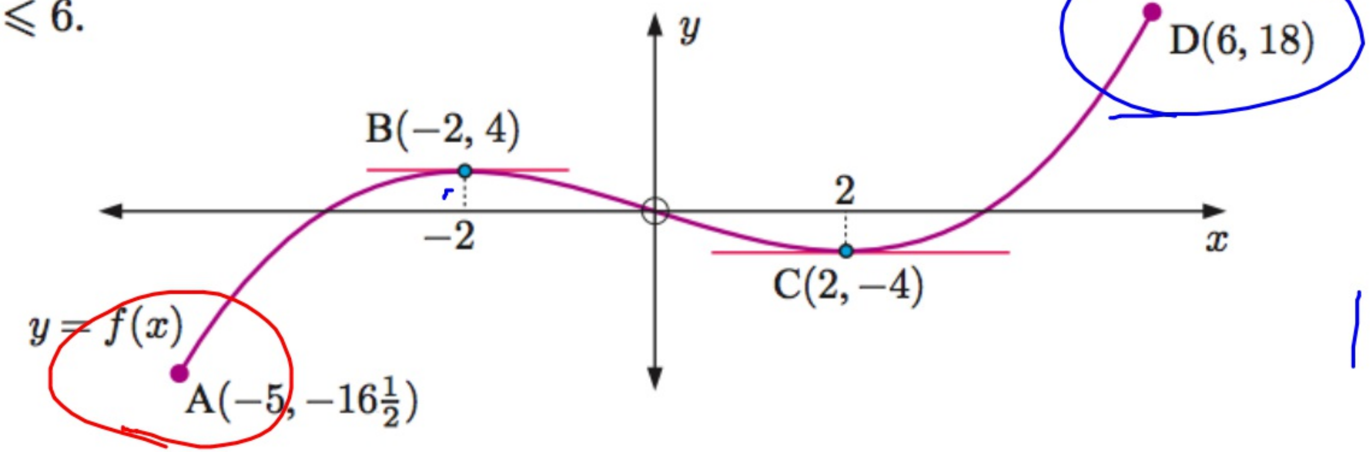
B STATIONARY POINTS

A **stationary point** of a function is a point such that $f'(x) = 0$.

a **local maximum**, a **local minimum**, or a **horizontal inflection**.

MAXIMUM AND MINIMUM POINTS

Consider the following graph which has a restricted domain of $-5 \leqslant x \leqslant 6$.

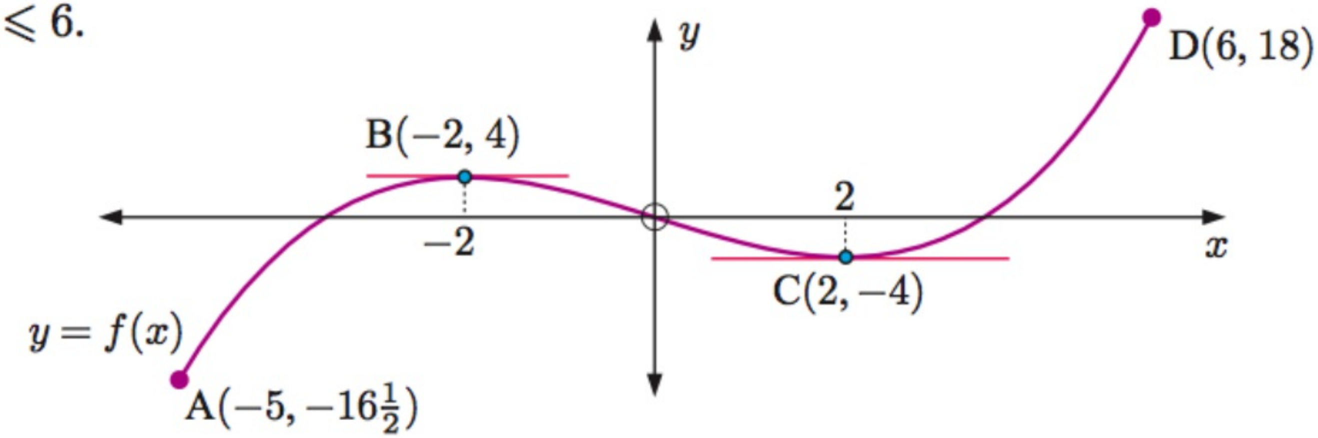


A is a **global minimum** as it is the minimum value of y on the entire domain.

B is a **local maximum** as it is a turning point where $f'(x) = 0$ and the curve has shape

MAXIMUM AND MINIMUM POINTS

Consider the following graph which has a restricted domain of $-5 \leqslant x \leqslant 6$.

