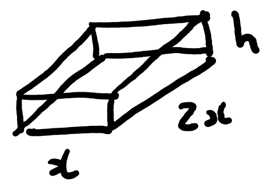
Week 14 Monday

December 3, 2018 1:29 PM

11

1)



Max $V = x \cdot 2x \cdot h$

$x + 2x + h = 140$

2) Single Variable

$h = 140 - 3x \rightarrow V$

$V = 2x^2 \cdot h$

$V = 2x^2(140 - 3x)$

$V = 280x^2 - 6x^3$

3) Critical Points

$V' = 560x - 18x^2$

$560x - 18x^2 = 0$

$x(560 - 18x) = 0$

$x = 0$

MIN

$560 - 18x = 0$

$560 = 18x$

$x = \frac{560}{18} = \frac{280}{9}$

MAX

4) $V = 280\left(\frac{280}{9}\right)^2 - 6\left(\frac{280}{9}\right)^3$

$\approx 90337 \text{ cm}^3$

Aside: 2^{nd} Derivative Test

$\cap$	$\cup$
MAX	MIN
$f'' < 0$	$f'' > 0$

Here $V'' = 560 - 36x$

$V''\left(\frac{280}{9}\right) < 0$

Max ✓

(16) $\int_a^b f(x)\,dx \approx \frac{\Delta x}{3}\left[f(x_0) + 4f(x_1) + 2f(x_2) + \dots + 4f(x_{n-1}) + f(x_n)\right]$

$$\Delta x = \frac{b-a}{n} = \frac{1-0}{4} = 0.25$$

x	0	0.25	0.5	0.75	1
$y = \sin x^3$	$\sin 0^3 = 0$	$\sin(0.25^3)$	$\sin(0.5^3)$	$\sin(0.75^3)$	$\sin 1$

1 - 4 - 2 - 4 - 1

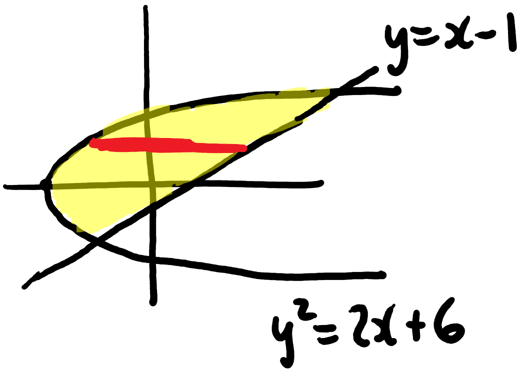
$$\int_0^1 \sin x^3\,dx \approx \frac{\Delta x}{3}\left[y_0 + \dots + y_4\right]$$

$$\approx \frac{0.25}{3}\left[0 + 4\sin(0.25^3) + 2\sin(0.5^3) + 4\sin(0.75^3) + \sin 1\right]$$

RADIANS!

$$\approx 0.2326$$

(18)



$$A = \int (x_r - x_\ell)\,dy$$

y-values

Intersection: $y = y$

$$y^2 = y^2$$

$$(x-1)^2 = 2x+6$$

$$x^2 - 2x + 1 = 2x + 6$$

$$x^2 - 4x - 5 = 0$$

$$(x-5)(x+1) = 0$$

$$x = -1, 5$$

$y = x-1$: $y = -2, 4$

x_r:

$y = x - 1$

$y + 1 = x$

$x_r = y + 1$

x_l:

$y^2 = 2x + 6$

$y^2 - 6 = 2x$

$x_l = \frac{y^2}{2} - 3$

$$A = \int (x_r - x_l)\,dy$$

y-values

$$= \int_{-2}^{4} \left[y + 1 - \left(\frac{y^2}{2} - 3\right)\right] dy$$

$$= \int_{-2}^{4} \left(y + 4 - \frac{y^2}{2}\right) dy$$

$$= \left[\frac{y^2}{2} + 4y - \frac{y^3}{6}\right]_{-2}^{4}$$

$$= \left(\frac{4^2}{2} + 4\cdot 4 - \frac{4^3}{6}\right) - \left(\frac{(-2)^2}{2} + 4(-2) - \frac{(-2)^3}{6}\right)$$

$$= 18$$