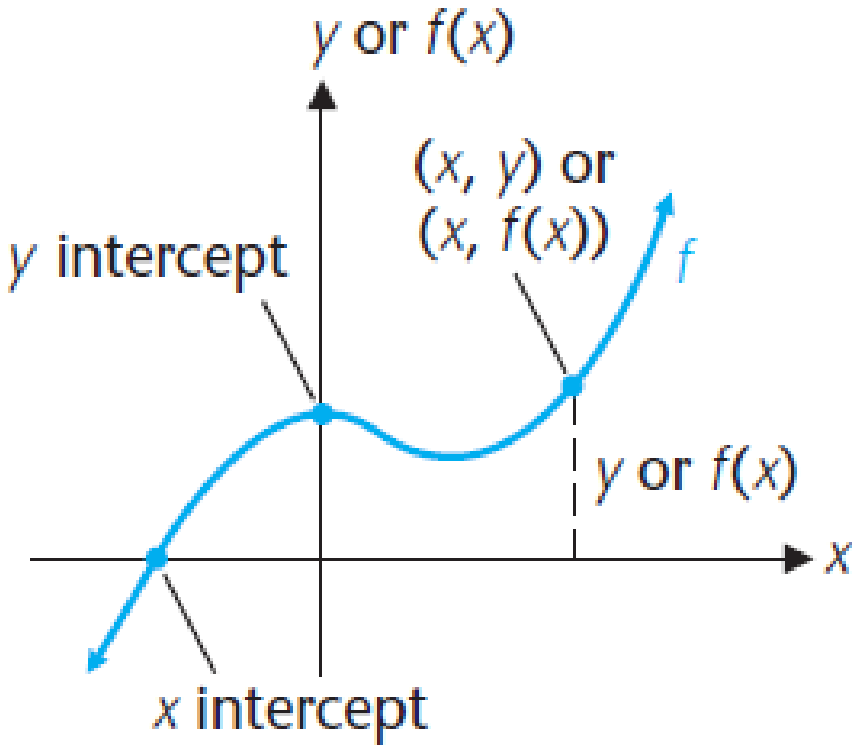
Intercepts

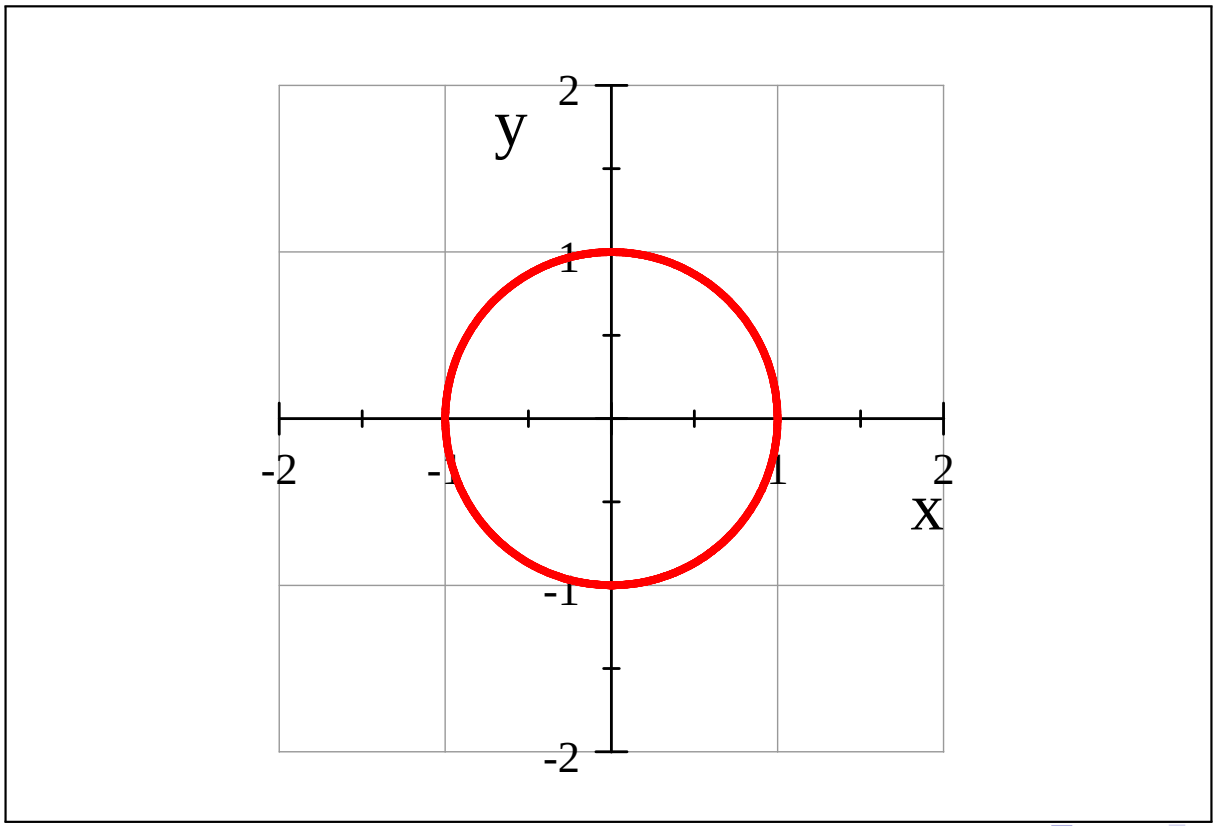
1. An x coordinate of a point where the graph of a function intersects the x axis is called an **x intercept** of the function
2. The y coordinate of a point where the graph of a function crosses the y axis is called the **y intercept** of the function



