Definition $y = \ldots f$ 2.1 37*, 39* 20090126 1/
Language/Notation 2.2 57*

Δx "delta-x"

$$\frac{dy}{dx} \equiv \lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x}$$

y' y-prime

$y = x^2$ $\frac{dy}{dx} = 2x$

$\left[\begin{array}{l} f(t) = t^2 \\ f'(t) = 2t \end{array}\right.$ $\left\{\begin{array}{l} f(x) = x^2 \\ f'(x) = x^2 \end{array}\right.$

<u>Formulas</u>

y	$\frac{dy}{dx}$	Common
x^2	$2x$	
x^p	px^{p-1}	Interpret p positive p negative, $p=1$ $x \neq 0$ or... $p = 0$; $x^0 = 1$, $\frac{dx^0}{dx} = 0$. p fraction

Algebraic Rules

— OK

$\pm$ $\frac{d}{dx}(Au \pm Bv) \longrightarrow A\frac{du}{dx} \pm B\frac{dv}{dx}$

~~$*$ (PROD)~~ more complicated

~~$\div$ $\frac{f}{g}$ $\frac{u}{v}$~~ Don't $\div 0$; special formula

Also:

<u>Example</u> $\frac{d}{dp}(-p^2 + 12p) = -(2p) + 12 \cdot 1$

2.1.#37 recorders / Cost = 20 each/piece
At price \$p, consumers buy $q = 120 - p$
Profit P as a fn of q and p: $\underset{\text{Profit}}{P} = \underbrace{q \cdot p}_{\text{revenue}} - \text{Cost} = \cancel{(120-p)p} - 20q$

OR (profit per item) $\cdot$ (q = num of items)

$= \cancel{(p-20)(120-p)}$ OR $(p-20)q$

(c) How is profit changing when $p=20$

$\frac{dP}{dp}$ when $p=20$.

$\cancel{P(p) = (p-20}$

Profit as function of q ( ) mean different things!

$P(q) = q\cdot(p) \quad - 20q$

$= q\,(\underbrace{120-q-20}_{\text{profit per item}}q) \quad \left[\, p \quad q=120-p \quad p=120-q \right.$

$= q(100-q)$

(d) Profit changing $q=20$, $q=50$, $q=\cancel{100}80$

$P(q) = \cancel{q} \; 100q - q^2$

$\frac{dP}{dq} = 100 - 2q$

at $q=20$: $\frac{dP}{dq} = 100 - 2\cdot 20 = 60 \ \frac{\text{dollars}}{\text{item}}$

(increase q, increase Profit

$q=50 \quad \frac{dP}{dq} = 100 - 2\cdot 50 = 0$??

$q=80 \quad \frac{dP}{dq}$ . . . .

(1.1) $\cancel{\text{pp}}$ p. 104 f diff at c

f is "inc at $x=c$" if $f'(x) > 0$

" dec $x=c$ if $f'(c) < 0$

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The 'best linear app' at c has slope $f'(c)$.

~~f(x)~~ Tan line PT / SLOPE

Near $x=c$ $\qquad f(x) \approx f(c) + f'(c)(x-c)$.

PT / SLOPE)

(39) $Q(L) \approx 3100\sqrt{L}$ output Q units as a fn of L work hrs, "small" output inc.

$Q(L)$

~~Q(L~~ L increase by ΔL, output ~~...~~

$$Q(L+\Delta L) \approx Q(c) + Q'(c)(L-c)$$

$\sqrt{3025} = 55$. (Formula)

Powers. $\sqrt{x} \to \dfrac{1}{2\sqrt{x}}$ Notation

Second and higher ord

(45) Position $s = 3t^5 - 5t^3 - 7$

$$\frac{ds}{dt} = 3 \cdot 5t^4 - 5 \cdot 3t^2 - 0$$

$$\frac{d^2s}{dt^2} = \frac{d}{dt}(15t^4 - 15t^2)$$

$$= 60t^3 - 30t.$$

Several examples - polynomials in x, t, y

Roots.