# SEMESTER REVIEW DAY 2

$$\frac{d}{dx}\int_1^{x^3} \frac{\sin^3 t - (\ln t)^4}{\cot^{-1}(x^2-4)}\,dt \qquad (x^3)^2$$

$$= \frac{\sin^3 x^3 - (\ln(x^3))^4}{\cot^{-1}(x^6-4)} \cdot 3x^2$$

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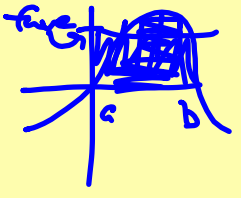
10/ Find average value ($f_{ave}$)

$$(b-a)f_{ave} = \int_a^b f(x)\,dx$$

$$f_{ave} = \frac{1}{b-a}\int_a^b f(x)\,dx$$



# SEMESTER REVIEW DAY 2

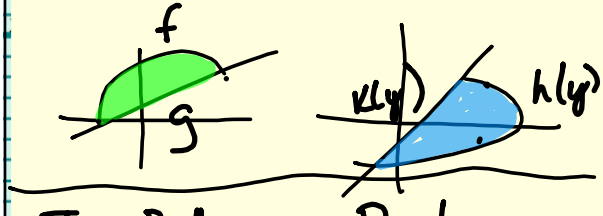
Find area.

$f(x) = 2|x+3| - 4$

from $x = -4$ to $x = 0$

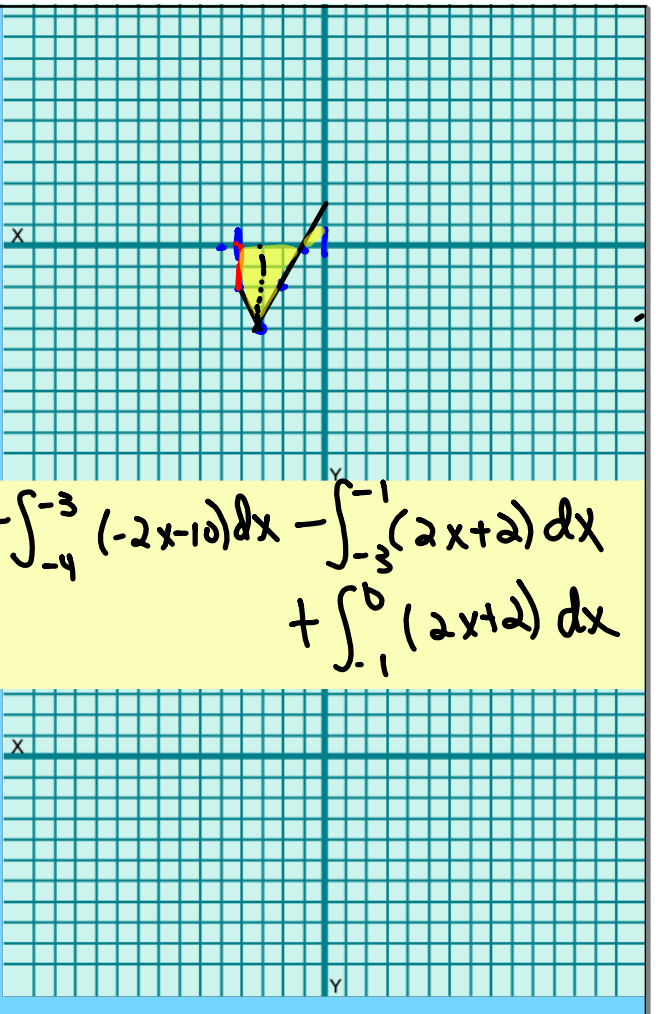
$2(x+3)-4 =$
$2x+6-4 = 2x+2$

$-2(x+3)-4 =$
$-2x-6-4 = -2x-10$




Top-Bottom R-L

$\int (f-g)\,dx \quad \int (h-K)\,dy$




$-\int_{-4}^{-3}(-2x-10)\,dx - \int_{-3}^{-1}(2x+2)\,dx + \int_{-1}^{0}(2x+2)\,dx$

# Volume


## Disk

$$\pi \int_a^b \left(r_o^2 - r_i^2\right) dx$$

▯ is ⊥ to axis of rev

## Shell

$$2\pi \int_a^b r\,(f-g)\,dx$$

▯ is ∥ to axis of rev.

