Good afternoon: warm up in notebooks

$$\int (\cos 3x)\, e^{\sin 3x} dx$$

Need:

$\cos 3x \cdot 3$

or

$3\cos 3x$

$$\frac{1}{3}\int 3\cos 3x \cdot e^{\sin 3x}\, dx$$

$$\frac{1}{3}\left[e^{\sin 3x} + C\right]$$

$$\boxed{\frac{1}{3}e^{\sin 3x} + C}$$

$$\int \ln e^{3x}\, dx$$

$\ln e^{\bullet} = \bullet$

$$\int 3x\, dx$$

$$3\,\frac{x^2}{2} + C$$

$$\frac{3x^2}{2} + C$$

$$\int \frac{\sec(x)\tan(x)}{\sec(x)+1}\, dx$$

$$\int \sec(x)\tan(x) \cdot \frac{1}{\sec x + 1}$$

$$\ln|\sec x + 1| + C$$

7. The velocity, in meters per second, of a moving body can be modeled by the differentiable function $v(t) = 3t - 2$. Find the position of the body at t=5 seconds if at t=0, the position was -4 meters.

$P(5) = ?$

$p(0) = -4$

P

V

a

$\int$

$V = 3t - 2$

$\int \frac{dP}{dt} = \int 3t - 2$

$P(t) = \frac{3}{2}t^2 - 2t + C$

$p(0) = -4 = \frac{3}{2}\cancel{0^2} - 2\cdot\cancel{0} + C$

$-4 = C$

$P(t) = \frac{3}{2}t^2 - 2t - 4$

$= \frac{3}{2}t^2 - 2t - 4$

$P(5) = 23.5$

Worksheet answers

1 39

2 39

3 35

4 19.5

5 10

6 101/15

7 30

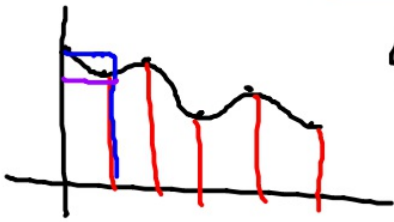
8 77/8

Let's do #9

9) $\displaystyle\int_0^{10} f(x)\,dx =$

x	0	1	4	6	9	10
$f(x)$	9	8	9	7	9	7

Δx: 1, 3, 2, 3, 1



LRAM

$1(9) + 3(8) + 2(9) + 3(7) + 1(9)$

Δx base $f(x)$ height

RRAM

$1(8) + 3(9) + 2(7) + 3(9) + 1(7)$

$= 83$

10) $\int_0^{10} f(x)\,dx$

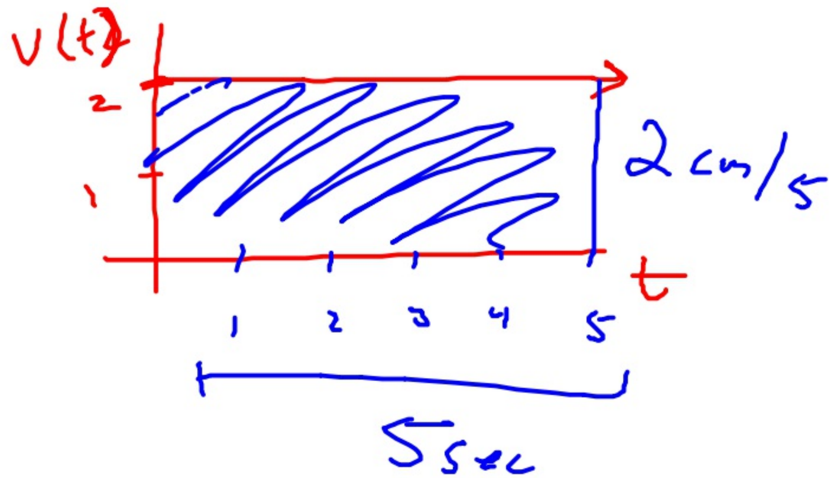
x	0	3	5	7	9	10
$f(x)$	3	2	3	5	7	5

LRAM 36

RRAM 41

Integration as Accumulation

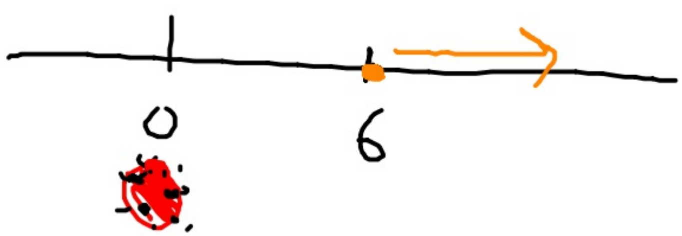
A snail travels 2 cm/s. After 5 seconds, how far has it traveled?



$$5\,\cancel{\text{sec}} \cdot 2\,\frac{\text{cm}}{\cancel{\text{sec}}}$$

10 cm

If its starting position was 6 cm from a ladybug, what is its position at t=8?