How to find coordinates of intercepts

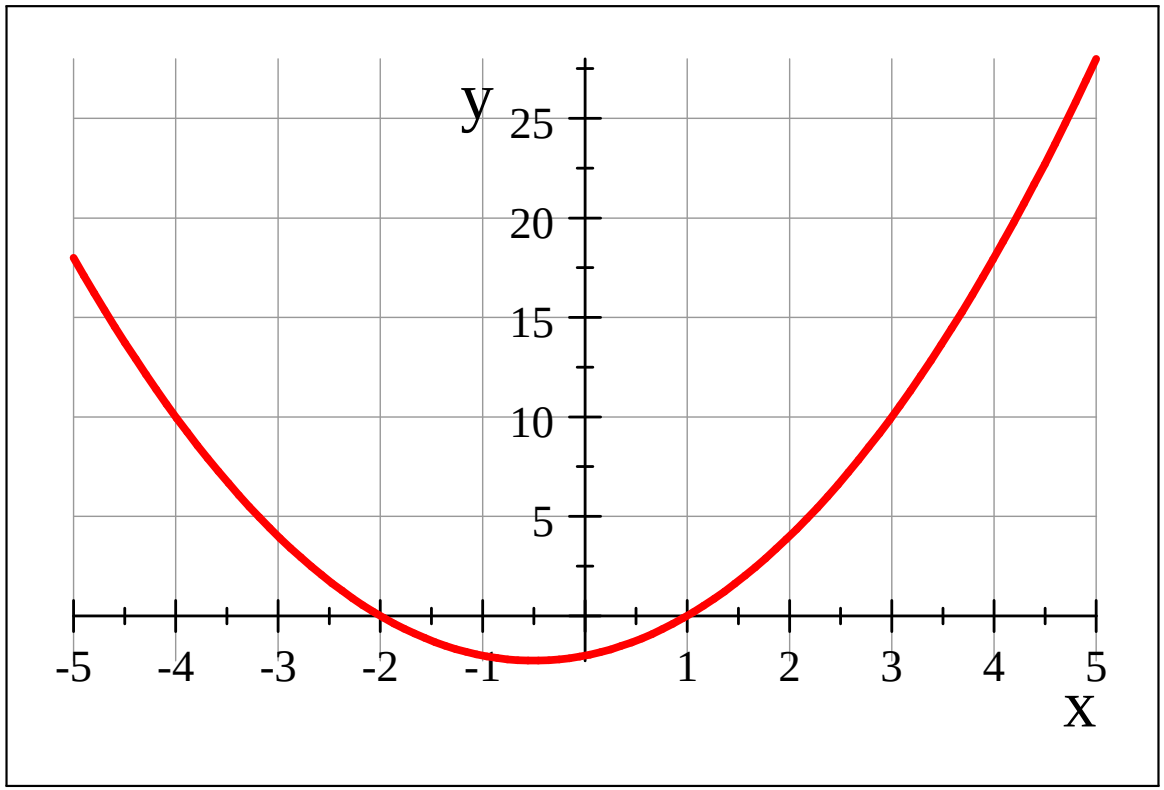
1. To find the coordinates of the **x-intercepts**, we set $y = 0$ and we solve for x.
2. To find the coordinates of the **y-intercepts**, we set $x = 0$ and we solve for y.

