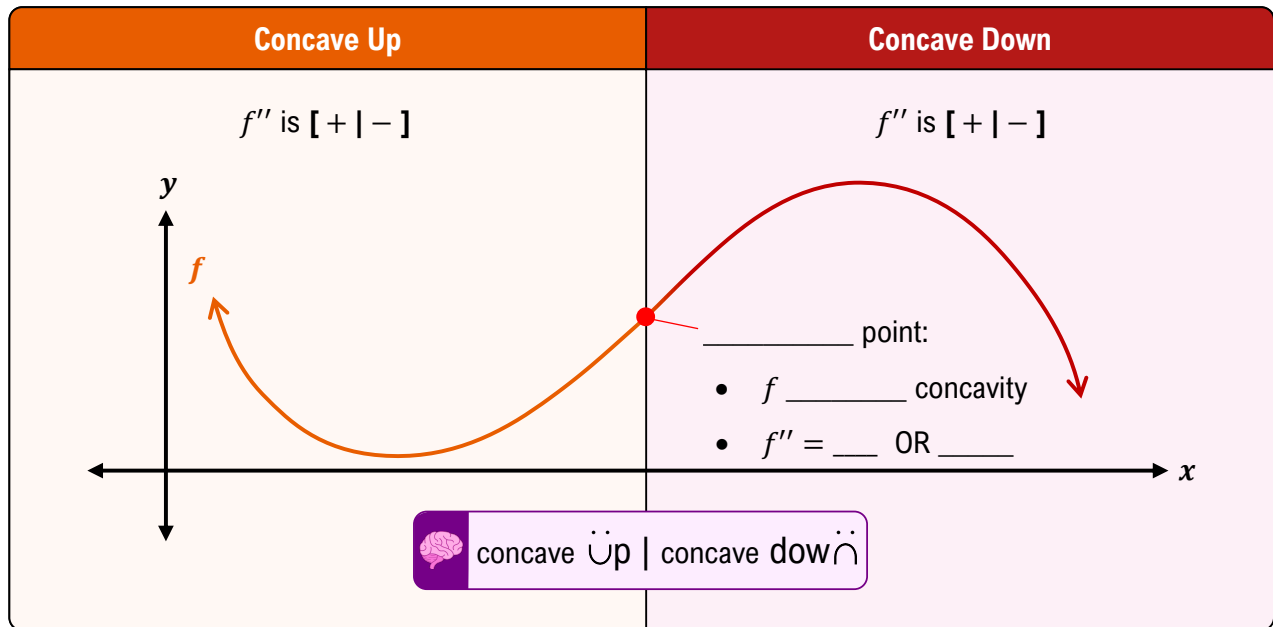


TOPIC: CONCAVITY

Determining Concavity from the Graph of f

◆ Recall: The sign of f' shows if a function is increasing or decreasing.

► The sign of ____ (_____ of f'), shows a function's **concavity**, affecting the **shape** of a graph.



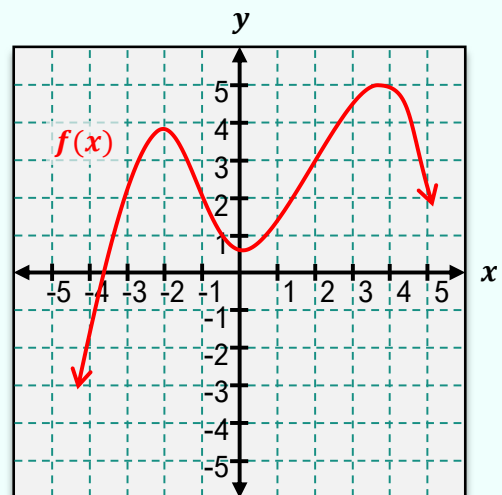
EXAMPLE

Identify the intervals where $f(x)$ is concave up or concave down. State the point(s) of inflection.

