathrm{d}y = \frac{4096\pi}{9}$$

24. Radius of shell: $x - 1$
Height of shell: x^2

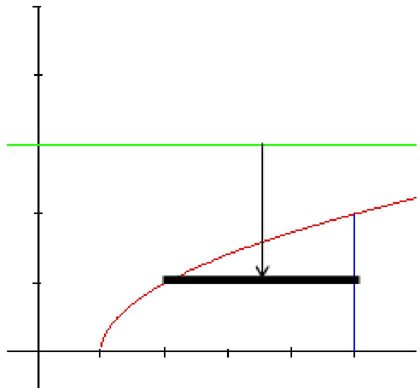


$$V = 2\pi \int_1^2 (x-1)x^2\,\mathrm{d}x = \frac{17\pi}{6}$$

25. This problem must be done in terms of y.

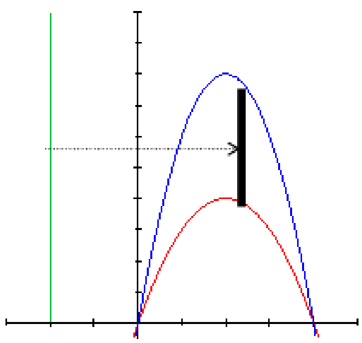
$y = \sqrt{x-1} \ \longrightarrow \ x = y^2 + 1$
The coordinates of the point where the left end of the element touches the curve can be written (y^2+1, y) and the intersection of the curve and $x = 5$ is $(5, 2)$.

Radius of shell:$5 - (y^2 + 1)$
Height of shell: $3 - y$



$$v = 2\pi \int_0^2 (3-y)\left[5 - (y^2+1)\right] \mathrm{d}y = 24\pi$$

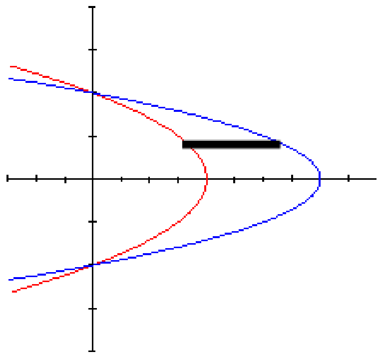
26. Radius of shell: $2 + x$
Height of shell: $(8x - 2x^2) - (4x - x^2)$



$$V = 2\pi \int_0^4 (2+x)\left[(8x - 2x^2) - (4x - x^2)\right] \mathrm{d}x = \frac{256\pi}{3}$$

27. Intersections
$4 - y^2 = 8 - 2y^2 \longrightarrow y = -2$ or $y = 2$

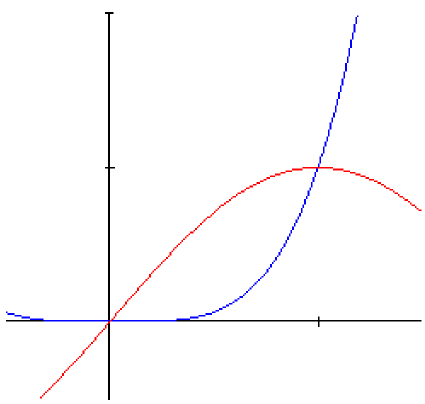
Radius of shell: $5 - y$
Height of shell: $(8 - 2y^2) - (4 - y^2)$



$$V = 2\pi \int_{-2}^{2} (5 - y) \left[(8 - 2y^2) - (4 - y^2)\right] \mathrm{d}y$$

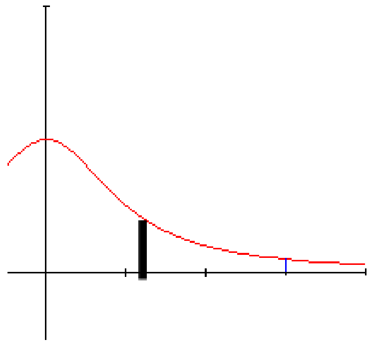
28. Intersections
$x^4 = \sin \frac{\pi x}{2} \longrightarrow x = 0$ or $x = 1$

Radius of shell: $1 + x$
Height of shell: $\sin \frac{\pi x}{2} - x^4$



$$v = 2\pi \int_{0}^{1} (1 + x) \left[\sin \frac{\pi x}{2} - x^4\right] \mathrm{d}x$$

29. Radius of shell: x
Height of shell: $\dfrac{1}{1+x^2}$



$$V = 2\pi \int_0^3 (x)\, \frac{1}{1+x^2}\, \mathrm{d}x$$