Example: Find the coordinates of the x and y intercepts of the circle of equation $x^2 + y^2 = 1$

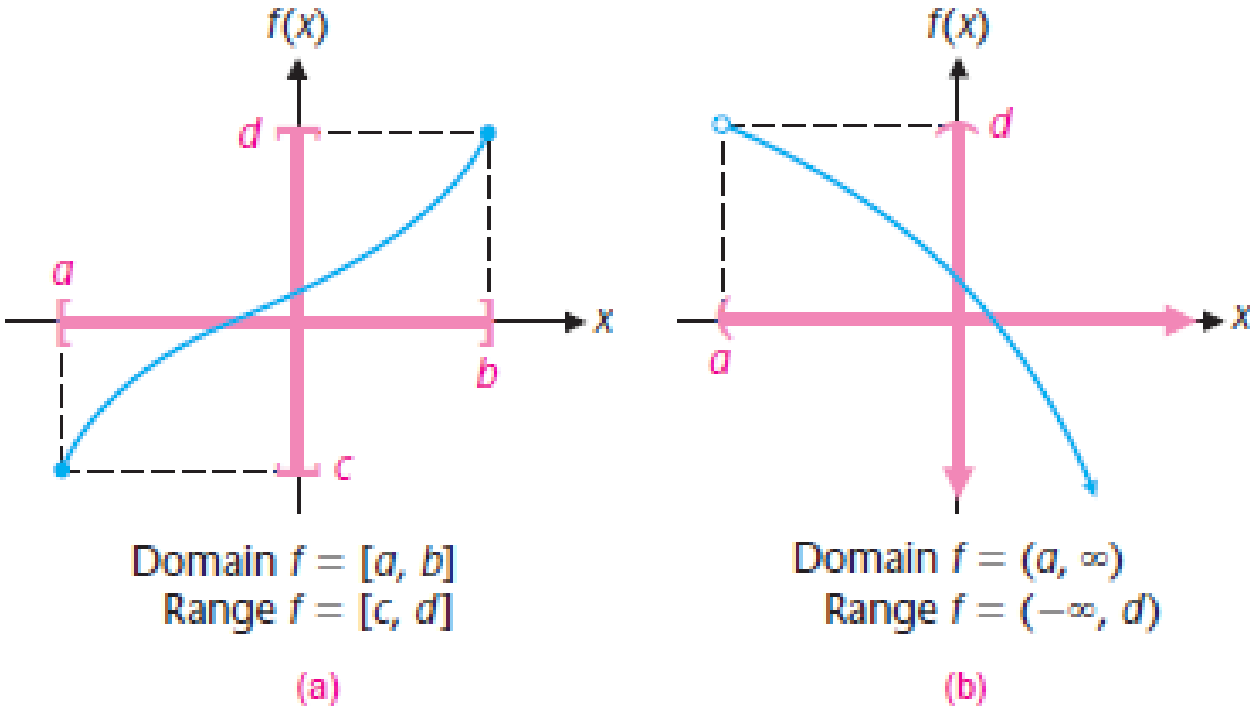


Example

Find the x and y intercepts of $f(x) = x^2 + x - 2$



Domain and Range



Example Find the domain and range of

1. $f(x) = (x-1)^2$
2. $g(x) = \frac{1}{x^2}$

DEFINITION 1 Increasing, Decreasing, and Constant Functions

Let I be an interval in the domain of function f. Then,

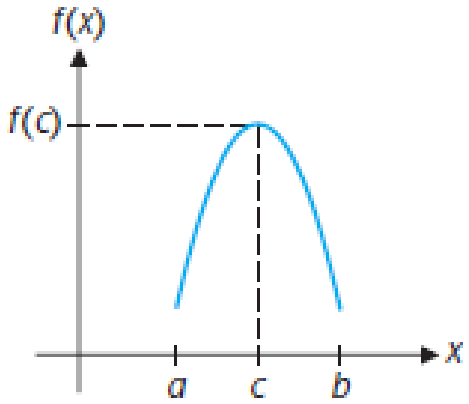
1. f is **increasing** on I and the graph of f is **rising** on I if $f(a) < f(b)$ whenever $a < b$ in I.
2. f is **decreasing** on I and the graph of f is **falling** on I if $f(a) > f(b)$ whenever $a < b$ in I.
3. f is **constant** on I and the graph of f is **horizontal** on I if $f(a) = f(b)$ whenever $a < b$ in I.