Concave **up** ($f'' +$) on _____

Concave **down** ($f'' -$) on _____

Inflection point(s) ($f'' = 0$ or DNE): _____

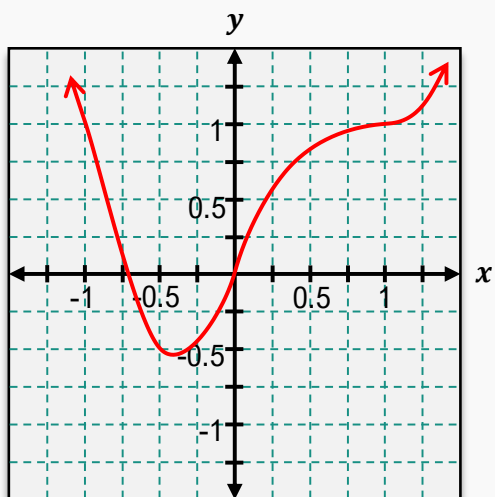


TOPIC: CONCAVITY

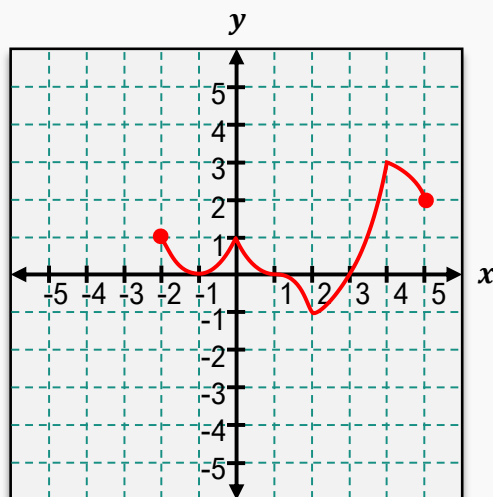
PRACTICE

For the following graph, find the open intervals for which the function is concave up or concave down. Identify any inflection points.

(A)

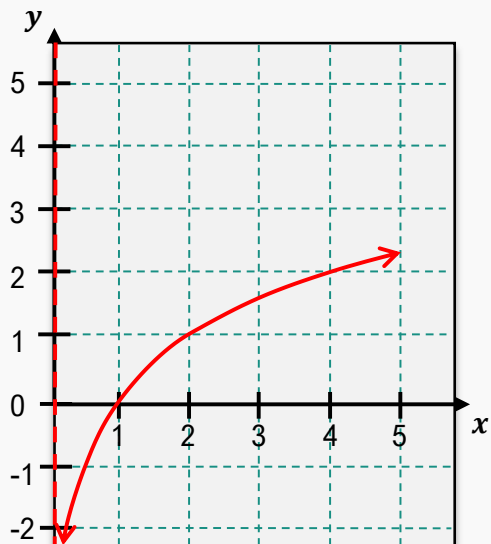


(B)



PRACTICE

For the following graph, find the open intervals for which the function is concave up or concave down. Identify any inflection points.

