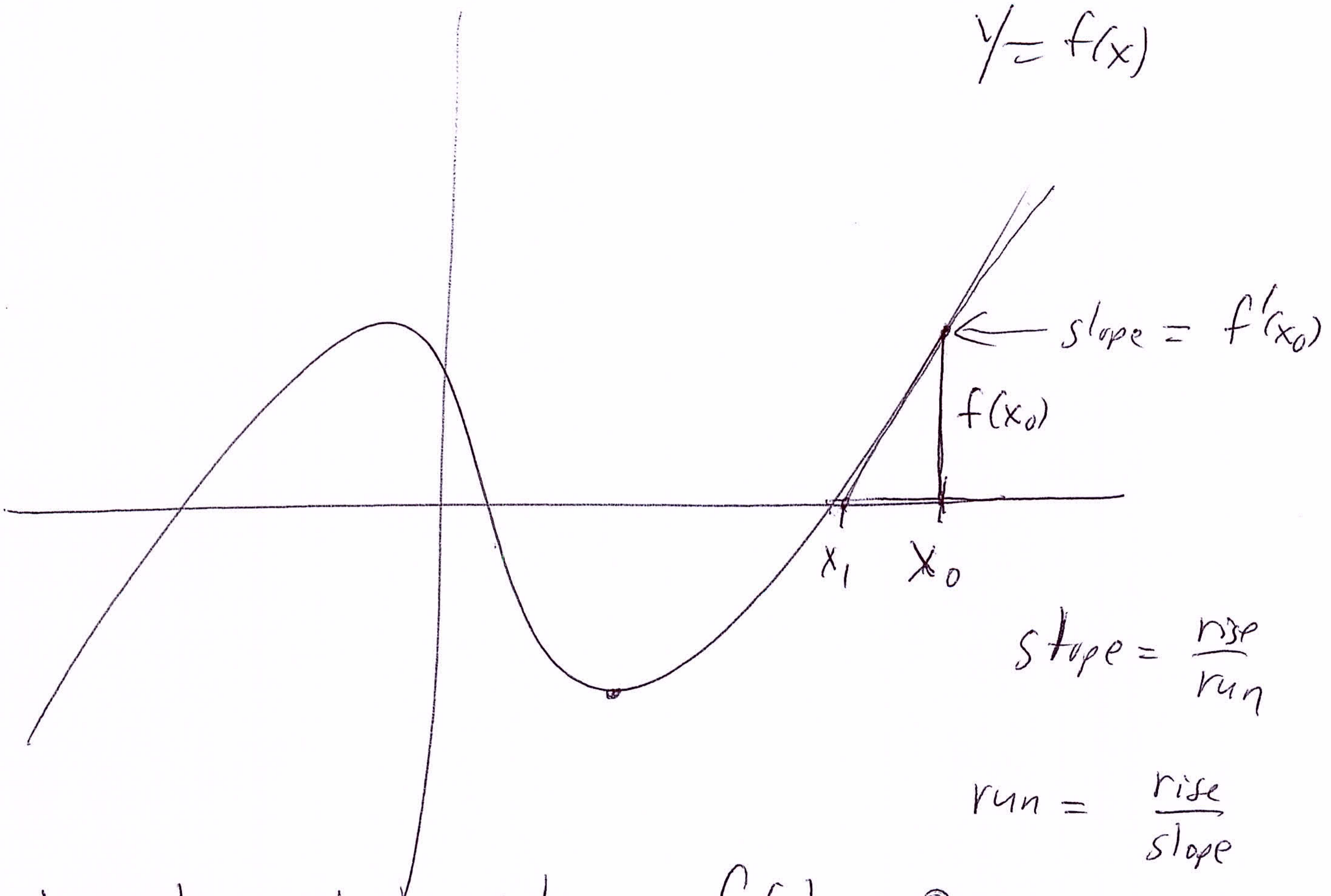


slope = $\frac{\text{rise}}{\text{run}}$