## Slicing

isosceles Rt Δ


$A = \frac{1}{2}s^2$

s = Top − Bottom

Semicircles

$A = \frac{\pi r^2}{2}$

Equilateral Δ

$A = \frac{\sqrt{3}}{4}s^2$

If rect is Vertical: $y = x$'s

If rect is horiz = $x = y$'s

## Length of Curve

$$\int_a^b \sqrt{1 + [f'(x)]^2}\,dx$$

## Surface Area of Rev

$$2\pi \int_a^b f(x)\sqrt{1 + [f'(x)]^2}\,dx$$

13(b)

Disk

$y^2 = x^2 - 16 \quad y = 0 \quad x = 5$

around y-axis

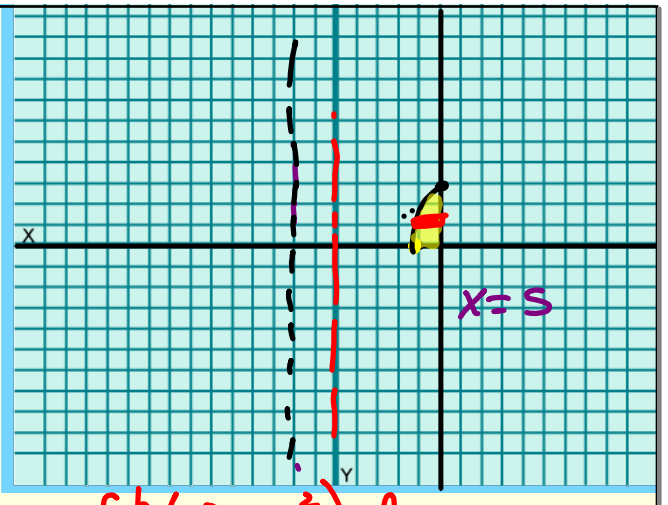
$y = \pm\sqrt{x^2 - 16}$

$5 \quad \sqrt{9} = 3$

$y^2 = x^2 - 16$

$y^2 + 16 = x^2$

$\sqrt{y^2 + 16} = x$

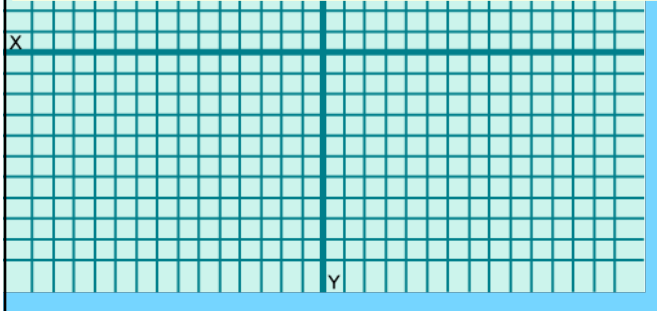



$\pi \int_a^b \left(r_o^2 - r_i^2\right) dx$

$\pi \int_0^3 \left[5^2 - \left(\sqrt{y^2+16}\right)^2\right] dy$

around $x = -2$

$\pi \int_0^3 \left[(5+2)^2 - \left(\sqrt{y^2+16}-2\right)^2\right] dy$



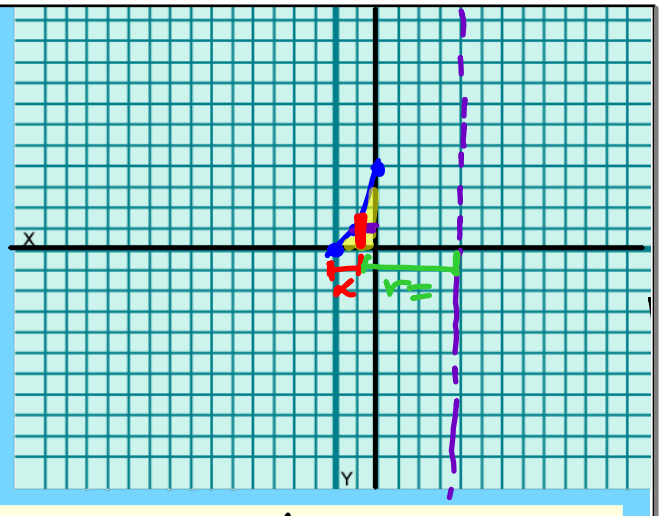
14(a) $y = x^2$, $y = 0$, $x = 2$

about x-axis $x = \sqrt{y}$

**Shell Method**

$$2\pi \int r\,(f - g)$$

$$2\pi \int_0^4 y\,(2 - \sqrt{y})\,dy$$




Around $x = 6$

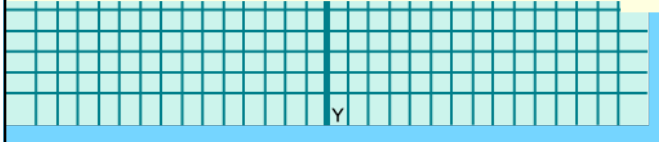
$y = x^2$ $y = 0$

