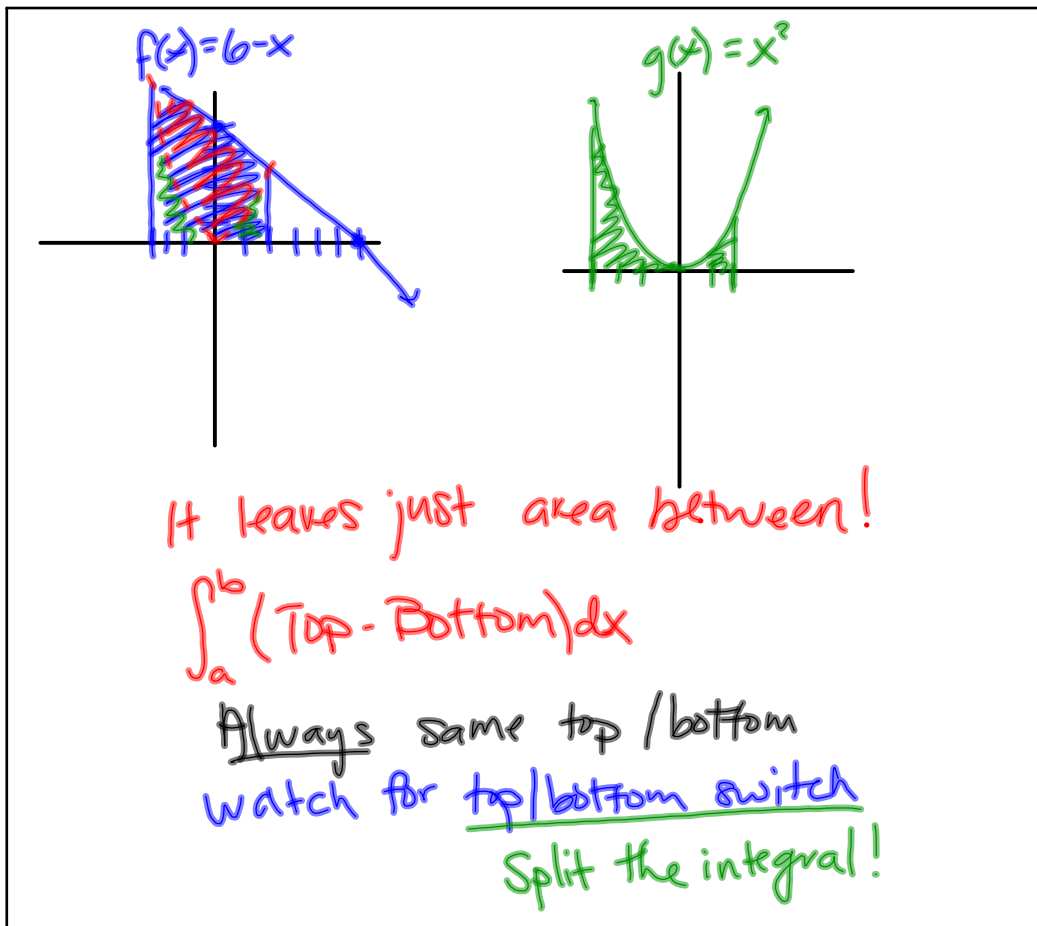


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RS #37

$$\int_a^b [f(x) - g(x)] dx \quad f(x) > g(x)$$

1.

$y = \sin x$ $y = \cos x$ $[\frac{\pi}{4}, \frac{5\pi}{4}]$
 $\sin x = \cos x$

$\int_{\frac{\pi}{4}}^{\frac{5\pi}{4}} (\sin x - \cos x) dx$
 $(-\cos x - \sin x) \Big|_{\frac{\pi}{4}}^{\frac{5\pi}{4}}$

$(-\cos \frac{5\pi}{4} - \sin \frac{5\pi}{4}) - (-\cos \frac{\pi}{4} - \sin \frac{\pi}{4})$
 $= \frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2} - (-\frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2})$
 $\sqrt{2} - (-\sqrt{2}) = 2\sqrt{2}$

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2. $f(x) = x^2$ $g(x) = -x^2 + 4$

$x^2 = -x^2 + 4$
 $2x^2 = 4$
 $x^2 = 2$ $x = \pm\sqrt{2}$

$\int_{-\sqrt{2}}^{\sqrt{2}} (-x^2 + 4 - x^2) dx$
 $= \int_{-\sqrt{2}}^{\sqrt{2}} (-2x^2 + 4) dx$