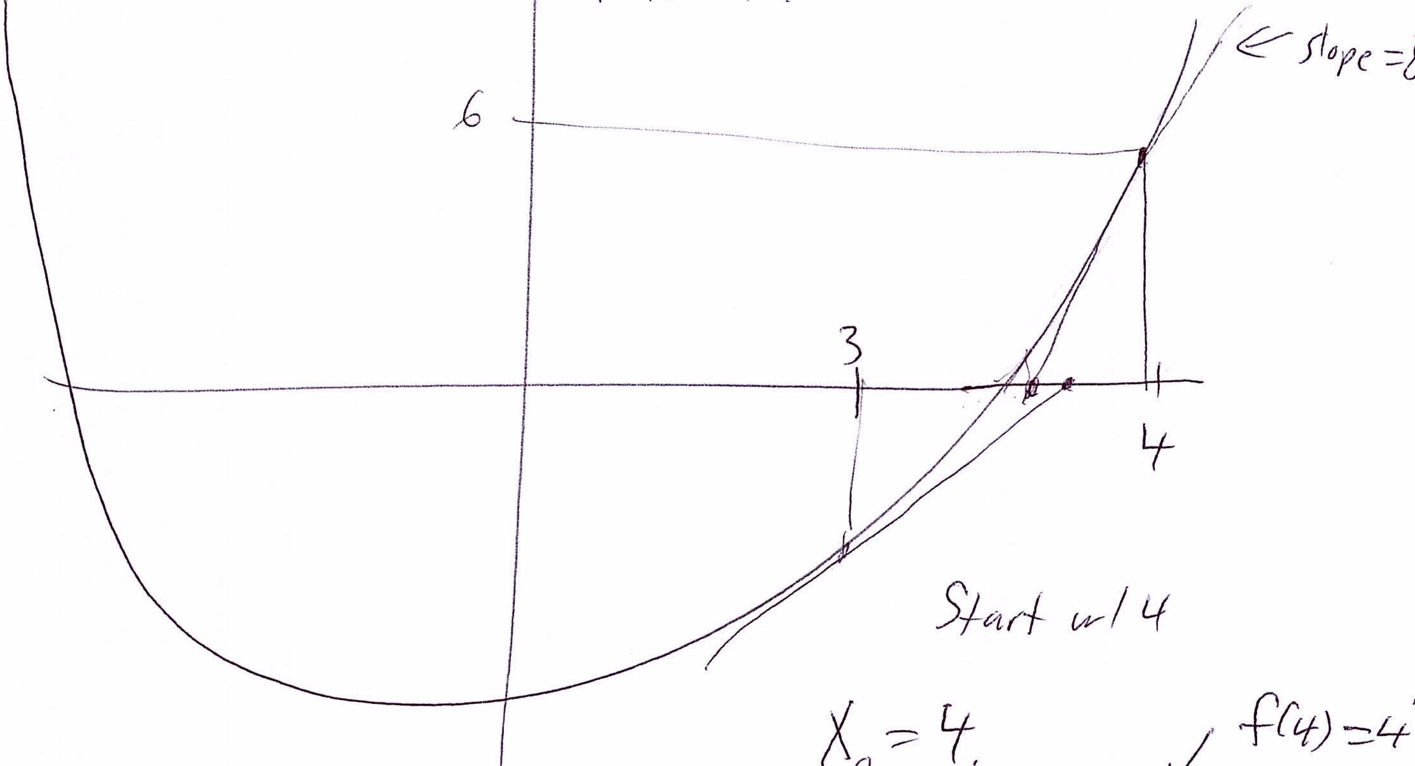
run = $\frac{\text{rise}}{\text{slope}}$

want to solve $f(x) = 0$.