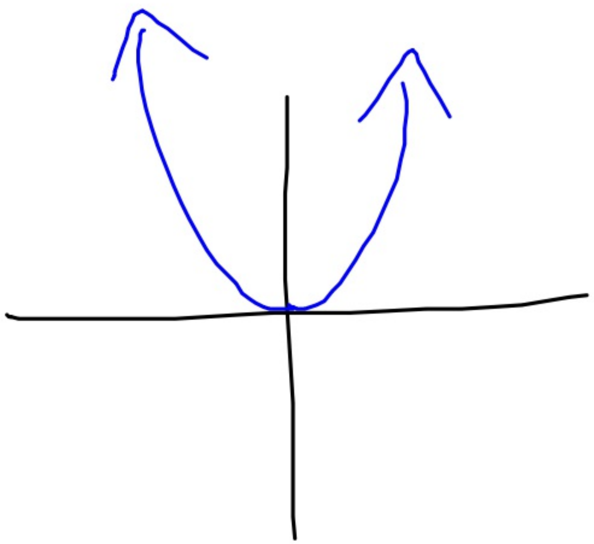


C is a **local minimum** as it is a turning point where $f'(x) = 0$ and the curve has shape 

D is a **global maximum** as it is the maximum value of y on the entire domain.

For many functions, a local maximum or minimum is also the global maximum or minimum.

For example, for $y = x^2$ the point (0, 0) is a local minimum and is also the global minimum.

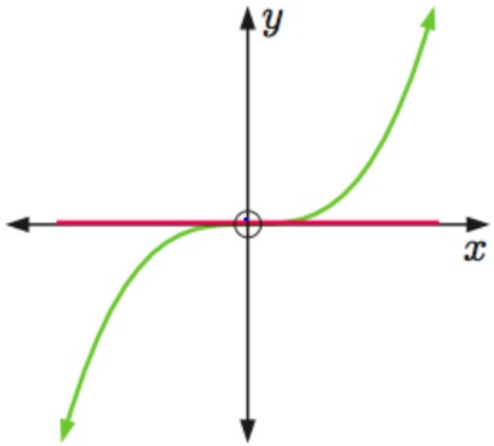


HORIZONTAL OR STATIONARY POINTS OF INFLECTION

A value of x where $f'(x) = 0$ does not always indicate a local maximum or minimum.

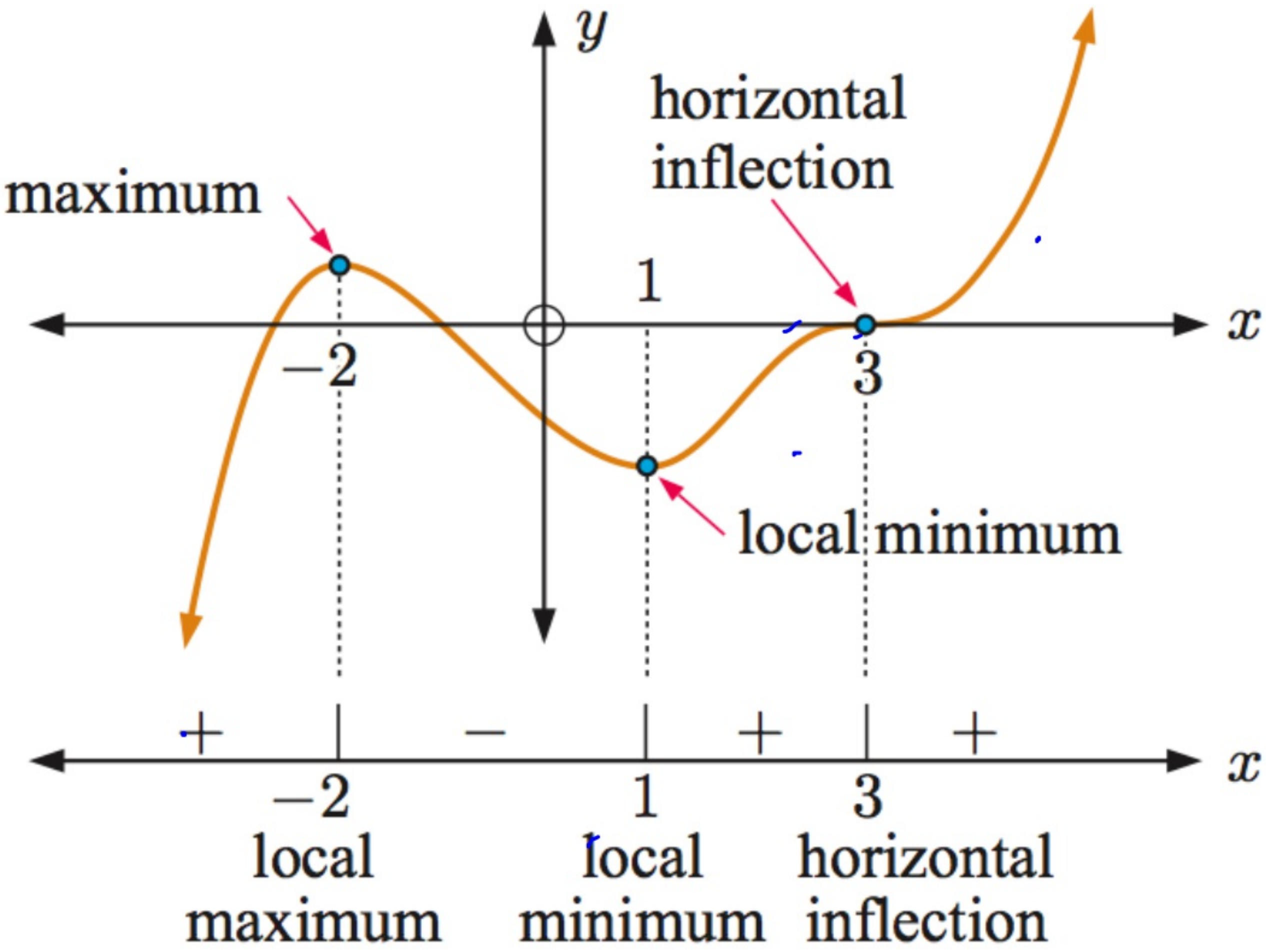
For example, if $f(x) = x^3$ then $f'(x) = 3x^2$