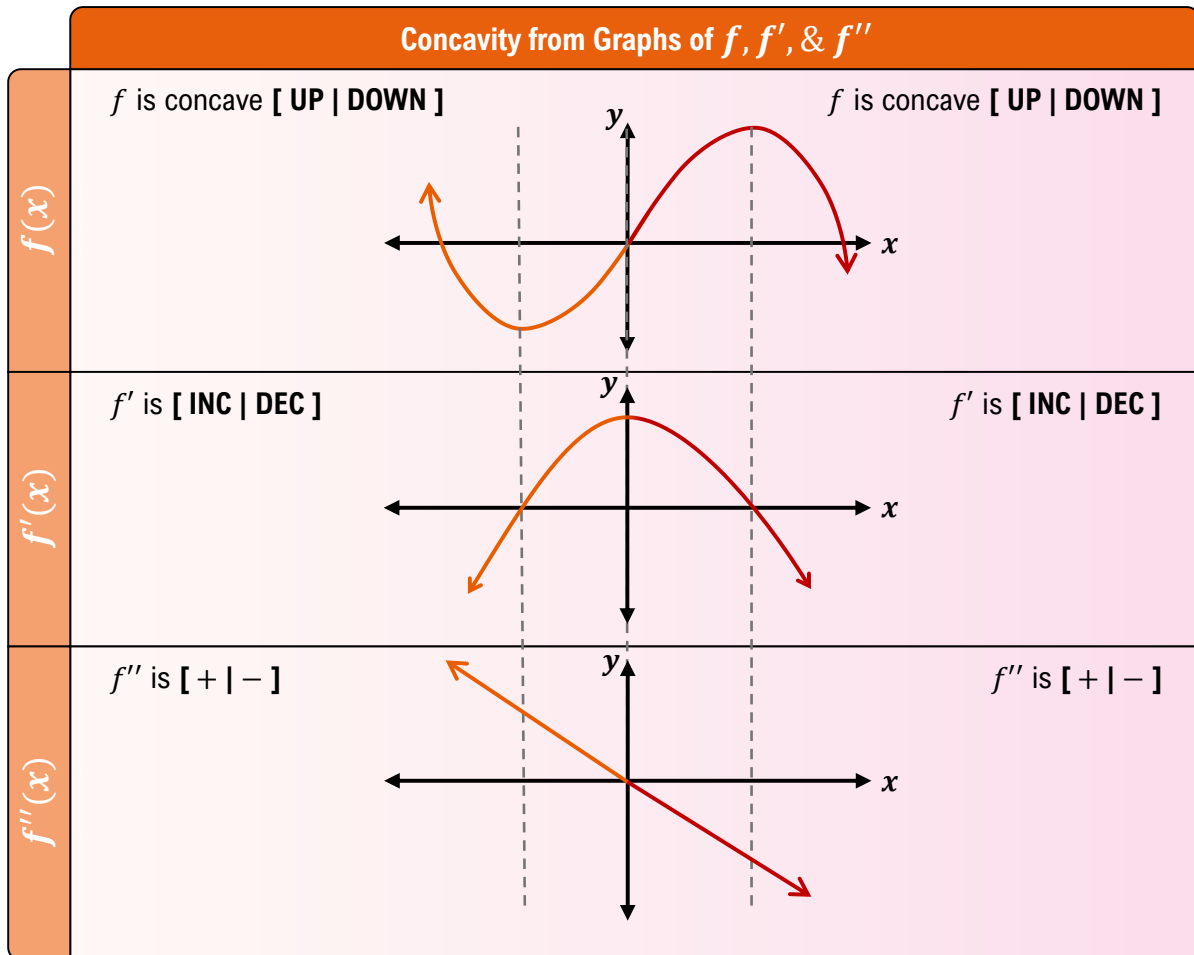


TOPIC: CONCAVITY

Determining Concavity from a Graph of f' or f''

◆ Recall: If f'' is positive, f is concave up. If f'' is negative, f is concave down.

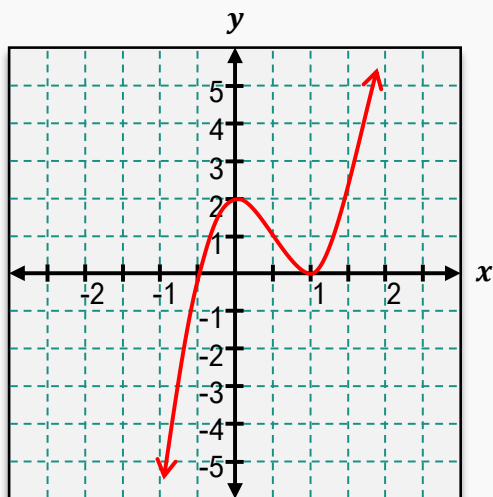
► Since f'' is the rate of change of f' , we can also determine concavity by whether f' is _____ or _____.



TOPIC: CONCAVITY

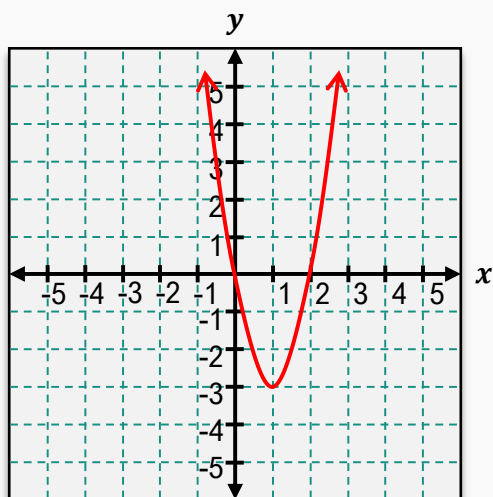
PRACTICE

The graph of $f'(x)$ is shown below. Use the graph to determine the intervals for which $f(x)$ is concave up or concave down and the location of any inflection points.