Extrema points

DEFINITION 2 Local Maxima and Local Minima

The function value $f(c)$ is called a **local maximum** if there is an interval (a, b) containing c such that

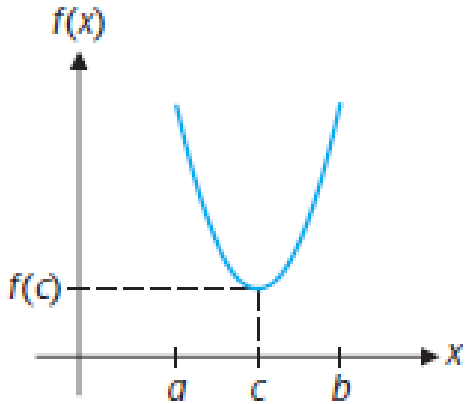
$$f(x) \leq f(c) \text{ for all } x \text{ in } (a, b)$$



Local maximum

The function value $f(c)$ is called a **local minimum** if there is an interval (a, b) containing c such that

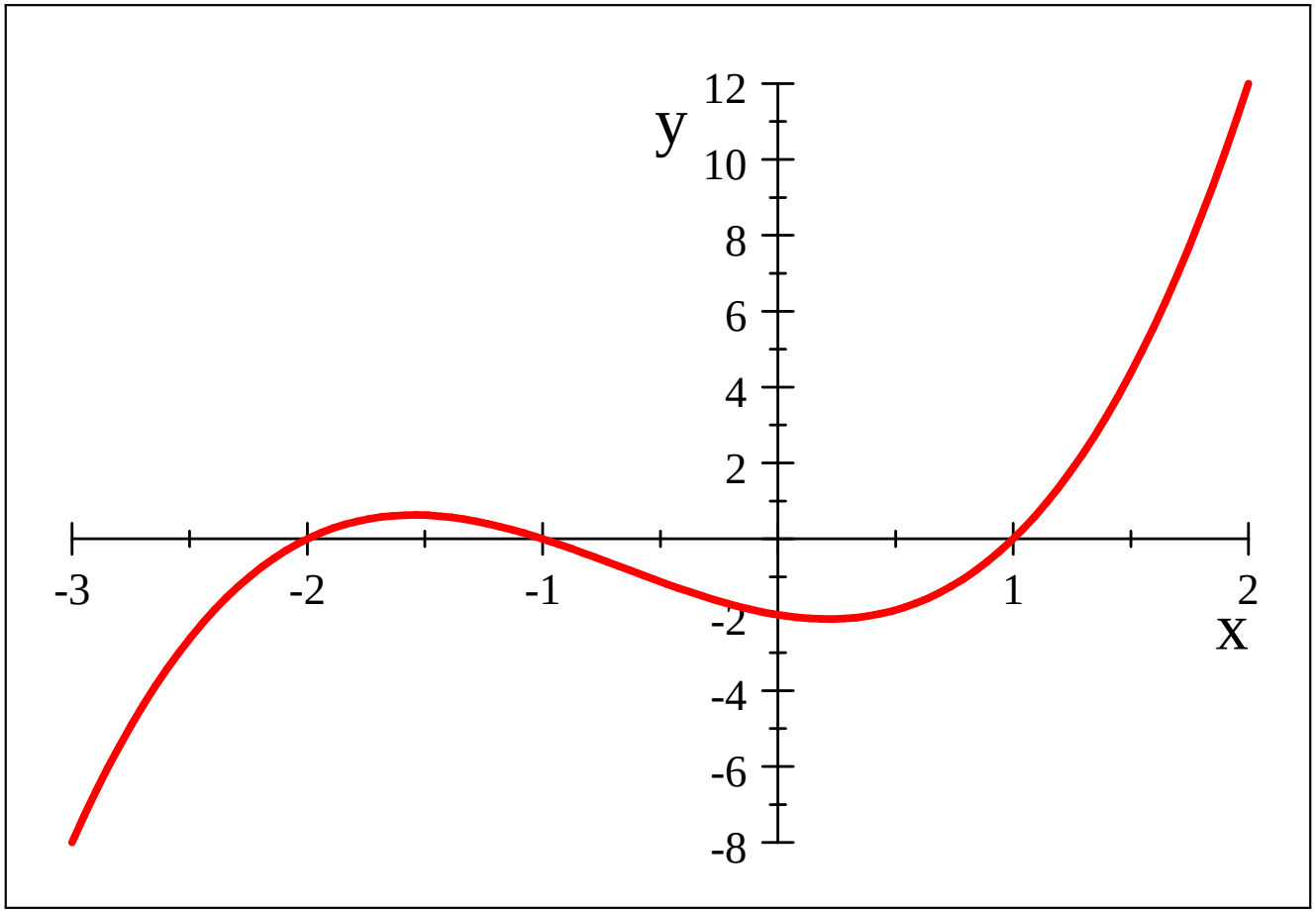
$$f(x) \geq f(c) \text{ for all } x \text{ in } (a, b)$$



