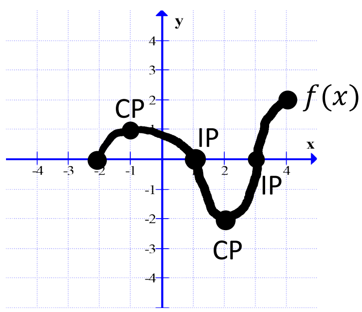
C12 - 3.13 - f,f',f'' Graph Notes

$\boxed{let\ m = slope}$ **Be careful of bounces!**



A function
ie. Position

Find $f(x)$ intervals of :
-increase
-decrease.

$f(x)\ m > 0$

$f(x)\ Inc : f'(x) > 0$

$Inc : (-2,1)U(2,4)$

$f(x)\ m < 0$

$f(x)\ Dec : f'(x) < 0$

$Dec : (-1,2)$

Find where $f(x)$ has a relative :
-maximum
-minimum

$f(x)\ Max : f'(x) = 0$
& $f'(x) > 0 \rightarrow f'(x) < 0$

$f(x)\ Max : (-1,1)$

$f(x)\ Min : f'(x) = 0$
& $f'(x) < 0 \rightarrow f'(x) > 0$

$f(x)\ Min\ : (2,-2)$

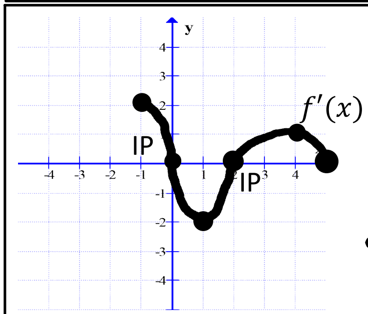
Find where $f(x)$ is concave :
-up
-down

$f(x)\ Conc\ up : f''(x) > 0$

$Conc\ up : (1,3)$

$f(x)\ Conc\ down : f''(x) > 0$

$Conc\ Down : (-2,1)U(3,4)$



A derivative function
ie. Velocity

Find $f(x)$ intervals of :
-increase
-decrease.

$f(x)\ Inc : f'(x) > 0$

$Inc : (-1,0)U(2,5)$

$f(x)\ Dec : f'(x) < 0$

$Dec : (0,2)$

Find where $f(x)$ has a :
-maximum
-minimum

$f'(x) = 0$ &

$f(x) : Max$

$f'(x) > 0 \rightarrow f'(x) < 0$

$x = 0$

$f(x) : Min$

$f'(x) > 0 \rightarrow f'(x) < 0$

$x = 2$

Find where $f(x)$ is concave :
-up
-down

$f(x)\ Conc\ up$:
$f''(x) > 0$

$f'(x)\ m > 0$

$Conc\ up : (1,4)$

$f(x)\ Conc\ down$:
$f''(x) < 0$

$f'(x)\ m < 0$

$Conc\ down : (-1,1)U(4,5)$

Find $f'(x)$ intervals of :
-increase
-decrease.

$f'(x)\ m > 0$

$f'(x)\ Inc : f''(x) > 0$

$Inc : (1,4)$

$f'(x)\ m < 0$

$f'(x)\ Dec : f''(x) < 0$

$Dec : (-1,1)U(4,5)$

Find out where $f(x)$ has a point of inflection.

$f''(x) \neq 0^*$ &

$f''(x) > 0 \rightarrow f''(x) < 0$ $\boxed{OR}$ $f''(x) < 0 \rightarrow f''(x) > 0$

$\boxed{OR}$ $\boxed{OR}$

$f'(x)\ m > 0 \rightarrow f'(x)\ m < 0$

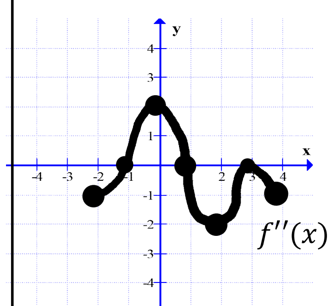
$f'(x)\ max$

$x = 4$

$f'(x)\ m < 0 \rightarrow f'(x)\ m > 0$

$f'(x)\ min$

$x = 1$



A Second derivative function
ie. Acceleration

Find out where $f(x)$ has a point of inflection.

$f''(x) \neq 0^*$ &

$f''(x) > 0 \rightarrow f''(x) < 0$

$x = 1$

$f''(x) < 0 \rightarrow f''(x) > 0$

$x = -1$

Find where $f(x)$ is concave
-up
-down

$f(x)\ Conc\ up$:
$f''(x) > 0$

$Conc\ up : (-1,1)$

$f(x)\ Conc\ down$:
$f''(x) < 0$

$Conc\ down : (-2,-1)U(1,3)U(3,4)$