$$\boxed{x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}}$$

$y = x^2 - 10$

$f'(x) = 2x.$



Start w/4

$X_0 = 4.$

$f(4) = 4^2 - 10$

$X_1 = 4 - \dfrac{6}{8}$ ← $f'(4)$

$= 4 - \frac{3}{4} = 3\frac{1}{4}$

Start w/3

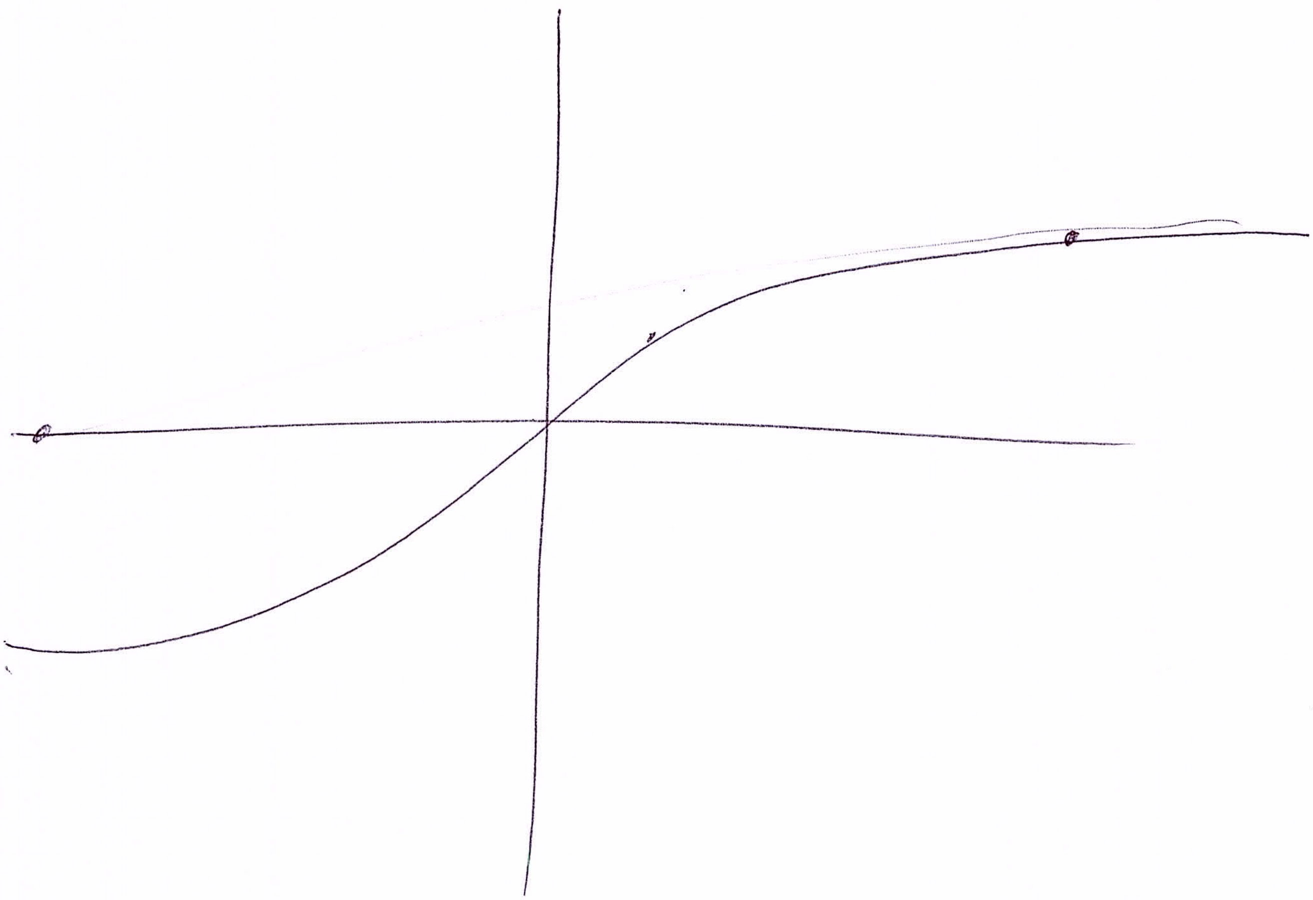
$X_0 = 3$

$f(3)$

$X_1 = 3 - \dfrac{-1}{6} = 3\frac{1}{6}$

$f'(3)$

$X_2 = 3\frac{1}{6} - \dfrac{f(3^1/_6)}{f'(3^1/_6)}$



Newton converts reasonably good guess
to (much) better guess.

But may not work if initial guess
is way off.

If $F'(x) = f(x)$ we say

f is the derivative of F

F is an anti-derivative of f.