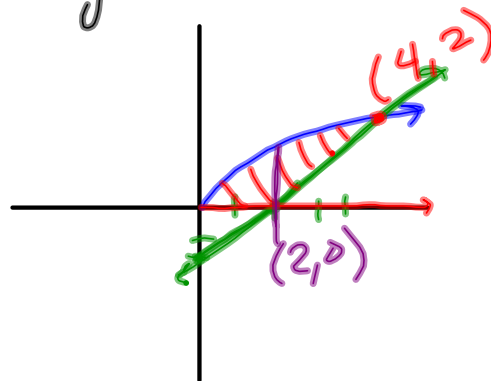
OR $= 2 \int_0^{\sqrt{2}} (-2x^2 + 4) dx$ use symmetry!

$2(-\frac{2}{3}x^3 + 4x) \Big|_0^{\sqrt{2}}$
 $2(-\frac{2}{3}(\sqrt{2})^3 + 4(\sqrt{2}) - 0)$
 $2(-\frac{2}{3}(2\sqrt{2}) + 4\sqrt{2})$
 $2(-\frac{4\sqrt{2}}{3} + 4\sqrt{2}) = 2(\frac{8\sqrt{2}}{3}) = \frac{16\sqrt{2}}{3}$

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$$3. \quad y = \sqrt{x} \quad y = x - 2 \quad y = 0$$

$$\begin{aligned} \sqrt{x} &= x - 2 \\ x &= (x - 2)^2 \\ x &= x^2 - 4x + 4 \\ 0 &= x^2 - 5x + 4 \\ 0 &= (x - 1)(x - 4) \\ x &= 1, 4 \end{aligned}$$



$$\begin{aligned} \int_0^2 (\sqrt{x} - 0) dx + \int_2^4 (\sqrt{x} - (x - 2)) dx \\ 1.886 + 1.448 \approx 3.333 \end{aligned}$$

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$$4. \quad y = 2x - x^2 \quad y = -3$$

$$\begin{aligned} 2x - x^2 &= -3 \\ x &= -1, 3 \end{aligned}$$

$$\begin{aligned} \int_{-1}^3 (2x - x^2 + 3) dx \\ \approx 10.667 \end{aligned}$$



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5. $y = x^3$ $x = y^2$
 $y = \sqrt[3]{x}$

$x^3 = \sqrt{x}$
 $x^6 = x$
 $x^6 - x = 0$
 $x(x^5 - 1) = 0$
 $x = 0, 1$

$\int_0^1 (\sqrt{x} - x^3) dx$
 $\approx .417$

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6. $x + y^2 = 0$ $x + 3y^2 = 2$
 $x = -y^2$ $x = -3y^2 + 2$

$-y^2 = -3y^2 + 2$
 $2y^2 = 2$
 $y^2 = 1$ $y = \pm 1$

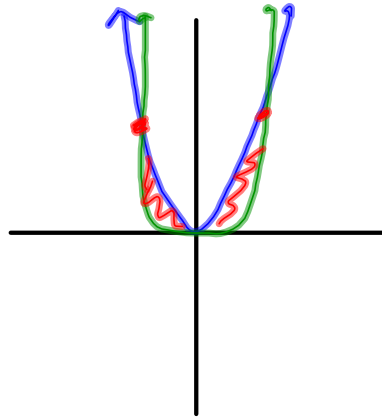
$\int_{-1}^1 (-3y^2 + 2 - (-y^2)) dy$
 $= \int_{-1}^1 (-2y^2 + 2) dy \approx 2.667$

right - left

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$$7. \quad y=x^2 \quad y=x^4$$

$$\begin{aligned} x^2 &= x^4 \\ x^4 - x^2 &= 0 \\ x^2(x^2 - 1) &= 0 \\ x &= 0, \pm 1 \end{aligned}$$



$$2 \int_0^1 (x^2 - x^4) dx \approx .267$$

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$$8. \quad 2 \int_0^1 (x^2 - (-2x^4)) dx = 2 \int_0^1 (x^2 + 2x^4) dx \approx 1.467$$

$$9. \quad \int_0^1 \left(x - \frac{x^2}{4}\right) dx + \int_1^2 \left(1 - \frac{x^2}{4}\right) dx \approx .833$$

$$\begin{aligned} 10. \quad & \int_{-2}^{-1} (-x+2 - (4-x^2)) dx + \int_{-1}^2 (4-x^2 - (-x+2)) dx \\ & + \int_2^3 (-x+2 - (4-x^2)) dx \approx \\ & 1.833 + 4.5 + 1.833 \approx 8.167 \end{aligned}$$

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