2/2/11

section 12.

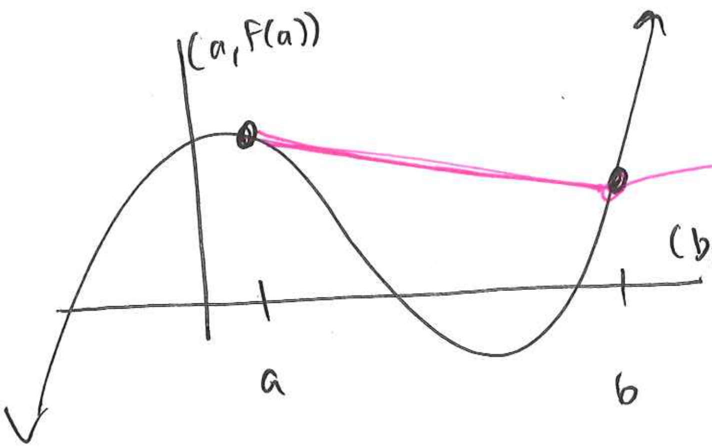
§2.2: continued

Average Rate of change: (AROC) $f(x)$ over $[a, b]$

a: $x=a$ start

b: $x=b$ stop.

$$\frac{\Delta \text{output}}{\Delta \text{input}} = \frac{f(b)-f(a)}{b-a}$$ ← "difference quotient"



slope of secant (i.e. the line connecting 2 distinct pts)

= AROC

= diff quotient

~~Applications~~:

Example 1: Determine the AROC of the given function over the given intervals.

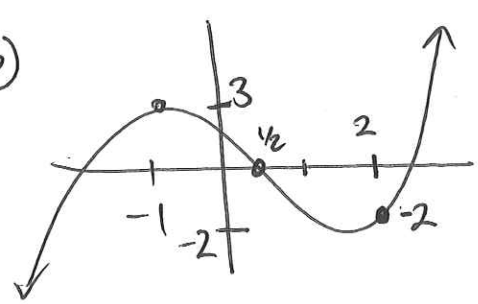
(a)

x	0	1	2	3
$f(x)$	1	3	9	27

(i) $(0, 1)$ — $x=0$, $x=1$ — AROC $\dfrac{3-1}{1-0} = 2$

(ii) $(2, 3)$ AROC $\dfrac{27-9}{3-2} = 18$

(b)



(i) $(-1, \frac{1}{2})$ AROC $\dfrac{0-3}{\frac{1}{2}-(-1)} = \dfrac{-3}{\frac{5}{2}} = \dfrac{-6}{5}$

(ii) $(-1, +2)$ AROC: $\dfrac{-2-3}{2-(-1)} = \dfrac{-5}{3}$

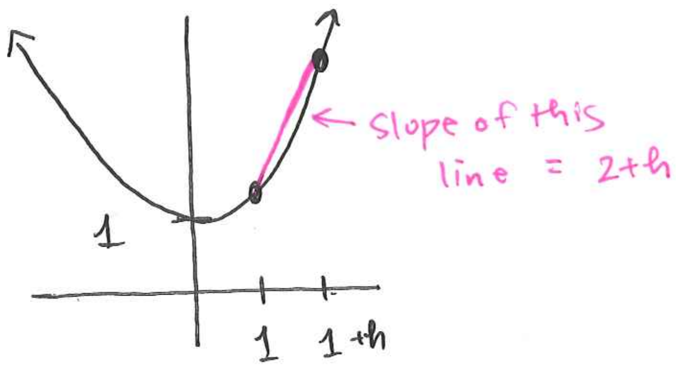
ⓒ $f(x) = x^2 + 1$

$(1, 1+h)$

$\underline{\text{AROC}} = \dfrac{[(1+h)^2 + \cancel{1}] - [(1)^2 + \cancel{1}]}{\cancel{1} + h - \cancel{1}}$

$= \dfrac{\cancel{1} + 2h + h^2 - \cancel{1}}{h} = \dfrac{2h + h^2}{h}$

$= 2 + h$



Applications: p 180

#31.)

ⓐ uphill: $(0, 150) \cup (300, \infty)$

ⓑ $x = 100$ to $x = 200$

$\dfrac{50 - 75 \text{ ft}}{200 - 100 \text{ days}} = \dfrac{-25}{100} = -\dfrac{1}{4}$ ft/day = average decrease in depth per day.

Practice: Graph $y = x^4 - 2x^3$ in graphing calc:

Find intervals of (i) negative

(ii) increasing

(iii) concave up.

(uphill)

32) (a) increasing: (0, 25)

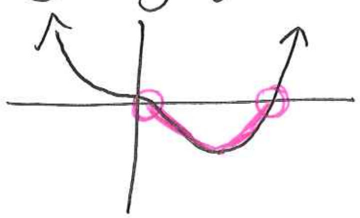
(b) x = 20 x = 40

$$\frac{40-40}{40-20} = \boxed{0 \text{ thousands of ppl/year}}$$

(c) Since the AROC is 0, the populations in 1970 and 1990 are the same.

the amount of increase and decrease in the population was the same over 1970–1990.

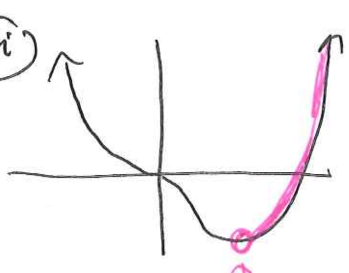
(i) neg y-values (QIII, IV)



(0, 2)

(iii) (−∞, 0) ∪ (1, ∞)

(ii)



use calc: min

(1.5, ∞)

Warning int of decreasing

(−∞, 0) ∪ (0, 1.5)

exclude 0 b/c graph is flat @ x=0.