PRACTICE

The graph of $f''(x)$ is given below. Use the graph to determine the intervals for which $f(x)$ is concave up or concave down and the location of any inflection points.

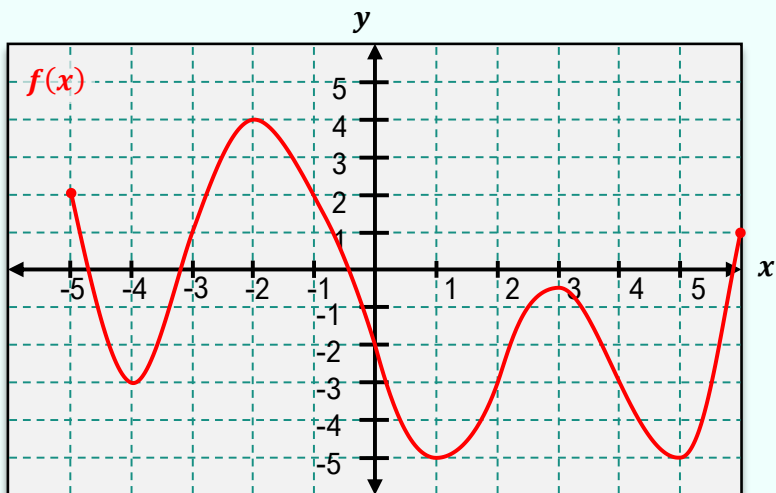


TOPIC: CONCAVITY

EXAMPLE

Use the graph of $f(x)$ below to identify the following:

- (A) Intervals for which $f(x)$ is increasing
- (B) Intervals for which $f(x)$ is decreasing
- (C) Intervals for which $f(x)$ is concave up
- (D) Intervals for which $f(x)$ is concave down
- (E) Coordinates of the point(s) of inflection



TOPIC: CONCAVITY

Determining Concavity Given a Function

◆ Recall: If f'' is +, f is concave up. If $-$, f is concave down. Concavity changes at inflection pts ($f'' = 0$ or DNE).

► Given a fcn, determine concavity by finding potential inflection pts, then testing the sign of f'' _____ those pts.

EXAMPLE

Determine the intervals for which $f(x)$ is concave up or down.

$$f(x) = 2x^3 + 12x^2 + 9x - 4$$

Concave **up** on _____

Concave **down** on _____

f'' :

←————→ x

HOW TO: Determine Intervals of Concavity

1) Find potential inflection points:

$$f''(x) = \text{___ or ___}$$

2) Make sign chart _____ based on potential **inflection points**

3) Plug value from each int. into f'' :

If +, f concave _____ on int.

If $-$, f concave _____ on int.

TOPIC: CONCAVITY

EXAMPLE

Determine the intervals for which the function is concave up or concave down. State the inflection points.

(A)

$$f(x) = 9x^{\frac{1}{5}}$$

HOW TO: Determine Intervals of Concavity

- 1) Find potential inflection points:
 $f''(x) = 0$ or DNE
- 2) Make sign chart **intervals** based on potential **inflection points**
- 3) Plug value from each int. into f'' :
If +, f concave **UP** on int.
If -, f concave **DOWN** on int.

(B)

$$f(x) = 5x^2 - 2x + 24$$

TOPIC: CONCAVITY

PRACTICE

Determine the intervals for which the function is concave up or concave down. State the inflection points.

(A) $f(x) = 2x(x + 9)^2$

HOW TO: Determine Intervals of Concavity

- 1) Find potential inflection points:
 $f''(x) = 0$ or DNE
- 2) Make sign chart **intervals** based on potential **inflection points**
- 3) Plug value from each int. into f'' :
If +, f concave **UP** on int.
If -, f concave **DOWN** on int.

(B) $f(x) = \frac{7}{2x - 9}$

(C) $f(x) = 4 \ln(3x^2)$