Ex $\frac{d}{dx}(x^2) = 2x$

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

If $F'(x) = G'(x)$ for all x, then

$F - G =$ constant.

$(F-G)' = F' - G' = 0$

To find <u>all</u> anti-derivatives of $f(x)$,

find <u>one</u> anti-derivative and add C.

Moving particle. Velocity $= V(t) = 12 + \cancel{10}\,2t$

$X(0) = 3.$

What is $X(t)$?

$\frac{dx}{dt} = V$; velocity is derivative of position

position is anti-derivative of velocity.

$$X(t) = 12t + t^2 + C$$

$$3 = X(0) = 12(0) + 0^2 + C = C \qquad C = 3,$$

$$X(t) = 12t + t^2 + 3 = t^2 + 12t + 3$$

If acceleration $= 2$, $v(0) = 12$,
$\quad\quad\quad\quad\quad\quad = a(t)$

what is $v(t)$?

acceleration = derivative of velocity

velocity = anti-derivative of acceleration.

$$v(t) = 2t + C$$

$$12 = v(0) = 2(0) + C = C \qquad C = 12$$

$$v(t) = 2t + 12.$$

If $a(t) = 2$, $V(0) = 12$, $X(0) = 3$,

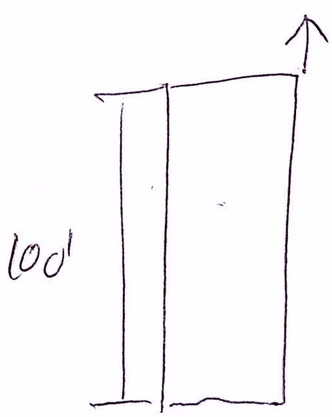
what is $X(t)$?

velocity = anti-derivative of acceleration

$= 2t + 12$

position = anti-derivative of velocity

$= t^2 + 12t + 3$



throws ball up at 64 feet/sec,

What is height of ball at time t? When does it hit the ground?

$a(t) = \cancel{32} \ -32$

$V(t) = -32t + C_1$ $\qquad 64 = V(0) = -32(0) + C_1 = C_1$

$= -32t + 64$

$X(t) = -16t^2 + 64t + C_2$ $\qquad 100 = X(0) = -16(0^2) + 64(0) + C_2$

$C_2 = 100$

$X(t) = -16t^2 + 64t + 100$

Hits the ground when

$$-16t^2 + 64t + 100 = 0$$

$$-4t^2 + 16t + 25 = 0$$

$$t = \frac{-16 \pm \sqrt{256 + 400}}{-8} = 2 \mp \frac{\sqrt{656}}{8}$$

If acceleration = constant = a

Initial velocity = V_0

Initial position = X_0

$$V(t) = at + V_0$$

$$X(t) = \frac{1}{2}at^2 + V_0 t + X_0$$

$f(x)$	$f'(x)$	
x^n	$n x^{n-1}$	
e^x	e^x	
$\ln(x) = \log_e(x)$.	$1/x$	$(x>0)$
$\ln(-x) = \log_e(-x)$.	$\cdot 1/x$	$(x<0)$
$\ln\lvert x\rvert$	$1/x$	$(x\neq 0)$
$\sin(x)$	$\cos(x)$	
$\cos(x)$	$-\sin(x)$	
etc.		

f	Particular anti-derivative of f	
nx^{n-1}	x^n	n
x^{n-1}	x^n/n	$(n\neq 0)$
x^n	$x^{n+1}/(n+1)$	$n\neq -1$
$1/x$	$\ln\lvert x\rvert$	
e^x	e^x	
$\sin(x)$	$-\cos(x)$	
$\cos(x)$	$\sin(x)$	
$\sec^2(x)$	$\tan(x)$	
$\frac{1}{\sqrt{1-x^2}}$	$\sin^{-1}(x)$	
$\frac{1}{1+x^2}$	$\tan^{-1}(x)$	
$x^3+5x^5+\cos(x)+e^x-\frac{1}{x}$	$\frac{x^4}{4}+5\frac{x^6}{6}+\sin(x)+e^x-\ln\lvert x\rvert$	