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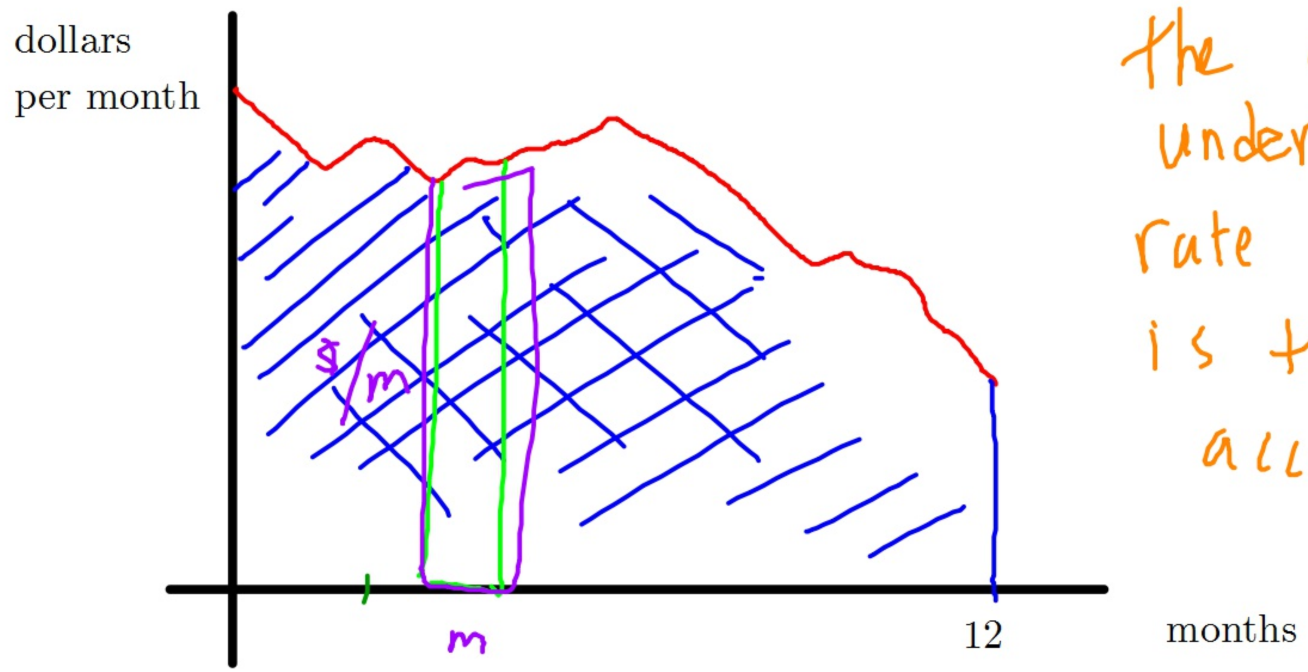
Concept example

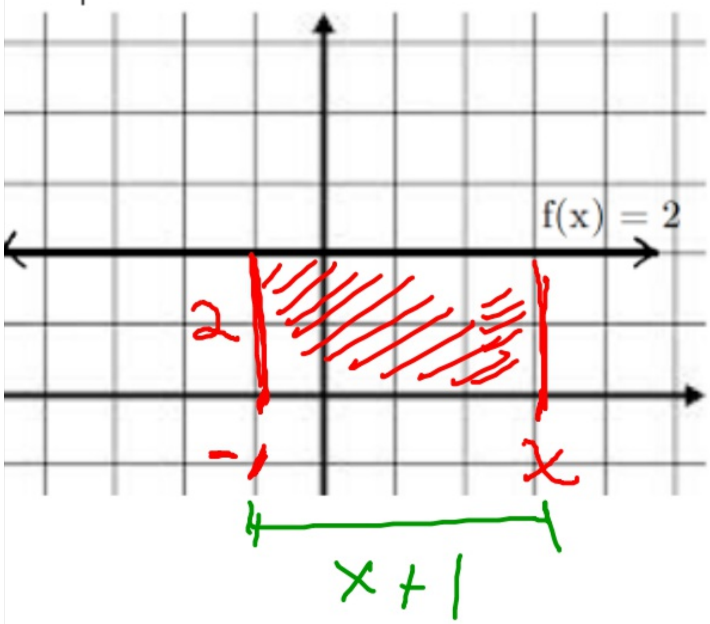


the area under a rate function is the total accumulated quantity.

nection between Area and Antiderivatives and Slope

each function, use geometry to find the area A(x) *under the function* f(x) *between* -1 and some nt x (or, over the interval $[-1, x]$). *Then, find* A'(x). What do you notice about f(x) and A'(x)?

1.