Local minimum

The function value $f(c)$ is called a **local extremum** if it is either a local maximum or a local minimum.

Given the function $f(x) = (x-1)(x+1)(x+2)$.

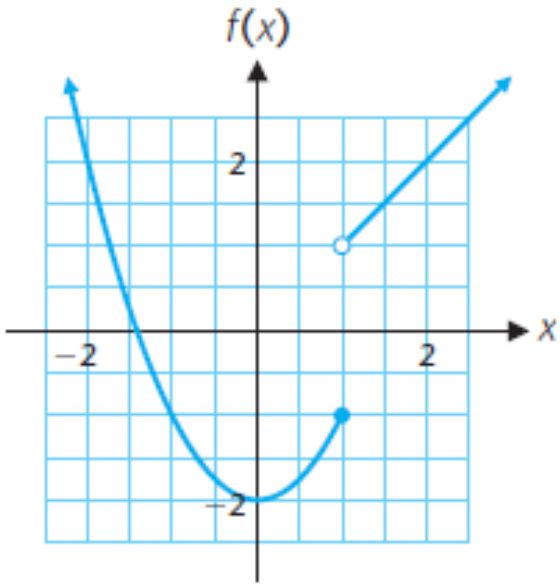


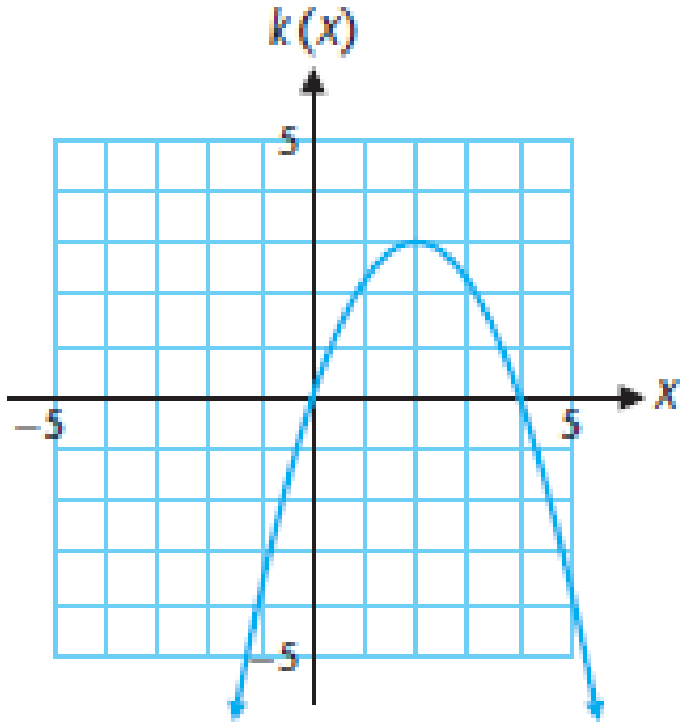
Find

1. the interval on which the function is increasing
2. the interval on which the function is decreasing
3. local maxima and Minima if any.

Continuity & Discontinuity

1. A graph (or portion of a graph) is said to be **continuous** if it contains no breaks or gaps and can be drawn without lifting a pen from the paper.
2. A graph is **discontinuous** at any points where there is a break or a gap.





$$f(x) = \begin{cases} x^2 - 2 & \text{for } x \leq 1 \\ x & \text{for } x > 1 \end{cases}$$