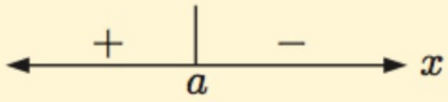
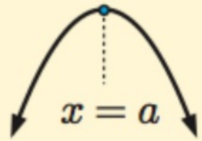
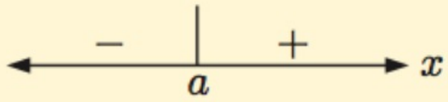
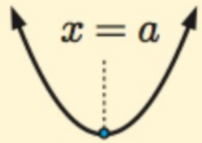
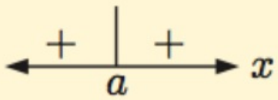
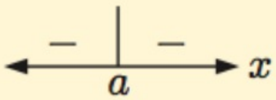
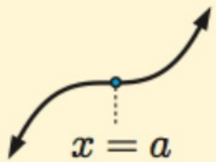
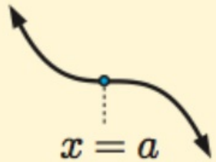
$\therefore$ $f'(x) = 0$ when $x = 0$.



It is called a **horizontal inflection** (or **inflexion**) as the curve changes its curvature or shape.

We can use the sign diagram to describe the stationary points of the function.



Stationary point	*Sign diagram of $f'(x)$ near $x = a$*	*Shape of curve near $x = a$*
local maximum		
local minimum		
horizontal inflection or stationary inflection	 or 	 or 

Find and classify all stationary points of $f(x) = x^3 - 3x^2 - 9x + 5$.

$$f'(x) = 3x^2 - 6x - 9$$

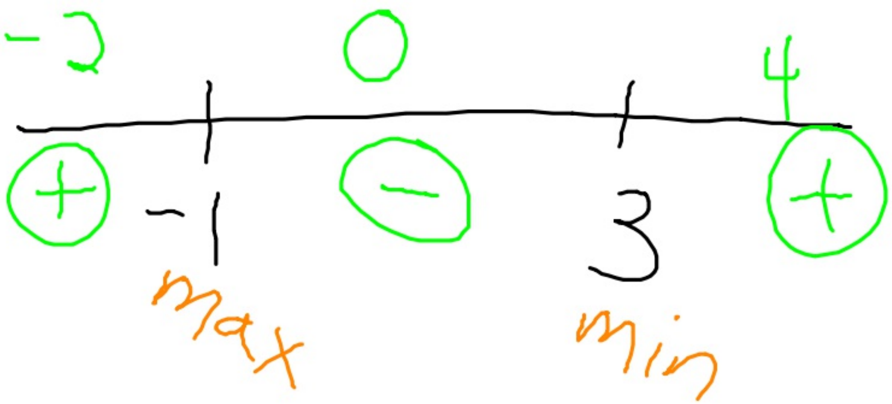
$$0 = 3x^2 - 6x - 9$$

$$3(x^2 - 2x - 3)$$

$$3(x-3)(x+1)$$

$$12 + 12 - 9$$

$$x = 3 \qquad x = -1$$



Find the greatest and least value of $x^3 - 6x^2 + 5$ on the interval $-2 \leqslant x \leqslant 5$.

$0 = 3x^2 - 12x$

$3x(x-4)$

$x = 0 \quad x = 4$

$(0, 5) \quad (4, -27)$

$(-2, -27)$

$(5, -20)$

greatest y-value = 5

least value = -27

If we are asked to find the greatest or least value on an interval, we should always check the endpoints also.

We seek the *global* maximum or minimum on the given domain.

Assignment

Exercise 21B ~~all~~

#1-4, 5a-e