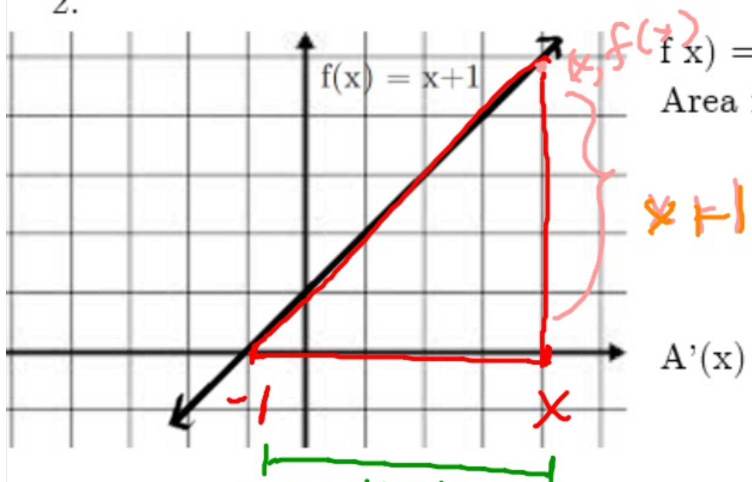


f(x) = 2

Area function A(x) = $2(x+1) = 2x+2$

A'(x) or $\frac{dA}{dx} = 2$.

2.



x+1

$\frac{1}{2}\, b \cdot h$

$\frac{1}{2}(x+1)(x+1)$

f(x) = x+1

Area function A(x) = $\frac{1}{2}(x+1)(x+1)$

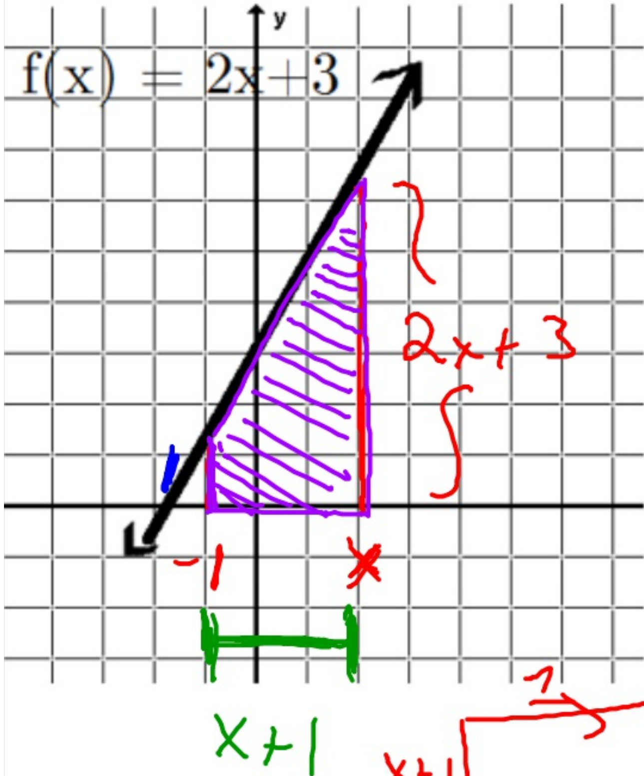
$\frac{1}{2}(x^2+2x+1)$

$\frac{1}{2}x^2 + x + \frac{1}{2}$

A'(x) or $\frac{dA}{dx}$ =

$x+1$ ✓ power rule

3.



$f(x) = 2x+3$

Area function $A(x) = \frac{1}{2}(1+2x+3)\cdot(x+1)$

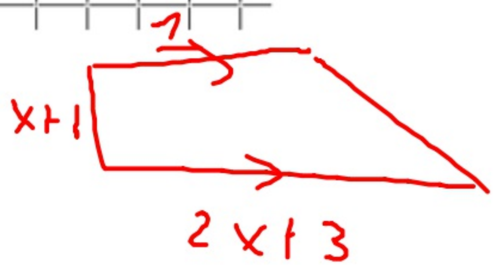
$\frac{1}{2}(2x+4)(x+1)$

$(x+2)(x+1)$

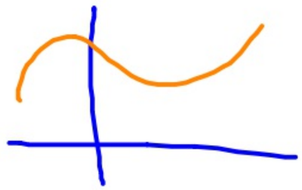
x^2+3x+2

$A'(x)$ or $\frac{dA}{dx} =$

$2x+3$



$$\text{Area under } f \underset{\text{Anti-deriv.}}{\overset{\text{deriv.}}{\rightleftarrows}} f$$



$$\int_a^b f(x)\,dx = \lim_{n\to\infty} \sum_{i=1}^{n} f(x_i)\,\Delta x$$

The Fundamental Theorem of Calculus Part II

If f is continuous, then

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

Area under f
from a to b.

$$\int_1^3 -x^2+2x+4 \; dx$$

$$\left[-\frac{1}{3}x^3+x^2+4x+C\right]_1^3$$

$$\underbrace{\left[-\frac{1}{3}(3)^3+3^2+4(3)+C\right]}_{\text{"}f(b)\text{"}} - \left[-\frac{1}{3}(1)^3+1^2+4+C\right]$$

$\neq 1$