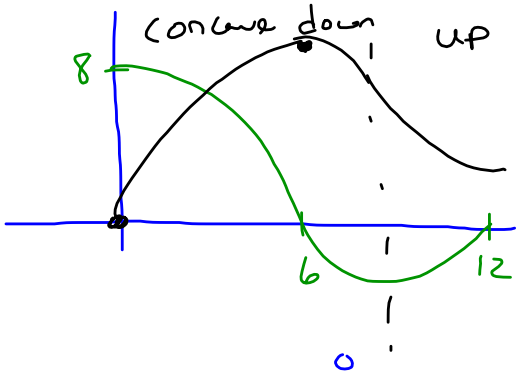
21. $\frac{dy}{dx} = \sin^3 x$ $y = 0$ $x = 5$

$y = C + \int_a^x f(t)\,dt$ $y = 0 + \int_5^x \sin^3 x\,dx$

57. $H(x) = \int_0^x f(t)\,dt$



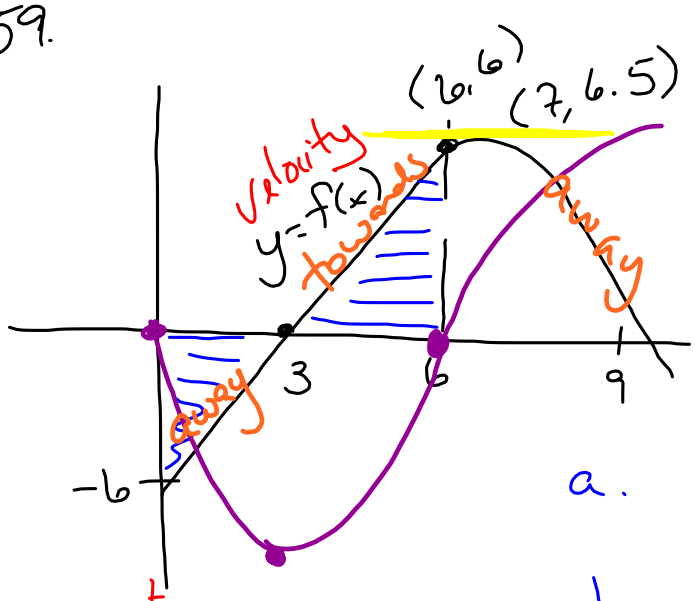
a. $H(0) = \int_0^0 f(t)\,dt = 0$

b. $H(x)$ increasing?

c.

d. $H(12)$ + or −

59.



a. v @ t = 3 is 0

b.

c. $s = \int_0^3 f(x)\,dx = -9$

$s = \int_0^t f(x)\,dx$

General Anti Dr.

$dy = \int x^2\,dx$

$y = \frac{x^3}{3} + C$

$x = 2$
$y = 5$

53.

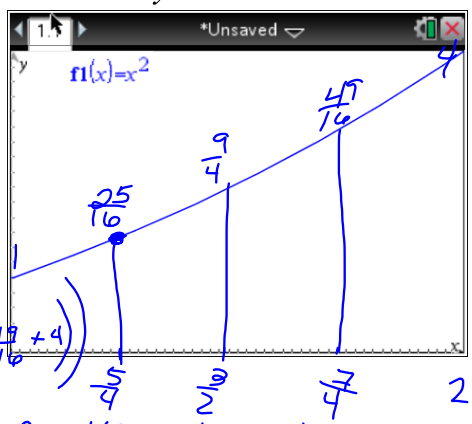
$$\int_0^x e^{-t^2}\,dt = .6$$

$$y_1 = \int_0^x e^{-t^2}\,dt$$

$$y_2 = .6$$

5.5 Trapezoidal Rule

Approximate the area under the curve $y = x^2$ from 1 to 2 using trapezoids.



$$A_{Trap} = \frac{h}{2}(b_1 + b_2)$$

$$\frac{1}{2}h(b_1 + b_2)$$

$$\frac{1}{2}\left(\frac{1}{4}\right)\left(\left(1+\frac{25}{16}\right)+\left(\frac{25}{16}+\frac{9}{4}\right)+\left(\frac{9}{4}+\frac{49}{16}\right)+\left(\frac{49}{16}+4\right)\right)$$

$$\frac{1}{2}\left(\frac{1}{4}\right)\left(1+\frac{25}{16}+\frac{25}{16}+\frac{9}{4}+\frac{9}{4}+\frac{49}{16}+\frac{49}{16}+4\right)$$

$$\frac{1}{2}(h)(b_1 + b_n + 2(b_2 + b_3 + b_4 + \cdots b_{n-1}))$$

$$A = \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(1+\frac{9}{4}\right) + \left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{9}{4}+4\right)$$

$$\frac{1}{2}\left(\frac{1}{2}\right)\left(\left(1+\frac{9}{4}\right)+\left(\frac{9}{4}+4\right)\right)$$

Trapezoid Rule:

general rule:

$$T = \frac{h}{2}\left(y_0 + 2y_1 + 2y_2 + \ldots + 2y_{n-1} + y_n\right)$$

$$T = \frac{1}{2}(h)(y_0 + y_n + 2(y_1 + y_2 + \cdots + y_{n-1}))$$

average of LRAM and RRAM

$$LRAM = h\left(y_0 + y_1 + y_2 + \ldots + y_{n-1}\right)$$

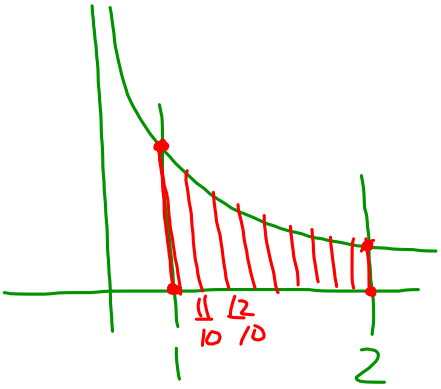
$$RRAM = h\ \left(y_1 + y_2 + \ldots + y_{n-1} + y_n\right)$$

$$\frac{h\left(y_0 + 2y_1 + 2y_2 + \cdots + 2y_{n-1} + y_n\right)}{2}$$

$$T = \frac{L + R}{2}$$

Concavity in estimates:

Estimate $\int_1^2 \frac{1}{x}\,dx$ with 10 trapezoids



$\frac{1}{2}\left(\frac{1}{10}\right)\left(1+\frac{1}{2}+2\left(\frac{10}{11}+\frac{10}{12}+\frac{10}{13}+\right.\right.$

$\left.\left.\frac{10}{14}+\frac{10}{15}+\frac{10}{16}+\frac{10}{17}+\frac{10}{18}+\frac{10}{19}\right)\right)$

how to use calculator

over or under estimate?

Calculate the area of $\int_2^4 2x^2\,dx$ using 4 trapezoids

Would you expect this to be an over or under estimate?

An observer measures the outside temperature every hour from noon until midnight, recording the temperature in the following table:

time	noon	1	2	3	4	5	6	7	8	9	10	11	mid
temp	63	65	66	68	70	69	68	68	65	64	62	58	55

What was the average temperature for the 12-hour period?

Error Bound for the Trapezoid rule:

$$|E| \le \frac{b-a}{12} h^2 M_{f''}$$

$M_{f''}$ is the max value of f''

Estimate the error in approximating $\int_1^2 \frac{1}{x}\,dx$ with 10 trapezoids.