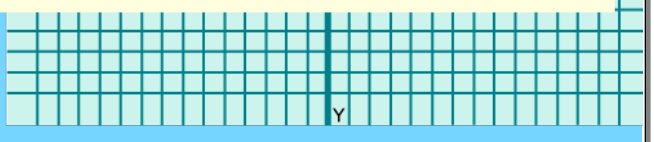
$$2\pi \int_0^2 (6 - x)(x^2 - 0)\,dx$$

Slicing — ↑ semicircles $A = \frac{\pi}{2} r^2$

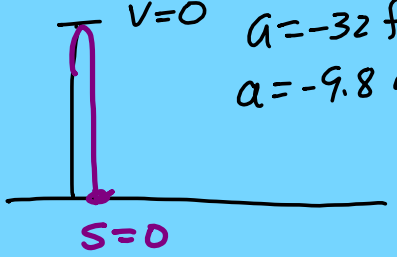
$$\int A(x)\,dx$$

$$\frac{\pi}{2} \int_0^2 \left(\frac{x^2 - 0}{2}\right)^2 dx$$



## Accel, Velocity, Position




Given $a(t) = -2$

How long to stop?

After 2 sec, moving 10 ft/s.

$a(t) = -2$

$V(t) = -2t + C$

$10 = -2(2) + C$

$14 = C$

$V(t) = -2t + 14$


$0 = -2t + 14$

$t = 7$

$s(7) = 49$ ft.

$s(t) = -t^2 + 14t + C$

$0 = 0 + 0$

$s(t) = -t^2 + 14t$

## Work $= \int F(x)\,dx$

Springs $F(x) = Kx$

$\int_2^5 7x$

Natural length = 3m

Stretch 5m to 8m.

Distance from natural length


## Pump Problems

$\int \rho \cdot A(x) \cdot \text{depth}\,dx$

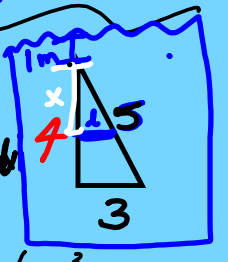
$\int_3^{10} 62.4 \cdot \pi \cdot \left(\frac{2}{5}(10-x)\right)^2 x\,dx$

$\frac{r}{4} = \frac{10-x}{10}$

$r = \frac{4}{10}(10-x)$

## Fluid Force

$\int \rho \cdot l(x) \cdot \text{depth}\,dx$




62.4 lb/ft³

9810 N/m³

$\int_0^4 9810 \cdot \left(\frac{3}{4}x\right)(x+1)\,dx$

$\frac{l}{3} = \frac{x}{4}$

$l = \frac{3}{4}x$